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ATMOS ENERGY CORPORATION

MID-STATES / KENTUCKY DIVISION

IN THE MATTER OF	**) CASE NO. 2006-00464**
RATE APPLICATION BY	**)**
ATMOS ENERGY CORPORATION	**)**
MID-STATES/KENTUCKY	**)**

RESPONSE OF ATMOS ENERGY CORPORATION

MID-STATES DIVISION

AG DATA REQUEST DATED FEBRUARY 20, 2007

(AG DATA REQUEST NO. 1)

DR 209 – DR 241

MARCH 16, 2007

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 209
Witness: Laurie Sherwood

Data Request:

Please provide copies of all correspondence between Atmos and the three major bond rating agencies (S&P, Reuters, and Fitch) from January 1, 2005 to the present. These include copies of letters, reports, presentations, emails, and notes from telephone conversations.

Response:

Information responsive to this data request (and labeled AG DR1-209 ATT) is being filed subject to the terms of a confidentiality petition accompanying Atmos' responses to the Attorney General's Initial Data Requests.

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 210
Witness: Laurie Sherwood

Data Request:

Please provide copies of all reports published by the three major credit rating agencies on Atmos since January 1, 2005.

Response:

Please see AG DR1-210 ATT attached to this response.

This Analysis provides a discussion of the factors underpinning the credit rating/s and should be read in conjunction with our Credit Opinion. The most recent ratings, opinion, and other research specific to this issuer are provided on Moodys.com. Click here to link.

Analysis

UNITED STATES
Americas

December 2005

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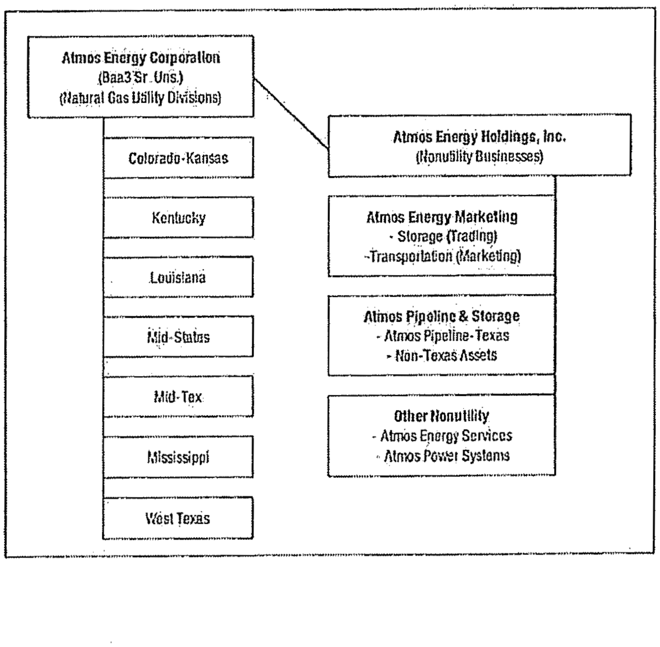
Duplex Copies

Atmos Energy Corporati

Atmos Energy Corporation is the largest natural gas distribution-only company in the United States in terms of number of customers. The company is comprised of three main operating segments: Utility (67% of 2005 EBIT), Pipeline and Storage (Pipeline, 20% of EBIT), Natural Gas Marketing (Marketing, 12%), and Other Non-Utility (1%). The rated issuer is the parent company, comprised of LDCs in 12 states and pipelines and storage in Texas. The other operations are housed in subsidiaries.



RATING RATIONALE

Atmos's ratings reflect the company's the low-risk, non-cyclical earnings from its gas utility and pipeline operations (about 90% of EBIT and assets); geographic and jurisdictional diversity afforded by its twelve-state service territory; and a good record of operating efficiently and integrating acquired assets. Although Atmos's results are seasonal and vary with the weather, this risk is allayed by having some form of weather mitigation in most of its jurisdictions, whether with weather normalization adjustments or rate structures that are based more on recovery of fixed costs than on volume.

The debt incurred in the TXU Gas acquisition (now known as the Mid-Tex division) at the beginning of FY05 has resulted in Atmos's leverage being high relative to its peers'. Atmos has successfully completed the integration of Mid-Tex's operations and realized cost savings in line with its original plan. However, it now expects that debt reduction will take longer than expected while it applies its free cash flow toward pipeline growth projects rather than debt reduction. The company intends to meet its book leverage target of 50%- 55% over a three-year timeframe. It has publicly committed not to make another acquisition until it reaches that target.

Regulatory lag is a persistent issue that Atmos needs to continually address. The company also suffered damage by hurricane Katrina, though future impacts appear manageable. Atmos Energy Marketing (AEM), the marketing subsidiary, is the riskiest element of the company. AEM is exposed to commodity price, counterparty, and other risks, and it is difficult to predict its financial results with accuracy. It also places a demand on working capital, which has increased recently because of higher gas prices.

RATING OUTLOOK

The stable outlook for Atmos reflects the expectation that its debt will not likely be reduced in the near term because of its increased capital budget. Credit metrics incorporated into its ratings include retained cash flow-to-debt at around 10% and leverage in the high 60% range, adjusted for leases and goodwill.

WHAT COULD CHANGE THE RATING-UP

Moody's could consider a positive outlook or an upgrade over the next 12 months if the company makes progress toward improving its modest credit metrics from: executing on its pipeline projects, obtaining rate recovery and margin stabilization (most importantly in Texas), and containing margin loss from the hurricane at around budgeted levels. Credit metrics that would cause us to consider an upgrade include retained cash flow-to-debt in the low teens, adjusted leverage trending toward the low-60% range, and ROE on a GAAP basis above 9%. Any positive rating action would be conditioned on our comfort with the potential risks posed by AEM, including its liquidity resources particularly in this time of high gas prices.

WHAT COULD CHANGE THE RATING-DOWN

Unlikely, given the low business risk of Atmos's asset base and its stated commitment to remain investment grade.

Credit Challenges

- Slower de-leveraging likely in the near term than previously expected

One significant change from the expectations incorporated in Atmos's current Baa3 ratings is the likelihood that Atmos will apply its free cash flows toward an expanded capital program rather than debt reduction. Moody's will monitor the near-term financial and execution risks related to Atmos's capital program, while considering the longer term enhancement of the company's business profile from the development of its pipeline business.

Atmos expects to use the $60-$70 million of free cash flow (cash flow from operations minus maintenance capex and dividends) that it expects to generate in fiscal 2006 toward an increased capital expenditure program. The increase is primarily in Pipelines, where it expects to spend roughly $80 million next year (see "Credit Strengths - Mid-Tex Intrastate Pipelines"). Management has stated its intention to return to its long-term target range of 50%-55% unadjusted leverage (debt/debt+equity) over a three-year timeframe. The company expects that incremental debt it will incur would be mitigated to a small degree by $40-$45 million of equity that it expects to issue through its DRIP and other stock programs. About 40-50% of the dividends paid have historically returned to the company under these programs.

- **Regulatory risk in efforts to mitigate regulatory lag, weather risk, and volume sensitivity**

Being a primarily regulated company with operations in 12 regulatory jurisdictions, regulatory risk a key concern for Atmos. Every year, the company files for $10-$20 million of rate increases to offset the effects of regulatory lag. It has long fought for improvement in its rate designs to protect its margins from the impacts of weather. It is seeking decoupling and other mechanisms that would help to immunize the company from the impacts of declining per-customer usage and conservation.

The addition of the Mid-Tex Utility division (roughly a quarter of its 2005 operating income) increased Atmos's sensitivity to weather, because its rates contain no weather normalization adjustment mechanisms. Weather lowered net income by $23 million (14%) in 2005. Atmos plans to request WNA in Mid-Tex and Louisiana (7% of operating income), the divisions that lack any type of weather normalization adjustment mechanism.

The company budgets a $5 million decline in margin every year as a result of declining use per customer. To stanch this margin erosion, Atmos is seeking rate mechanisms that shift greater percentages of margin from volumetric to a fixed customer charge. It is also pursuing mechanisms that accelerate the recovery of capital spent and is allocating capital toward jurisdictions where more timely recovery is allowed. In addition, the company is requesting mechanisms that would allow it to recover the gas cost portion of bad debt expense. Although natural gas prices at historic highs present a risk, Atmos has a good track record of keeping bad debt expense in check.

- **Commodity price, counterparty, and liquidity risks related to Marketing**

Marketing is subject to natural gas price movements, counterparty credit risk, and liquidity risk associated with fluctuations in natural gas prices. As 12% of total 2005 EBIT, Moody's considers Marketing as the riskiest element of the company.

- **Relatively modest returns**

Atmos's nominal ROEs in the 9% range are noticeably lower than most of its LDC peers. This weakness results from its equity reflecting the $490 million of goodwill incurred in the Mid-Tex acquisition. Atmos paid a full price (11x the assets' 2003 unadjusted EBITDA) for Mid-Tex and is not earning a regulated return on the acquisition premium. In monitoring the company, Moody's will assess the prospect of Atmos's improving its returns, much of which will depend on the company's executing on the above-mentioned pipeline projects and obtaining rate relief in some of its jurisdictions

- **Hurricane Katrina impacts**

Hurricane Katrina affected about 11% of Atmos's total customers. The company estimates that 2% of its customers could be lost for an extended period or permanently. The company forecasts damages and expenses of about $13-$15 million plus lost margin of $10-$12 million in fiscal 2006. Atmos is in discussions with the Louisiana Public Service Commission to recover the incremental O&M, the lost gas and lost margins incurred because of the hurricane. Atmos also has insurance coverage for property damage. In monitoring the company, Moody's will consider the near term impact of the hurricane on Atmos's results, although the company's estimated impacts appear manageable.

Credit Strengths

- **Stability of cash flow, predominantly generated by regulated assets**

Atmos's regulated Utility and Pipeline segments provide a sound foundation for its credit. These regulated segments accounted for approximately 87% of total EBIT in fiscal 2005 (67% from Utility and 20% from Pipeline).

- **Record of operating efficiently**

Atmos has a good track record in improving the operating efficiency of its legacy assets and in bringing those efficiencies to the utilities it acquires. The successful integration of Mid-Tex within its projected time frame upholds this record. The company accelerated $20 million of operational expense savings into fiscal 2005 that were originally budgeted in fiscal 2006.

- **Geographic and jurisdictional diversity**

Atmos has good scale compared to many other LDCs, with 3.2 million customers and operations in twelve states. Its geographic diversity helps to mitigate negative impacts from weather, local economic conditions, and regulation.

- **Mid-Tex's intrastate pipelines – an additional source of regulated, stable cash flows**

The Mid-Tex intrastate pipeline system is a valuable franchise that has a higher growth potential than Atmos's legacy Utility business. The Pipeline generates stable cash flows that are less seasonal than its primary Utility segment. Management has some identified growth projects for these assets. The increased gas production in the Barnett Shale and Bossier Sands, located within Mid-Texas' service territory, has raised the need for additional pipeline take-away capacity. The Pipeline connects to the Mid-Tex Utility division that serves the fast growing Dallas/FortWorth market. These expansion projects not only solve some deliverability issues for the Utility, but also create commercial opportunities for the Pipeline.

The company has allocated $80 million of capex among four growth projects between calendar 2005 and 2006. These expenditures are fully recoverable through Gas Reliability Infrastructure Program (GRIP) filings that are allowed by Texas state statute. Through this program, distribution and pipeline capital expenditures can be recovered from customers through a monthly charge.

The incremental annual revenues from these projects are estimated at around $15 million, of which $7 million is expected to be generated in fiscal 2006. Capital expenditures can be included in a GRIP filing when the project becomes operational. The following table shows the four planned projects and the timing of the related GRIP filings.

Project	Description	Estimated On-line Date	CAPEX Actual 2005	CAPEX Estimated 2006	GRIP Filings 2005	GRIP Filings 2006
Northside Loop JV with Energy Transfer	JV with Energy Transfer Fuel to construct and operate approx. 45 miles of 30" pipeline extending from Justin to Frisco, in the northern part of the DFW Metroplex, creating incremental capacity of 225 MMcf/d.	March-06	$1.6	$43.4	$13.0	$32.0
Enbridge Line/Corridor Compression	Executed agreement in May 2005 to install compression to enhance re-injection capabilities at Bethal.	Calendar 2006	$4.0	$16.0	$-	$20.0
Devon Line/Corridor Compression	Executed agreement in July 2005 to transport up to 50 MMcf/d into Enbridge.	Calendar 2006	$-	$-	$-	$-
Katy Capacity Expansion/ Compression	Signed Agreements in July 2005 with three shippers to transport an additional 50 MMcf/d of capacity to the Katy area (suburb of Houston)	June-06	$1.3	$13.7	$0.0	$15.0
		Total:	$6.9	$73.1	$13.0	$67.0

Financial Analysis

PROFITABILITY

With rate-regulated tariffs supporting the majority of its margins, Atmos's earnings are generally stable and reliable, with some sensitivity to weather. The Pipeline segment has added a significant new source of earnings. Rate base increases also provide margin growth. Marketing's earnings contributions fluctuate from year to year, depending arbitrage opportunities caused by locational and seasonal gas price differentials.

CASH FLOW GENERATION

According to Atmos's 12/05 analyst guidance, the company expects to generate roughly $400 million of cash flow from operations and to spend about $220 million on maintenance capex and about $100 million in dividends. The resulting roughly $60-$70 million of free cash flow will go toward financing roughly $180 million of growth capex. External funds are expected to come from about $40 million in stock issued as part of the company's various stock plans and the remaining $70-$80 from short-term borrowings.

An important financial goal of the company is for it to maintain minimal annual dividend increases of a couple of cents/share a year, and a dividend payout of around 65%. Historically, Atmos's payouts have been higher than its target, with a 73% dividend payout in fiscal 2005, which is higher than many of its industry peers.

LEVERAGE

The $1.3 billion dollars of debt incurred in the TXU Gas acquisition still weighs on Atmos' balance sheet. Both Atmos' book leverage of 58% and adjusted leverage of 71% are high among investment grade LDCs. The company intends to meet its book leverage target of 50%– 55% over a three-year timeframe. The company has publicly committed not to make another acquisition until it reaches that target.

Related Research

Special Comment:

Impact Of Conservation On Gas Margins And Financial Stability In The Gas LDC Sector, June 2005 (92787)

To access any of these reports, click on the entry above. Note that these references are current as of the date of publication of this report and that more recent reports may be available. All research may not be available to all clients.

To order reprints of this report (100 copies minimum), please call 1.212.553.1658.
Report Number: 95900

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Atmos Energy Corp. (BBB/Stable/A-2)

Maturities

2006	$3 million
2007	$3 million
2008	$304 million
2009	$2 million
2010	$401 million
Thereafter	$1,476 million

Rationale

On Dec. 21, 2005 Standard & Poor's affirmed its BBB rating on Atmos Energy Corp. and raised the rating on its first mortgage bonds to A- from BBB. A recovery rating of "1+" was also assigned to the first mortgage bonds, indicating the highest expectation of full recovery of principal in the event of default. The outlook remains stable. The ratings on Atmos Energy Corp. reflect the company's strong business profile (a "4" on a scale of 1-10, where 1 is excellent and 10 is vulnerable), its current market position as one of the largest natural gas local distribution company (LDC) in the U.S., as well as its reasonably stable revenues and customer base from its gas distribution operations and geographic and regulatory diversity. These factors are offset by integration challenges associated with its TXU Gas acquisition, weak credit measures, and exposure to weather-related risk. Dallas, Texas-based Atmos has about $2.3 billion of rated debt.

The acquisition of TXU Gas in late 2004 effectively doubled Atmos' size, making it the largest LDC in the U.S. After the acquisition, Atmos increased the number of customers served in 12 states to 3.2 million. Standard & Poor's Ratings Services continues to be concerned about the integration challenges facing Atmos after the acquisition and will monitor the company's operational performance as it transitions to a much larger LDC.

These challenges include managing new business segments such as TXU Gas' pipeline assets, improving TXU Gas' historically subpar regulatory relationships, and integrating TXU Gas' operations with Atmos' operations. With the acquisition of TXU Gas, about 60% of Atmos' customer base is not covered by weather-normalization clauses or weather insurance. However, management has achieved considerable cost savings through overhead reduction, in 2005. In addition, Standard & Poor's is concerned with the business risk associated with Atmos' nonregulated marketing company, Atmos Energy Marketing (AEM).

However, by acquiring TXU Gas, Atmos increased its operating income from regulated operations to about 87% from 75% of total operating income. The company derives some modest benefit from the geographic and regulatory diversity of its operations, which are spread over 12 states, mitigating adverse conditions relating to regulatory or economic circumstances. Atmos has worked toward easing the effects of weather and protecting utility margins by adding weather-normalization adjustments to several rate filings and hopes to achieve weather normalization in TXU Gas' operating area over time.

Atmos' financial strength will depend in part on management's ability to continue to realize cost savings and improve TXU Gas' profitability over the next several years. In the near term, however, credit measures are weaker following the acquisition. The debt financing constrains cash measures, with funds from operations (FFO) to average total debt at 14% and FFO interest coverage at 3.2x for the fiscal year ended Sept. 30, 2005. Furthermore, the company's adjusted debt leverage has increased to 60% from 45% at the end of fiscal years 2005 and 2004, respectively.

Short Term Credit Factors

The short-term rating on Atmos is 'A-2'. For the fiscal year ended Sept. 30, 2005, Atmos generated cash from operations of about $387 million. Atmos working capital needs can vary significantly due to changes in the price of natural gas charged by suppliers and the increased gas supplies required to meet customers' needs during periods of cold weather. Atmos has reacted to the recent increase in natural gas prices by increasing the size of its credit facilities. As of Sept. 30, 2005, Atmos had about $40 million of cash on hand and credit facilities totaling $968 million. $618 million of the $968 million were committed facilities, including a $600 million facility that matures in October 2008. In addition to these facilities, Atmos recently added a $300 million committed facility that matures November 2006. At Sept. 30, 2005, there was $129.9 million outstanding under Atmos' commercial paper program and $14.9 million outstanding under its bank credit facilities. The financial covenants in the revolving credit facilities require Atmos to maintain a ratio of total debt to total capitalization of no greater than 70%. At September 30, 2005, Atmos' total-debt-to-total-capitalization ratio was 61%.

In addition, nonregulated marketing company, AEM, has a $250 million uncommitted demand working-capital credit facility that expires in March, 2006. The size of this facility was increased to $580 million in November 2005. AEM is the borrower under this credit facility and Atmos Energy Holdings, Atmos' nonutility subsidiary, is the sole guarantor of the facility. Atmos also has an unsecured short-term uncommitted bank credit line for $25 million. While there were no borrowings under either of the two uncommitted credit facilities as of Sept. 30, 2005, Atmos' LOCs and various financial covenants reduced the amount available to about $131 million.

AEM is required by the financial covenants in its uncommitted demand working capital facility to maintain a maximum ratio of total liabilities to tangible net worth of 5 to 1, along with minimum levels of net working capital ranging from $20 million to $50 million. At September 30, 2005, AEM's ratio of total liabilities to tangible net worth was 2.18 to 1. In addition, AEM's credit agreement contains a cross-default provision whereby AEM would be in default if it defaults on other indebtedness, as defined, by at least $250 thousand in the aggregate. Additionally, this agreement contains a provision that would limit the amount of credit available if Atmos were downgraded below BBB.

Capital expenditures were approximately $330 million for the fiscal year ended Sept 30, 2005. Standard & Poor's expects capital expenditures for fiscal 2006 at about $400 million to $415 million, 70% of this capital should be internally funded. About $224 million is for maintenance capital. Atmos forecasts meeting the shortfall through company stock plans and potentially, equity offerings. These expenditures include additional mains, services, meters, and equipment. Debt maturities are minimal with only about $6 million due in 2006 and 2007 combined.

Outlook

The outlook on Atmos is stable. FFO to debt, FFO interest coverage, and debt to capital are in line with the current rating. Standard & Poor's could raise the rating over time if Atmos improves its financial condition. Conversely, the ratings could be lowered if expected free cash flow from the combined company is insufficient to significantly reduce leverage or management experiences significant operational difficulties that cause credit measures to deteriorate.

Business Description

Atmos Energy Corporation, (AEC), headquartered in Dallas, Texas, is engaged primarily in the natural gas utility business as well as other natural gas nonutility businesses. Atmos local distribution company (LDC) utility businesses made up about 68% of operating income in fiscal 2005. Atmos is one of the country's largest natural-gas-only distributors based on number of customers and one of the largest intrastate pipeline operators in Texas based upon miles of pipe. Atmos' service territory includes 12 states, with primary service areas located in Colorado, Kansas, Kentucky, Louisiana, Mississippi, Tennessee and Texas. Atmos has more limited service areas in Georgia, Illinois, Iowa, Missouri and Virginia. In addition, Atmos transports natural gas for others through its distribution system. Pipeline and storage accounted for 20% of operating income in 2005. Through its unregulated businesses, Atmos provides natural gas management and marketing services to municipalities, local gas distribution companies and industrial customers in 22 states and natural gas transportation and storage services to certain utility divisions and to third parties. Atmos nonregulated businesses made up about 12% of operating income in fiscal 2005.

Ratings Methodology

Atmos' first mortgage bonds are rated two notches higher than the firm's corporate credit rating. These bonds are collateralized by utility property and Standard & Poor's concludes that first mortgage bondholders would receive their principal in a bankruptcy scenario. The company's senior unsecured debt is rated the same as the corporate credit rating because these bondholders are not materially disadvantaged by the $10 million in outstanding first mortgage bonds.

Business Profile
Regulation

Atmos' operates in 12 different jurisdictions, which gives the company some regulatory diversity. Regulatory diversity can be a moderating factor against adverse rate outcomes or a time lag within a particular jurisdiction. In general, Atmos has average relationships with its regulators. Some jurisdictions are more supportive to credit, as evidenced by timely rate recovery, weather normalization clauses and minimal prudence review. Atmos is attempting to improve its relationships with the regulators of its largest division, Mid-Tex, which suffered from sub-par regulatory relations prior to the acquisition in

2004. Atmos' rate strategy focuses on addressing rate design and regulatory lag issues. Atmos seeks rate designs that decouple the recovery of approved margins from customer usage patterns due to weather related variability, declining use per customer and energy conservation. Rates established by regulatory authorities are adjusted for increases and decreases in purchased gas cost through purchased gas adjustment mechanisms. Although substantially all utility sales fluctuate with the cost of gas, utility gross profit is generally not affected by fluctuations in the cost of gas due to the purchased gas adjustment mechanism. Additionally, certain jurisdictions have introduced performance-based ratemaking adjustments to provide incentives to natural gas utilities to minimize purchased gas costs through improved storage management and use of financial hedges to lock in gas costs. Under the performance-based ratemaking adjustment, purchased gas costs savings are shared between the utility and its customers.

The effect of weather that is above or below normal is partially offset through weather normalization adjustments (WNA) as approved by the regulators in certain service areas. WNA allows Atmos to increase customers' bills to offset lower gas usage when weather is warmer than normal and decrease customers' bills to offset higher gas usage when weather is colder than normal. As of September 30, 2005 Atmos had WNA for approximately 1.0 million meters. However, Atmos' largest division, Mid-Tex, does not have WNA. Yet, their operations benefit from a rate structure that combines a monthly customer charge with a declining block rate schedule to partially mitigate the impact of warmer-than-normal weather on revenue. The combination of the monthly customer charge and the customer billing under the first block of the declining block rate schedule provides for the recovery of most fixed costs for such operations under a variety of weather conditions. However, this rate structure is not as beneficial during periods where weather is significantly warmer than normal

Atmos attempts to address regulatory lag issues by directing discretionary capital spending to jurisdictions that permit more timely recovery and filing rate cases on a more frequent basis to keep actual returns more closely aligned with allowed returns. Net annual revenue increases resulting from ratemaking activity totaling $6.3 million, $16.2 million and $18.6 million became effective in fiscal 2005, 2004 and 2003.

Table 1 – Regulation Summary

Division	Jurisdiction	Last Rate Action	Rate Base ($000)	Authorized ROE (%)	WNA
Atmos Pipeline	Texas	5/24/04	417,111	10.00	N/A
Colorado-Kansas	Colorado	7/1/05	84,711	11.25	No
	Kansas	3/1/04	(1)	(1)	Yes
Kentucky	Kentucky	12/21/99	(1)	(1)	Yes
Louisiana	Trans LA	10/1/04	81,645	10.50-11.50	No
	LGS	10/1/04	170,358	10.88-11.50	No
Mid-States	Georgia	11/25/96	38,451	11.50	Yes
	Illinois	11/1/00	24,564	11.56	No
	Iowa	3/1/01	5,000	11.00	No
	Missouri	10/14/95	(1)	12.15	No
	Tennessee	11/15/95	111,970	(1)	Yes
	Virginia	8/1/04	30,672	9.50-10.50	Yes
Mid-Tex	Texas	5/24/04	769,721	10.00	No
Mississippi	Mississippi	1/1/05	196,801	9.80	Yes
West Texas	Amarillo	9/1/03	36,844	12.00	Yes
	Lubbock	3/1/04	43,400	11.25	Yes
	West Texas	5/1/04	87,500	10.50	Yes.

Some of Atmos' recent material regulatory filings are illustrated below:
Atmos Pipeline-Texas. In December 2004, Atmos Pipeline — Texas made a Gas Reliability Infrastructure Program (GRIP) filing to include in $12.0 million of pipeline capital expenditures made by TXU Gas in rate base, which should increase revenues by $1.8 million. The Railroad Commission of Texas (RRC) approved this filing in March 2005 and the costs are being recovered through a monthly customer charge that began in April 2005. Also, In September, 2005, Atmos Pipeline — Texas made a GRIP filing to include $10.6 million of pipeline capital expenditures in rate base. About $1.9 million in additional annual revenue should be authorized through this filing. A decision on this filing must be made by the RRC before January 4, 2006.

Atmos Energy Mid-Tex Division. In December 2004, the Mid-Tex Division made a GRIP filing to include $32.0 million of distribution capital expenditures made by TXU Gas in rate base, which should result in additional revenues of approximately $6.7 million. These capital costs will be recovered through a monthly customer charge that began in October 2005. Also, in September 2005, the Mid-Tex Division made a GRIP filing to include $29.4 million of distribution capital costs in rate base. About $6.7 million in additional annual revenue should be authorized through this filing. The cities in this division's service area and the RRC must rule on this filing before January 4, 2006. If necessary, the RRC will rule on an appeal of any cities actions in the first quarter of calendar year 2006.

On September 1, 2005, the Mid-Tex Division filed its annual gas cost reconciliation with the RRC. The filing involves approximately $14.0 million in refunds of amounts overcollected from customers between July 1, 2004 and June 30, 2005. The Mid-Tex Division has proposed to accelerate the refunds to December through March rather than during the usual refund period of October through June to help offset higher gas costs for residential, commercial and industrial customers during the 2005 — 2006 heating season. The proposal is still under consideration.

In September 2004, the Mid-Tex Division filed its 36-Month Gas Contract Review with the RRC. This proceeding involves a prudency review of gas purchases totaling $2.2 billion made by the Mid-Tex Division from November 1, 2000 through October 31, 2003. A hearing on this matter was held before the RRC in late June. No decision is expected from the RRC until the end of December 2005 or January 2006.

In August 2005, the company received a "show cause" order from the City of Dallas, which requires it to provide information that demonstrates good cause for showing that the existing distribution rates charged to customers in the city of Dallas should not be reduced. Atmos filed its response by the November 22, 2005 due date.

Atmos Energy West Texas Division. In September 2005, the West Texas Division made a GRIP filing to include $22.6 million of distribution capital costs in rate base, which should result in additional annual revenues of approximately $3.8 million. These capital costs should be recovered through a monthly customer charge beginning in December 2005.

Atmos Energy Mississippi Division. Through the first quarter of fiscal 2005, the Mississippi PSC required that Atmos file for rate adjustments every six months. Rate filings were made in May and November of each year and the rate adjustments typically became effective in the following July and January. Effective October 1, 2005, Atmos rate design was modified to substitute the original agreed-upon benchmark with a sharing mechanism to allow the sharing of cost savings above an allowed return on equity level and the semi-annual filing process was changed to an annual process. Atmos now includes a fixed monthly customer base charge, which makes a portion of its earnings less susceptible to usage. The company will make its first annual filing under this new structure in September 2006.

Atmos filed its second semiannual filing for 2004 in November 2004, requesting rate adjustments of $6.0 million in annualized revenue. The MPSC allowed Atmos to include $3.0 million in annualized revenue in its rates effective January 1, 2005. In February 2005, the company entered into an agreement with the Mississippi Public Utilities Staff that provides for an additional $1.3 million in annualized revenue that was retroactive to January 2005, which was approved by the MPSC during the second quarter of fiscal 2005.

Markets
Although Atmos operates its gas utility business in 12 states, Texas, Mississippi, and Louisiana, made up 74% of 2005 operating margin. The company benefits from some geographic diversity, which mitigates economic downturns in any particular region. Also, as evidenced by the recent Hurricane Katrina disaster in Mississippi and Louisiana, Atmos' regional diversity reduces its exposure to natural disasters within a particular region. Overall the forecast includes growth assumptions of about 1-2% at the LDCs and about 3-4% for the regulated pipeline.

Texas. The diversification of the Texas economy continues with less dependence on energy-related industries; with the shift away from these industries, Texas' economy now resembles the national economy. With a population now estimated at about 23 million, Texas ranks second among states. Officials are projecting labor force and employment to increase by about 2% annually over the next five years. Texas added 299,400 jobs over the 12 months from August 2004-2005. Overall, the services sector accounted for 24% of employment while the trade and manufacturing sectors accounted for 20% and 9%, respectively. Construction activity continues its strong growth at 1.7% over the previous year. Economic forecasts show Texas continuing to outperform the nation over the next few years. The military's strong presence in the state will continue because the latest Base Realignment and Closure Committee recommendations include additional personnel at Fort Bliss in El Paso, Texas and Fort Sam Houston in San Antonio, Texas.

Mississippi. The development of the gaming sector drove solid employment growth from 1992-1998. Unemployment averaged 5.8% in 2004, which was slightly above the nation's 5.5% rate. Between 1995 and 2002, service sector employment had increased by 14% to 31% of total employment. Service employment grew by an average of 8.0% annually, almost double the nation's 4.2% growth rate, due mostly to casino- and hotel-related employment. Leisure and tourism employment accounted for 123,600 jobs in 2005, or 10.9% of total state employment. Mississippi now has the nation's third-largest gaming industry behind Nevada and New Jersey. Gaming-related activities account for almost 10% of the state's total tax revenues. The industry's future in Mississippi, however, is uncertain due to the extensive damage caused by Hurricane Katrina and competition from other states. During the special session called by Gov. Barbour that began on Sept. 27, the state Legislature adopted legislation that would permit casinos to be built on land. Legislative changes to the current law are likely to influence casino owners deciding whether to rebuild damaged and destroyed gaming facilities.

Spillover effects of the gaming industry have included housing starts and construction employment. Despite the success of gaming in the state, losses in the manufacturing sector have slowed Mississippi's overall economic growth. Between 1995 and 2002, manufacturing employment declined by 18% to nearly 17% of total state employment. The underlying economy remains somewhat weak since Mississippi's educational attainment remains low. At 76% of the national average, the state's per capita income levels are the nation's lowest levels. State officials, however, have made efforts to use some of the gaming receipts to improve the state's educational system and attract new businesses seeking skilled, educated workers.

Louisiana. As a result of Hurricane Katrina, the state experienced significant economic effects. The storm caused unprecedented damage to the state, particularly to its largest city, New Orleans, which remains economically devastated. Reduced economic activity throughout the state and the associated financial pressures are likely to continue over the intermediate term. On a long-term basis, Louisiana will be challenged to rebuild its economy. Most of the state's key industries suffered damage from the storm, including tourism, seafood production, oil and gas, and chemicals. Unknown at this time, and critical to the state's well being, is how quickly, and to what extent, these industries can recover; of more certainty is the oil and gas industry, whose restoration of capacity continues at a rapid pace. Emergency assistance and rebuilding of critical infrastructure is providing an inflow of revenues, and should positively affect the state with some multiplier effect. Furthermore, as residents return to damaged property and begin to rebuild, reconstruction and refurnishing expenditures will provide a further boost, all of which will result in revenues to the state in the form of hotel, sales, and fuel taxes. The federal government has recently enacted several measures aimed at giving the damaged Gulf Coast region's economy a shot in the arm, including federal loan guarantees for economic development. However, while incentives such as these are useful, their affects on the state are not measurable at this time.

Operations

Although Hurricane Katrina significantly affected Atmos' Louisiana operations, it is not expected to have a material affect on Atmos' financial results. The affected customers represent about 7% of total customer base and about 40% of these were restored to service within 3 months. Atmos expects to have restored 70% of the affected customers to service within six months and 90% within a year. Atmos expects about $8 million in lost margin due to Katrina in 2006. Damages to the system should be covered by insurance proceeds. Total Louisiana operations, including those not affected by Katrina contributed about 7% of operating income in 2005. Atmos Mississippi operations (about 5% of operating income) were not significantly affected by Katrina because its service territories are primarily located in northern Mississippi.

Atmos natural gas supply comes from a variety of third party providers and from gas held in storage. The natural gas supply for the upcoming winter heating season will be provided by a variety of suppliers, including independent producers, marketers and pipeline companies, in addition to withdrawals of gas from storage. Additionally, the natural gas supply the Mid-Tex Division includes peaking and spot purchase agreements. Atmos also contracts for storage service in underground storage facilities on interstate pipelines. The peak-day availability of natural gas supply from long-term contracts, short-term contracts and withdrawals from underground storage is about 4.2 Bcf. The peak-day demand for utility operations in fiscal 2005 was on December 23, 2004, when sales to customers reached approximately 3.5 Bcf.

Atmos receives gas deliveries for its utility divisions, except for Mid-Tex, through 37 pipeline transportation companies, both interstate and intrastate. The pipeline transportation agreements are firm and many of them have "pipeline no-notice" storage service which provides for daily balancing between system requirements and nominated flowing supplies. These agreements have been negotiated with the shortest term necessary while still maintaining a right of first refusal. The natural gas supply for Mid-Tex is delivered by Atmos Pipeline — Texas Division, which was formed from the natural gas transmission and storage operations that Atmos acquired in the TXU Gas acquisition.

Atmos conducts is business under seven natural gas utility divisions.

Atmos Energy Mid-Tex Division. This division represents the distribution assets and operations that Atmos acquired from TXU Gas on October 1, 2004 and contributed 24% of operating income in 2005. It includes natural gas distribution operations that operate in the north-central, eastern and western parts of Texas. The Mid-Tex Division purchases, distributes and sells natural gas to approximately 1.5 million residential and business customers in approximately 550 cities and towns, including the 11-county Dallas/ Fort Worth metropolitan area. Under a May 2004 rate filing, this division operates under a system-wide rate structure along with the pipeline operations acquired in the acquisition. The governing body of each municipality has original jurisdiction over all utility rates, operations and services within its city limits, except with respect to sales of natural gas for vehicle fuel and agricultural use. Mid Tex operates under non-exclusive franchises granted by the municipalities it serves, which are subject to renewal from time to time. The RRC has exclusive appellate jurisdiction over all rate and regulatory orders and ordinances of the municipalities and exclusive original jurisdiction over rates and services to customers not located within the limits of a municipality.

At closing of the acquisition, TXU Gas and some of its affiliates entered into transitional services agreements with Atmos to provide call center, meter reading, customer billing, collections, information reporting, software, accounting, treasury, administrative and other services to the Mid-Tex Division. Some of these services were outsourced by TXU Gas to Capgemini Energy L.P. However, Atmos took over the operations of the Waco, Texas call center on April 1, 2005 and purchased from Capgemini Energy L.P. all of the related call center assets on October 1, 2005. The remaining transitional services agreements expired on September 30, 2005 and were not renewed as Atmos in-sourced all of these functions, effective October 1, 2005.

Atmos Energy West Texas Division. This division operates in Texas in three primary service areas: Amarillo, Lubbock and West Texas. The West Texas division contributed 8% of operating income in 2005. Similar to the Mid-Tex Division, the governing body of each municipality served has original jurisdiction over all utility rates, operations and services within its city limits. Atmos operates under non-exclusive franchises granted by the municipalities, which are subject to renewal from time to time. The RRC has exclusive appellate jurisdiction over all rate and regulatory orders and ordinances of the municipalities and exclusive original jurisdiction over rates and services to customers not located within the limits of a municipality. During 2004, the West Texas Division received approval from the City of Lubbock, Texas and the 66 cities in the West Texas system, for WNA in these service areas, which is effective October through May of each year, beginning with the 2004-2005 winter heating season. Atmos also has WNA in its Amarillo service area.

Atmos Energy Mid-States Division. This division operates in Georgia, Illinois, Iowa, Missouri, Tennessee and Virginia. The Mid-States division contributed 10% of operating income in 2005. In each of these states, rates, services and operations as a natural gas distribution company are subject to general regulation by each state's public service commission. Atmos operates in each community under a franchise granted by the municipality for a fixed term of years.

Atmos Energy Louisiana Division. This division operates in Louisiana and includes the operations of the Louisiana Gas Service Company, which serves the metropolitan area of Monroe and the suburban areas of New Orleans, and the Trans La Division, which serves western Louisiana. The Louisiana division contributed 7% of operating income in 2005. The Louisiana Division is regulated by the Louisiana Public Service Commission (LPSC) under a non-exclusive franchise granted by the governing authority of each area.

Atmos Energy Mississippi Division. This division is regulated by the Mississippi Public Service Commission (MPSC) with respect to rates, services and operations and operates under non-exclusive franchises granted by the municipalities served. The Mississippi division contributed 5% of operating income in 2005.

Atmos Energy Colorado-Kansas Division. This division operates in Colorado, Kansas and the southwestern corner of Missouri and is regulated by each respective state's public service commission under non-exclusive franchises granted by the various cities. The Colorado-Kansas division contributed 7% of operating income in 2005.

Atmos Energy Kentucky Division. This division operates in Kentucky and is regulated by the Kentucky Public Service Commission and operates in various incorporated cities under non-exclusive franchises granted by these cities. The Kentucky division contributed 5% of operating income in 2005. Atmos will operate under a performance-based rate program through March 2006.

In addition to its LDC utility divisions, Atmos' pipeline and storage segment consists of the regulated pipeline and storage operations of the Atmos Pipeline — Texas Division and the nonregulated pipeline and storage operations of Atmos Pipeline and Storage, LLC. The natural gas transmission and storage operations that were acquired in the TXU Gas acquisition represent one of the largest intrastate pipeline operations in Texas and provided 20% of operating income in 2005. These operations include interconnected natural gas transmission lines, five underground storage reservoirs (including a salt dome facility) and 24 compressor stations and related properties, all within Texas.

Competitiveness

Although Atmos' utility operations are not in significant direct competition with any other distributors of natural gas to residential and commercial customers within its service areas, they do compete with other natural gas suppliers and suppliers of alternative fuels for sales to industrial and agricultural customers. Atmos also competes with alternative energy sources, including electricity. Electric utilities offer electricity as a rival energy source and compete for the space heating, water heating and cooking markets. Promotional incentives, improved equipment efficiencies and promotional rates all contribute to the acceptability of electrical equipment. The principal means to compete against alternative fuels is lower prices, and natural gas historically has maintained its price advantage in the residential, commercial and industrial markets. However, higher gas prices, coupled with the electric utilities' marketing efforts, have increased competition for residential and commercial customers. In addition, Atmos' natural gas marketing segment competes with other natural gas brokers in obtaining natural gas supplies for its customers.

Deregulated Operations

Atmos deregulated operations provided about 13% of 2005 operating income and are significantly riskier than the regulated LDC and pipeline businesses. The operating margins are more volatile and the collateral requirements can be high. Atmos' natural gas marketing and other nonutility segments are organized under Atmos Energy Holdings, Inc. (AEH) and have operations in 22 states. Atmos Energy Marketing, LLC (AEM) provides a variety of natural gas management services to municipalities, natural gas utility systems and industrial natural gas consumers primarily in the southeastern and midwestern states and to Atmos' Kentucky, Louisiana and Mid-States divisions. These services primarily consist of furnishing natural gas supplies at fixed and market-based prices, contract negotiation and administration, load forecasting, gas storage acquisition and management services, transportation services, peaking sales and balancing services, capacity utilization strategies and gas price management through the use of derivative products. The company uses proprietary and customer-owned transportation and storage assets to provide the various services. As a result, margins are based on Atmos' ability to extract value by optimizing the storage and transportation capacity. The company purchases or sells physical natural gas and then sells or purchases financial contracts at a price sufficient to cover carrying costs and provide a profit margin. AEM's management of natural gas requirements involves the sale of natural gas and the management of storage and transportation supplies under contracts with customers generally having one to two year terms. AEM also sells natural gas to some of its industrial customers on a delivered burner tip basis under contract terms from 30 days to two years. At September 30, 2005, AEM had a total of 558 industrial, 69 municipal and 210 other customers.

Atmos other nonutility segment consists primarily of the operations of Atmos Energy Services, LLC (AES), and Atmos Power Systems, Inc. Through AES, the company provides natural gas management services to its utility operations, other than the Mid-Tex Division. These services, which began on April 1, 2004, include aggregating and purchasing gas supply, arranging transportation and storage logistics and ultimately delivering the gas to the utility service areas. Atmos Power Systems, Inc., constructs gas-fired electric peaking power-generating plants and associated facilities and enters into agreements to either lease or sell these plants.

Financial Profile

Accounting

Standard & Poor's calculates an off-balance-sheet (OBS) amount for debt, interest expense, and depreciation and includes these amounts in the calculation of its adjusted ratios. The present value of the company's operating leases is determined using the average cost of debt as a discount rate and is treated as a debt equivalent. Operating lease interest expense is also computed in credit metrics. The amounts included in Atmos' adjusted ratios for fiscal year end 2005 were $100 million for OBS debt and $6.6 million for OBS interest. Pensions and other post-retirement benefits were under funded by about $62 million at fiscal year end (on a projected benefit obligation basis), however OBS ratio adjustments due to this under funding was not material to the rating.

AEM is exposed to risks associated with changes in the market price of natural gas, which are managed through a combination of storage and financial derivatives, including futures, over-the-counter and exchange-traded options and swap contracts with counterparties. Under SFAS 133, natural gas inventory is the hedged item in a fair-value hedge and is marked to market monthly using the inside FERC (iFERC) price at the end of each month. Changes in fair value are recognized as unrealized gains and losses in the period of change. Costs to store the gas are recognized in the period the costs are incurred. Derivatives associated with natural gas inventory are marked to market each month based upon the NYMEX price with changes in fair value recognized as unrealized gains and losses in the period of change. The difference in the indices used to mark to market physical inventory (iFERC) and the related fair-value hedge (NYMEX) is reported as a component of revenue and can result in volatility in reported net income. Over time, gains and losses on the sale of storage gas inventory should be offset by gains and losses on the fair-value hedges, resulting in the realization of the economic gross profit margin anticipated at the time the original transaction was structured.

Effective April 1, 2004, Atmos began treating its fixed-price forward contracts as normal purchases and sales. As a result, the company ceased marking the fixed-price forward contracts to market. The offsetting derivative contracts are designated as cash flow hedges of anticipated transactions. As a result of this change, unrealized gains and losses on these open derivative contracts are now recorded as a component of accumulated other comprehensive income and are recognized in earnings as a component of revenue when the hedged volumes are sold. Hedge ineffectiveness, to the extent incurred, is reported as a component of revenue.

Financial Policy & Risk Tolerance

Atmos' financial policy is characterized by projected improvement in the financial ratios over the forecast period. The ratios for 2005 are on the weak side, but consistent with the current rating. However, the ratios are expected to improve as Atmos grows its equity base through capital projects, while maintaining debt at current levels. Atmos' stated strategy is to maintain investment grade ratings and improve its credit rating over time. No new large acquisitions are expected in the near term.

Cash Flow Adequacy

Cash flow protection measures at Atmos are adequate for the rating, but are expected to improve, especially over the near term. Improvements are primarily due to the implementation of new rate agreements and the addition of regulated capital projects into ratebase. Average adjusted FFO to interest coverage was solid at 3.2x for fiscal 2005, and is projected to average about 3.6x in 2006-2010. Adjusted FFO to total debt was weak for the rating at 14% in 2005, but is expected to improve to about 16% over the next two years. Capital expenditures were approximately $330 million for the fiscal year ended Sept 30, 2005. Standard & Poor's expects capital expenditures for fiscal 2006 at about $400 million to $415 million, 70% of this capital should be internally funded. About $224 million is for maintenance capital. Atmos forecasts meeting the shortfall through company stock plans and potentially, equity offerings. These expenditures include additional mains, services, meters, and equipment. Debt maturities are minimal with only about $6 million due in 2006 and 2007 combined.

Capital Structure

Adjusted total debt to total capital was high for the rating category at 60% at fiscal year-end 2005. The adjustment includes the capitalization of operating leases. Standard & Poor's expects the average total debt to total capital ratio to improve to about 57% by 2008, which would be in line with the current rating. The change in capital structure should be achieved through level debt amounts and higher level of equity through capital additions.

Press Release Source: Fitch Ratings

Fitch Affirms Atmos Unsecured Debt at 'BBB+'

Friday January 13, 11:49 am ET

Outlook Stable

NEW YORK--(BUSINESS WIRE)--Jan. 13, 2006--Atmos Energy Corp.'s (Atmos) senior unsecured debt rating applying to approximately $2.17 billion of outstanding notes and debentures is affirmed at 'BBB+'. In addition, Atmos' short-term debt rating relating to its $600 million commercial paper program is affirmed at 'F2'. Atmos' issuer default rating (IDR) has been lowered to 'BBB' from 'BBB+'. IDRs were initially assigned to corporate issuers by Fitch during 2005 and reflect the ability of issuers to meet financial commitments on a timely basis, compared with individual security ratings which also consider recovery prospects and may be higher or lower than an issuer's IDR.

The Rating Outlook for Atmos is revised to Stable from Negative. Fitch also withdraws at this time the 'BBB+' indicative rating assigned to Atmos' secured debt given the relative immateriality of the debt. Only $10 million principal amount of private secured debt remains outstanding and no future secured debt financings are anticipated.

The rating actions follow a comprehensive review of Atmos' financial condition and a reassessment of its ratings utilizing Fitch's new IDR methodology. The one-notch separation between the 'BBB' IDR and the 'BBB+' senior unsecured debt is typical for low risk, predominantly regulated entities.

Current ratings recognize the increased debt leverage that Atmos incurred with the TXU Gas purchase and Fitch's expectation that leverage-related credit measures will be weak for the rating category over the near term. In this regard, the recovery in credit measures is now expected to be slower that originally anticipated due to an increase of growth capital expenditures. Debt-to-EBITDA was 4.4 times (x) at the end of fiscal 2005 but should improve to the 4.0x to 3.5x range as pipeline expansion projects are completed and regulatory filings are made to capture incremental cash flows. Given steadily increasing cash flow from operations and the ongoing issuance of new equity through direct purchase and internal stock issue plans, Atmos should be positioned to finance its growth initiatives with minimal need to access debt capital markets.

Atmos' ratings and Rating Outlook are supported by the scale, quality, and geographic and regulatory diversity of its operations. Fitch also favorably recognizes Atmos' 20-year track record in acquiring and managing regulatory assets. Most notably, Atmos has fully integrated ahead of target the TXU Gas Company assets it acquired on Oct. 1, 2004 in a transaction that nearly doubled the size of the company. The ratings also consider Atmos efficient operations and effective practices in dealing with regulators across its multi-state service territory. In particular, management has been diligent in reducing regulatory lag with timely rate filings and in limiting earnings volatility by adopting weather normalization provisions and implementing rate design changes. Also, considered in the ratings and of moderate concern is the higher level of business risk associated with its unregulated activities. For fiscal 2005, unregulated operations generated 13% of operating income. A material increase in the relative size of the unregulated operations could contribute to a negative rating action.

Atmos is the largest natural-gas-only utility in the U.S. serving over 3.1 million customers in 12 states across the South and Midwest. Utility operations were built through a series of acquisitions over the past 20 years. The $1.905 billion purchase of TXU Gas nearly doubled the size of the company and resulted in a rating downgrade reflecting a weakened post-acquisition credit profile and near term integration risk. On balance, Fitch considers the TXU Gas distribution operations, which primarily serve the Dallas-Fort Worth area and its 6,800-mile Texas intrastate pipeline and storage system, as a good fit with Atmos' other operations. Atmos Energy Holdings, Inc., through Atmos Energy Marketing, LLC and other subsidiaries, provides gas supply management, marketing, and pipeline and storage services for a range of customers, including, municipals, industrials, power generators, gas utilities, and utility affiliates of Atmos.

Fitch's rating definitions and the terms of use of such ratings are available on the agency's public site, www.fitchratings.com. Published ratings, criteria and methodologies are available from this site, at all times. Fitch's code of conduct, confidentiality, conflicts of interest, affiliate firewall, compliance and other relevant policies and procedures are also available from the 'Code of Conduct' section of this site.

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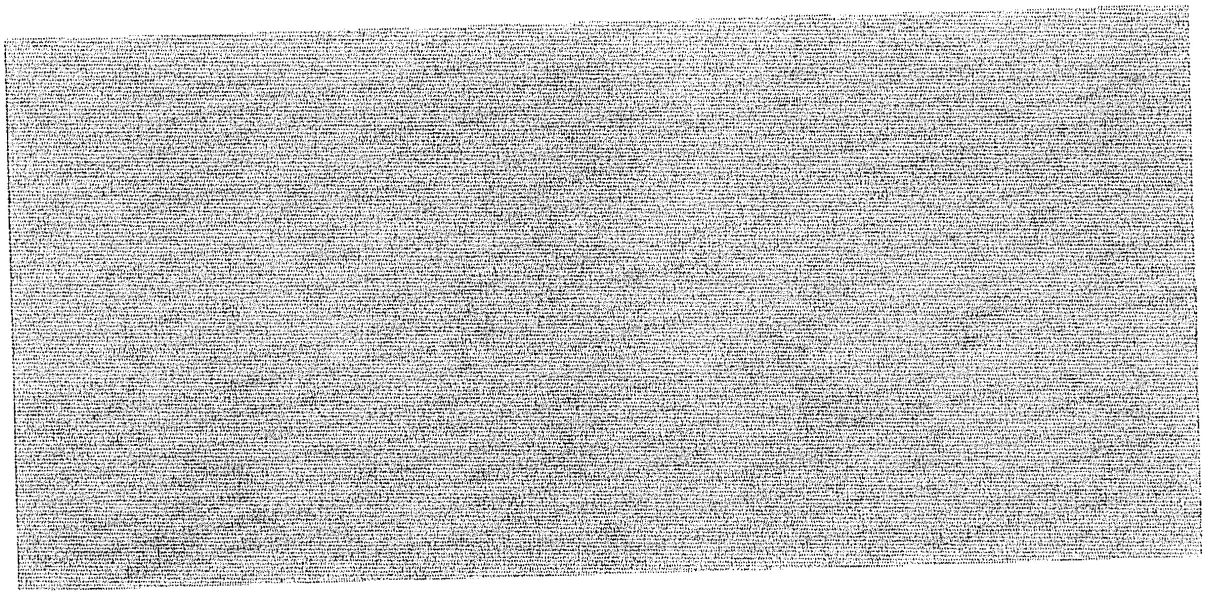
Source: Fitch Ratings

Global Credit Research
Credit Opinion
22 MAR 2006

Credit Opinion: Atmos Energy Corporation

Atmos Energy Corporation



Dallas, Texas, United States

Ratings

Category	Moody's Rating
Outlook	Stable
Senior Unsecured	Baa3
Bkd Commercial Paper	P-3

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Key Indicators

Atmos Energy Corporation	9/30/2005	9/30/2004	9/30/2003	9/30/2002	9/30/2001	9/30/2000
Net Income to Average Common Equity	9.9%	8.7%	10.0%	10.3%	11.5%	9.3%
Fixed Charge Coverage	2.59	2.88	2.86	2.55	2.70	1.89
Retained Cash Flow to Adjusted Debt	10.0%	15.7%	15.2%	10.7%	11.8%	11.3%
Adjusted Debt to Adjusted Capital [1]	68%	45%	57%	63%	59%	57%
Funds from Operations to Fixed Charges	3.5	4.1	4.2	3.3	4.2	3.5
Dividends/Net Income	73%	77%	77%	82%	79%	100%

[1] Adjusted capital includes: + deferred taxes - goodwill

Note: For definitions of Moody's most common ratio terms please see the accompanying User's Guide.

Opinion

Credit Challenges

- Slower de-leveraging likely in the near term than previously expected

- Regulatory risk in efforts to mitigate regulatory lag, weather risk, and volume sensitivity

- Commodity price, counterparty, and liquidity risks related to its energy marketing business

Credit Strengths

- Stability of cash flow, predominantly generated by regulated assets

- Record of operating efficiently

- Conservative management

Rating Rationale

Atmos Energy Corporation's ratings reflect the company's the low-risk, non-cyclical earnings from its gas utility and pipeline operations (about 90% of EBIT and assets) and a good record of operating efficiently and integrating acquired assets. Although Atmos's results are seasonal and vary with the weather, this risk is allayed by having some form of weather mitigation in most of its jurisdictions, whether with weather normalization adjustments or rate structures that are based more on recovery of fixed costs than on volume.

The debt incurred in the TXU Gas acquisition (now known as the Mid-Tex division) at the beginning of FY05 has resulted in Atmos's leverage being high relative to its peers'. Atmos has successfully completed the integration of Mid-Tex's operations and realized cost savings in line with its original plan. However, it now expects that debt reduction will take longer than expected while it applies its free cash flow toward pipeline growth projects rather than debt reduction. The company intends to meet its book leverage target of 50% - 55% over the next 3 to 5 years. It intends not to make a significant leveraged acquisition until it reaches that target.

Regulatory lag is a persistent issue that Atmos needs to continually address. The company also suffered damage by hurricane Katrina, though future impacts appear manageable. Atmos Energy Marketing (AEM), the marketing subsidiary, is the riskiest element of the company. AEM is exposed to commodity price, counterparty, and other risks, and it is difficult to predict its financial results with accuracy. It also places a demand on working capital, which has increased recently because of higher gas prices.

Rating Outlook

The stable outlook for Atmos reflects the expectation that its debt will not likely be reduced in the near term because of its increased capital budget. Credit metrics incorporated into its ratings include retained cash flow-to-debt at around 10% and leverage in the high 60% range, adjusted for leases and goodwill.

What Could Change the Rating - UP

Atmos intends to de-leverage over the next 3-5 years. Moody's could consider a positive outlook when the company's modest credit metrics begin to improve from executing on its pipeline projects, obtaining rate recovery and margin stabilization (most importantly in Texas), and containing margin loss from the hurricane at around budgeted levels. Credit metrics that would cause us to consider an upgrade include retained cash flow-to-debt in the low teens, adjusted leverage trending toward the low-60% range, and ROE on a GAAP basis above 9%. Any positive rating action would be conditioned on our comfort with the potential risks posed by AEM, including its liquidity resources particularly in this time of volatile gas prices. The uncommitted nature of AEM's large working capital facility is a rating restraint.

What Could Change the Rating - DOWN

Unlikely, given the low business risk of Atmos's asset base and its stated commitment to remain investment grade.

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STANDARD & POOR'S RATINGSDIRECT

RESEARCH

Summary: Atmos Energy Corp.

Publication date: 09-Jun-2006
Primary Credit Analyst: Jeffrey Wolinsky, CFA, New York (1) 212-438-2117; jeffrey_wolinsky@standardandpoors.com

Credit Rating: BBB/Stable/A-2

Rationale

The ratings on natural gas distributor Atmos Energy Corp. reflect the company's strong business profile of '4' (business profiles are categorized from '1' (excellent) to '10' (vulnerable)), its current market position as the largest natural gas local distribution company in the U.S., and its reasonably stable revenues and customer base from its gas distribution operations and geographic and regulatory diversity. These factors are offset by integration challenges associated with its TXU Gas acquisition, weak credit measures, and exposure to weather-related risk. Dallas, Texas-based Atmos has about $2.4 billion of debt.

The acquisition of TXU Gas in late 2004 effectively doubled Atmos' size, making it the largest local gas distribution company (LDC) in the U.S. After the acquisition, Atmos increased the number of customers served in 12 states to 3.2 million. Standard & Poor's continues to be concerned about the integration challenges facing Atmos after the acquisition and will monitor the company's operational performance as it transitions to a much larger LDC.

These challenges include managing new business segments such as TXU Gas' pipeline assets, improving TXU Gas' historically subpar regulatory relationships, and integrating TXU Gas' operations with Atmos' operations. With the acquisition of TXU Gas, about 60% of Atmos' customer base is not covered by weather-normalization clauses or weather insurance. However, management achieved considerable cost savings through overhead reduction in 2005. In addition, Standard & Poor's is concerned with the business risk associated with Atmos' nonregulated marketing company, Atmos Energy Marketing (AEM).

However, by acquiring TXU Gas, Atmos increased its operating income from regulated operations to about 81% from 75% of total operating income. The company derives some modest benefit from the geographic and regulatory diversity of its operations, which are spread over 12 states, mitigating adverse conditions relating to regulatory or economic circumstances. Atmos has worked toward easing the effects of weather and protecting utility margins by adding weather-normalization adjustments to several rate filings and hopes to achieve weather normalization in TXU Gas' operating area over time.

Atmos' financial strength will depend in part on management's ability to continue to realize cost savings and improve TXU Gas' profitability over the next several years. In the near term, however, credit measures are weaker following the acquisition. The debt financing constrains cash measures, with funds from operations (FFO) to average total debt at 15% and FFO interest coverage at 3.4x for the 12 months ended March 31, 2006. Furthermore, the company's adjusted debt leverage was 60%.

Short-term credit factors

The short-term rating on Atmos is 'A-2'. For the 12 months ended March 31, 2006, Atmos generated funds from operations of about $371 million. Atmos working capital needs can vary significantly due to changes in the price of natural gas charged by suppliers and the increased gas supplies required to meet customers' needs during periods of cold weather. Atmos has reacted to the recent increase in natural gas prices by increasing the size of its credit facilities.

As of March 31, 2006, Atmos had about $48 million of cash on hand and three committed credit facilities totaling $918 million. The $918 million amount consists of a $600 million facility that backstops Atmos' commercial paper program and matures in October 2008, a $300 million committed facility that matures November 2006, and an $18 million committed facility that expires on March 31, 2007. As of March 31, 2006, there was $262.3 million outstanding under Atmos' commercial paper program, leaving $655.7 million of availability under the three facilities. The financial covenants in the revolving credit facilities require Atmos to maintain a ratio of total debt to total capitalization of no greater than 70%. As of March 31, 2006, Atmos' total debt to total capitalization ratio was 62%.

In addition, nonregulated marketing company, AEM, has a $580 million uncommitted demand working-capital credit facility that expires March 31, 2007. AEM is the borrower under this credit facility and Atmos Energy Holdings, Atmos' nonutility subsidiary, is the sole guarantor of the facility. As of March 31, 2006, no borrowings were outstanding under this facility, but Atmos' LOCs and various financial covenants reduced the amount available to about $174.2 million. Atmos also has an unsecured short-term uncommitted bank credit line for $25 million and LOCs reduced the amount available by $4.5 million.

AEM is required by the financial covenants in its uncommitted demand working capital facility to maintain a maximum ratio of total liabilities to tangible net worth of 5x, along with minimum levels of net working capital ranging from $20 million to $120 million. As of March 31, 2006, AEM's ratio of total liabilities to tangible net worth was 1.21x. In addition, AEM's credit agreement contains a cross-default provision whereby AEM would be in default if it defaults on other debt, as defined by at least $250,000 in aggregate. In addition, this agreement contains a provision that would limit the amount of credit available if Atmos were downgraded below 'BBB'.

Atmos had about $400 million in capital expenditures for the 12 months ended March 31, 2006. Standard & Poor's expects capital expenditures for fiscal 2006 to be about $400 million to $415 million, and 70% of this should be internally funded. About $224 million is for maintenance capital. Atmos forecasts meeting the shortfall through company stock plans and, potentially, equity offerings. These expenditures include additional mains, services, meters, and equipment. Debt maturities are minimal with only about $6 million due in 2006 and 2007 combined.

Outlook

The outlook on Atmos is stable. FFO to debt, FFO interest coverage, and debt to capital are in line with the current rating. Standard & Poor's could raise the rating over time if Atmos improves its financial condition. Conversely, the ratings could be lowered if expected free cash flow from the combined company is insufficient to significantly reduce leverage or management experiences significant operational difficulties that cause credit measures to deteriorate.

Atmos Energy CorporationGlobal Credit Research
Liquidity Risk Assessment
12 FEB 2007

Liquidity Risk Assessment: Atmos Energy Corporation

Atmos Energy Corporation

Dallas, Texas, United States
Broad Industry:Public Utility
Specific Industry:Gas Distribution
Short Term Rating:P-3 (Backed)

Contacts

AnalystPhone
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John Diaz/New York

Opinion

Atmos Energy Corporation (AEC) is a utility parent company with divisions engaged in regulated gas distribution and transmission (Utility). AEC has an intermediate holding company Atmos Energy Holdings, Inc. (AEH), which holds non-utility subsidiaries including Atmos Energy Marketing, LLC (AEM), a gas marketing subsidiary. Atmos maintains separate liquidity facilities for AEC, AEH, and AEM in order to avoid commingling the financing activities of the utility and non-utility businesses and to comply with regulatory restrictions.
The company has acceptable liquidity to cover its operating requirements and to meet unexpected payments. AEC's Prime-3 commercial paper rating reflects the stable financial profile of its substantially regulated assets. The company has the potential to generate free cash flow, though that is not expected in the near term. AEC has a high-quality credit facility that should be sufficient to meet the foreseeable needs of its Utility. However, Moody's considers the lack of committed facilities for AEM as a weakness in its alternate liquidity and a rating restraint for AEC. Seasonality and gas supply costs add an element of unpredictability to Atmos's internal cash sources and working capital needs. Borrowings typically peak at about January at the peak of the heating season. Peak commercial paper borrowing during the last twelve months ending September 30, 2006 was $479 million, which was within AEC's commercial paper program of $600 million. The average commercial paper borrowing for the same time period was $206 MM. The $600 million commercial paper program is backed by a $600 million 5-year facility terminating in December 2011. This 5-year facility replaces the $600 million 3-year committed credit facility entered into in October 2005. AEC also renewed its $300 million 364-day facility, which will terminate in November 2008. AEC will only utilize the 364-day facility if the capacity on the 5-year facility is reached. Both renewed facilities have substantially similar terms to the respective prior facilities except for the maturity date. The terms of the facilities provide high-quality liquidity insurance, including no requirement to represent and warrant on the MAC clause after closing. The sole financial covenant is maximum

leverage of 70%. AEC is well in compliance with that calculation in the low 60% range as of fiscal year-end September 2006. AEC also has a committed $18 million 364-day revolving credit facility with a local bank that is used for general corporate purposes. Moody's does not consider AEC's $25 million uncommitted line to be a reliable source of liquidity.
AEM relies on an uncommitted $580 million demand working capital facility that is unconditionally guaranteed by AEH. Moody's ascribes no "liquidity insurance" value to this line, as any draw on it is payable on demand by the issuing bank. Liquidity support for AEM from AEC is limited by regulators to $100 million from the inter-company uncommitted demand facility between AEC and AEH. Regulators recently approved an increase in the total amount of the facility between AEC and AEH to $200 million.
AEC's next long-term debt maturity is on October 15, 2007, when $300 million of senior notes come due. Other maturing debt obligations coming due over the next 3 fiscal years include $4 MM, $2 MM and $401 MM in 2008, 2009, and 2010, respectively. Additionally, capital expenditures for fiscal 2007 are projected to be approximately $434 million.

made by or on behalf of any user of the information contained herein, and each such user must accordingly make its own study and evaluation of each security and of each issuer and guarantor of, and each provider of credit support for, each security that it may consider purchasing, holding or selling.

MOODY'S hereby discloses that most issuers of debt securities (including corporate and municipal bonds, debentures, notes and commercial paper) and preferred stock rated by MOODY'S have, prior to assignment of any rating, agreed to pay to MOODY'S for appraisal and rating services rendered by it fees ranging from $1,500 to approximately $2,400,000. Moody's Corporation (MCO) and its wholly-owned credit rating agency subsidiary, Moody's Investors Service (MIS), also maintain policies and procedures to address the independence of MIS's ratings and rating processes. Information regarding certain affiliations that may exist between directors of MCO and rated entities, and between entities who hold ratings from MIS and have also publicly reported to the SEC an ownership interest in MCO of more than 5%, is posted annually on Moody's website at www.moodys.com under the heading "Shareholder Relations - Corporate Governance - Director and Shareholder Affiliation Policy."

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 211
Witness: Don Murry

Data Request:

Please provide a list of the publications of Donald Murray.

Response:

Dr. Murry does not maintain a complete file of all presentations, reports and non-refereed publications. Please see the attached representative list of Dr. Murry's Academic and Professional Publications.

DONALD A. MURRY, Ph.D.
A LIST OF ACADEMIC AND PROFESSIONAL PUBLICATIONS

"An Empirical Analysis of Market Power in the U. S. Natural Gas Market," *The Energy Journal*, With Zhen Zhu, Ph.D. (forthcoming)

"An Empirical Analysis of Market Power in the U. S. Natural Gas Market," 24th USAEE/IAEE North American Conference, July, 2004, with Zhen Zhu.

"EnronOnline and Informational Efficiency in the U. S. Natural Gas Market," *The Energy Journal,* Vol. 25, No. 2. with Zhen Zhu.

"The Potential Impact of The 'Standardized Market Design' on Oklahoma's Electric Power Infrastructure." State Policy & Economic Development in Oklahoma: 2003, 2003, pp 81-87.

"EnronOnline and Efficiency In the U. S. Natural Gas Market." Presented at the Meeting of the International Association of Energy Economists, October 7-8, 2002. With Zhen Zhu, Ph.D.

"Cascading Caution: *California Crisis Delays Deregulation."* Public Utilities Fortnightly, September 1, 2001.With Jeremy D. Oller, J.D.

"Electric Energy Deregulation Experiences and Some Lessons for Oklahoma." State Policy & Economic Development: 2001, Oklahoma city, pp. 81-94, for Oklahoma 21st Century, Inc. Presented to Economics Roundtable, Rose State College, November 7, 2001.

"The Economic Impact of Open Access and Unbundling in The Gas Distribution Sector." A Presentation to the Oklahoma Gas Association Annual Conference, September 30, 1997.

"A Definition of The Gross Domestic Product-Electrification Interrelationship." The Journal of Energy and Development, Vol. 19, No.2 1996 by the International Research Center for Energy and Economic Development. With Gehaung David Nan, Ph.D.

"Gas and Electric Deregulation and Economic Development Effects in Oklahoma." State Policy & Economic Development in Oklahoma. Pages 61-69. 1996.

"Emerging Issues in Public Service Property Taxation in Oklahoma." Oklahoma 2000, Inc., with Alexander Holmes, Kent Olson and Larkin Warner. 1995.

"Market Forces, LDC Deregulation and The Efficiency/Equity Tradeoff." Presented: The Oklahoma Corporation Commission Symposium on Restructuring the Oklahoma Energy Utility Industry, Oklahoma City, OK, October 17, 1995.

"Rural Electric Power Requirements Forecasts: Detecting and Correcting for Weaknesses and Bias." Management Quarterly. With Gehuang David Nan, Ph.D. and Bryan Harrington. Fall 1993.

"Utility Allowed Returns and Market Extremes." Public Utilities Fortnightly, March 1, 1993. With Gehuang David Nan and Bryan M. Harrington.

"The Clean Air Act: Emissions Trading and Regulated Markets." The Economics Committee, Edison Electric Institute, Chicago, IL., June 4, 1992.

"Energy Demand with the Flexible Double-Logarithmic Functional Form." The Energy Journal, 1992, Vol. 13 No. 4, pp. 149-159. With Gehuang David Nan.
"The Energy Consumption and Employment Relationship: A Clarification." The Journal of Energy and Development 1992, Vol. 16 No. 1, pp. 121-131. With Gehuang David Nan.

"An R&D Policy for Regulated Natural Gas and Electric Utilities," Public Utilities Fortnightly, Vol. 127 No. 4 Feb 15, 1991. With Barnet Groten and Jack Chambless.

"A Strategy for Negotiating End-Use Gas Contracts," Engineering & Operations Workshop, American Public Power Association, Orlando, Florida, Feb. 27, 1991.

"Energy Demand in the Northeastern U.S.," in Energy Development in the 1990's: Challenges Facing Global/Pacific Markets, ed. by F. Fesharaki and J. P. Dorian, Honolulu, HI, 1991, (With Gehuang David Nan).

"Energy Demand and Electricity Sales Surtaxes: California Case," Western Economics Association, Seattle, WA, 1991. (With Gehuang David Nan).

"The Market for Oil and Gas Assets Defined in Survey," The Oil and Gas Journal, Nov. 18, 1991, pp. 62-66. (With D. Lynn Taggart).

"Energy Demand: A Utility Approach with Alternative Functional Forms," North American Conference, International Association of Energy Economists, Chicago, IL, Nov. 1991. In Energy Disruptions: Lessons, Opportunities and Prospects, (With Gehuang David Nan).

"A Method for Forecasting Electric Load Curves." NRECA Accounting and Finance Conference, Orlando, Florida, August 28, 1989.

"Do Natural Gas Sales Enhance Market Efficiency," The Institute for the Study of Regulation, 1985, (Proceedings).

"Regulatory Impediments to Expanding End-Use Natural Gas Markets," Issues Involving Natural Gas Law Conference, Oklahoma City University, 1985.

"End-Use Natural Gas Markets." Gas Distributors Information Service Roundtable Symposium on Risks and Opportunities Facing Distribution Companies Under Order No. 436, Washington, DC, December 13, 1985.

"Economic and Financial Analysis." 1983 Kansas REC Accountants Meeting, Wichita, KS, October 13, 1983.

"Analyzing the Impact of Ratemaking Policies in a Changing Market for Electricity," Joint Meeting of the Canadian Electrical Rate and Load Studies Section and The American Public Power Section Rate and Load Research Committee, Calgary, Alberta, Canada, 1981.

"An Economic Model of the Intrastate Natural Gas Market in Oklahoma," (Coauthor) AUBER Energy Workshop, 1978, Proceedings. Published in Regional Supply and Demand of Coal and Petroleum for Energy Production, 1979.

"Consumer Perceptions and Acceptance of Nontraditional Electric Rates," Western Economic

Association, 1979, (Coauthor).

"A Benefit - Cost Analysis of the Impact Upon an Existing Utility of a Solar Electric Experimental Plant," International Solar Energy Society Conference, May 1979, Proceedings.

"Some Perspectives for Weather Information Use in Changing Utility Forecasting Environment," Impact of Climate: Economic Modeling Workshop, 1979.

"An Analysis of the Redistributive Effects of Alternative Lifeline Rate Structures," Southern Economic Association, 1978.

"Migration Into Oklahoma: Who is Coming and What Does It Mean?" (Coauthor) Review of Regional Economics and Business, October, 1977, pp. 3-9.

"Rate of Return Regulation under Demand Uncertainty: Comment," Missouri Valley Economic Association, 1976. (Proceedings).

"The Impact of Solar Central Electric Technology on the Regulated Utility," UMR-MEC Conference on Energy, University of Missouri at Rolla, October, 1976. (Proceedings).

"The Pragmatic Difficulties of Applying Marginal Cost Principles in Regulation: The Case of LNG and SNG," in Proceedings of the Symposium on Rate Design Problems of Regulated Industries, University of Missouri Press, 1975, pp. 147-156.

The Rate Base as a Factor in Electric Utility Rate Making: A Comment," The Southwestern Economic Association, 1974.

"Practical Economics of Public Utility Regulation: An Application to Pipelines," at the Conference on Current Issues in Public Utility Management and Regulation, 1971, published in Milton Russell, ed., Perspectives in Public Regulation, Southern Illinois University Press, 1973.

"A Technique for Evaluating Residential Gas Demand Using Census Data." The Regulatory Information Systems Conference, 1973. (Proceedings).

"The Effects of the 'Energy Crisis' Upon Regulation and Some Alternatives," The Mid-Continent Research & Development Council, 1972. (Proceedings).

"Allocating Natural Gas To Environmentally Valuable End-Users," at the Conference on Social Sciences Research and the Environment, 1972. (Proceedings).

"The Investor Capitalization Theory of the Cost of Equity Capital: A Comment," (Coauthor) Land Economics, May, 1972.

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 212
Witness: Don Murry

Data Request:

With respect to page 9, lines 14-21, please provide a copy of the current Blue Chip Financial Forecasts.

Response:

Please reference AG DR1-212 ATT1 attached to this response.

Consensus Forecasts Of U.S. Interest Rates And Key Assumptions[1]

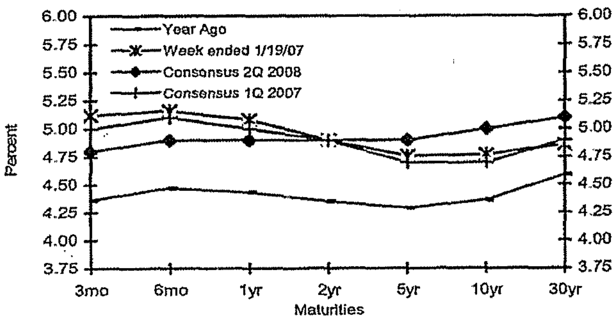
	History								Consensus Forecasts-Quarterly Avg.					
	Average For Week Ending				Average For Month			Latest Q						
Interest Rates	Jan.19	Jan.12	Jan.5	Dec.29	Dec.	Nov.	Oct.	4Q 2006	1Q 2007	2Q 2007	3Q 2007	4Q 2007	1Q 2008	2Q 2008
Federal Funds Rate	5.24	5.23	5.22	5.24	5.24	5.25	5.25	5.25	5.3	5.2	5.1	5.0	4.9	4.9
Prime Rate	8.25	8.25	8.25	8.25	8.25	8.25	8.25	8.25	8.3	8.2	8.1	8.0	7.9	7.9
LIBOR, 3-mo.	5.36	5.36	5.36	5.36	5.36	5.37	5.37	5.37	5.4	5.3	5.2	5.2	5.1	5.1
Commercial Paper, 1-mo.	5.20	5.24	5.23	5.25	5.23	5.21	5.20	5.21	5.3	5.2	5.2	5.1	5.0	5.0
Treasury bill, 3-mo.	5.12	5.09	5.05	5.00	4.97	5.07	5.05	5.03	5.0	5.0	4.9	4.8	4.8	4.8
Treasury bill, 6-mo.	5.16	5.14	5.09	5.10	5.07	5.15	5.12	5.11	5.1	5.1	5.0	5.0	4.9	4.9
Treasury bill, 1 yr.	5.08	5.03	4.98	4.99	4.94	5.01	5.01	4.99	5.0	5.0	5.0	4.9	4.9	4.9
Treasury note, 2 yr.	4.90	4.82	4.76	4.78	4.67	4.74	4.80	4.74	4.9	4.9	4.9	4.9	4.9	4.9
Treasury note, 5 yr.	4.76	4.70	4.65	4.65	4.53	4.58	4.69	4.60	4.7	4.8	4.8	4.9	4.9	4.9
Treasury note, 10 yr.	4.77	4.70	4.66	4.67	4.56	4.60	4.73	4.63	4.7	4.8	4.8	4.9	4.9	5.0
Treasury note, 30 yr.	4.86	4.79	4.76	4.78	4.68	4.69	4.85	4.74	4.9	4.9	5.0	5.0	5.1	5.1
Corporate Aaa bond	5.41	5.34	5.31	5.43	5.32	5.33	5.51	5.39	5.5	5.6	5.7	5.8	5.9	5.9
Corporate Baa bond	6.35	6.29	6.27	6.32	6.22	6.20	6.42	6.28	6.5	6.6	6.6	6.7	6.8	6.8
State & Local bonds	4.25	4.21	4.15	4.17	4.11	4.14	4.30	4.18	4.3	4.4	4.4	4.5	4.5	4.6
Home mortgage rate	6.23	6.21	6.18	6.18	6.14	6.24	6.36	6.25	6.3	6.4	6.4	6.5	6.5	6.6

	History								Consensus Forecasts-Quarterly Avg.					
Key Assumptions	1Q 2005	2Q 2005	3Q 2005	4Q 2005	1Q 2006	2Q 2006	3Q 2006	*4Q* 2006*	1Q 2007	2Q 2007	3Q 2007	4Q 2007	1Q 2008	2Q 2008
Major Currency Index	81.3	83.5	84.7	85.8	84.9	82.2	81.7	81.6	81.4	81.0	80.6	80.2	79.9	79.6
Real GDP	3.4	3.3	4.2	1.8	5.6	2.6	2.0	*2.9*	2.5	2.5	2.8	3.0	3.1	3.1
GDP Price Index	3.5	2.4	3.3	3.3	3.3	3.3	1.9	*1.4*	2.4	2.2	2.2	2.1	2.2	2.1
Consumer Price Index	2.3	3.8	5.5	3.3	2.2	4.9	3.0	-2.1	2.4	2.5	2.4	2.3	2.3	2.3

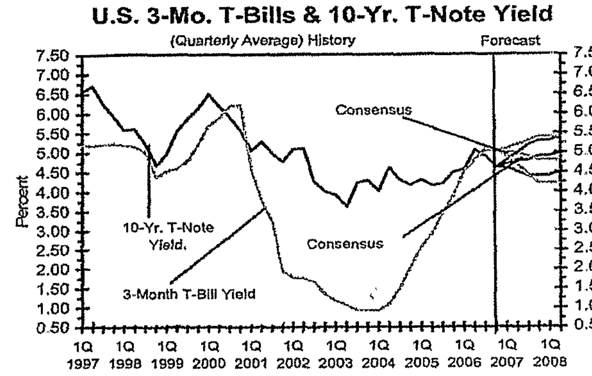
[1]Individual panel members' forecasts are on pages 4 through 9. Historical data for interest rates except LIBOR is from Federal Reserve Release (FRSR) H.15. LIBOR quotes available from *The Wall Street Journal.* Definitions reported here are same as those in FRSR H.15. Treasury yields are reported on a constant maturity basis. Historical data for the U.S. Federal Reserve Board's Major Currency Index is from FRSR H.10 and G.5. Historical data for Real GDP and GDP Chained Price Index are from the Bureau of Economic Analysis (BEA). Consumer Price Index (CPI) history is from the Department of Labor's Bureau of Labor Statistics (BLS). ***Figures for 4Q 2006 Real GDP and GDP Chained Price Index are consensus forecasts based on a special question asked of the panel members this month. Actual data will be released January 31st. Q4 2006 data for the Consumer Price Index and the Fed's Major Currency Index are actuals.***

U.S. Treasury Yield Curve

Week ended January 19, 2007 and Year Ago vs. 1Q 2007 and 2Q 2008 Consensus forecasts

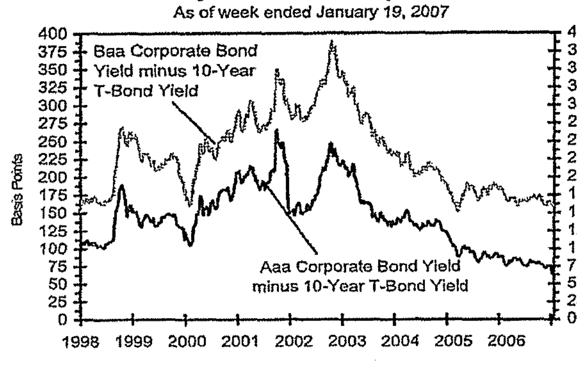


U.S. 3-Mo. T-Bills & 10-Yr. T-Note Yield



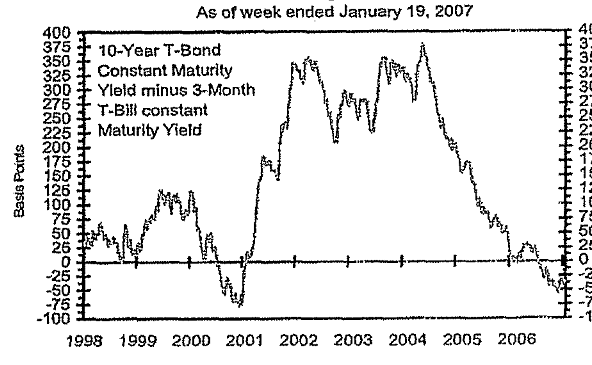
Corporate Bond Spreads

As of week ended January 19, 2007



U.S. Treasury Yield Curve

As of week ended January 19, 2007



Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 213
Witness: Don Murry

Data Request:

With respect to page 13, lines 1-22, please indicate what gas distribution companies covered by Value Line were excluded from the group comparable to Atmos, and the reason they were excluded.

Response:

Dr. Murry excluded Cascade Natural Gas, KeySpan Energy, and People's Energy because they have mergers or acquisitions in the works. The witness removed SEMCO Energy because it does not pay a dividend. Neither Southern Union nor UGI are primary gas distributors. The market capitalization of Laclede Group and South Jersey Industries are less than $1 billion.

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 214
Witness: Don Murry

Data Request:

With respect to page 14, lines 4-9, and Schedule DAM-5, please provide (a) an electronic version of all work papers used in developing the capital structure, (b) the company's actual capital structure as of the end of the test year, (c) a list of all assumptions and adjustments made to the actual capital structure in arriving at the recommended capital structure. For the electronic version (Microsoft Excel), please keep all data and equations intact.

Response:

(a) An electronic file containing the capital structure calculation is included on the attached CD, under the file name Case 2006-00464 AG DR1-214(a) ATT.xls. See a list of assumptions underlying these capital structure projections in part (c) below.

(b) The company's actual capital structure at the end of the test year is not yet known, since the test year will end on March 31, 2007. The latest known capital structure is provided in response to AG DR1–7, and the projected capital structure for the end of the test year is included in part (a) above, as well as in REVISED schedule FR10(9)h 11.

(c) The following is a list of assumptions underlying the workpapers submitted in response to (a) above:

1. The annual dividend rate is increased $.02 per year, which matches the actual annual increase over the past six years.
2. Equity (Retained Earnings) is increased (decreased) by the amount of monthly budgeted net income (loss), adjusted for the interest expense reduction caused by the December 2006 equity offering.
3. Accumulated Other Comprehensive Income was set at approximately the actual November 2006 level, and held at that level for all projected months.
4. Equity (Common Stock and Paid-in-Capital) is increased by equal monthly amounts in fiscal 2007 and 2008, based on budgeted annualized issuances of $40 million in 2007 and $41.2 million in 2008.
5. Equity is increased $191,864,188 in December 2006 for the equity offering that occurred on December 13, 2006.
6. Long-Term Debt outstanding is projected by month according to maturity and payment schedules associated with the note agreements. The $300 million Unsecured Notes that come due in October 2007 are assumed to be immediately refinanced as long-term debt.

Cap Structure
As of December 21, 2006
DR AG 1-214

		Base Period	Base Period	Base Period	Base Period	Base Period	Base Period	Base Period
	February '06	March '06	April	May	June	July	August	September
Common Stock	404,828	405,386	405,758	406,786	407,691	407,979	408,216	408,698
Treasury Stock	0	0	0	0	0	0	0	-
Common Stock Subscribed	0	0	0	0	0	0	0	-
Additional Paid-In Capital	1,443,842,625	1,447,733,683	1,450,301,554	1,452,234,724	1,456,033,071	1,458,185,629	1,460,129,500	1,467,241,415
Retained Earnings	178,836,534	178,836,534	178,836,534	178,836,534	178,836,534	178,836,534	178,836,534	178,836,534
Accum. Other Comprehensive Income	(45,700,615)	(29,574,752)	(32,320,463)	(35,584,806)	(35,840,144)	(17,061,925)	(30,578,213)	(43,850,361)
Current Year Net Income	151,392,075	159,823,121	144,169,952	148,440,047	141,677,507	159,512,791	148,937,313	147,737,211
Dividends	(50,933,257)	(50,933,257)	(50,933,257)	(76,559,265)	(76,559,265)	(76,559,265)	(102,275,352)	(102,275,352)
Equity	1,677,842,191	1,706,290,715	1,690,460,078	1,667,774,020	1,664,555,394	1,703,321,743	1,655,457,998	1,648,098,144
Long-Term debt (including curr maturities	2,184,525,017	2,184,427,797	2,184,329,969	2,184,181,530	2,184,082,478	2,183,917,333	2,183,648,921	2,183,548,011
Short Term Notes.Payable - daily avg	186,207,821	186,226,613	148,120,000	167,400,000	179,760,000	250,205,645	272,648,355	314,803,500
Total Capitalization	4,048,575,029	4,076,945,124	4,022,910,047	4,019,355,549	4,028,397,871	4,137,444,721	4,111,755,274	4,146,449,655
Equity%		42%	42%	41%	41%	41%	40%	40%
Debt %		58%	58%	59%	59%	59%	60%	60%
Total		100%	100%	100%	100%	100%	100%	100%
Excl STD								
Equity%		43.9%	43.6%	43.3%	43.3%	43.8%	43.1%	43.0%
Debt %		56.1%	56.4%	56.7%	56.7%	56.2%	56.9%	57.0%

Cap Structure
As of December 21, 2006
DR AG 1-214

	Base Period October 'Fy 07	Base Period November	Base Period December	Base Period January '07	Base Period February '07	Base Period March '07	13 month Average Base (STD used 12 mos.)
Common Stock	409,248	409,798	441,973	442,523	443,073	443,623	415,535
Treasury Stock	0	0	0	0	0	0	-
Common Stock Subscribed	0	0	0	0	0	0	-
Additional Paid-In Capital	1,470,575,240	1,473,909,065	1,669,075,453	1,672,409,278	1,675,743,103	1,679,076,927	1,525,588,357
Retained Earnings	224,298,393	224,298,393	224,298,393	224,298,393	224,298,393	224,298,393	199,818,930
Accum. Other Comprehensive Income	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(23,911,858)
Current Year Net Income	(1,032,613)	19,311,927	63,893,340	111,909,463	144,255,242	163,119,133	119,365,726
Dividends	-	(26,271,330)	(26,271,330)	(26,271,330)	(54,672,269)	(54,672,269)	(55,711,811)
Equity	1,679,909,686	1,677,317,271	1,917,097,247	1,968,447,746	1,975,726,960	1,997,925,226	1,765,564,880
Long-Term debt (including curr maturities	2,183,446,478	2,182,094,317	2,181,941,525	2,181,772,624	2,181,668,563	2,181,563,864	2,183,124,878
Short Term Notes Payable - daily avg	210,199,657	271,578,039	203,095,407	94,248,284	18,704,832	34,632,449	180,449,681
Total Capitalization	4,073,555,821	4,130,989,627	4,302,134,180	4,244,468,654	4,176,100,355	4,214,121,539	4,129,139,438
Equity%	41%	41%	45%	46%	47%	47%	42.8%
Debt %	59%	59%	55%	54%	53%	53%	57.2%
Total	100%	100%	100%	100%	100%	100%	100.0%
Excl STD							
Equity%	43.5%	43.5%	46.8%	47.4%	47.5%	47.8%	44.7%
Debt %	56.5%	56.5%	53.2%	52.6%	52.5%	52.2%	55.3%

Cap Structure
As of December 21, 2006
DR AG 1-214

	March '07	April '07	May '07	Test period June '07	Test period July	Test period August	Test period September
Common Stock	443,623	444,173	444,723	445,273	445,823	446,373	446,923
Treasury Stock	0	0	0	0	0	0	0
Common Stock Subscribed	0	0	0	0	0	0	0
Additional Paid-In Capital	1,679,076,927	1,682,410,752	1,685,744,577	1,689,078,402	1,692,412,227	1,695,746,052	1,699,079,877
Retained Earnings	224,298,393	224,298,393	224,298,393	224,298,393	224,298,393	224,298,393	224,298,393
Accum. Other Comprehensive Income	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)
Current Year Net Income	163,119,133	168,639,406	165,586,229	161,577,091	161,404,467	161,370,075	161,931,642
Dividends	(54,672,269)	(54,672,269)	(83,178,817)	(83,178,817)	(83,178,817)	(111,790,974)	(111,790,974)
Equity	1,997,925,226	2,006,779,874	1,978,554,524	1,977,879,762	1,981,041,512	1,955,729,339	1,959,625,280
Long-Term debt (including curr maturities	2,181,563,864	2,181,458,522	2,181,352,536	2,181,195,902	2,181,023,142	2,180,915,204	2,180,806,609
Short Term Notes Payable - daily avg	34,632,449	29,544,295	41,535,991	57,791,649	118,196,996	97,734,336	76,742,900
Total Capitalization	4,214,121,539	4,217,782,692	4,201,443,051	4,216,867,313	4,280,261,650	4,234,378,879	4,217,174,790
Equity%	47%	48%	47%	47%	46%	46%	46%
Debt %	53%	52%	53%	53%	54%	54%	54%
Total	100%	100%	100%	100%	100%	100%	100%
Excl STD							
Equity%	47.8%	47.9%	47.6%	47.6%	47.6%	47.3%	47.3%
Debt %	52.2%	52.1%	52.4%	52.4%	52.4%	52.7%	52.7%

Cap Structure
As of December 21, 2006
DR AG 1-214

	Test period October Fy '08	Test period November	Test period December	Test period January	Test period February	Test period March
Common Stock	447,457	447,991	448,525	449,059	449,593	450,127
Treasury Stock	0	0	0	0	0	0
Common Stock Subscribed	0	0	0	0	0	0
Additional Paid-In Capital	1,702,413,718	1,705,747,559	1,709,081,400	1,712,415,241	1,715,749,082	1,719,082,923
Retained Earnings	274,439,061	274,439,061	274,439,061	274,439,061	274,439,061	274,439,061
Accum. Other Comprehensive Income	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)
Current Year Net Income	(1,147,705)	21,464,371	70,670,086	123,444,457	158,801,919	179,174,847
Dividends	-	(29,164,396)	(29,164,396)	(29,164,396)	(58,432,924)	(58,432,924)
Equity	1,961,811,951	1,958,594,005	2,011,134,095	2,067,242,842	2,076,666,150	2,100,373,453
Long-Term debt (including curr maturities	2,180,697,356	2,179,337,439	2,179,176,858	2,179,000,131	2,178,888,210	2,178,775,613
Short Term Notes Payable - daily avg	126,093,051	179,846,433	215,143,813	179,005,866	96,087,414	104,640,031
Total Capitalization	4,268,602,357	4,317,777,878	4,405,454,766	4,425,248,839	4,351,641,773	4,383,789,097
	6.17%					
Equity%	46%	45%	46%	47%	48%	48%
Debt %	54%	55%	54%	53%	52%	52%
Total	100%	100%	100%	100%	100%	100%
Excl STD						
Equity%	47.4%	47.3%	48.0%	48.7%	48.8%	49.1%
Debt %	52.6%	52.7%	52.0%	51.3%	51.2%	50.9%

Cap Structure
As of December 21, 2006
DR AG 1-214

	Test period April	Test period May '08	Test Period June '08	13 month Average Test (STD used 12 mos.)
Common Stock	450,661	451,195	451,729	448,518
Treasury Stock	0	0	0	-
Common Stock Subscribed	0	0	0	-
Additional Paid-In Capital	1,722,416,764	1,725,750,605	1,729,084,446	1,709,081,408
Retained Earnings	274,439,061	274,439,061	274,439,061	259,011,163
Accum. Other Comprehensive Income	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)
Current Year Net Income	184,716,920	180,729,974	175,680,521	133,832,205
Dividends	(58,432,924)	(87,805,585)	(87,805,585)	(63,718,670)
Equity	2,109,249,901	2,079,224,670	2,077,509,591	2,024,314,042
Long-Term debt (including curr maturities	2,178,662,340	2,177,751,385	2,177,647,863	2,179,529,081
Short Term Notes Payable - daily avg	91,926,877	96,293,572	104,924,231	123,886,293
Total Capitalization	4,379,839,118	4,353,269,627	4,360,081,685	4,327,729,417
Equity%	48%	48%	48%	46.8%
Debt %	52%	52%	52%	53.2%
Total	100%	100%	100%	100.0%
Excl STD				
Equity%	49.2%	48.8%	48.8%	48.2%
Debt %	50.8%	51.2%	51.2%	51.8%

Company
Service Area
Cost Center
Type
Ending Bal
DR AG 1-214

	ACTUAL Fiscal 2005 September	ACTUAL Fiscal 2006 October	ACTUAL Fiscal 2006 November	ACTUAL Fiscal 2006 December	ACTUAL Fiscal 2006 January	ACTUAL Fiscal 2006 February	ACTUAL Fiscal 2006 March
Common Stock	402,697	402,948	403,759	404,264	404,614	404,828	405,386
Treasury Stock	0	0	0	0	0	0	0
Common Stock Subscribed	0	0	0	0	0	0	0
Additional Paid-In Capital	1,426,523,217	1,428,326,540	1,430,867,713	1,434,044,310	1,440,932,413	1,443,842,625	1,447,733,683
Retained Earnings	142,029,456	178,836,534	178,836,534	178,836,534	178,836,534	178,836,534	178,836,534
Accum. Other Comprehensive Income	(3,340,581)	(18,061,936)	(23,095,328)	(26,138,590)	(28,815,022)	(45,700,615)	(29,574,752)
Current Year Net Income	135,784,731	16,404,815	36,076,399	71,026,900	108,077,155	151,392,075	159,823,121
Dividends	(98,977,652)	-	(25,429,048)	(25,429,048)	(25,429,048)	(50,933,257)	(50,933,257)
Equity	**1,602,421,869**	**1,605,908,902**	**1,597,660,029**	**1,632,744,369**	**1,674,006,645**	**1,677,842,191**	**1,706,290,715**
Long-Term debt (including curr maturities)	2,186,367,572	2,186,273,350	2,184,928,534	2,184,783,121	2,184,621,632	2,184,525,017	2,184,427,797
Total Capitalization	3,788,789,441	3,792,182,252	3,782,588,563	3,817,527,490	3,858,628,277	3,862,367,208	3,890,718,511
Notes Payable - DAILY AVG Balances		156,300,161	236,930,933	303,849,194	268,228,226	186,207,821	186,226,613
Dividend Rate							1.26
Stock Issued							
Common Stock		251	811	505	350	214	557
PIC		1,803,323	2,541,172	3,176,597	6,888,103	2,910,212	3,891,059
Total Plans	0	1,803,574	2,541,983	3,177,102	6,888,453	2,910,426	3,891,616
Additional Issuance							
Total Common Stock Issued	0	1,803,574	2,541,983	3,177,102	6,888,453	2,910,426	3,891,616
Dividends related to Additional Issuance							
Shares O/S							
Issue Price		35.87	15.68	31.44	98.50	67.88	34.90
New Shares		50,281	162,148	101,048	69,934	42,874	111,494
Ending Shares	80,539,401	80,589,682	80,751,830	80,852,878	80,922,812	80,965,686	81,077,180
Budgeted Avg STD		156,300,161	236,930,933	303,849,194	268,228,226	186,207,821	186,226,613
Equity Offering							
Notes Payable - daily average balances		156,300,161	236,930,933	303,849,194	268,228,226	186,207,821	186,226,613

PLAN projection
Common Stock
PIC
Total

Company
Service Area
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	ACTUAL Fiscal 2006 April	ACTUAL Fiscal 2006 May	ACTUAL Fiscal 2006 June	ACTUAL Fiscal 2006 July	ACTUAL Fiscal 2006 August	ACTUAL Fiscal 2006 September	BUDGET October Fy 07	BUDGET November
Common Stock	405,758	406,786	407,691	407,979	408,216	408,698	409,248	409,798
Treasury Stock	0	0	0	0	0	-	0	0
Common Stock Subscribed	0	0	0	0	0		0	0
Additional Paid-In Capital	1,450,301,554	1,452,234,724	1,456,033,071	1,458,185,629	1,460,129,500	1,467,241,415	1,470,575,240	1,473,909,065
Retained Earnings	178,836,534	178,836,534	178,836,534	178,836,534	178,836,534	178,836,534	224,298,393	224,298,393
Accum. Other Comprehensive Income	(32,320,463)	(35,584,806)	(35,840,144)	(17,061,925)	(30,578,213)	(43,850,361)	(14,340,581)	(14,340,581)
Current Year Net Income	144,169,952	148,440,047	141,677,507	159,512,791	148,937,313	147,737,211	(1,032,613)	19,311,927
Dividends	(50,933,257)	(76,559,265)	(76,559,265)	(76,559,265)	(102,275,352)	(102,275,352)	-	(26,271,330)
Equity	**1,690,460,078**	**1,667,774,020**	**1,664,555,394**	**1,703,321,743**	**1,655,457,998**	**1,648,098,144**	**1,679,909,686**	**1,677,317,271**
Long-Term debt (including curr maturities)	2,184,329,969	2,184,181,530	2,184,082,478	2,183,917,333	2,183,648,921	2,183,548,011	2,183,446,478	2,182,094,317
Total Capitalization	3,874,790,047	3,851,955,549	3,848,637,871	3,887,239,076	3,839,106,919	3,831,646,155	3,863,356,164	3,859,411,588
Notes Payable - DAILY AVG Balances	148,120,000	167,400,000	179,760,000	250,205,645	272,648,355	314,803,500	210,199,657	271,578,039
Dividend Rate	1.26	1.26	1.26	1.26	1.26	1.26	1.28	1.28
Stock Issued								
Common Stock	372	1,028	905	288	238	481	550	550
PIC	2,567,871	1,933,169	3,798,348	2,152,558	1,943,871	7,111,914	3,333,825	3,333,825
Total Plans	2,568,243	1,934,198	3,799,252	2,152,845	1,944,109	7,112,396	3,334,375	3,334,375
Additional Issuance								
Total Common Stock Issued	2,568,243	1,934,198	3,799,252	2,152,845	1,944,109	7,112,396	3,334,375	3,334,375
Dividends related to Additional Issuance								
Shares O/S								
Issue Price	34.52	9.40	21.00	37.39	40.91	30.31	30.31	30.31
New Shares	74,398	205,660	180,902	57,576	47,518	234,655	110,009	110,009
Ending Shares	81,151,578	81,357,238	81,538,140	81,595,716	81,643,234	81,877,889	81,987,898	82,097,907
Budgeted Avg STD	148,120,000	167,400,000	179,760,000	250,205,645	272,648,355	314,803,500	210,199,657	271,578,039
Equity Offering								
Notes Payable - daily average balances	148,120,000	167,400,000	179,760,000	250,205,645	272,648,355	314,803,500	210,199,657	271,578,039

FY 2007			**FY 2008**		
Total 12 mos	Monthly Avg	Projection	Total 12 mos	Monthly Avg	Projection
6,600	550	6,600	6,600	550	6,600
40,005,900	3,333,825	40,005,900	41,206,275	3,433,856	41,206,275
40,012,500	3,334,375	40,012,500	41,212,875	3,434,406	41,212,875

Company
Service Area
Cost Center
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	BUDGET	BUDGET	BUDGET	BUDGET	BUDGET	BUDGET	BUDGET Test Period	BUDGET Test Period
	December	January '07	February '07	March	April	May	June '07	July
Common Stock	441,973	442,523	443,073	443,623	444,173	444,723	445,273	445,823
Treasury Stock	0	0	0	0	0	0	0	0
Common Stock Subscribed	0	0	0	0	0	0	0	0
Additional Paid-In Capital	1,669,075,453	1,672,409,278	1,675,743,103	1,679,076,927	1,682,410,752	1,685,744,577	1,689,078,402	1,692,412,227
Retained Earnings	224,298,393	224,298,393	224,298,393	224,298,393	224,298,393	224,298,393	224,298,393	224,298,393
Accum. Other Comprehensive Income	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)
Current Year Net Income	63,893,340	111,909,463	144,255,242	163,119,133	168,639,406	165,586,229	161,577,091	161,404,467
Dividends	(26,271,330)	(26,271,330)	(54,672,269)	(54,672,269)	(54,672,269)	(83,178,817)	(83,178,817)	(83,178,817)
Equity	**1,917,097,247**	**1,968,447,746**	**1,975,726,960**	**1,997,925,226**	**2,006,779,874**	**1,978,554,524**	**1,977,879,762**	**1,981,041,512**
Long-Term debt (including curr maturities)	2,181,941,525	2,181,772,624	2,181,668,563	2,181,563,864	2,181,458,522	2,181,352,536	2,181,195,902	2,181,023,142
Total Capitalization	4,099,038,772	4,150,220,370	4,157,395,523	4,179,489,090	4,188,238,397	4,159,907,060	4,159,075,664	4,162,064,654
Notes Payable - DAILY AVG Balances	203,095,407	94,248,284	18,704,832	34,632,449	29,544,295	41,535,991	57,791,649	118,196,996
Dividend Rate	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
Stock Issued								
Common Stock	32,175	550	550	550	550	550	550	550
PIC	195,166,388	3,333,825	3,333,825	3,333,825	3,333,825	3,333,825	3,333,825	3,333,825
Total Plans	195,198,563	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375
Additional Issuance								
Total Common Stock Issued	195,198,563	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375
Dividends related to Additional Issuance								
Shares O/S								
Issue Price	30.31	30.31	30.31	30.31	30.31	30.31	30.31	30.31
New Shares	6,435,009	110,009	110,009	110,009	110,009	110,009	110,009	110,009
Ending Shares	88,532,916	88,642,925	88,752,934	88,862,944	88,972,953	89,082,962	89,192,971	89,302,980
Budgeted Avg STD	314,500,420	286,112,472	210,569,020	226,496,637	221,408,483	233,400,179	249,655,837	310,061,184
Equity Offering	(111,405,012)	(191,864,188)	(191,864,188)	(191,864,188)	(191,864,188)	(191,864,188)	(191,864,188)	(191,864,188)
Notes Payable - daily average balances	203,095,407	94,248,284	18,704,832	34,632,449	29,544,295	41,535,991	57,791,649	118,196,996

Company
Service Area
Cost Center
Type
Ending Bal
DR AG 1-214

			Net Income 2008	$ 174,294,175.34	2008 avg shares 90,314,797			
	BUDGET Test Period August	**BUDGET Test Period** September	**BUDGET Test Period** October Fy '08	**BUDGET Test Period** November	**BUDGET Test Period** December	**BUDGET Test Period** January	**BUDGET Test Period** February	**BUDGET Test Period** March
Common Stock	446,373	446,923	447,457	447,991	448,525	449,059	449,593	450,127
Treasury Stock	0	0	0	0	0	0	0	0
Common Stock Subscribed	0	0	0	0	0	0	0	0
Additional Paid-In Capital	1,695,746,052	1,699,079,877	1,702,413,718	1,705,747,559	1,709,081,400	1,712,415,241	1,715,749,082	1,719,082,923
Retained Earnings	224,298,393	224,298,393	274,439,061	274,439,061	274,439,061	274,439,061	274,439,061	274,439,061
Accum. Other Comprehensive Income	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)
Current Year Net Income	161,370,075	161,931,642	(1,147,705)	21,464,371	70,670,086	123,444,457	158,801,919	179,174,847
Dividends	(111,790,974)	(111,790,974)	-	(29,164,396)	(29,164,396)	(29,164,396)	(58,432,924)	(58,432,924)
Equity	**1,955,729,339**	**1,959,625,280**	**1,961,811,951**	**1,958,594,005**	**2,011,134,095**	**2,067,242,842**	**2,076,666,150**	**2,100,373,453**
Long-Term debt (including curr maturities)	2,180,915,204	2,180,806,609	2,180,697,356	2,179,337,439	2,179,176,858	2,179,000,131	2,178,888,210	2,178,775,613
Total Capitalization	4,136,644,543	4,140,431,890	4,142,509,306	4,137,931,445	4,190,310,953	4,246,242,973	4,255,554,360	4,279,149,066
Notes Payable - DAILY AVG Balances	97,734,336	76,742,900	126,093,051	179,846,433	215,143,813	179,005,866	96,087,414	104,640,031
Dividend Rate	1.28	1.28	1.30	1.30	1.30	1.30	1.30	1.30
Stock Issued								
Common Stock	550	550	534	534	534	534	534	534
PIC	3,333,825	3,333,825	3,333,841	3,333,841	3,333,841	3,333,841	3,333,841	3,333,841
Total Plans	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375
Additional Issuance								
Total Common Stock Issued	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375
Dividends related to Additional Issuance								
Shares O/S								
Issue Price	30.31	30.31	31.22	31.22	31.22	31.22	31.22	31.22
New Shares	110,009	110,009	106,803	106,803	106,803	106,803	106,803	106,803
Ending Shares	89,412,989	89,522,998	89,629,800	89,736,603	89,843,406	89,950,208	90,057,011	90,163,813
Budgeted Avg STD	289,598,524	268,607,088	317,957,239	371,710,621	407,008,001	370,870,054	287,951,602	296,504,219
Equity Offering	(191,864,188)	(191,864,188)	(191,864,188)	(191,864,188)	(191,864,188)	(191,864,188)	(191,864,188)	(191,864,188)
Notes Payable - daily average balances	97,734,336	76,742,900	126,093,051	179,846,433	215,143,813	179,005,866	96,087,414	104,640,031

Company
Service Area
Cost Center
Type
Ending Bal
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	BUDGET Test Period April	BUDGET Test Period May '08	BUDGET Test Period June '08
Common Stock	450,661	451,195	451,729
Treasury Stock	0	0	0
Common Stock Subscribed	0	0	0
Additional Paid-In Capital	1,722,416,764	1,725,750,605	1,729,084,446
Retained Earnings	274,439,061	274,439,061	274,439,061
Accum. Other Comprehensive Income	(14,340,581)	(14,340,581)	(14,340,581)
Current Year Net Income	184,716,920	180,729,974	175,680,521
Dividends	(58,432,924)	(87,805,585)	(87,805,585)
Equity	**2,109,249,901**	**2,079,224,670**	**2,077,509,591**
Long-Term debt (including curr maturities)	2,178,662,340	2,177,751,385	2,177,647,863
Total Capitalization	4,287,912,241	4,256,976,055	4,255,157,454
Notes Payable - DAILY AVG Balances	91,926,877	96,293,572	104,924,231
Dividend Rate	1.30	1.30	1.30
Stock Issued			
Common Stock	534	534	534
PIC	3,333,841	3,333,841	3,333,841
Total Plans	3,334,375	3,334,375	3,334,375
Additional Issuance			
Total Common Stock Issued	3,334,375	3,334,375	3,334,375
Dividends related to Additional Issuance			
Shares O/S			
Issue Price	31.22	31.22	31.22
New Shares	106,803	106,803	106,803
Ending Shares	90,270,616	90,377,418	90,484,221
Budgeted Avg STD	283,791,065	288,157,760	296,788,419
Equity Offering	(191,864,188)	(191,864,188)	(191,864,188)
Notes Payable - daily average balances	91,926,877	96,293,572	104,924,231

ATMOS ENERGY CORPORATION
LTD Monthly Balances
2007 Budget

Last Update : 12/20/2006

DR AG 1-214

	Mar-06	Apr-06	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06	Jan-07
ATMOS											
Series P	8,750,000	8,750,000	8,750,000	8,750,000	8,750,000	8,750,000	8,750,000	8,750,000	7,500,000	7,500,000	7,500,000
10.00% M D. Fredericks	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654
10.00% Kingdom Foundation	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654
6.75% - Debentures	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000
7.375% Sr Note	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000
5.125% Sr Note 2003-2013	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000
Floating Sr Note 2004-2007	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000
4.00% Sr Note 2004-2009	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000
4.95% Sr Note 2004-2014	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000
5.95% Sr Note 2004-2034	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000
SUBTOTAL	2,161,053,308	2,161,053,308	2,161,053,308	2,161,053,308	2,161,053,308	2,161,053,308	2,161,053,308	2,161,053,308	2,159,803,308	2,159,803,308	2,159,803,308
MTN, Series A											
1995-1	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
1995-2	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
SUBTOTAL	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000
TOTAL	2,181,053,308	2,181,053,308	2,181,053,308	2,181,053,308	2,181,053,308	2,181,053,308	2,181,053,308	2,181,053,308	2,179,803,308	2,179,803,308	2,179,803,308
ATMOS POWER SYSTEMS											
Columbus IDB	982,142	982,142	982,142	982,142	916,666	916,666	916,666	916,666	916,666	916,666	851,189
Wells Fargo Equipmt Lease	2,289,292	2,235,203	2,180,859	2,126,259	2,071,403	2,016,287	1,960,913	1,905,277	1,849,380	1,793,219	1,736,795
US Bancorp	3,237,491	3,156,741	3,075,635	2,994,171	2,912,349	2,830,165	2,747,620	2,664,710	2,581,435	2,497,793	2,413,782
SUBTOTAL	6,508,925	6,374,086	6,238,636	6,102,572	5,900,417	5,763,118	5,625,198	5,486,653	5,347,481	5,207,678	5,001,766
UNITED CITIES PROPANE GAS, INC.											
Pulaski -- Ingram	125,000	125,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	75,000	75,000
Pulaski -- Carvell	125,000	125,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	75,000	75,000
Evensville, TN -- E-Con	168,125	168,125	168,125	168,125	168,125	0	0	0	0	0	0
	418,125	418,125	368,125	368,125	368,125	200,000	200,000	200,000	200,000	150,000	150,000
Outstanding Balance @	2,187,980,358	2,187,845,519	2,187,660,069	2,187,524,005	2,187,321,850	2,187,016,426	2,186,878,506	2,186,739,961	2,185,350,789	2,185,160,986	2,184,955,074
Unamortized Balance	3,552,560	3,515,549	3,478,538	3,441,527	3,404,516	3,367,505	3,330,494	3,293,483	3,256,472	3,219,461	3,182,450
Net LT Debt	2,184,427,798	2,184,329,970	2,184,181,531	2,184,082,478	2,183,917,334	2,183,648,921	2,183,548,012	2,183,446,478	2,182,094,317	2,181,941,525	2,181,772,624
	2,184,427,797	2,184,329,969	2,184,181,530	2,184,082,478	2,183,917,333	2,183,648,921					

ATMOS ENERGY CORPORATION
LTD Monthly Balances
2007 Budget

Last Update : 12/20/2006

DR AG 1-214

	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07
ATMOS											
Series P	7,500,000	7,500,000	7,500,000	7,500,000	7,500,000	7,500,000	7,500,000	7,500,000	7,500,000	6,250,000	6,250,000
10.00% M D. Fredericks	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654
10.00% Kingdom Foundation	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654
6.75% - Debentures	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000
7.375% Sr Note	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000
5.125% Sr Note 2003-2013	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000
Floating Sr Note 2004-2007	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000
4.00% Sr Note 2004-2009	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000
4.95% Sr Note 2004-2014	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000
5.95% Sr Note 2004-2034	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000
SUBTOTAL	2,159,803,308	2,159,803,308	2,159,803,308	2,159,803,308	2,159,803,308	2,159,803,308	2,159,803,308	2,159,803,308	2,159,803,308	2,158,553,308	2,158,553,308
MTN, Series A											
1995-1	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
1995-2	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
SUBTOTAL	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000
TOTAL	2,179,803,308	2,179,803,308	2,179,803,308	2,179,803,308	2,179,803,308	2,179,803,308	2,179,803,308	2,179,803,308	2,179,803,308	2,178,553,308	2,178,553,308
ATMOS POWER SYSTEMS											
Columbus IDB	851,189	851,189	851,189	851,189	851,189	785,713	785,713	785,713	785,713	785,713	785,713
Wells Fargo Equipmt Lease	1,680,104	1,623,146	1,565,921	1,508,426	1,450,660	1,392,622	1,334,311	1,275,725	1,216,864	1,157,725	1,098,308
US Bancorp	2,329,401	2,244,648	2,159,521	2,074,019	1,988,140	1,901,883	1,815,245	1,728,225	1,640,822	1,553,033	1,464,858
SUBTOTAL	4,860,694	4,718,984	4,576,631	4,433,634	4,289,989	4,080,218	3,935,269	3,789,663	3,643,399	3,496,471	3,348,879
UNITED CITIES PROPANE GAS, INC											
Pulaski -- Ingram	75,000	75,000	75,000	75,000	50,000	50,000	50,000	50,000	50,000	50,000	25,000
Pulaski -- Carvell	75,000	75,000	75,000	75,000	50,000	50,000	50,000	50,000	50,000	50,000	25,000
Evensville, TN -- E-Con	0	0	0	0	0	0	0	0	0	0	0
	150,000	150,000	150,000	150,000	100,000	100,000	100,000	100,000	100,000	100,000	50,000
Outstanding Balance @	2,184,814,002	2,184,672,292	2,184,529,939	2,184,386,942	2,184,193,297	2,183,983,526	2,183,838,577	2,183,692,971	2,183,546,707	2,182,149,779	2,181,952,187
Unamortized Balance	3,145,439	3,108,428	3,071,417	3,034,406	2,997,395	2,960,384	2,923,373	2,886,362	2,849,351	2,812,340	2,775,329
Net LT Debt	2,181,668,563	2,181,563,864	2,181,458,522	2,181,352,536	2,181,195,902	2,181,023,142	2,180,915,204	2,180,806,609	2,180,697,356	2,179,337,439	2,179,176,858

ATMOS ENERGY CORPORATION
LTD Monthly Balances
2007 Budget

Last Update : 12/20/2006

DR AG 1-214

	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	13 Months thru Mar-07	13 Months thru Jun-08
ATMOS								
Series P	6,250,000	6,250,000	6,250,000	6,250,000	6,250,000	6,250,000	8,269,231	6,730,769
10.00% M D. Fredericks	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654
10.00% Kingdom Foundation	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654
6.75% - Debentures	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000
7.375% Sr Note	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000
5.125% Sr Note 2003-2013	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000
Floating Sr Note 2004-2007	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000
4.00% Sr Note 2004-2009	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000
4.95% Sr Note 2004-2014	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000
5.95% Sr Note 2004-2034	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000
SUBTOTAL	2,158,553,308	2,158,553,308	2,158,553,308	2,158,553,308	2,158,553,308	2,158,553,308	2,160,572,539	2,159,034,077
MTN, Series A								
1995-1	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
1995-2	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
SUBTOTAL	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000
TOTAL	2,178,553,308	2,178,553,308	2,178,553,308	2,178,553,308	2,178,553,308	2,178,553,308	2,180,572,539	2,179,034,077
ATMOS POWER SYSTEMS								
Columbus IDB	720,237	720,237	720,237	720,237	720,237	720,237	921,702	760,530
Wells Fargo Equipmt Lease	1,038,611	978,633	918,373	857,829	0	0	1,959,088	978,435
US Bancorp	1,376,293	1,287,338	1,197,992	1,108,251	1,018,114	927,581	2,745,072	1,462,137
SUBTOTAL	3,135,141	2,986,209	2,836,601	2,686,317	1,738,351	1,647,818	5,625,862	3,201,102
UNITED CITIES PROPANE GAS, INC								
Pulaski -- Ingram	25,000	25,000	25,000	25,000	25,000	0	96,154	34,615
Pulaski -- Carvell	25,000	25,000	25,000	25,000	25,000	0	96,154	34,615
Evensville, TN -- E-Con	0	0	0	0	0	0	64,663	0
	50,000	50,000	50,000	50,000	50,000	0	256,971	69,231
Outstanding Balance @	2,181,738,449	2,181,589,517	2,181,439,909	2,181,289,625	2,180,341,659	2,180,201,126	2,186,455,372	2,182,304,410
Unamortized Balance	2,738,318	2,701,307	2,664,296	2,627,285	2,590,274	2,553,263	3,330,494	2,775,329
Net LT Debt	2,179,000,131	2,178,888,210	2,178,775,613	2,178,662,340	2,177,751,385	2,177,647,863	2,183,124,878	2,179,529,081

DR AG 1-214

View
Type

Service Area
Cost Center

Atmos Energy Corporation

Income Statements

Company

Income / Loss, Before Income Taxes	(1,685,516)	33,655,000	73,301,413	78,510,446	52,668,853	30,177,623	8,010,492	(6,139,497)	(7,772,187)	(1,379,701)	(1,110,995)	25,032	258,260,963
Total Provision (Benefit) for Inc Tax	(652,903)	13,310,460	29,030,040	31,028,281	20,857,032	11,847,690	3,024,176	(2,552,362)	(3,229,092)	(673,118)	(542,645)	(2,577)	101,444,982
Income / Loss, Before Cumulative Effect	(1,032,613)	20,344,540	44,271,373	47,482,165	31,811,821	18,329,934	4,986,315	(3,587,135)	(4,543,095)	(706,582)	(568,349)	27,608	156,815,982
Cumulative Effect of Acct Change, Net of Tax	0	0	0	0	0	0	0	0	0	0	0	0	0
Income Statement - Net (Income) Loss	(1,032,613)	20,344,540	44,271,373	47,482,165	31,811,821	18,329,934	4,986,315	(3,587,135)	(4,543,095)	(706,582)	(568,349)	27,608	156,815,982
Avg Shares O/S													82,600,000
EPS													$ 1.90

Adjustments to Net Income													
Debt Reduction from Equity Offering (Pre-Tax)			510,606	879,378	879,378	879,378	879,378	879,378	879,378	879,378	879,378	879,378	8,425,004
Tax Effect			(200,566)	(345,420)	(345,420)	(345,420)	(345,420)	(345,420)	(345,420)	(345,420)	(345,420)	(345,420)	(3,309,344)
Net Income Adjustment	-	-	310,040	533,958	533,958	533,958	533,958	533,958	533,958	533,958	533,958	533,958	5,115,660
ADJUSTED Net Income	(1,032,613)	20,344,540	44,581,413	48,016,123	32,345,778	18,863,891	5,520,273	(3,053,178)	(4,009,137)	(172,624)	(34,392)	561,566	161,931,642
ADJUSTED Avg. Shares O/S													87,642,671
ADJUSTED EPS													$ 1.85

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 214
Witness: Don Murry

Data Request:

With respect to page 14, lines 4-9, and Schedule DAM-5, please provide (a) an electronic version of all work papers used in developing the capital structure, (b) the company's actual capital structure as of the end of the test year, (c) a list of all assumptions and adjustments made to the actual capital structure in arriving at the recommended capital structure. For the electronic version (Microsoft Excel), please keep all data and equations intact.

Response:

(a) An electronic file containing the capital structure calculation is included on the attached CD, under the file name Case 2006-00464 AG DR1-214(a) ATT.xls. See a list of assumptions underlying these capital structure projections in part (c) below.

(b) The company's actual capital structure at the end of the test year is not yet known, since the test year will end on March 31, 2007. The latest known capital structure is provided in response to AG DR1–7, and the projected capital structure for the end of the test year is included in part (a) above, as well as in REVISED schedule FR10(9)h 11.

(c) The following is a list of assumptions underlying the workpapers submitted in response to (a) above:

1. The annual dividend rate is increased $.02 per year, which matches the actual annual increase over the past six years.
2. Equity (Retained Earnings) is increased (decreased) by the amount of monthly budgeted net income (loss), adjusted for the interest expense reduction caused by the December 2006 equity offering.
3. Accumulated Other Comprehensive Income was set at approximately the actual November 2006 level, and held at that level for all projected months.
4. Equity (Common Stock and Paid-in-Capital) is increased by equal monthly amounts in fiscal 2007 and 2008, based on budgeted annualized issuances of $40 million in 2007 and $41.2 million in 2008.
5. Equity is increased $191,864,188 in December 2006 for the equity offering that occurred on December 13, 2006.
6. Long-Term Debt outstanding is projected by month according to maturity and payment schedules associated with the note agreements. The $300 million Unsecured Notes that come due in October 2007 are assumed to be immediately refinanced as long-term debt.

Cap Structure
As of December 21, 2006
DR AG 1-214

		Base Period	Base Period	Base Period	Base Period	Base Period	Base Period	Base Period
	February '06	March '06	April	May	June	July	August	September
Common Stock	404,828	405,386	405,758	406,786	407,691	407,979	408,216	408,698
Treasury Stock	0	0	0	0	0	0	0	-
Common Stock Subscribed	0	0	0	0	0	0	0	-
Additional Paid-In Capital	1,443,842,625	1,447,733,683	1,450,301,554	1,452,234,724	1,456,033,071	1,458,185,629	1,460,129,500	1,467,241,415
Retained Earnings	178,836,534	178,836,534	178,836,534	178,836,534	178,836,534	178,836,534	178,836,534	178,836,534
Accum. Other Comprehensive Income	(45,700,615)	(29,574,752)	(32,320,463)	(35,584,806)	(35,840,144)	(17,061,925)	(30,578,213)	(43,850,361)
Current Year Net Income	151,392,075	159,823,121	144,169,952	148,440,047	141,677,507	159,512,791	148,937,313	147,737,211
Dividends	(50,933,257)	(50,933,257)	(50,933,257)	(76,559,265)	(76,559,265)	(76,559,265)	(102,275,352)	(102,275,352)
Equity	1,677,842,191	1,706,290,715	1,690,460,078	1,667,774,020	1,664,555,394	1,703,321,743	1,655,457,998	1,648,098,144
Long-Term debt (including curr maturities	2,184,525,017	2,184,427,797	2,184,329,969	2,184,181,530	2,184,082,478	2,183,917,333	2,183,648,921	2,183,548,011
Short Term Notes.Payable - daily avg	186,207,821	186,226,613	148,120,000	167,400,000	179,760,000	250,205,645	272,648,355	314,803,500
Total Capitalization	4,048,575,029	4,076,945,124	4,022,910,047	4,019,355,549	4,028,397,871	4,137,444,721	4,111,755,274	4,146,449,655
Equity%		42%	42%	41%	41%	41%	40%	40%
Debt %		58%	58%	59%	59%	59%	60%	60%
Total		100%	100%	100%	100%	100%	100%	100%
Excl STD								
Equity%		43.9%	43.6%	43.3%	43.3%	43.8%	43.1%	43.0%
Debt %		56.1%	56.4%	56.7%	56.7%	56.2%	56.9%	57.0%

Cap Structure
As of December 21, 2006
DR AG 1-214

	Base Period October 'Fy 07	Base Period November	Base Period December	Base Period January '07	Base Period February '07	Base Period March '07	13 month Average Base (STD used 12 mos.)
Common Stock	409,248	409,798	441,973	442,523	443,073	443,623	415,535
Treasury Stock	0	0	0	0	0	0	-
Common Stock Subscribed	0	0	0	0	0	0	-
Additional Paid-In Capital	1,470,575,240	1,473,909,065	1,669,075,453	1,672,409,278	1,675,743,103	1,679,076,927	1,525,588,357
Retained Earnings	224,298,393	224,298,393	224,298,393	224,298,393	224,298,393	224,298,393	199,818,930
Accum. Other Comprehensive Income	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(23,911,858)
Current Year Net Income	(1,032,613)	19,311,927	63,893,340	111,909,463	144,255,242	163,119,133	119,365,726
Dividends	-	(26,271,330)	(26,271,330)	(26,271,330)	(54,672,269)	(54,672,269)	(55,711,811)
Equity	1,679,909,686	1,677,317,271	1,917,097,247	1,968,447,746	1,975,726,960	1,997,925,226	1,765,564,880
Long-Term debt (including curr maturities	2,183,446,478	2,182,094,317	2,181,941,525	2,181,772,624	2,181,668,563	2,181,563,864	2,183,124,878
Short Term Notes Payable - daily avg	210,199,657	271,578,039	203,095,407	94,248,284	18,704,832	34,632,449	180,449,681
Total Capitalization	4,073,555,821	4,130,989,627	4,302,134,180	4,244,468,654	4,176,100,355	4,214,121,539	4,129,139,438

Equity%	41%	41%	45%	46%	47%	47%	42.8%
Debt %	59%	59%	55%	54%	53%	53%	57.2%
Total	100%	100%	100%	100%	100%	100%	100.0%
Excl STD							
Equity%	43.5%	43.5%	46.8%	47.4%	47.5%	47.8%	44.7%
Debt %	56.5%	56.5%	53.2%	52.6%	52.5%	52.2%	55.3%

Cap Structure
As of December 21, 2006
DR AG 1-214

	March '07	April '07	May '07	Test period June '07	Test period July	Test period August	Test period September
Common Stock	443,623	444,173	444,723	445,273	445,823	446,373	446,923
Treasury Stock	0	0	0	0	0	0	0
Common Stock Subscribed	0	0	0	0	0	0	0
Additional Paid-In Capital	1,679,076,927	1,682,410,752	1,685,744,577	1,689,078,402	1,692,412,227	1,695,746,052	1,699,079,877
Retained Earnings	224,298,393	224,298,393	224,298,393	224,298,393	224,298,393	224,298,393	224,298,393
Accum. Other Comprehensive Income	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)
Current Year Net Income	163,119,133	168,639,406	165,586,229	161,577,091	161,404,467	161,370,075	161,931,642
Dividends	(54,672,269)	(54,672,269)	(83,178,817)	(83,178,817)	(83,178,817)	(111,790,974)	(111,790,974)
Equity	1,997,925,226	2,006,779,874	1,978,554,524	1,977,879,762	1,981,041,512	1,955,729,339	1,959,625,280
Long-Term debt (including curr maturities	2,181,563,864	2,181,458,522	2,181,352,536	2,181,195,902	2,181,023,142	2,180,915,204	2,180,806,609
Short Term Notes Payable - daily avg	34,632,449	29,544,295	41,535,991	57,791,649	118,196,996	97,734,336	76,742,900
Total Capitalization	4,214,121,539	4,217,782,692	4,201,443,051	4,216,867,313	4,280,261,650	4,234,378,879	4,217,174,790
Equity%	47%	48%	47%	47%	46%	46%	46%
Debt %	53%	52%	53%	53%	54%	54%	54%
Total	100%	100%	100%	100%	100%	100%	100%
Excl STD							
Equity%	47.8%	47.9%	47.6%	47.6%	47.6%	47.3%	47.3%
Debt %	52.2%	52.1%	52.4%	52.4%	52.4%	52.7%	52.7%

Cap Structure
As of December 21, 2006
DR AG 1-214

	Test period October Fy '08	Test period November	Test period December	Test period January	Test period February	Test period March
Common Stock	447,457	447,991	448,525	449,059	449,593	450,127
Treasury Stock	0	0	0	0	0	0
Common Stock Subscribed	0	0	0	0	0	0
Additional Paid-In Capital	1,702,413,718	1,705,747,559	1,709,081,400	1,712,415,241	1,715,749,082	1,719,082,923
Retained Earnings	274,439,061	274,439,061	274,439,061	274,439,061	274,439,061	274,439,061
Accum. Other Comprehensive Income	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)
Current Year Net Income	(1,147,705)	21,464,371	70,670,086	123,444,457	158,801,919	179,174,847
Dividends	-	(29,164,396)	(29,164,396)	(29,164,396)	(58,432,924)	(58,432,924)
Equity	1,961,811,951	1,958,594,005	2,011,134,095	2,067,242,842	2,076,666,150	2,100,373,453
Long-Term debt (including curr maturities	2,180,697,356	2,179,337,439	2,179,176,858	2,179,000,131	2,178,888,210	2,178,775,613
Short Term Notes Payable - daily avg	126,093,051	179,846,433	215,143,813	179,005,866	96,087,414	104,640,031
Total Capitalization	4,268,602,357	4,317,777,878	4,405,454,766	4,425,248,839	4,351,641,773	4,383,789,097
	6.17%					
Equity%	46%	45%	46%	47%	48%	48%
Debt %	54%	55%	54%	53%	52%	52%
Total	100%	100%	100%	100%	100%	100%
Excl STD						
Equity%	47.4%	47.3%	48.0%	48.7%	48.8%	49.1%
Debt %	52.6%	52.7%	52.0%	51.3%	51.2%	50.9%

Cap Structure
As of December 21, 2006
DR AG 1-214

	Test period April	Test period May '08	Test Period June '08	13 month Average Test (STD used 12 mos.)
Common Stock	450,661	451,195	451,729	448,518
Treasury Stock	0	0	0	-
Common Stock Subscribed	0	0	0	-
Additional Paid-In Capital	1,722,416,764	1,725,750,605	1,729,084,446	1,709,081,408
Retained Earnings	274,439,061	274,439,061	274,439,061	259,011,163
Accum. Other Comprehensive Income	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)
Current Year Net Income	184,716,920	180,729,974	175,680,521	133,832,205
Dividends	(58,432,924)	(87,805,585)	(87,805,585)	(63,718,670)
Equity	2,109,249,901	2,079,224,670	2,077,509,591	2,024,314,042
Long-Term debt (including curr maturities	2,178,662,340	2,177,751,385	2,177,647,863	2,179,529,081
Short Term Notes Payable - daily avg	91,926,877	96,293,572	104,924,231	123,886,293
Total Capitalization	4,379,839,118	4,353,269,627	4,360,081,685	4,327,729,417
Equity%	48%	48%	48%	46.8%
Debt %	52%	52%	52%	53.2%
Total	100%	100%	100%	100.0%
Excl STD				
Equity%	49.2%	48.8%	48.8%	48.2%
Debt %	50.8%	51.2%	51.2%	51.8%

Company
Service Area
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	ACTUAL Fiscal 2005 September	**ACTUAL** Fiscal 2006 October	**ACTUAL** Fiscal 2006 November	**ACTUAL** Fiscal 2006 December	**ACTUAL** Fiscal 2006 January	**ACTUAL** Fiscal 2006 February	**ACTUAL** Fiscal 2006 March
Common Stock	402,697	402,948	403,759	404,264	404,614	404,828	405,386
Treasury Stock	0	0	0	0	0	0	0
Common Stock Subscribed	0	0	0	0	0	0	0
Additional Paid-In Capital	1,426,523,217	1,428,326,540	1,430,867,713	1,434,044,310	1,440,932,413	1,443,842,625	1,447,733,683
Retained Earnings	142,029,456	178,836,534	178,836,534	178,836,534	178,836,534	178,836,534	178,836,534
Accum. Other Comprehensive Income	(3,340,581)	(18,061,936)	(23,095,328)	(26,138,590)	(28,815,022)	(45,700,615)	(29,574,752)
Current Year Net Income	135,784,731	16,404,815	36,076,399	71,026,900	108,077,155	151,392,075	159,823,121
Dividends	(98,977,652)	-	(25,429,048)	(25,429,048)	(25,429,048)	(50,933,257)	(50,933,257)
Equity	**1,602,421,869**	**1,605,908,902**	**1,597,660,029**	**1,632,744,369**	**1,674,006,645**	**1,677,842,191**	**1,706,290,715**
Long-Term debt (including curr maturities)	2,186,367,572	2,186,273,350	2,184,928,534	2,184,783,121	2,184,621,632	2,184,525,017	2,184,427,797
Total Capitalization	3,788,789,441	3,792,182,252	3,782,588,563	3,817,527,490	3,858,628,277	3,862,367,208	3,890,718,511
Notes Payable - DAILY AVG Balances		156,300,161	236,930,933	303,849,194	268,228,226	186,207,821	186,226,613
Dividend Rate							1.26
Stock Issued							
Common Stock		251	811	505	350	214	557
PIC		1,803,323	2,541,172	3,176,597	6,888,103	2,910,212	3,891,059
Total Plans	0	1,803,574	2,541,983	3,177,102	6,888,453	2,910,426	3,891,616
Additional Issuance							
Total Common Stock Issued	0	1,803,574	2,541,983	3,177,102	6,888,453	2,910,426	3,891,616
Dividends related to Additional Issuance							
Shares O/S							
Issue Price		35.87	15.68	31.44	98.50	67.88	34.90
New Shares		50,281	162,148	101,048	69,934	42,874	111,494
Ending Shares	80,539,401	80,589,682	80,751,830	80,852,878	80,922,812	80,965,686	81,077,180
Budgeted Avg STD		156,300,161	236,930,933	303,849,194	268,228,226	186,207,821	186,226,613
Equity Offering							
Notes Payable - daily average balances		156,300,161	236,930,933	303,849,194	268,228,226	186,207,821	186,226,613

PLAN projection
Common Stock
PIC
Total

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	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	BUDGET	BUDGET
	Fiscal 2006	Fiscal 2006	Fiscal 2006	Fiscal 2006	Fiscal 2006	Fiscal 2006		
	April	May	June	July	August	September	October 'Fy 07	November
Common Stock	405,758	406,786	407,691	407,979	408,216	408,698	409,248	409,798
Treasury Stock	0	0	0	0	0	-	0	0
Common Stock Subscribed	0	0	0	0	0	-	0	0
Additional Paid-In Capital	1,450,301,554	1,452,234,724	1,456,033,071	1,458,185,629	1,460,129,500	1,467,241,415	1,470,575,240	1,473,909,065
Retained Earnings	178,836,534	178,836,534	178,836,534	178,836,534	178,836,534	178,836,534	224,298,393	224,298,393
Accum. Other Comprehensive Income	(32,320,463)	(35,584,806)	(35,840,144)	(17,061,925)	(30,578,213)	(43,850,361)	(14,340,581)	(14,340,581)
Current Year Net Income	144,169,952	148,440,047	141,677,507	159,512,791	148,937,313	147,737,211	(1,032,613)	19,311,927
Dividends	(50,933,257)	(76,559,265)	(76,559,265)	(76,559,265)	(102,275,352)	(102,275,352)	-	(26,271,330)
Equity	**1,690,460,078**	**1,667,774,020**	**1,664,555,394**	**1,703,321,743**	**1,655,457,998**	**1,648,098,144**	**1,679,909,686**	**1,677,317,271**
Long-Term debt (including curr maturities)	2,184,329,969	2,184,181,530	2,184,082,478	2,183,917,333	2,183,648,921	2,183,548,011	2,183,446,478	2,182,094,317
Total Capitalization	3,874,790,047	3,851,955,549	3,848,637,871	3,887,239,076	3,839,106,919	3,831,646,155	3,863,356,164	3,859,411,588
Notes Payable - DAILY AVG Balances	148,120,000	167,400,000	179,760,000	250,205,645	272,648,355	314,803,500	210,199,657	271,578,039
Dividend Rate	1.26	1.26	1.26	1.26	1.26	1.26	1.28	1.28
Stock Issued								
Common Stock	372	1,028	905	288	238	481	550	550
PIC	2,567,871	1,933,169	3,798,348	2,152,558	1,943,871	7,111,914	3,333,825	3,333,825
Total Plans	2,568,243	1,934,198	3,799,252	2,152,845	1,944,109	7,112,396	3,334,375	3,334,375
Additional Issuance								
Total Common Stock Issued	2,568,243	1,934,198	3,799,252	2,152,845	1,944,109	7,112,396	3,334,375	3,334,375
Dividends related to Additional Issuance								

FY 2007			FY 2008		
Total 12 mos	Monthly Avg	Projection	Total 12 mos	Monthly Avg	Projection
6,600	550	6,600	6,600	550	6,600
40,005,900	3,333,825	40,005,900	41,206,275	3,433,856	41,206,275
40,012,500	3,334,375	40,012,500	41,212,875	3,434,406	41,212,875

	April	May	June	July	August	September	October 'Fy 07	November
Shares O/S								
Issue Price	34.52	9.40	21.00	37.39	40.91	30.31	30.31	30.31
New Shares	74,398	205,660	180,902	57,576	47,518	234,655	110,009	110,009
Ending Shares	81,151,578	81,357,238	81,538,140	81,595,716	81,643,234	81,877,889	81,987,898	82,097,907
Budgeted Avg STD	148,120,000	167,400,000	179,760,000	250,205,645	272,648,355	314,803,500	210,199,657	271,578,039
Equity Offering								
Notes Payable - daily average balances	148,120,000	167,400,000	179,760,000	250,205,645	272,648,355	314,803,500	210,199,657	271,578,039

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	BUDGET	BUDGET	BUDGET	BUDGET	BUDGET	BUDGET	BUDGET Test Period	BUDGET Test Period
	December	January '07	February '07	March	April	May	June '07	July
Common Stock	441,973	442,523	443,073	443,623	444,173	444,723	445,273	445,823
Treasury Stock	0	0	0	0	0	0	0	0
Common Stock Subscribed	0	0	0	0	0	0	0	0
Additional Paid-In Capital	1,669,075,453	1,672,409,278	1,675,743,103	1,679,076,927	1,682,410,752	1,685,744,577	1,689,078,402	1,692,412,227
Retained Earnings	224,298,393	224,298,393	224,298,393	224,298,393	224,298,393	224,298,393	224,298,393	224,298,393
Accum. Other Comprehensive Income	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)
Current Year Net Income	63,893,340	111,909,463	144,255,242	163,119,133	168,639,406	165,586,229	161,577,091	161,404,467
Dividends	(26,271,330)	(26,271,330)	(54,672,269)	(54,672,269)	(54,672,269)	(83,178,817)	(83,178,817)	(83,178,817)
Equity	**1,917,097,247**	**1,968,447,746**	**1,975,726,960**	**1,997,925,226**	**2,006,779,874**	**1,978,554,524**	**1,977,879,762**	**1,981,041,512**
Long-Term debt (including curr maturities)	2,181,941,525	2,181,772,624	2,181,668,563	2,181,563,864	2,181,458,522	2,181,352,536	2,181,195,902	2,181,023,142
Total Capitalization	4,099,038,772	4,150,220,370	4,157,395,523	4,179,489,090	4,188,238,397	4,159,907,060	4,159,075,664	4,162,064,654
Notes Payable - DAILY AVG Balances	203,095,407	94,248,284	18,704,832	34,632,449	29,544,295	41,535,991	57,791,649	118,196,996
Dividend Rate	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
Stock Issued								
Common Stock	32,175	550	550	550	550	550	550	550
PIC	195,166,388	3,333,825	3,333,825	3,333,825	3,333,825	3,333,825	3,333,825	3,333,825
Total Plans	195,198,563	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375
Additional Issuance								
Total Common Stock Issued	195,198,563	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375
Dividends related to Additional Issuance								
Shares O/S								
Issue Price	30.31	30.31	30.31	30.31	30.31	30.31	30.31	30.31
New Shares	6,435,009	110,009	110,009	110,009	110,009	110,009	110,009	110,009
Ending Shares	88,532,916	88,642,925	88,752,934	88,862,944	88,972,953	89,082,962	89,192,971	89,302,980
Budgeted Avg STD	314,500,420	286,112,472	210,569,020	226,496,637	221,408,483	233,400,179	249,655,837	310,061,184
Equity Offering	(111,405,012)	(191,864,188)	(191,864,188)	(191,864,188)	(191,864,188)	(191,864,188)	(191,864,188)	(191,864,188)
Notes Payable - daily average balances	203,095,407	94,248,284	18,704,832	34,632,449	29,544,295	41,535,991	57,791,649	118,196,996

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			Net Income 2008	$ 174,294,175.34	2008 avg shares 90,314,797			
	BUDGET Test Period August	**BUDGET Test Period** September	**BUDGET Test Period** October Fy '08	**BUDGET Test Period** November	**BUDGET Test Period** December	**BUDGET Test Period** January	**BUDGET Test Period** February	**BUDGET Test Period** March
Common Stock	446,373	446,923	447,457	447,991	448,525	449,059	449,593	450,127
Treasury Stock	0	0	0	0	0	0	0	0
Common Stock Subscribed	0	0	0	0	0	0	0	0
Additional Paid-In Capital	1,695,746,052	1,699,079,877	1,702,413,718	1,705,747,559	1,709,081,400	1,712,415,241	1,715,749,082	1,719,082,923
Retained Earnings	224,298,393	224,298,393	274,439,061	274,439,061	274,439,061	274,439,061	274,439,061	274,439,061
Accum. Other Comprehensive Income	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)	(14,340,581)
Current Year Net Income	161,370,075	161,931,642	(1,147,705)	21,464,371	70,670,086	123,444,457	158,801,919	179,174,847
Dividends	(111,790,974)	(111,790,974)	-	(29,164,396)	(29,164,396)	(29,164,396)	(58,432,924)	(58,432,924)
Equity	**1,955,729,339**	**1,959,625,280**	**1,961,811,951**	**1,958,594,005**	**2,011,134,095**	**2,067,242,842**	**2,076,666,150**	**2,100,373,453**
Long-Term debt (including curr maturities)	2,180,915,204	2,180,806,609	2,180,697,356	2,179,337,439	2,179,176,858	2,179,000,131	2,178,888,210	2,178,775,613
Total Capitalization	4,136,644,543	4,140,431,890	4,142,509,306	4,137,931,445	4,190,310,953	4,246,242,973	4,255,554,360	4,279,149,066
Notes Payable - DAILY AVG Balances	97,734,336	76,742,900	126,093,051	179,846,433	215,143,813	179,005,866	96,087,414	104,640,031
Dividend Rate	1.28	1.28	1.30	1.30	1.30	1.30	1.30	1.30
Stock Issued								
Common Stock	550	550	534	534	534	534	534	534
PIC	3,333,825	3,333,825	3,333,841	3,333,841	3,333,841	3,333,841	3,333,841	3,333,841
Total Plans	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375
Additional Issuance								
Total Common Stock Issued	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375	3,334,375
Dividends related to Additional Issuance								
Shares O/S								
Issue Price	30.31	30.31	31.22	31.22	31.22	31.22	31.22	31.22
New Shares	110,009	110,009	106,803	106,803	106,803	106,803	106,803	106,803
Ending Shares	89,412,989	89,522,998	89,629,800	89,736,603	89,843,406	89,950,208	90,057,011	90,163,813
Budgeted Avg STD	289,598,524	268,607,088	317,957,239	371,710,621	407,008,001	370,870,054	287,951,602	296,504,219
Equity Offering	(191,864,188)	(191,864,188)	(191,864,188)	(191,864,188)	(191,864,188)	(191,864,188)	(191,864,188)	(191,864,188)
Notes Payable - daily average balances	97,734,336	76,742,900	126,093,051	179,846,433	215,143,813	179,005,866	96,087,414	104,640,031

Company
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	BUDGET Test Period April	**BUDGET Test Period** May '08	**BUDGET Test Period** June '08
Common Stock	450,661	451,195	451,729
Treasury Stock	0	0	0
Common Stock Subscribed	0	0	0
Additional Paid-In Capital	1,722,416,764	1,725,750,605	1,729,084,446
Retained Earnings	274,439,061	274,439,061	274,439,061
Accum. Other Comprehensive Income	(14,340,581)	(14,340,581)	(14,340,581)
Current Year Net Income	184,716,920	180,729,974	175,680,521
Dividends	(58,432,924)	(87,805,585)	(87,805,585)
Equity	**2,109,249,901**	**2,079,224,670**	**2,077,509,591**
Long-Term debt (including curr maturities)	2,178,662,340	2,177,751,385	2,177,647,863
Total Capitalization	4,287,912,241	4,256,976,055	4,255,157,454
Notes Payable - DAILY AVG Balances	91,926,877	96,293,572	104,924,231
Dividend Rate	1.30	1.30	1.30
Stock Issued			
Common Stock	534	534	534
PIC	3,333,841	3,333,841	3,333,841
Total Plans	3,334,375	3,334,375	3,334,375
Additional Issuance			
Total Common Stock Issued	3,334,375	3,334,375	3,334,375
Dividends related to Additional Issuance			
Shares O/S			
Issue Price	31.22	31.22	31.22
New Shares	106,803	106,803	106,803
Ending Shares	90,270,616	90,377,418	90,484,221
Budgeted Avg STD	283,791,065	288,157,760	296,788,419
Equity Offering	(191,864,188)	(191,864,188)	(191,864,188)
Notes Payable - daily average balances	91,926,877	96,293,572	104,924,231

ATMOS ENERGY CORPORATION
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	Mar-06	Apr-06	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06	Jan-07
ATMOS											
Series P	8,750,000	8,750,000	8,750,000	8,750,000	8,750,000	8,750,000	8,750,000	8,750,000	7,500,000	7,500,000	7,500,000
10.00% M D. Fredericks	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654
10.00% Kingdom Foundation	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654
6.75% - Debentures	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000
7.375% Sr Note	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000
5.125% Sr Note 2003-2013	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000
Floating Sr Note 2004-2007	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000
4.00% Sr Note 2004-2009	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000
4.95% Sr Note 2004-2014	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000
5.95% Sr Note 2004-2034	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000
SUBTOTAL	2,161,053,308	2,161,053,308	2,161,053,308	2,161,053,308	2,161,053,308	2,161,053,308	2,161,053,308	2,161,053,308	2,159,803,308	2,159,803,308	2,159,803,308
MTN, Series A											
1995-1	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
1995-2	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
SUBTOTAL	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000
TOTAL	2,181,053,308	2,181,053,308	2,181,053,308	2,181,053,308	2,181,053,308	2,181,053,308	2,181,053,308	2,181,053,308	2,179,803,308	2,179,803,308	2,179,803,308
ATMOS POWER SYSTEMS											
Columbus IDB	982,142	982,142	982,142	982,142	916,666	916,666	916,666	916,666	916,666	916,666	851,189
Wells Fargo Equipmt Lease	2,289,292	2,235,203	2,180,859	2,126,259	2,071,403	2,016,287	1,960,913	1,905,277	1,849,380	1,793,219	1,736,795
US Bancorp	3,237,491	3,156,741	3,075,635	2,994,171	2,912,349	2,830,165	2,747,620	2,664,710	2,581,435	2,497,793	2,413,782
SUBTOTAL	6,508,925	6,374,086	6,238,636	6,102,572	5,900,417	5,763,118	5,625,198	5,486,653	5,347,481	5,207,678	5,001,766
UNITED CITIES PROPANE GAS, INC.											
Pulaski -- Ingram	125,000	125,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	75,000	75,000
Pulaski -- Carvell	125,000	125,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	75,000	75,000
Evensville, TN -- E-Con	168,125	168,125	168,125	168,125	168,125	0	0	0	0	0	0
	418,125	418,125	368,125	368,125	368,125	200,000	200,000	200,000	200,000	150,000	150,000
Outstanding Balance @	2,187,980,358	2,187,845,519	2,187,660,069	2,187,524,005	2,187,321,850	2,187,016,426	2,186,878,506	2,186,739,961	2,185,350,789	2,185,160,986	2,184,955,074
Unamortized Balance	3,552,560	3,515,549	3,478,538	3,441,527	3,404,516	3,367,505	3,330,494	3,293,483	3,256,472	3,219,461	3,182,450
Net LT Debt	2,184,427,798	2,184,329,970	2,184,181,531	2,184,082,478	2,183,917,334	2,183,648,921	2,183,548,012	2,183,446,478	2,182,094,317	2,181,941,525	2,181,772,624
	2,184,427,797	2,184,329,969	2,184,181,530	2,184,082,478	2,183,917,333	2,183,648,921					

ATMOS ENERGY CORPORATION
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	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07
ATMOS											
Series P	7,500,000	7,500,000	7,500,000	7,500,000	7,500,000	7,500,000	7,500,000	7,500,000	7,500,000	6,250,000	6,250,000
10.00% M D. Fredericks	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654
10.00% Kingdom Foundation	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654
6.75% - Debentures	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000
7.375% Sr Note	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000
5.125% Sr Note 2003-2013	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000
Floating Sr Note 2004-2007	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000
4.00% Sr Note 2004-2009	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000
4.95% Sr Note 2004-2014	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000
5.95% Sr Note 2004-2034	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000
SUBTOTAL	2,159,803,308	2,159,803,308	2,159,803,308	2,159,803,308	2,159,803,308	2,159,803,308	2,159,803,308	2,159,803,308	2,159,803,308	2,158,553,308	2,158,553,308
MTN, Series A											
1995-1	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
1995-2	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
SUBTOTAL	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000
TOTAL	2,179,803,308	2,179,803,308	2,179,803,308	2,179,803,308	2,179,803,308	2,179,803,308	2,179,803,308	2,179,803,308	2,179,803,308	2,178,553,308	2,178,553,308
ATMOS POWER SYSTEMS											
Columbus IDB	851,189	851,189	851,189	851,189	851,189	785,713	785,713	785,713	785,713	785,713	785,713
Wells Fargo Equipmt Lease	1,680,104	1,623,146	1,565,921	1,508,426	1,450,660	1,392,622	1,334,311	1.275,725	1,216,864	1,157,725	1,098,308
US Bancorp	2,329,401	2,244,648	2,159,521	2,074,019	1,988,140	1,901,883	1,815,245	1,728,225	1,640,822	1,553,033	1,464,858
SUBTOTAL	4,860,694	4,718,984	4,576,631	4,433,634	4,289,989	4,080,218	3,935,269	3,789,663	3,643,399	3,496,471	3,348,879
UNITED CITIES PROPANE GAS, INC											
Pulaski -- Ingram	75,000	75,000	75,000	75,000	50,000	50,000	50,000	50,000	50,000	50,000	25,000
Pulaski -- Carvell	75,000	75,000	75,000	75,000	50,000	50,000	50,000	50,000	50,000	50,000	25,000
Evensville, TN -- E-Con	0	0	0	0	0	0	0	0	0	0	0
	150,000	150,000	150,000	150,000	100,000	100,000	100,000	100,000	100,000	100,000	50,000
Outstanding Balance @	2,184,814,002	2,184,672,292	2,184,529,939	2,184,386,942	2,184,193,297	2,183,983,526	2,183,838,577	2,183,692,971	2,183,546,707	2,182,149,779	2,181,952,187
Unamortized Balance	3,145,439	3,108,428	3,071,417	3,034,406	2,997,395	2,960,384	2,923,373	2,886,362	2,849,351	2,812,340	2,775,329
Net LT Debt	2,181,668,563	2,181,563,864	2,181,458,522	2,181,352,536	2,181,195,902	2,181,023,142	2,180,915,204	2,180,806,609	2,180,697,356	2,179,337,439	2,179,176,858

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	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	13 Months thru Mar-07	13 Months thru Jun-08
ATMOS								
Series P	6,250,000	6,250,000	6,250,000	6,250,000	6,250,000	6,250,000	8,269,231	6,730,769
10.00% M D. Fredericks	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654
10.00% Kingdom Foundation	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654	1,151,654
6.75% - Debentures	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000	150,000,000
7.375% Sr Note	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000	350,000,000
5.125% Sr Note 2003-2013	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000	250,000,000
Floating Sr Note 2004-2007	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000	300,000,000
4.00% Sr Note 2004-2009	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000	400,000,000
4.95% Sr Note 2004-2014	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000
5.95% Sr Note 2004-2034	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000	200,000,000
SUBTOTAL	2,158,553,308	2,158,553,308	2,158,553,308	2,158,553,308	2,158,553,308	2,158,553,308	2,160,572,539	2,159,034,077
MTN, Series A								
1995-1	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
1995-2	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
SUBTOTAL	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000
TOTAL	2,178,553,308	2,178,553,308	2,178,553,308	2,178,553,308	2,178,553,308	2,178,553,308	2,180,572,539	2,179,034,077
ATMOS POWER SYSTEMS								
Columbus IDB	720,237	720,237	720,237	720,237	720,237	720,237	921,702	760,530
Wells Fargo Equipmt Lease	1,038,611	978,633	918,373	857,829	0	0	1,959,088	978,435
US Bancorp	1,376,293	1,287,338	1,197,992	1,108,251	1,018,114	927,581	2,745,072	1,462,137
SUBTOTAL	3,135,141	2,986,209	2,836,601	2,686,317	1,738,351	1,647,818	5,625,862	3,201,102
UNITED CITIES PROPANE GAS, INC								
Pulaski -- Ingram	25,000	25,000	25,000	25,000	25,000	0	96,154	34,615
Pulaski -- Carvell	25,000	25,000	25,000	25,000	25,000	0	96,154	34,615
Evensville, TN -- E-Con	0	0	0	0	0	0	64,663	0
	50,000	50,000	50,000	50,000	50,000	0	256,971	69,231
Outstanding Balance @	2,181,738,449	2,181,589,517	2,181,439,909	2,181,289,625	2,180,341,659	2,180,201,126	2,186,455,372	2,182,304,410
Unamortized Balance	2,738,318	2,701,307	2,664,296	2,627,285	2,590,274	2,553,263	3,330,494	2,775,329
Net LT Debt	2,179,000,131	2,178,888,210	2,178,775,613	2,178,662,340	2,177,751,385	2,177,647,863	2,183,124,878	2,179,529,081

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View
Type

Service Area
Cost Center

Atmos Energy Corporation

Income Statements

Company

Income / Loss, Before Income Taxes	(1,685,516)	33,655,000	73,301,413	78,510,446	52,668,853	30,177,623	8,010,492	(6,139,497)	(7,772,187)	(1,379,701)	(1,110,995)	25,032	258,260,963
Total Provision (Benefit) for Inc Tax	(652,903)	13,310,460	29,030,040	31,028,281	20,857,032	11,847,690	3,024,176	(2,552,362)	(3,229,092)	(673,118)	(542,645)	(2,577)	101,444,982
Income / Loss, Before Cumulative Effect	(1,032,613)	20,344,540	44,271,373	47,482,165	31,811,821	18,329,934	4,986,315	(3,587,135)	(4,543,095)	(706,582)	(568,349)	27,608	156,815,982
Cumulative Effect of Acct Change, Net of Tax	0	0	0	0	0	0	0	0	0	0	0	0	0
Income Statement - Net (Income) Loss	(1,032,613)	20,344,540	44,271,373	47,482,165	31,811,821	18,329,934	4,986,315	(3,587,135)	(4,543,095)	(706,582)	(568,349)	27,608	156,815,982
Avg Shares O/S													82,600,000
EPS													$ 1.90

Adjustments to Net Income													
Debt Reduction from Equity Offering (Pre-Tax)			510,606	879,378	879,378	879,378	879,378	879,378	879,378	879,378	879,378	879,378	8,425,004
Tax Effect			(200,566)	(345,420)	(345,420)	(345,420)	(345,420)	(345,420)	(345,420)	(345,420)	(345,420)	(345,420)	(3,309,344)
Net Income Adjustment	-	-	310,040	533,958	533,958	533,958	533,958	533,958	533,958	533,958	533,958	533,958	5,115,660
ADJUSTED Net Income	(1,032,613)	20,344,540	44,581,413	48,016,123	32,345,778	18,863,891	5,520,273	(3,053,178)	(4,009,137)	(172,624)	(34,392)	561,566	161,931,642
ADJUSTED Avg. Shares O/S													87,642,671
ADJUSTED EPS													$ 1.85

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 215
Witness: Don Murry

Data Request:

With respect to page 15, lines 21-25, please provide (a) the Company's quarterly capitalization amounts and ratios, both including and excluding short-term debt, for the past three years. Please provide the data in both paper and electronic (Microsoft Excel) formats. For the electronic version, please keep all data and equations intact.

Response:

Please see the response to DR Item 235 of the Attorney General's Initial Data Request.

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 216
Witness: Don Murry

Data Request:

With respect to Schedule DAM-5, does the Company maintain a separate capital structure for its seven different regulated gas divisions? If so, please provide quarterly capitalization amounts and ratios, including and excluding short-term debt, for each division over the 2004-2006 period.

Response:

The company does not maintain a separate capital structure for its seven different regulated gas divisions.

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 217
Witness: Don Murry

Data Request:

With respect to Schedule DAM-5, please provide the Company's use of short-term debt on a monthly basis for (a) the past year and (b) as projected for the future test year. Please specify the amounts outstanding and the interest rate charged. Please provide the data in both paper and electronic (Microsoft Excel) formats. For the electronic version, please keep all data and equations intact.

Response:

Please see the response to DR Item 239 of the Attorney General's Initial Data Request.

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 218
Witness: Don Murry

Data Request:

With respect to page 15, lines 21-25, please provide the Company's current cost of short-term debt and the methodology used to compute that rate. Please provide copies of all relevant documents indicating the methodology.

Response:

Please see response to DR Item 240 of the Attorney General's Initial Data Request.

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 219
Witness: Don Murry

Data Request:

With respect to page 16, lines 17-23, please provide (a) an electronic copy of Schedule DAM-8, (b) all calculations involved in the determining the "Less Unamortized Debt Discount" and "Annualized Amortization of Debt Exp. & Debt Discount" (c) the issuance date for each issue, as well as methodology used to estimate the coupon rate for all projected financings, and (d) copies of the relevant work papers used in developing the long-term debt cost rate. Please provide the data in both paper and electronic (Microsoft Excel) formats. For the electronic version, please keep all data and equations intact.

Response:

Please see the response to DR Item 241 of the Attorney General's Initial Data Request.

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 220
Witness: Don Murry

Data Request:

With respect to page 25, lines 17-25, please provide copies of all studies that provide empirical evidence that the DCF provides "no cushion so that the realized return will be sufficient to attract and maintain capital."

Response:

By estimating the expected value at a point in time of future returns, the DCF measures the marginal cost of that investment. If an allowed return on investment is set at this level, by definition, a marginal investor will foresee no margin for market exigencies or other unpredicted events. Dr. Murry does not have a file of empirical studies that may have demonstrated this point.

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 221
Witness: Don Murry

Data Request:

With respect to page 26, lines 13-20, please provide copies of all regulatory decisions in which any and all regulatory commission(s) has or have explicitly stated that it is applying adjustments "to compensate for the marginal cost nature of the DCF."

Response:

In his Direct Testimony at page 24, line 17 through page 28, line 22, Dr. Murry noted that, when setting allowed returns, many times in the past both federal and state regulatory bodies have applied specific adjustments for "flotation costs," "market pressure" and the differential in the market value and book value of common stock to DCF calculations. He has not maintained a file of these specific adjustments. As an example of a regulatory decision that discusses such adjustments please see the decision of *In RE: Indiana Michigan Power Company*, 116 PUR 4^{th} 1, 17), attached hereto and labeled AG DR1-221 ATT.

All four non-company witnesses used the standard DCF model, and all except the Public's Mr. Kahal also performed a risk premium analysis. In each case, the DCF model was applied **[*41]** to AEP on a stand-alone basis and/or a proxy group of risk-comparable companies. Dr. Bowyer employed a nine-company proxy group with the proxy companies selected based on bond ratings and common stock quality ratings, obtaining a range of 11.49 percent to 12.15 percent. Dr. Kennedy obtained 11.48 percent applying the DCF model to AEP and 12.43 percent when applying it to his comparable group. Staff Witness Pilalis performed an AEP stand-alone analysis and found a cost rate of 11.26 percent. Public Witness Kahal performed three DCF studies, applying the model to AEP stand-alone, to a comparable group of 20 electrics rated Baa and to Mr. Brennan's comparable group. He obtained midpoint return results of 11.5 percent, 11.75 percent and 11.8 percent, respectively.

The DCF method, used by all the expert witnesses in this Cause, equates the value of a common stock security to the discounted present value of future dividend cash flows and price appreciation for this security. The discount rate that equates the future dividend and the price appreciation income streams to the current market price of the common stock security is the required market-based rate of return that is demanded **[*42]** by the holder or prospective buyer of the security. This anticipated rate of return can be computed, in simplified terms, by adding the expected dividend yield of the common stock security to the expected growth rate of the dividends per share that will be paid to the common equity shareholder.

The DCF method also contains a number of assumptions for its application. It assumes that the common stock security of a given firm is held by an investor for an indefinite period of time, that the market price, the cash dividends, and the book value of the security grow at the same rate over time, that the investor's expected total return from the security remains constant over time, and that the cash dividends to the holder of the security grow at a constant rate over time. Moreover, the DCF method expressly assumes that the financial markets correctly value the common stock shares of any given firm and, implicitly, assumes that the "payout ratio" (the portion of earnings per share paid in cash dividends) and the "price to earnings" or "P/E" ratio (the price for a common stock share divided by the earnings per share) remain constant over time.

Although the theoretical assumptions of **[*43]** the DCF method may appear to be incompatible with the empirical realities of the financial markets -- a point stressed by Mr. Brennan in his critique of the "constant growth" model -- it nevertheless remains the analytical method of choice in all regulatory jurisdictions, state and federal, in the United States. Mr. Brennan himself conceded under cross-examination that he did not know of any other regulatory authority that had adopted his "modified" DCF approach (TR. B-100). We must nevertheless note that no witness in this proceeding argued for a simple mechanical application of a DCF result. Instead, by taking into consideration the results of other types of analysis (e.g., the Capital Assets Pricing Model, or CAPM), all five cost-of-capital witnesses adjusted their final recommendations upward from the numbers produced by their own DCF analyses. This suggests, as we have noted in other cases, that judgment, rather than simple mathematics, must play the crucial role in our determination of a utility's cost of equity (See, most recently, our Order in Cause No. 37414-S2, April 4, 1990, pp. 19-32).

There are three principal reasons for our unwillingness to place a great deal **[*44]** of weight on the results of any DCF analysis. One is the reason given by Mr. Brennan: the failure of the DCF model to conform to empirical reality. The second is the undeniable fact that rarely if ever do two expert witnesses agree on the terms of a DCF equation for the same utility -- for example, as we shall see in more detail below, projections of future dividend cash flow and anticipated price appreciation of the stock can vary widely. And, the third reason is that the unadjusted DCF result is almost always well below what any informed financial analyst would regard as defensible, and therefore requires an upward adjustment based largely on the expert witness' judgment. In these circumstances, we find it difficult to regard the results of a DCF computation as any more than suggestive.

To that extent, however, we should note that the DCF model calls for the derivation of a "dividend yield" and for the adoption of a "growth rate," so that the market-related cost of common equity for a given firm can be computed. The financial market information that is used for the DCF cost of common equity computation for a specific firm must, to a large extent, relate to the firm's publicly **[*45]** traded common stock securities. Petitioner, however, is a wholly owned subsidiary of American Electric Power Company ("AEP") and does not have any publicly traded common stock securities. AEP's common stock is publicly traded on the New York Stock Exchange. In performing their respective DCF model analyses, therefore, all of the cost-of-capital expert witnesses in this Cause utilized stock market information for the publicly traded securities of AEP, other utilities, and other companies with utility subsidiaries.

By choosing AEP and other utilities or utility holding companies as "proxies" for the non-traded common

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 222
Witness: Don Murry

Data Request:

With respect to page 29, footnote 4, please provide a copy of the cited document.

Response:

Please reference AG DR1-222 ATT1 attached hereto.

Ninth Edition

FINANCIAL MANAGEMENT

THEORY AND PRACTICE

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CHAPTER 10

The Cost of Capital

What company is America's top wealth creator? According to a recent Fortune *article, the winner is Coca-Cola. Investors have entrusted $10.8 billion to Coke's managers, who then caused that investment to grow to $135.7 billion. The difference between the $135.7 billion market value and the $10.8 billion Coke's investors provided is called its* Market Value Added, *or* MVA. *Thus, Coke's managers have, since the company's inception, added a stunning $124.9 billion to their shareholders' wealth. General Electric, Microsoft, Intel, and Merck are next on* Fortune's *list of top MVA creators.*

Is there any way to pick a company today that is likely to be a superior wealth creator in the future? Fortune *reported that Steven Einhorn, research chief at Goldman Sachs, along with other top analysts, uses a tool called* Economic Value Added, *or* EVA, *to evaluate companies, while companies themselves use EVA to measure their performance and to determine managerial bonuses.*

Exactly what is EVA? Developed by the consulting firm Stern Stewart & Company, EVA is designed to measure a corporation's true profitability for a given year, and it is calculated as after-tax operating profits less the annual cost of all the capital the firm uses.

The idea behind EVA is simple—firms are truly profitable and create value if and only if their income exceeds the cost of all the capital they use to finance operations. The conventional measure of performance, net income, takes into account the cost of debt, which shows up on financial statements as interest expense, but it does not reflect the cost of equity. Therefore, a firm can report positive net income yet still be unprofitable in an economic sense if its net income is less than its cost of equity. EVA corrects this flaw by recognizing that to properly measure a firm's performance, it is necessary to account for the cost of equity capital.

Managers create EVA by developing, implementing, and nurturing projects that generate returns greater than their costs of capital. On average, Coke's projects earned 36 percent, which greatly exceeded its 9.7 percent cost of capital. As a result, Coke had an EVA of $2.4 billion, which is outstanding. On the other hand, RJR Nabisco's average project earned a meager 6.2 percent, much less than its 9.8 percent cost of capital, so its EVA was a negative *$1.2 billion. EVA represents value added during a single year, and MVA represents total value created since the company's inception, so there is an obvious correlation between EVA and MVA. Therefore, given RJR's negative EVA, it is not surprising that its lifetime MVA was a negative $12.0 billion. Note, though, that EVA for a given year could be negative, yet a company could still have a positive MVA because it had performed well in prior years.*

In this chapter, we explain how a company can measure its cost of capital and then use that cost of capital to help make various decisions. As you go through the chapter, think about Coca-Cola and RJR Nabisco, and the role the cost of capital plays in creating or destroying wealth.

SOURCE: Richard Teitelbaum, "America's Greatest Wealth Creators," *Fortune,* November 10, 1997, 265–276.

Thus, investors expect to receive a dividend yield, D_1/P_0, plus a capital gain, g, for a total expected return of $\hat{k}_s$, and in equilibrium this expected return is also equal to the required return, k_s. This method of estimating the cost of equity is called the *discounted cash flow, or DCF, method.* Henceforth, we will assume that equilibrium exists, hence $\hat{k} = k$, so we can use the terms k_s and $\hat{k}_s$ interchangeably.

It is easy to determine the dividend yield, but it is difficult to establish the proper growth rate. If past growth rates in earnings and dividends have been relatively stable, and if investors appear to be projecting a continuation of past trends, then g may be based on the firm's historic growth rate. *However, if the company's past growth has been abnormally high or low, either because of its own unique situation or because of general economic fluctuations, then investors will not project the past growth rate into the future.* In this case, g must be estimated in some other manner.

Security analysts regularly make earnings and dividend growth forecasts, looking at such factors as projected sales, profit margins, and competitive factors. For example, *Value Line,* which is available in most libraries, provides growth rate forecasts for 1,700 companies, and Merrill Lynch, Salomon Smith Barney, and other organizations make similar forecasts. Therefore, someone making a cost of equity estimate can obtain several analysts' forecasts, average them, use the average as a proxy for the growth expectations of investors in general, and then combine this g with the current dividend yield to estimate $\hat{k}_s$ as follows:

$$\hat{k}_s = \frac{D_1}{P_0} + \text{Growth rate as projected by security analysts.}$$

Again, note that this estimate of $\hat{k}_s$ is based on the assumption that g is expected to remain constant in the future.[6]

Another method for estimating g is called the **retention growth rate method.** Here we first forecast the firm's average future dividend payout ratio and its complement, the *retention rate,* and then multiply the retention rate by the company's expected future rate of return on equity (ROE):

$$g = (\text{Retention rate})(\text{ROE}) = (1.0 - \text{Payout rate})(\text{ROE}). \qquad \textbf{(10-7)}$$

Security analysts often use this procedure when they estimate growth rates. For example, suppose NCC is expected to have a constant ROE of 14.5 percent, and it is expected to pay out 52 percent of its earnings and to retain 48 percent. In this case, its forecasted growth rate would be g = (0.48)(14.5%) = 7.0%.

To illustrate the DCF approach, suppose NCC's stock sells for \$32; its next expected dividend is \$2.40; and its expected growth rate is 7 percent. NCC's expected and required rate of return, hence its cost of common stock, would then be 14.5 percent:

$$\begin{aligned}\hat{k}_s = k_s &= \frac{\$2.40}{\$32.00} + 7.0\% \\ &= 7.5\% + 7.0\% \\ &= 14.5\%.\end{aligned}$$

---

[6]Analysts' growth rate forecasts are usually for five years into the future, and the rates provided represent the average growth rate over that five-year horizon. Studies have shown that analysts' forecasts represent the best source of growth rate data for DCF cost of capital estimates. See Robert Harris, "Using Analysts' Growth Rate Forecasts to Estimate Shareholder Required Rates of Return," *Financial Management,* Spring 1986.

Note also that two organizations—IBES and Zacks—collect the forecasts of leading analysts for most larger companies, average these forecasts, and then publish the averages. The IBES and Zacks data are available over the Internet through on-line computer data services.

On the Use of Consensus Forecasts of Growth in the Constant Growth Model: The Case of Electric Utilities

Stephen G. Timme and Peter C. Eisemann

Stephen G. Timme is an Associate Professor of Finance and Peter C. Eisemann is a Professor of Finance, both at Georgia State University, Atlanta.

■ The constant growth model is often used for estimating the cost of equity capital in utility rate setting proceedings. A major source of controversy over the cost of equity is the method used to estimate the model's projected growth variable. (See, for example, [23, 24, 36] for a discussion of several technical aspects related to the estimation of the dividend yield component in the constant growth model.) The best estimate of projected growth is assumed to be one that incorporates all information regarding future growth contained in alternative growth proxies. In recent years, utility commissions and researchers have been more receptive to consensus financial analyst's forecasts (FAF's) of growth as opposed to historical growth rates as the basis for the growth variable estimate (e.g., [5], [10], [12], and [21]).[1] A consensus forecast should incorporate the information contained in alternative forecasts and therefore provide the most appropriate estimate for rate of return regulation and research. (Motivation for the use of a consensus growth estimate is provided by the forecasting literature that examines the benefits of combined forecasts, e.g., [18, 19, 26].)

Here the informational content of the increasingly popular consensus forecast provided by Lynch, Jones, and Ryan's *Institutional Brokers Estimate System* (I/B/E/S)

Our thanks to Louis Ederington and two anonymous referees for their valuable comments. All remaining errors are the responsibility of the authors. We wish to also thank the Center for the Study of Regulated Industry at Georgia State University for financial support; to Lynch, Jones, and Ryan for providing the I/B/E/S data through an academic research grant; and to Salomon Brothers, Inc. for also providing data.

[1]There is a growing body of literature demonstrating the superiority of FAF's relative to naive forecasts (e.g. [6, 7, 14]) and that the revision of FAF's conveys information to investors (e.g. [1, 11, 15, 16]). See [17] for an in-depth review of this literature.

is examined relative to the frequently used alternative forecasts by Salomon Brothers, Inc. and Value Line. In comparing the relative informational content of FAF's, this adds to previous research (e.g., [8, 30, 37, 38]) that has to date only examined the use of FAF's versus historical growth rates as estimates of the growth rate in the constant growth model. For completeness, historical growth estimates are also examined. The analysis is performed for a group of electric utilities over 1982–1986. Electric utilities are commonly the focus of applied academic research (e.g., [4, 5, 21, 28, 29, 30, 37, 38]), and the constant growth model is frequently used in electric utilities' rate setting proceedings.

The results of the analyses for the sample utilities show the following:

(i) There generally are large size differences between both the various FAF's and between the FAF's and historical growth rates;

(ii) Neither the consensus I/B/E/S forecast nor the FAF forecasts by Salomon Brothers and Value Line contain by itself all the information included in the other FAF forecasts; and

(iii) FAF-based growth rates contain all the information found in historical growth rates.

The study's primary conclusion is that although a consensus FAF can be formed to contain all the information incorporated in alternative analysts', forecasts, and historical growth rates, the construction of the consensus forecast requires the judicious choice of the weight to be assigned to each forecast. More generally, the results suggest that the informational content of forecasts used as proxies for investor expectations should be compared using a methodology similar to this study's before being accepted in research and regulatory proceedings.

I. Hypothesis, Model, and Methodology

A. The Hypothesis

The standard constant growth model states,

$$k = \frac{D_0(1+g)}{P_0} + g\,, \tag{1}$$

where,

P_0 = current stock price,
D_0 = current dividend per share,
g = expected constant growth rate of dividends, and
k = required rate of return on equity.

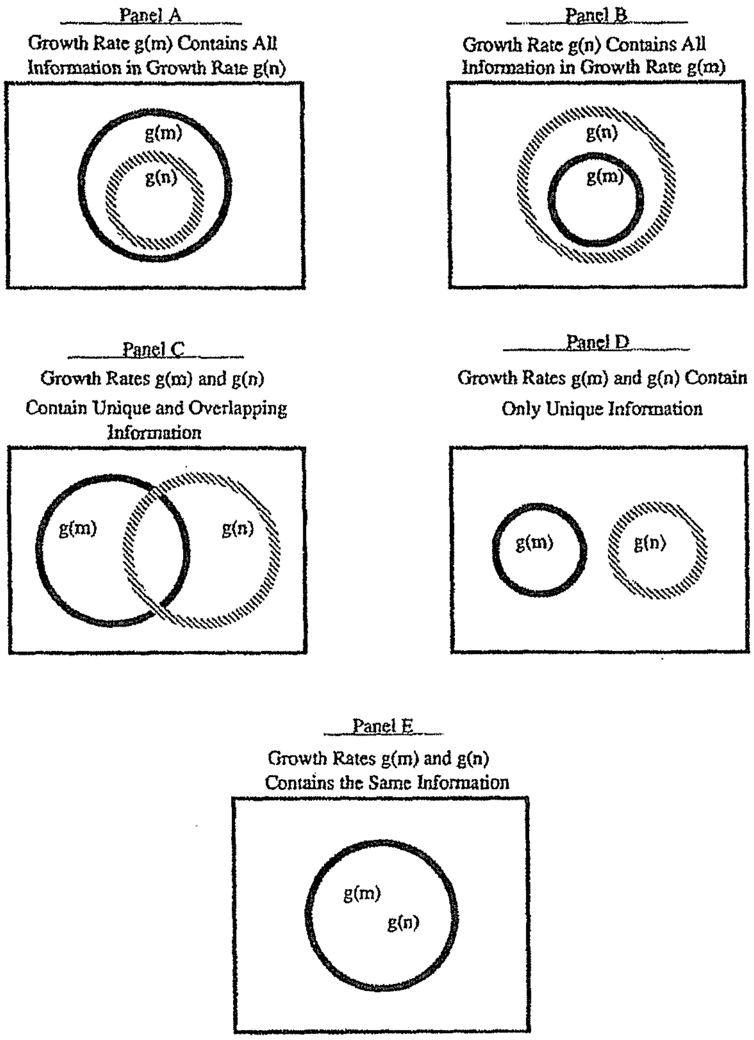
The estimate of the constant growth rate chosen for Equation (1) ideally contains all the information regarding the valuation of equity capital included in all other alternative growth estimates. This concept is depicted graphically in Exhibit 1, which compares the relative informational content of two growth estimates, *g(m)* and *g(n)*. For exposition purposes, it is assumed that *g(m)* and *g(n)* are the only two growth estimates available to investors. However, the analysis can be easily extended to the joint comparison of more than two growth estimates.

In Exhibit 1, the solid-lined circle encompasses all the information included in *g(m)* and the broken-lined circle all the information in *g(n)*, which investors incorporate into stock prices. Panel A depicts a scenario in which *g(m)* contains all the information incorporated in *g(n)*, and *g(n)* does not contain all the information in *g(m)*. As a result, *g(m)* should be wholly used to estimate the growth component in Equation (1). Panel B depicts an opposite scenario in which *g(n)* should be used instead of *g(m)* as a proxy. In Panel C neither growth estimate contains all the information found in the other, although there is some overlap of information as shown by the shaded area of intersection. In Panel D, both estimates contain unique information; there is no common information. Because neither forecast in Panels C and D contains all the information included in the other, some type of average of *g(m)* and *g(n)* should be used as the growth estimate. Finally, in Panel E both *g(m)* and *g(n)* contain exactly the same information found in the other. In this case, *g(m)* and *g(n)* should be equal and either could be used as an estimate of growth.

B. The Model

The growth estimate's relative informational content is tested using the model developed in the works by Malkiel [27] and Cragg and Malkiel [8]. In their research on expectations and valuation, Cragg and Malkiel constructed a linear price-earnings model that approximates a dividend growth model, such as Equation (1) (see their equations 3.3-13 and 3.3-14, 3.3-18, and 4.4-1). The linear price-earnings model is stated as follows:

Exhibit 1. Graphical Depiction of Growth Estimates' Relative Informational Content



$$\frac{P_0}{E_0} = \varphi + \beta_1 \frac{D_0}{E_0} + \beta_2 g + \Sigma\, \alpha_i\, RISK_i + \epsilon . \tag{2}$$

That is, the price-earnings is a linear function of a constant, plus the dividend payout ratio factor, expected future growth factor, and a series of risk factors. In Equation (2), $RISK_i$ is the ith measure of risk associated with the cost of equity k, and ϵ is an error term. Malkiel [27] and more recently Vander Weide and Carleton [37, 38] found that the linear specification in Equation (2) is a fairly robust approximation of the true nonlinear price-earning ratio model which can be derived from Equation (1) and, therefore, is useful for examining alternative proxies for growth. The specific measures of risk used in Equation (2) are discussed in Section II. However, to facilitate the presentation of the paper's methodology, the sources of the growth estimates are discussed first.

C. The Growth Estimates

Five end-of-the-year growth estimates were collected for a group of 62 electric utilities for December 1982 through December 1986. The selection criteria are discussed in Section II. The growth rates are:

GIBES = mean 5-year financial analysts' consensus earnings growth forecast available through Lynch, Jones, and Ryan's *Institutional Brokers Estimate System* (I/B/E/S);[2]

GSB = The projected 5-year normalized growth rate forecasted by Salomon Brothers, Inc. in their publication *Electric Utility Monthly;*

GVLD = The 3 to 5-year forecasted growth in dividends per share as reported in the *Value Line Investment Survey;*

GVLE = The 3 to 5-year forecasted growth in earnings per share as reported in the *Value Line Investment Survey;* and

GHD5 = The 5-year log-linear historical growth in dividends paid per share.[3]

The financial analysts' forecasts GIBES, GSB, GVLD, and GVLE are included in the study for several reasons. First, these growth estimates have been used in previous research to examine electric utilities' cost of equity (e.g., [5, 21]) and are frequently used in rate setting proceedings. Second, for the five years examined in this study, this set of growth estimates permits an appreciably larger sample of utilities than do sets of these estimates combined with other growth estimates (e.g., Merrill Lynch) also available to the authors. Third, although the model in Equation (2) specifies dividend growth, this study uses both dividend and earnings estimates. Theoretically, dividends and earnings per share growth are identical in the constant growth model, and from a practical viewpoint, financial analysts focus on earnings and, therefore, earnings per share data are more readily available. Finally, the historical growth rate GHD5 is included to provide additional insights into the use of analysts' versus historical growth rates. See also [8, 29, 30, 37, 38] for an examination of the use of historical growth rates to estimate the cost of equity.

D. Methodology

The model in Equation (2) is initially estimated using each growth forecast to test hypotheses that each forecast contains all the information contained in all other forecasts. Later, the model in Equation (2) is used to examine the relative informational content of various combinations of forecasts. Similar to all empirical valuation models, a caveat of these tests is that they are really joint tests of each growth rate's informational content and that investors price equity securities in a manner consistent with Equation (2). Maintaining that investors follow Equation (2) in setting security prices, the hypotheses regarding the alternative growth forecasts' informational content are tested using the following variation of Equation (2):

$$\frac{P_0}{E_0} = \varphi + \beta_1 \frac{D_0}{E_0} + \beta_2^* g(m) + \beta_2^{**} g(n) + \Sigma\, \alpha_i RISK_i + \epsilon, \qquad (3)$$

for

m and n = GIBES, GSB, GVLD, GVLE, and GHD5, but $m \neq n$.

The informational content of each growth estimate, as depicted in Exhibit 1, is tested by performing pairwise likelihood ratio tests using Equations (2) and (3). See Maddala [25] for details on tests using likelihood ratios. In performing the tests, the basic approach is to compare $g(m)$ and $g(n)$ via two tests. In the first test, Equation (2) is estimated using $g(m)$ and Equation (3) is estimated using $g(m)$ and $g(n)$. The overall fit of Equation (2), as measured by the log of the likelihood function, is then tested against the overall fit of Equation (3). As an example, suppose the test statistic is significant. This indicates that $g(n)$ contains some information not found in $g(m)$. The second test involves estimating Equation (2) using $g(n)$ and comparing its overall fit to Equation (3), again estimated using $g(m)$ and $g(n)$. If the test statistic from the second test is insignificant, then $g(m)$ does not contain any information not already incorporated in $g(n)$. In this case, these results would suggest that $g(n)$ is a better proxy for investor expectations than $g(m)$, again maintaining that

[2]Use of the I/B/E/S median as opposed to the mean growth forecasts does not alter the study's findings. These results are available from the authors.

[3]Five-year historical growth in earnings per share was also examined. The results for the 5-year historical earnings growth rate show it never contains information not already incorporated in the FAF growth estimates, and that the FAF growth estimates always contain significantly more information than the 5-year historical earnings growth rates. In the interest of space these results are not presented but are available from the authors.

Exhibit 2. Possible Outcomes of Pairwise Likelihood Ratio Tests of the Informational Content of Two Alternative Constant Growth Estimates, $g(m)$ and $g(n)$

Test No.[1]	Significant	Relative Importance
1	Yes	Growth rate $g(m)$ contains all the information in $g(n)$ plus some additional information. See Panel A, Exhibit 1. Growth rate $g(m)$ should be used as an estimate of the constant growth rate.
2	No	
1	No	Growth rate $g(n)$ contains all the information in $g(m)$ plus some additional information. See Panel B, Exhibit 1. Growth rate $g(n)$ should be used as an estimate of the constant growth rate.
2	Yes	
1	Yes	The growth rates $g(m)$ and $g(n)$ contain both unique and overlapping information, or only unique information. See Panels C and D, Exhibit 1. A combination of $g(m)$ and $g(n)$ should be used as an estimate of the constant growth rate.
2	Yes	
1	No	The growth rates $g(m)$ and $g(n)$ contain the same information. See Panel E, Exhibit 1. Either growth rate can be used as an estimate of the constant growth rate.
2	No	

[1]Using Equations (2) and (3). Test No. 1 tests the informational content of $g(m)$ relative to $g(n)$. Test No. 2 tests the informational content of $g(n)$ relative to $g(m)$.

investors follow Equation (2) in setting stock prices. Four outcomes are possible when performing the pairwise likelihood ratio tests using Equations (2) and (3). These outcomes and their interpretation as they relate to the growth estimates' relative informational content are summarized in Exhibit 2.

Exhibit 3. Listing of Electric Utility Companies in Sample

Allegheny Power	Louisville Gas & Elec.
American Elec. Pwr.	MDU Resource Group
Atlantic City Elec.	Minnesota Pwr. & Lt.
Baltimore Gas & Elec.	Nevada Power Co.
Boston Edison	New England Electric
Carolina Pwr. & Lt.	Northeast Utilities
Central & South West	Northern States Power
Central Ill. Pub. Svc.	Ohio Edison
Cilcorp	Oklahoma Gas & Electric
Commonwealth Edison	Orange & Rockland Util.
Commonwealth Energy	Otter Tail Power
Consolidated Edison	PacifiCorp
Dayton Pwr. & Lt.	Pacific Gas & Elec.
Delmarva Pwr. & Lt.	Penn. Pwr. & Lt.
Detroit Edison	Portland General Corp.
Duke Power Co.	Potomac Electric Pwr.
Eastern Utilities	Public Service Ent. Group
El Paso Electric	Public Service New Mexico
Empire District Electric	Puget Sound Pwr. & Lt.
FPL Group	San Diego Gas & Elec.
Hawaiian Electric	Savannah Electric
Houston Industries	Southern Calf. Edison
Idaho Power Co.	Southern Ind. Gas & Elec.
Illinois Power Co.	Southern Company
Interstate Power	TECO Energy
Iowa Electric Lt. & Pwr.	Texas Utilities
Iowa Resources Inc.	Tucson Electric Pwr.
Iowa Southern Utilities	Union Electric
Ipalco Enterprises	Utah Pwr & Lt.
Kansas Pwr. & Lt.	Wisconsin Pwr. & Lt.
Kentucky Utilities	Wisconsin Public Service

II. The Data

A. The Companies

End-of-the year data were collected for 1982–1986 for a sample of investor-owned electric utilities operating in the United States. Several different criteria are imposed in the selection of the sample companies. First, the sample comprises companies for which data are available through I/B/E/S, Salomon Brothers, Inc.'s *Electric Utility Monthly*, and the *Value Line Investment Survey* for each of the five years in the study, and each year's forecasted growth rates are positive for each source. Second, companies were excluded which experienced negative historical dividend growth over 1982–1986 except through stock splits and stock dividends. These criteria exclude companies for which it is believed the constant growth model is not appropriate, since in practice the model is not used to estimate the cost of equity for companies with negative growth rates. Excluded companies are primarily those which have exhibited considerable financial burdens due to nuclear construction programs (e.g., Long Island Lighting, Public Service Indiana, and Public Service New Hampshire). Third, to avoid possible distortions, sample companies are required to have a fiscal year ending December 31. Imposing these criteria results in the sample of 62 utilities listed in Exhibit 3.

B. The Risk Variables

A large number of variables have been used in research and regulatory proceedings to characterize electric utilities' equity risk. (Cragg and Malkiel [8] used risk measures such as equity beta and the variance of the long-term growth forecast [chapter 4], and Vander Weide and Carleton [37, 38] used the firm's pre-tax interest coverage ratio and the stability of the firm's five-year historical earnings per share among others.) The risk measures, $RISK_i$ in Equations (2) and (3), used in this study are defined below.

BETA = The company's equity beta.

BOND1, *BOND2*, and *BOND3* = A dummy variable for the Moody's bond rating. If a company has either an "Aaa" or "Aa" rating, *BOND1* is assigned a value of 1 and *BOND2* and *BOND3* values of 0. For an "A" rating, *BOND2* is assigned a value of 1 and *BOND1* and *BOND3* values of 0. Finally, for a company with a "Baa" rating, *BOND3* is assigned a value of 1 and *BOND1* and *BOND2* values of 0.

NUKE = A dummy variable for the company's nuclear status. *NUKE* is assigned a value of 0 if the company did not exhibit significant nuclear construction/regulatory risk during the 1982–1986 sample period. *NUKE* is assigned a value of 1 if the company did exhibit significant nuclear related construction/regulatory risk during the sample period. The source of data for *NUKE* is discussed below.

A primary consideration in the choice of these risk variables is that they have all been used in academic studies to characterize equity risk.[4] Beta is widely used as a measure of systematic risk, and its theoretical underpinnings are well-known.[5] Studies have shown that bond ratings incorporate numerous measures of risk (e.g., [9, 31, 32]) and that bond ratings are significantly correlated with equity returns (e.g. [20, 33, 39]). The importance of nuclear risk for capital costs became apparent with the Three Mile Island accident on March 28, 1979. Studies have shown that as a result of the accident, both bond risk premiums [2] and stock prices ([3, 22]) for the entire electric utility industry reflected an increased perception of risk, with the risk effect being the greatest for firms with significant nuclear exposure.

C. Data Sources

The sources of data for the growth estimates were described in Section I. The dependent variable P_0/E_0 in Equations (2) and (3) is the end-of-year price-earnings ratio. It equals the closing price on the last trading day of each year divided by earnings per share normalized for the effects of extraordinary items and discontinued operations.[6] Three proxies were used for normalized earnings. They are the estimates for the forthcoming year of primary earning per share before extraordinary items and discontinued operations provided by I/B/E/S, Salomon Brothers, and Value Line.[7] The dividend payout ratio D_0/E_0 equals the end-of-year indicated dividend per share, divided by the proxy for normalized earnings per share. Dividends also exclude the payment of special dividends. The source of data for dividends is *Electric Utility Monthly*. The source of data for BETA is the *Value Line Investment Survey* and bond rating data are obtained from *Moody's Bond Record*. Finally the data for the risk variable NUKE are from various Salomon Brothers publications (e.g., [34]). In these

[4] In an earlier version of this paper, various accounting measures (e.g., debt-to-equity and times-interest-earned) were used, as well as the dispersion of the analysts' forecasts, as measures of equity risk. The results using these measures are consistent with the conclusions associated with the results reported in this paper, that the consensus I/B/E/S consensus forecast does not contain all relevant information and the construction of a consensus forecast requires the judicious choice of the weight to be assigned each analyst's forecast. The authors prefer usage of BETA, BOND, and NUKE because of their intuitive appeal and their apparent ability to parsimoniously represent the information contained in the other risk measurers.

[5] The authors acknowledge that the use of beta to estimate utilities' cost of equity capital continues to be debated in the literature (e.g., [4] and the comments and replies in earlier issues of this journal).

[6] As pointed out by a referee, a caveat to this paper's analyses relates to the comparability of utilities' earnings per share both across companies and through time. The level and quality of earnings may vary across companies due to, for example, differing treatment of allowances for funds used during construction (AFUDC) and the tax effects of normalization versus flow-through accounting (e.g., the treatment of depreciation, tax deferrals, and investment tax credits). Earnings per share may not be directly comparable across time due to changes in accounting conventions. In SFAS 90, for example, it was decided during this study's sample period that plant abandonment and disallowances were no longer extraordinary items for regulated utilities.

Exhibit 4. Mean Values and Standard Deviations (in parentheses) for Sample Utilities[1]

	1982		1983		1984		1985		1986	
	Non-Nuclear Group	Nuclear Group	Non-Nuclear Group	Nuclear Group	Non-Nuclear Group	Nuclear Group	Non-Nuclear Group	Nuclear Group	Non-Nuclear Group	Nuclear Group
P/E[2]	6.98	6.78	7.09	6.02	7.41	6.42	9.19	7.42	11.45	9.11
	(0.82)	(1.45)	(1.06)	(0.93)	(1.07)	(0.70)	(1.03)	(0.90)	(1.10)	(1.31)
GIBES	5.23%	5.17%	5.14%	4.99%	4.90%	4.40%	4.67%	4.38%	4.64%	3.94%
	(1.15%)	(1.33%)	(1.29%)	(0.95%)	(1.22%)	(1.23%)	(1.15%)	(1.11%)	(1.05%)	(1.18%)
GVLD	5.89	6.16	5.69	5.09	5.66	4.91	5.53	4.96	4.99	4.30
	(2.62)	(2.33)	(2.50)	(1.78)	(2.62)	(1.49)	(2.23)	(1.58)	(2.05)	(1.72)
GVLE	6.30	6.50	5.65	5.64	5.54	4.75	4.93	4.43	4.44	3.45
	(2.19)	(1.44)	(2.12)	(1.91)	(2.72)	(1.67)	(1.95)	(1.90)	(1.55)	(1.90)
GSB	6.35	6.05	6.31	5.81	6.33	5.50	5.93	5.05	5.61	4.71
	(1.34)	(1.25)	(1.25)	(1.25)	(1.44)	(1.23)	(1.28)	(1.13)	(1.23)	(1.17)
GH5D	6.18	5.70	6.07	5.69	6.03	5.51	5.94	5.22	5.68	4.68
	(3.79)	(3.38)	(2.86)	(3.05)	(2.77)	(2.56)	(2.91)	(2.27)	(3.03)	(2.38)

[1]The growth rates are defined as follows: GIBES, the mean I/B/E/S consensus five-year earnings forecast; GSB, the Salomon Brothers' projected 5-year normalized growth; GVLD, the Value Line 3 to 5-year forecasted growth in dividends; GVLE, the Value Line 3 to 5-year forecasted growth in earnings; and GHD5, 5-year historical growth in dividends.

[2]The price-earnings ratio is calculated for each company using the year-ending closing price divided by the I/B/E/S consensus estimate of primary earnings per share before extraordinary items and discontinued operations for the forthcoming year.

publications, Salomon Brothers categorizes electric utilities into two groups—those with (NUKE = 1) and those without (NUKE = 0) significant nuclear risk based upon the utilities' investment in nuclear construction relative to the value of equity and other factors.

III. Empirical Results

A. Summary Statistics

Exhibit 4 reports the means and standard deviations of the price-earnings ratios and all growth estimates for each year in the study. For comparative purposes the data are reported by nuclear risk classification, i.e., for the Nonnuclear Group the risk variable NUKE = 0 and for the Nuclear Group NUKE = 1. Of particular interest is the appreciable difference between the various FAF's for each group. For example, GSB generally exceeds GIBES for both groups. The difference, approximately 100 basis points, is statistically and potentially economically significant in all years.[8] For example,

[7]Fortunately, the various sources of projected earnings per share and forecasted growth rates exhibited only slight correlation. Regressing the projected earnings per share on forecasted growth resulted in an average adjusted R-square of approximately 0.15. Thus, the effects of spurious correlation in the regression analysis presented in this paper should be minimal.

The tests were also conducted using several other definitions of earnings per share, including the most recent reported twelve-month earnings per share, which, as of the end of December was for the period from October of the previous year through September of the current year. Assuming perfect foresight, normalized earnings were also defined in an earlier version of this paper as the annual primary earning per share actually reported for the current year. These earnings are generally not available until February or March of the following year. The conclusions drawn from the use of all of these alternative definitions of earnings per share are the same as those reported in this paper. The empirical results using these alternative definitions are available from the authors upon request.

[8]For each year statistical tests were conducted to test whether each pair of forecasts was significantly different. These results are available upon request.

Exhibit 5. Estimates of Regression Coefficients for the Price-Earnings Model Using Equation (4)[a]

		Growth Estimate Used in Regression				
Variable	Regression Coefficient	GIBES	GSB	GVLD	GVLE	GHD5
Constant	φ_1	3.09*	-0.99	1.47	3.29*	3.49*
		(0.92)	(0.99)	(0.87)	(0.85)	(0.80)
YR83	φ_2	-0.17	-0.13	-0.09	-0.10	-0.19
		(0.16)	(0.14)	(0.15)	(0.16)	(0.15)
YR84	φ_3	0.38#	0.47*	0.43*	0.41*	0.28
		(0.16)	(0.15)	(0.17)	(0.16)	(0.15)
YR85	φ_4	1.74*	1.97*	1.72*	1.80*	1.62*
		(0.17)	(0.15)	(0.15)	(0.16)	(0.16)
YR86	φ_5	3.68*	3.98*	3.70*	3.80*	3.56*
		(0.17)	(0.16)	(0.15)	(0.17)	(0.16)
D_0/E_0	β_1	6.99*	9.51*	8.84*	6.99*	6.95*
		(0.63)	(0.66)	(0.66)	(0.59)	(0.57)
g	β_2	24.01*	51.37*	22.80*	15.11*	11.70*
		(5.46)	(5.71)	(2.93)	(2.84)	(1.92)
BETA	α_1	-2.40#	-2.23#	-2.06#	-2.14#	-2.19#
		(1.03)	(0.94)	(0.97)	(1.02)	(1.00)
NUKE	α_2	-0.84*	-0.63*	-0.79*	-0.83	-0.87
		(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
BOND2	α_3	-0.49*	-0.28*	-0.50*	-0.61*	-0.41
		(0.11)	(0.10)	(0.10)	(0.11)	(0.11)
BOND3	α_4	-1.12*	-0.62*	-1.19*	-1.32*	-1.04
		(0.17)	(0.17)	(0.16)	(0.17)	(0.17)
Logged Likelihood Function		-388.79	-361.35	-369.86	-384.57	-380.45
Adjusted R^2		0.80	0.83	0.82	0.80	0.80

[a]Standard errors in parentheses.

*Significant at the 0.01 level.

#Significant at the 0.05 level.

a 100 basis point difference in the recommended cost of equity translates into a change in revenue requirements in excess of $2.0 billion per year for the electric utility industry.[9]

B. Estimation

The models in Equations (2) and (3) are estimated by pooling the data across companies and time periods. As is common when pooling cross-section and time-series data, dummy variables are also added to allow the intercept term to vary for each year (e.g., see Maddala [25, Chapter 14]). The dummy variables are included to allow for yearly changes in variables, such as general capital market conditions and investor behavior, which are not explicitly included in Equations (2) and (3), and are maintained to result in an additive shift in the overall level of all firms' price-earnings ratios. With the inclusion of the time dummy variables and the risk variables discussed in Section II, the final formulation of Equation (2) is

$$\frac{P_0}{E_0} = \varphi_1 + \varphi_2 YR83 + \varphi_3 YR84 + \varphi_4 YR85 + \varphi_5 YR86 + \beta_1 \frac{D_0}{E_0} + \beta_2 g + \alpha_1 BETA + \alpha_2 NUKE + \alpha_3 BOND2 + \alpha_4 BOND3 + \epsilon . \tag{4}$$

where,

$YR83$ = 1 if 1983, 0 otherwise;
$YR84$ = 1 if 1984, 0 otherwise;
$YR85$ = 1 if 1985, 0 otherwise;
$YR86$ = 1 if 1986, 0 otherwise; and

all other variables are as previously defined.

A reformulation similar to Equation (4) is also applied to Equation (3).

The regression model in Equation (4) is structured such that the intercept term, φ_1, captures the combined effects of a utility with either a "Aaa" or "Aa" bond rating, BOND1 = 1, and a company with no nuclear risk, NUKE = 0. Therefore, the bond rating regression parameters α_3 and α_4 measure, respectively, the mean differences between the price-earnings ratio P_0/E_0 of utilities with "A" and "Baa" rated bonds relative to those with "Aaa" or "Aa" rated bonds holding all else constant. Likewise, the regression parameter α_2 measures the differences between the mean price-earnings ratios of utilities with nuclear risk relative to companies without such risk, again holding all other factors constant.

C. The Results

Exhibit 5 reports selected statistics from estimation of Equation (4) using each of the growth estimates and the I/B/E/S proxy for normalized earnings per share.[10] Only the results using the I/B/E/S proxy for normalized earnings are reported since the conclusions drawn from the empirical findings are the same regardless of the proxy for normalized earnings.[11] The results in Exhibit 5 indicate that Equation (4) is a reasonable model of the electric utilities' price-earning ratios with the signs of all the estimated regression coefficients as expected. For example, β_2 shows that utilities with higher expected growth rates, holding all else constant, have higher price-earnings ratios. Also, the negative coefficient for α_2 indicates that utilities with significant nuclear risk have, on average, price-earnings ratios approximately 0.90 lower than utilities without such risk. The negative coefficients for α_3 and α_4, for "A" and "Baa" rated bonds, respectively, indicate that utilities with lower bond ratings exhibit lower price-earnings ratios (approximately 0.5 lower for "A" and 1.0 lower for "Baa" rated bonds). The results also show that the regression coefficient α_1 for BETA is, as expected, negatively related to the price-earnings ratio. Finally, the coefficients for the yearly dummy variables are consistent with the significantly upward trend in the sample companies' price-earnings ratios over the sample period (see summary statistics for P/E ratio in Exhibit 4).

Exhibit 6 reports the calculated pairwise likelihood ratio tests and is arranged such that the calculated likelihood ratios correspond to tests of the informational content of the growth estimates in Column 1 relative to the growth estimates in Columns 2 through 6. The results in Exhibit 6 show that when the informational content of GIBES is tested relative to all other growth estimates, all calculated likelihood ratios are significant at the 0.01 level (see Row 1). (Because of the serious economic consequences which could result from the incorrect rejection of the null hypotheses and the large number of pairwise tests, the probability of Type I error is set at 0.01.) For example, when the

[9]Salomon Brothers [35] reports \$133 billion of common equity outstanding as of June 30, 1986 for their 100 Electric Utilities. Using a marginal tax rate of 40% (federal and state), a 100 basis point difference in the recommended cost of equity would translate into a \$2.22 billion [(\$133 billion × 1%)/ (1 - 40%)] difference in annual revenue requirements.

[10]The regression estimates for the reformulated version of Equation (4) are available upon request.

[11]The results using the Salomon Brothers and Value Line proxy for normalized earnings are available upon request.

Exhibit 6. Pairwise Likelihood Ratio Tests of the Informational Content of Alternative Proxies for Growth Rate in the Constant Growth Model[1]

	Calculated Likelihood Ratio Tests[2]				
	GIBES	GSB	GVLD	GVLE	GHD5
(1)	(2)	(3)	(4)	(5)	(6)
(1) GIBES	N/A	56.32*	40.20*	11.72*	17.80*
(2) GSB	1.44	N/A	8.12*	10.48*	1.42
(3) GVLD	2.34	25.14*	N/A	3.78	2.18
(4) GVLE	3.28	56.92*	33.20*	N/A	25.44*
(5) GHD5	7.12*	39.62*	23.36*	17.20*	N/A

*Significant at the 0.01 level.

[1]The growth rates are defined as follows: GIBES, the mean I/B/E/S consensus 5-year earnings forecast; GSB, the Salomon Brothers' projected 5-year normalized growth; GVLD, the Value Line 3 to 5-year forecasted growth in dividends; GVLE, the Value Line 3 to 5-year forecasted growth in earnings; and GHD5, 5-year historical growth in dividends.

[2]Significant likelihood ratio tests indicate that the growth rate in Columns (2)–(6) contains information not incorporated in the growth rate in Column (1). The ratio tests are chi-squared distributed with 1 degree of freedom. The critical test values are 3.84 at the 0.05 level of significance, and 6.63 at the 0.01 level.

informational content of GIBES is compared to the Salomon Brothers growth rate, GSB, the calculated likelihood ratio equals 56.32 (see Row 1, Column 3) which is highly significant, indicating that GSB contains information not incorporated in GIBES. Conversely, when the informational content of all the other growth estimates is tested relative to GIBES (see Column 2), only GHD5 is significant. For example, when testing the hypothesis that GIBES contains information not found in GSB, the calculated likelihood ratio equals 1.44 (see Row 2, Column 2), which is insignificant. This suggests that the I/B/E/S growth estimate does not contain any information not already found in GSB. The overall results indicate that all alternative growth estimates contained information not incorporated in GIBES (Row 1), whereas GIBES only contained some information not in GHD5 (Column 2). Consequently, maintaining that Equation (2) represents investors' pricing behavior for the sample utilities, the results suggest that GIBES was not the best proxy.

If the set of all possible growth estimates is restricted to only those analyzed in this study, the results suggest that for the sample utilities, investor expectations are best proxied from some combination of GSB and GVLD. The hypothesis that GSB contained all information included in other growth rates is rejected when tested relative to GVLE and GVLD, whereas the hypotheses for all growth rates are rejected when tested relative to GSB. In addition, the hypothesis that GVLE includes all information is rejected when tested against all other growth estimates including GVLD, whereas the hypothesis the GVLD contains all information is not rejected when tested against GVLE. This finding provides supports, therefore, for the use of some type of combined financial analyst forecast for estimating the constant growth term.[12]

Additional analyses were performed comparing the combined informational content of GSB and GVLD relative to the information contained in various combinations of GIBES, GVLE, and GHD5. When testing the hypothesis that the combination of GSB and GVLD contains more information than the combinations of *(i)* GIBES and GVLE, *(ii)* GIBES and GHD5, and *(iii)* GVLE and GHD5, the calculated likelihood ratios are 56.66, 39.56, and 34.28, respectively, which are all highly significant. In testing the hypotheses that these three combined forecasts contain information not already incorporated in GSB and GVLD, all likelihood ratio tests were insignificant. As an additional test, the hypothesis that the combination of GSB and GVLD contains more information than the combination of GIBES, GVLE, and GHD5 was also tested resulting in a likelihood ratio of 34.10, which is again highly significant. Finally, the combination of GIBES, GVLE, and GHD5 was found not to contain any information in addition to that incorporated in GSB and GVLD.

D. Performance of the I/B/E/S Consensus Forecast

The performance of the consensus forecast, GIBES, is possibly explained by several factors. First, GIBES

[12]Insights into the weights to assign to GSB and GVLD to derive the optimal growth estimate, g^{*}, are provided from the estimated regression coefficients, β_2^{*} for GSB and β_2^{**} for GVLD, from the reformulated version of Equation (4) by letting $g^{*} = wGSB + (1 - w)GVLD$, and maintaining the hypothesis that $\beta_2^{*} = w\beta_2$ and $\beta_2^{**} = (1 - w)\beta_2$. The estimate for w is $(\beta_2^{*}/\beta_2^{**})/(1 + \beta_2^{*}/\beta_2^{**})$. The estimated coefficients for β_2^{*} and β_2^{**} equal 37.54 and 10.50, respectively, resulting in an estimate of w of approximately 80% for GSB and 20% $(1 - w)$ for GVLD.

equally weights each individual analyst's forecast to obtain the consensus forecast. However, studies (e.g., [13, 19]) of other economic variables indicate that in an optimal forecast the weights assigned to individual forecasts are usually unequal. Since GSB and GVLE are often included in the derivation of GIBES, the results suggest that it may be that the equal weighting scheme is suboptimal. Furthermore, the finding that an individual forecast such as GSB comes close to including all information found in the other forecasts is consistent with the findings in the other studies (e.g., [16, 26]) that have examined forecasts of macroeconomic variables. These studies show that in cases where the combined forecast is derived using incorrect weights, it is possible for a good individual forecast to actually outperform the combined forecast.

Another possible limitation of the I/B/E/S consensus data which has been noted in the literature (e.g., [17, 21]) is that the forecasts contained in the I/B/E/S consensus forecast may not represent each source's most recent forecast. To the extent that there is a lag in collecting the most recent forecasts, GIBES may not incorporate all relevant current information.

The I/B/E/S data used in this study were usually made publicly available the Thursday of the third week of December. The Salomon Brothers forecast, GSB, was prepared at the end of each November and was published in the *Electric Utility Monthly* usually within the first week of December. Since this study uses end-of-month December price and earnings data, the published GSB was approximately one month old and may not have represented Salomon Brothers most recent unpublished forecast. (See [1] for an examination of the impact on stock prices from releasing revisions of analysts' forecasts to select clients before making them available to the general public.) Also, for some of the utilities in the sample the Value Line forecasts were approximately two months old. Hence, considering the timing of the release of the Salomon Brothers and Value Line data, the performance of GIBES relative to GSB and GVLE cannot be fully explained by the possibility that the I/B/E/S consensus data did not contain all the most recent forecasts.[13]

E. Financial Analysts' Forecast vs. Historical Growth

The results in Exhibit 6 also provide additional evidence of the superiority of FAF's over historical growth based forecasts. The results show that all financial analysts' forecasts contain a significant amount of information used by investors in the determination of share prices not found in the historical growth rate GHD5. However, the historical growth rate, GHD5, also contains information not incorporated in GIBES and GVLE.

It seems somewhat paradoxical that the financial analysts' forecasts GIBES and GVLE would not contain all the information found in the readily available historical growth rate GHD5. However both GIBES and GVLE are forecasts of growth in earnings, not dividends. The information incorporated in a rational earnings forecast need not include information found in historical dividend growth, even if such information is incorporated in stock prices, unless historical dividend growth also contains information pertaining to future growth in earnings. However, it would be expected that a rational forecast of future growth in dividends would at least incorporate any information found in historical dividend growth rates. Exhibit 6 shows that the Value Line's forecasted dividend growth rate, GVLD, contains all the information in the historical growth rate, GHD5, and more.

Finally, GSB always contains information not found in GHD5 and GHD5 does not contain information not already incorporated in GSB. Since GSB is, for the sample companies, a part of the appropriate proxy for g, the results indicate that an estimate comprised wholly of FAF's is preferable to one based solely on historical growth rates, or a combination of historical growth rates and FAF's. These findings are consistent with those in [8, 37]. However Newbold, Zumwalt, and Kannan [30] compared ARIMA model forecasts to Value Line's, and found that combining forecasts increased forecasting ability.

IV. Summary and Conclusion

Consensus analysts' forecasts are being increasingly used as proxies for investor expectations. Exclusive use of a consensus forecast assumes that it incorporates all information relating to equity valuation contained in alternative proxies. This assumption is of critical im-

[13]As pointed out by a referee, the I/B/E/S consensus growth forecasts are a mixture of both arithmetic and geometric growth rates and, therefore, it may be argued that their comparison to individual analyst's forecasts is unfair. However, as also noted by the referee, such criticism is moot since I/B/E/S forecasts are purchased by analysts, regulators, and companies who use I/B/E/S as an alternative to other forecasts.

portance both in investor research and in regulatory rate setting proceedings where consensus forecasts are often used to establish cost of equity recommendations. Using an approximation to a constant growth valuation model, this study examined the informational content of the commonly used I/B/E/S consensus growth forecast relative to selected individual analyst's forecasts provided by Salomon Brothers and Value Line. Historical growth rates were also examined. The analyses were performed for a group of electric utilities.

Within the limitations of the empirical pricing model used in the study the results indicate, for the sample of utilities examined, that the I/B/E/S consensus forecast did not contain all relevant information. Instead, the selected individual analysts' forecasts consistently contained significant amounts of information not reflected in the consensus data. The results demonstrate that in research and regulatory proceedings, analyses similar to that performed in this study should be conducted to establish the adequacy of forecasts used as proxies for growth. Finally, the results provide additional evidence that historical growth rates are poor proxies for investor expectations; hence, they should not be used to estimate utilities' cost of equity capital.

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Investor growth expectations: Analysts vs. history

Analysts' growth forecasts dominate past trends in predicting stock prices.

James H. Vander Weide and Willard T. Carleton

For the purposes of implementing the Discounted Cash Flow (DCF) cost of equity model, the analyst must know which growth estimate is embodied in the firm's stock price. A study by Cragg and Malkiel (1982) suggests that the stock valuation process embodies analysts' forecasts rather than historically based growth figures such as the ten-year historical growth in dividends per share or the five-year growth in book value per share. The Cragg and Malkiel study is based on data for the 1960s, however, a decade that was considerably more stable than the recent past.

As the issue of which growth rate to use in implementing the DCF model is so important to applications of the model, we decided to investigate whether the Cragg and Malkiel conclusions continue to hold in more recent periods. This paper describes the results of our study.

STATISTICAL MODEL

The DCF model suggests that the firm's stock price is equal to the present value of the stream of dividends that investors expect to receive from owning the firm's shares. Under the assumption that investors expect dividends to grow at a constant rate, g, in perpetuity, the stock price is given by the following simple expression:

$$P_S = \frac{D(1+g)}{k-g} \tag{1}$$

where:

P_S = current price per share of the firm's stock;

D = current annual dividend per share;

g = expected constant dividend growth rate; and

k = required return on the firm's stock.

Dividing both sides of Equation (1) by the firm's current earnings, E, we obtain:

$$\frac{P_S}{E} = \frac{D}{E} \cdot \frac{(1+g)}{k-g} \tag{2}$$

Thus, the firm's price/earnings (P/E) ratio is a nonlinear function of the firm's dividend payout ratio (D/E), the expected growth in dividends (g), and the required rate of return.

To investigate what growth expectation is embodied in the firm's current stock price, it is more convenient to work with a linear approximation to Equation (2). Thus, we will assume that:

$$P/E = a_0(D/E) + a_1 g + a_2 k. \tag{3}$$

(Cragg and Malkiel found this assumption to be reasonable throughout their investigation.)

Furthermore, we will assume that the required

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Financial support for this project was provided by BellSouth and Pacific Telesis. The authors wish to thank Paul Blalock at BellSouth, Mohan Gyani at Pacific Telesis, Bill Keck at Southern Bell, and John Carlson, their programmer, for help with this project.

rate of return, k, in Equation (3) depends on the values of the risk variables B, Cov, Rsq, and Sa, where B is the firm's Value Line beta; Cov is the firm's pretax interest coverage ratio; Rsq is a measure of the stability of the firm's five-year historical EPS; and Sa is the standard deviation of the consensus analysts' five-year EPS growth forecast for the firm. Finally, as the linear form of the P/E equation is only an approximation to the true P/E equation, and B, Cov, Rsq, and Sa are only proxies for k, we will add an error term, e, that represents the degree of approximation to the true relationship.

With these assumptions, the final form of our P/E equation is as follows:

$$P/E = a_0(D/E) + a_1g + a_2B + a_3Cov + a_4Rsq + a_5Sa + e. \qquad (4)$$

The purpose of our study is to use more recent data to determine which of the popular approaches for estimating future growth in the Discounted Cash Flow model is embodied in the market price of the firm's shares.

We estimated Equation (4) to determine which estimate of future growth, g, when combined with the payout ratio, D/E, and risk variables B, Cov, Rsq, and Sa, provides the best predictor of the firm's P/E ratio. To paraphrase Cragg and Malkiel, we would expect that growth estimates found in the best-fitting equation more closely approximate the expectation used by investors than those found in poorer-fitting equations.

DESCRIPTION OF DATA

Our data sets include both historically based measures of future growth and the consensus analysts' forecasts of five-year earnings growth supplied by the Institutional Brokers Estimate System of Lynch, Jones & Ryan (IBES). The data also include the firm's dividend payout ratio and various measures of the firm's risk. We include the latter items in the regression, along with earnings growth, to account for other variables that may affect the firm's stock price.

The data include:

Earnings Per Share. Because our goal is to determine which earnings variable is embodied in the firm's market price, we need to define this variable with care. Financial analysts who study a firm's financial results in detail generally prefer to "normalize" the firm's reported earnings for the effect of extraordinary items, such as write-offs of discontinued operations, or mergers and acquisitions. They also attempt, to the extent possible, to state earnings for different firms using a common set of accounting conventions.

We have defined "earnings" as the consensus analyst estimate (as reported by IBES) of the firm's earnings for the forthcoming year.[1] This definition approximates the normalized earnings that investors most likely have in mind when they make stock purchase and sell decisions. It implicitly incorporates the analysts' adjustments for differences in accounting treatment among firms and the effects of the business cycle on each firm's results of operations. Although we thought at first that this earnings estimate might be highly correlated with the analysts' five-year earnings growth forecasts, that was not the case. Thus, we avoided a potential spurious correlation problem.

Price/Earnings Ratio. Corresponding to our definition of "earnings," the price/earnings ratio (P/E) is calculated as the closing stock price for the year divided by the consensus analyst earnings forecast for the forthcoming fiscal year.

Dividends. Dividends per share represent the common dividends declared per share during the calendar year, after adjustment for all stock splits and stock dividends). The firm's dividend payout ratio is then defined as common dividends per share divided by the consensus analyst estimate of the earnings per share for the forthcoming calendar year (D/E). Although this definition has the deficiency that it is obviously biased downward — it divides this year's dividend by next year's earnings — it has the advantage that it implicitly uses a "normalized" figure for earnings. We believe that this advantage outweighs the deficiency, especially when one considers the flaws of the apparent alternatives. Furthermore, we have verified that the results are insensitive to reasonable alternative definitions (see footnote 1).

Growth. In comparing historically based and consensus analysts' forecasts, we calculated forty-one different historical growth measures. These included the following: 1) the past growth rate in EPS as determined by a log-linear least squares regression for the latest year,[2] two years, three years, . . ., and ten years; 2) the past growth rate in DPS for the latest year, two years, three years, . . ., and ten years; 3) the past growth rate in book value per share (computed as the ratio of common equity to the outstanding common equity shares) for the latest year, two years, three years, . . ., and ten years; 4) the past growth rate in cash flow per share (computed as the ratio of pretax income, depreciation, and deferred taxes to the outstanding common equity shares) for the latest year, two years, three years, . . ., and ten years; and 5) plowback growth (computed as the firm's retention ratio for the current year times the firm's latest annual return on common equity).

We also used the five-year forecast of earnings per share growth compiled by IBES and reported in mid-January of each year. This number represents the consensus (i.e., mean) forecast produced by analysts from the research departments of leading Wall Street and regional brokerage firms over the preceding three months. IBES selects the contributing brokers "because of the superior quality of their research, professional reputation, and client demand" (IBES *Monthly Summary Book*).

Risk Variables. Although many risk factors could potentially affect the firm's stock price, most of these factors are highly correlated with one another. As shown above in Equation (4), we decided to restrict our attention to four risk measures that have intuitive appeal and are followed by many financial analysts: 1) B, the firm's beta as published by Value Line; 2) Cov, the firm's pretax interest coverage ratio (obtained from Standard & Poor's Compustat); 3) Rsq, the stability of the firm's five-year historical EPS (measured by the R^2 from a log-linear least squares regression); and 4) Sa, the standard deviation of the consensus analysts' five-year EPS growth forecast (mean forecast) as computed by IBES.

After careful analysis of the data used in our study, we felt that we could obtain more meaningful results by imposing six restrictions on the companies included in our study:

1. Because of the need to calculate ten-year historical growth rates, and because we studied three different time periods, 1981, 1982, and 1983, our study requires data for the thirteen-year period 1971-1983. We included only companies with at least a thirteen-year operating history in our study.
2. As our historical growth rate calculations were based on log-linear regressions, and the logarithm of a negative number is not defined, we excluded all companies that experienced negative EPS during any of the years 1971-1983.
3. For similar reasons, we also eliminated companies that did not pay a dividend during any one of the years 1971-1983.
4. To insure comparability of time periods covered by each consensus earnings figure in the P/E ratios, we eliminated all companies that did not have a December 31 fiscal year-end.
5. To eliminate distortions caused by highly unusual events that distort current earnings but not expected future earnings, and thus the firm's price/earnings ratio, we eliminated any firm with a price/earnings ratio greater than 50.
6. As the evaluation of analysts' forecasts is a major part of this study, we eliminated all firms that IBES did not follow.

Our final sample consisted of approximately sixty-five utility firms.[3]

RESULTS

To keep the number of calculations in our study to a reasonable level, we performed the study in two stages. In Stage 1, all forty-one historically oriented approaches for estimating future growth were correlated with each firm's P/E ratio. In Stage 2, the historical growth rate with the highest correlation to the P/E ratio was compared to the consensus analyst growth rate in the multiple regression model described by Equation (4) above. We performed our regressions for each of three recent time periods, because we felt the results of our study might vary over time.

First-Stage Correlation Study

Table 1 gives the results of our first-stage correlation study for each group of companies in each of the years 1981, 1982, and 1983. The values in this table measure the correlation between the historically oriented growth rates for the various time periods and the firm's end-of-year P/E ratio.

The four variables for which historical growth rates were calculated are shown in the left-hand column: EPS indicates historical earnings per share growth, DPS indicates historical dividend per share growth, BVPS indicates historical book value per share growth, and CFPS indicates historical cash flow per share growth. The term "plowback" refers to the product of the firm's retention ratio in the currennt year and its return on book equity for that year. In all, we calculated forty-one historically oriented growth rates for each group of firms in each study period.

The goal of the first-stage correlation analysis was to determine which historically oriented growth rate is most highly correlated with each group's year-end P/E ratio. Eight-year growth in CFPS has the highest correlation with P/E in 1981 and 1982, and ten-year growth in CFPS has the highest correlation with year-end P/E in 1983. In all cases, the plowback estimate of future growth performed poorly, indicating that — contrary to generally held views — plowback is not a factor in investor expectations of future growth.

Second-Stage Regression Study

In the second stage of our regression study, we ran the regression in Equation (4) using two different measures of future growth, g: 1) the best historically oriented growth rate (g_h) from the first-stage correlation study, and 2) the consensus analysts' forecast (g_a) of five-year EPS growth. The regression results, which are shown in Table 2, support at least

TABLE 1

Correlation Coefficients of All Historically Based Growth Estimates by Group and by Year with P/E

Current Year	Historical Growth Rate Period in Years: 1	2	3	4	5	6	7	8	9	10
1981										
EPS	−0.02	0.07	0.03	0.01	0.03	0.12	0.08	0.09	0.09	0.09
DPS	0.05	0.18	0.14	0.15	0.14	0.15	0.19	0.23	0.23	0.23
BVPS	0.01	0.11	0.13	0.13	0.16	0.18	0.15	0.15	0.15	0.15
CFPS	−0.05	0.04	0.13	0.22	0.28	0.31	0.30	0.31	−0.57	−0.54
Plowback	0.19									
1982										
EPS	−0.10	−0.13	−0.06	−0.02	−0.02	−0.01	−0.03	−0.03	0.00	0.00
DPS	−0.19	−0.10	0.03	0.05	0.07	0.08	0.09	0.11	0.13	0.13
BVPS	0.07	0.08	0.11	0.11	0.09	0.10	0.11	0.11	0.09	0.09
CFPS	−0.02	−0.08	0.00	0.10	0.16	0.19	0.23	0.25	0.24	0.07
Plowback	0.04									
1983										
EPS	−0.06	−0.25	−0.25	−0.24	−0.16	−0.11	−0.05	0.00	0.02	0.02
DPS	0.03	−0.10	−0.03	0.08	0.15	0.21	0.21	0.21	0.22	0.24
BVPS	0.03	0.10	0.04	0.09	0.15	0.16	0.19	0.21	0.22	0.21
CFPS	−0.08	0.01	0.02	0.08	0.20	0.29	0.35	0.38	0.40	0.42
Plowback	−0.08									

two general conclusions regarding the pricing of equity securities.

First, we found overwhelming evidence that the consensus analysts' forecast of future growth is superior to historically oriented growth measures in predicting the firm's stock price. In every case, the R^2 in the regression containing the consensus analysts' forecast is higher than the R^2 in the regression containing the historical growth measure. The regression coefficients in the equation containing the consensus analysts' forecast also are considerably more significant than they are in the alternative regression. These results are consistent with those found by Cragg and Malkiel for data covering the period 1961-1968. Our results also are consistent with the hypothesis that investors use analysts' forecasts, rather than historically oriented growth calculations, in making stock buy-and-sell decisions.

TABLE 2

Regression Results
Model I

Part A: *Historical*

$P/E = a_0 + a_1 D/E + a_2 g_h + a_3 B + a_4 Cov + a_5 Rsq + a_6 Sa$

Year	$\hat{a}_0$	$\hat{a}_1$	$\hat{a}_2$	$\hat{a}_3$	$\hat{a}_4$	$\hat{a}_5$	$\hat{a}_6$	R^2	F Ratio
1981	−6.42*	10.31*	7.67*	3.24	0.54*	1.42*	57.43	0.83	46.49
	(5.50)	(14.79)	(2.20)	(2.86)	(2.50)	(2.85)	(4.07)		
1982	−2.90*	9.32*	8.49*	2.85	0.45*	−0.42	3.63	0.86	65.53
	(2.75)	(18.52)	(4.18)	(2.83)	(2.60)	(0.05)	(0.26)		
1983	−5.96*	10.20*	19.78*	4.85	0.44*	0.33	32.49	0.82	45.26
	(3.70)	(12.20)	(4.83)	(2.95)	(1.89)	(0.50)	(1.29)		

Part B: *Analysis*

$P/E = a_0 + a_1 D/E + a_2 g_a + a_3 B + a_4 Cov + a_5 Rsq + a_6 Sa$

Year	$\hat{a}_0$	$\hat{a}_1$	$\hat{a}_2$	$\hat{a}_3$	$\hat{a}_4$	$\hat{a}_5$	$\hat{a}_6$	R^2	F Ratio
1981	−4.97*	10.62*	54.85*	−0.61	0.33*	0.63*	4.34	0.91	103.10
	(6.23)	(21.57)	(8.56)	(0.68)	(2.28)	(1.74)	(0.37)		
1982	−2.16*	9.47*	50.71*	−1.07	0.36*	−0.31	119.05*	0.90	97.62
	(2.59)	(22.46)	(9.31)	(1.14)	(2.53)	(1.09)	(1.60)		
1983	−8.47*	11.96*	79.05*	2.16	0.56*	0.20	−34.43	0.87	69.81
	(7.07)	(16.48)	(7.84)	(1.55)	(3.08)	(0.38)	(1.44)		

Notes:
* Coefficient is significant at the 5% level (using a one-tailed test) and has the correct sign. T-statistic in parentheses.

Second, there is some evidence that investors tend to view risk in traditional terms. The interest coverage variable is statistically significant in all but one of our samples, and the stability of the operating income variable is statistically significant in six of the twelve samples we studied. On the other hand, the beta is never statistically significant, and the standard deviation of the analysts' five-year growth forecasts is statistically significant in only two of our twelve samples. This evidence is far from conclusive, however, because, as we demonstrate later, a significant degree of cross-correlation among our four risk variables makes any general inference about risk extremely hazardous.

Possible Misspecification of Risk

The stock valuation theory says nothing about which risk variables are most important to investors. Therefore, we need to consider the possibility that the risk variables of our study are only proxies for the "true" risk variables used by investors. The inclusion of proxy variables may increase the variance of the parameters of most concern, which in this case are the coefficients of the growth variables.[4]

To allow for the possibility that the use of risk proxies has caused us to draw incorrect conclusions concerning the relative importance of analysts' growth forecasts and historical growth extrapolations, we have also estimated Equation (4) with the risk variables excluded. The results of these regressions are shown in Table 3.

Again, there is overwhelming evidence that the consensus analysts' growth forecast is superior to the historically oriented growth measures in predicting the firm's stock price. The R^2 and t-statistics are higher in every case.

CONCLUSION

The relationship between growth expectations and share prices is important in several major areas of finance. The data base of analysts' growth forecasts collected by Lynch, Jones & Ryan provides a unique opportunity to test the hypothesis that investors rely more heavily on analysts' growth forecasts than on historical growth extrapolations in making security buy–and–sell decisions. With the help of this data base, our studies affirm the superiority of analysts' forecasts over simple historical growth extrapolations in the stock price formation process. Indirectly, this finding lends support to the use of valuation models whose input includes expected growth rates.

[1] We also tried several other definitions of "earnings," including the firm's most recent primary earnings per share prior to any extraordinary items or discontinued operations. As our results were insensitive to reasonable alternative definitions of "earnings" we report only the results for the IBES consensus.

TABLE 3

Regression Results
Model II

Part A: *Historical*

$P/E = a_0 + a_1 D/E + a_2 g_h$

Year	$\hat{a}_0$	$\hat{a}_1$	$\hat{a}_2$	R^2	F Ratio
1981	−1.05	9.59	21.20	0.73	82.95
	(1.61)	(12.13)	(7.05)		
1982	0.54	8.92	12.18	0.83	167.97
	(1.38)	(17.73)	(6.95)		
1983	−0.75	8.92	12.18	0.77	107.82
	(1.13)	(12.38)	(7.94)		

Part B: *Analysis*

$P/E + a_0 + a_1 D/E + a_2 g_a$

Year	$\hat{a}_0$	$\hat{a}_1$	$\hat{a}_2$	R^2	F Ratio
1981	3.96	10.07	60.53	0.90	274.16
	(8.31)	(8.31)	(20.91)	(15.79)	
1982	−1.75	9.19	44.92	0.88	246.36
	(4.00)	(4.00)	(21.35)	(11.06)	
1983	−4.97	10.95	82.02	0.83	168.28
	(6.93)	(6.93)	(15.93)	(11.02)	

Notes:
* Coefficient is significant at the 5% level (using a one-tailed test) and has the correct sign. T-statistic in parentheses.

[2] For the latest year, we actually employed a point-to-point growth calculation because there were only two available observations.

[3] We use the word "approximately," because the set of available firms varied each year. In any case, the number varied only from zero to three firms on either side of the figures cited here.

[4] See Maddala (1977).

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CHAPTER 10

THE COST OF CAPITAL

What company is America's top wealth creator? According to a recent Fortune *article, the winner is Coca-Cola. Investors have entrusted $10.8 billion to Coke's managers, who then caused that investment to grow to $135.7 billion. The difference between the $135.7 billion market value and the $10.8 billion Coke's investors provided is called its* Market Value Added, *or* MVA. *Thus, Coke's managers have, since the company's inception, added a stunning $124.9 billion to their shareholders' wealth. General Electric, Microsoft, Intel, and Merck are next on* Fortune's *list of top MVA creators.*

Is there any way to pick a company today that is likely to be a superior wealth creator in the future? Fortune *reported that Steven Einhorn, research chief at Goldman Sachs, along with other top analysts, uses a tool called* Economic Value Added, *or* EVA, *to evaluate companies, while companies themselves use EVA to measure their performance and to determine managerial bonuses.*

Exactly what is EVA? Developed by the consulting firm Stern Stewart & Company, EVA is designed to measure a corporation's true profitability for a given year, and it is calculated as after-tax operating profits less the annual cost of all the capital the firm uses.

The idea behind EVA is simple — firms are truly profitable and create value if and only if their income exceeds the cost of all the capital they use to finance operations. The conventional measure of performance, net income, takes into account the cost of debt, which shows up on financial statements as interest expense, but it does not reflect the cost of equity. Therefore, a firm can report positive net income yet still be unprofitable in an economic sense if its net income is less than its cost of equity. EVA corrects this flaw by recognizing that to properly measure a firm's performance, it is necessary to account for the cost of equity capital.

Managers create EVA by developing, implementing, and nurturing projects that generate returns greater than their costs of capital. On average, Coke's projects earned 36 percent, which greatly exceeded its 9.7 percent cost of capital. As a result, Coke had an EVA of $2.4 billion, which is outstanding. On the other hand, RJR Nabisco's average project earned a meager 6.2 percent, much less than its 9.8 percent cost of capital, so its EVA was a negative *$1.2 billion. EVA represents value added during a single year, and MVA represents total value created since the company's inception, so there is an obvious correlation between EVA and MVA. Therefore, given RJR's negative EVA, it is not surprising that its lifetime MVA was a negative $12.0 billion. Note, though, that EVA for a given year could be negative, yet a company could still have a positive MVA because it had performed well in prior years.*

In this chapter, we explain how a company can measure its cost of capital and then use that cost of capital to help make various decisions. As you go through the chapter, think about Coca-Cola and RJR Nabisco, and the role the cost of capital plays in creating or destroying wealth.

SOURCE: Richard Teitelbaum, "America's Greatest Wealth Creators," *Fortune,* November 10, 1997, 265–276.

Thus, investors expect to receive a dividend yield, D_1/P_0, plus a capital gain, g, for a total expected return of $\hat{k}_s$, and in equilibrium this expected return is also equal to the required return, k_s. This method of estimating the cost of equity is called the *discounted cash flow, or DCF, method.* Henceforth, we will assume that equilibrium exists, hence $\hat{k} = k$, so we can use the terms k_s and $\hat{k}_s$ interchangeably.

It is easy to determine the dividend yield, but it is difficult to establish the proper growth rate. If past growth rates in earnings and dividends have been relatively stable, and if investors appear to be projecting a continuation of past trends, then g may be based on the firm's historic growth rate. *However, if the company's past growth has been abnormally high or low, either because of its own unique situation or because of general economic fluctuations, then investors will not project the past growth rate into the future.* In this case, g must be estimated in some other manner.

Security analysts regularly make earnings and dividend growth forecasts, looking at such factors as projected sales, profit margins, and competitive factors. For example, *Value Line,* which is available in most libraries, provides growth rate forecasts for 1,700 companies, and Merrill Lynch, Salomon Smith Barney, and other organizations make similar forecasts. Therefore, someone making a cost of equity estimate can obtain several analysts' forecasts, average them, use the average as a proxy for the growth expectations of investors in general, and then combine this g with the current dividend yield to estimate $\hat{k}_s$ as follows:

$$\hat{k}_s = \frac{D_1}{P_0} + \text{Growth rate as projected by security analysts.}$$

Again, note that this estimate of $\hat{k}_s$ is based on the assumption that g is expected to remain constant in the future.[6]

Another method for estimating g is called the **retention growth rate method.** Here we first forecast the firm's average future dividend payout ratio and its complement, the *retention rate,* and then multiply the retention rate by the company's expected future rate of return on equity (ROE):

$$g = (\text{Retention rate})(\text{ROE}) = (1.0 - \text{Payout rate})(\text{ROE}). \qquad \textbf{(10-7)}$$

Security analysts often use this procedure when they estimate growth rates. For example, suppose NCC is expected to have a constant ROE of 14.5 percent, and it is expected to pay out 52 percent of its earnings and to retain 48 percent. In this case, its forecasted growth rate would be g = (0.48)(14.5%) = 7.0%.

To illustrate the DCF approach, suppose NCC's stock sells for \$32; its next expected dividend is \$2.40; and its expected growth rate is 7 percent. NCC's expected and required rate of return, hence its cost of common stock, would then be 14.5 percent:

$$\begin{aligned}\hat{k}_s = k_s &= \frac{\$2.40}{\$32.00} + 7.0\% \\ &= 7.5\% + 7.0\% \\ &= 14.5\%.\end{aligned}$$

[6]Analysts' growth rate forecasts are usually for five years into the future, and the rates provided represent the average growth rate over that five-year horizon. Studies have shown that analysts' forecasts represent the best source of growth rate data for DCF cost of capital estimates. See Robert Harris, "Using Analysts' Growth Rate Forecasts to Estimate Shareholder Required Rates of Return," *Financial Management,* Spring 1986.

Note also that two organizations—IBES and Zacks—collect the forecasts of leading analysts for most larger companies, average these forecasts, and then publish the averages. The IBES and Zacks data are available over the Internet through on-line computer data services.

On the Use of Consensus Forecasts of Growth in the Constant Growth Model: The Case of Electric Utilities

Stephen G. Timme and Peter C. Eisemann

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■ The constant growth model is often used for estimating the cost of equity capital in utility rate setting proceedings. A major source of controversy over the cost of equity is the method used to estimate the model's projected growth variable. (See, for example, [23, 24, 36] for a discussion of several technical aspects related to the estimation of the dividend yield component in the constant growth model.) The best estimate of projected growth is assumed to be one that incorporates all information regarding future growth contained in alternative growth proxies. In recent years, utility commissions and researchers have been more receptive to consensus financial analyst's forecasts (FAF's) of growth as opposed to historical growth rates as the basis for the growth variable estimate (e.g., [5], [10], [12], and [21]).[1] A consensus forecast should incorporate the information contained in alternative forecasts and therefore provide the most appropriate estimate for rate of return regulation and research. (Motivation for the use of a consensus growth estimate is provided by the forecasting literature that examines the benefits of combined forecasts, e.g., [18, 19, 26].)

Here the informational content of the increasingly popular consensus forecast provided by Lynch, Jones, and Ryan's *Institutional Brokers Estimate System* (I/B/E/S)

Our thanks to Louis Ederington and two anonymous referees for their valuable comments. All remaining errors are the responsibility of the authors. We wish to also thank the Center for the Study of Regulated Industry at Georgia State University for financial support; to Lynch, Jones, and Ryan for providing the I/B/E/S data through an academic research grant; and to Salomon Brothers, Inc. for also providing data.

[1]There is a growing body of literature demonstrating the superiority of FAF's relative to naive forecasts (e.g. [6, 7, 14]) and that the revision of FAF's conveys information to investors (e.g. [1, 11, 15, 16]). See [17] for an in-depth review of this literature.

is examined relative to the frequently used alternative forecasts by Salomon Brothers, Inc. and Value Line. In comparing the relative informational content of FAF's, this adds to previous research (e.g., [8, 30, 37, 38]) that has to date only examined the use of FAF's versus historical growth rates as estimates of the growth rate in the constant growth model. For completeness, historical growth estimates are also examined. The analysis is performed for a group of electric utilities over 1982–1986. Electric utilities are commonly the focus of applied academic research (e.g., [4, 5, 21, 28, 29, 30, 37, 38]), and the constant growth model is frequently used in electric utilities' rate setting proceedings.

The results of the analyses for the sample utilities show the following:

(i) There generally are large size differences between both the various FAF's and between the FAF's and historical growth rates;

(ii) Neither the consensus I/B/E/S forecast nor the FAF forecasts by Salomon Brothers and Value Line contain by itself all the information included in the other FAF forecasts; and

(iii) FAF-based growth rates contain all the information found in historical growth rates.

The study's primary conclusion is that although a consensus FAF can be formed to contain all the information incorporated in alternative analysts', forecasts, and historical growth rates, the construction of the consensus forecast requires the judicious choice of the weight to be assigned to each forecast. More generally, the results suggest that the informational content of forecasts used as proxies for investor expectations should be compared using a methodology similar to this study's before being accepted in research and regulatory proceedings.

I. Hypothesis, Model, and Methodology

A. The Hypothesis

The standard constant growth model states,

$$k = \frac{D_0(1+g)}{P_0} + g, \qquad (1)$$

where,

P_0 = current stock price,
D_0 = current dividend per share,
g = expected constant growth rate of dividends, and
k = required rate of return on equity.

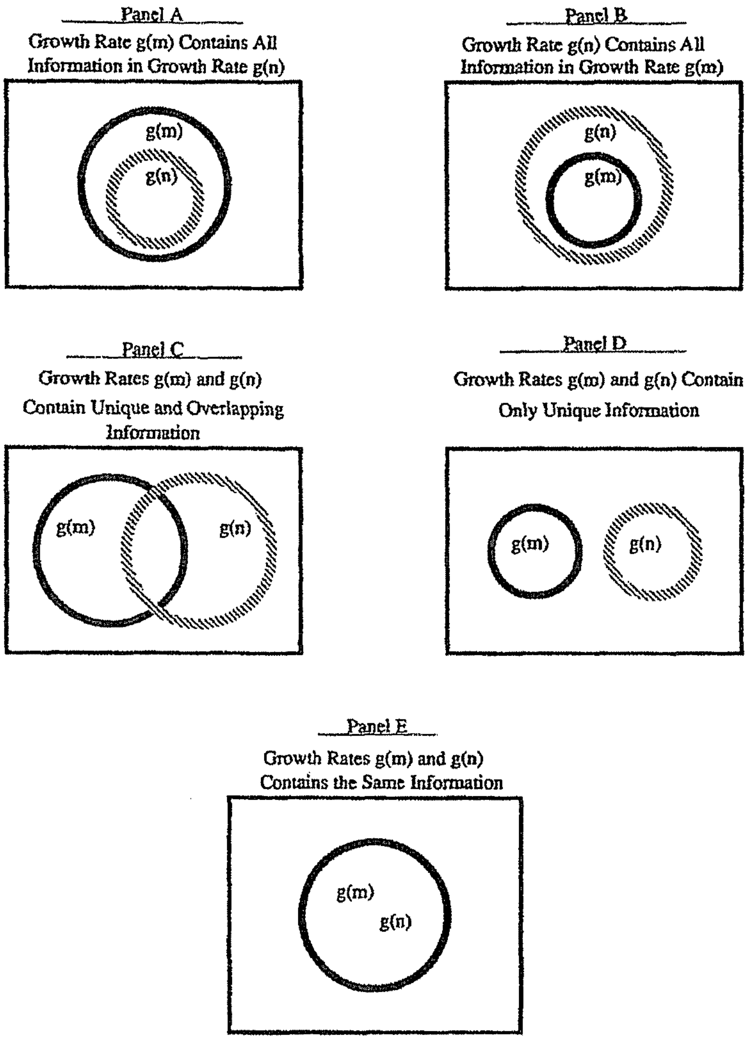
The estimate of the constant growth rate chosen for Equation (1) ideally contains all the information regarding the valuation of equity capital included in all other alternative growth estimates. This concept is depicted graphically in Exhibit 1, which compares the relative informational content of two growth estimates, $g(m)$ and $g(n)$. For exposition purposes, it is assumed that $g(m)$ and $g(n)$ are the only two growth estimates available to investors. However, the analysis can be easily extended to the joint comparison of more than two growth estimates.

In Exhibit 1, the solid-lined circle encompasses all the information included in $g(m)$ and the broken-lined circle all the information in $g(n)$, which investors incorporate into stock prices. Panel A depicts a scenario in which $g(m)$ contains all the information incorporated in $g(n)$, and $g(n)$ does not contain all the information in $g(m)$. As a result, $g(m)$ should be wholly used to estimate the growth component in Equation (1). Panel B depicts an opposite scenario in which $g(n)$ should be used instead of $g(m)$ as a proxy. In Panel C neither growth estimate contains all the information found in the other, although there is some overlap of information as shown by the shaded area of intersection. In Panel D, both estimates contain unique information; there is no common information. Because neither forecast in Panels C and D contains all the information included in the other, some type of average of $g(m)$ and $g(n)$ should be used as the growth estimate. Finally, in Panel E both $g(m)$ and $g(n)$ contain exactly the same information found in the other. In this case, $g(m)$ and $g(n)$ should be equal and either could be used as an estimate of growth.

B. The Model

The growth estimate's relative informational content is tested using the model developed in the works by Malkiel [27] and Cragg and Malkiel [8]. In their research on expectations and valuation, Cragg and Malkiel constructed a linear price-earnings model that approximates a dividend growth model, such as Equation (1) (see their equations 3.3-13 and 3.3-14, 3.3-18, and 4.4-1). The linear price-earnings model is stated as follows:

Exhibit 1. Graphical Depiction of Growth Estimates' Relative Informational Content



$$\frac{P_0}{E_0} = \varphi + \beta_1 \frac{D_0}{E_0} + \beta_2 g + \Sigma\, \alpha_i\, RISK_i + \epsilon . \qquad (2)$$

That is, the price-earnings is a linear function of a constant, plus the dividend payout ratio factor, expected future growth factor, and a series of risk factors. In Equation (2), $RISK_i$ is the ith measure of risk associated with the cost of equity k, and ϵ is an error term. Malkiel [27] and more recently Vander Weide and Carleton [37, 38] found that the linear specification in Equation (2) is a fairly robust approximation of the true nonlinear price-earning ratio model which can be derived from Equation (1) and, therefore, is useful for examining alternative proxies for growth. The specific measures of risk used in Equation (2) are discussed in Section II. However, to facilitate the presentation of the paper's methodology, the sources of the growth estimates are discussed first.

C. The Growth Estimates

Five end-of-the-year growth estimates were collected for a group of 62 electric utilities for December 1982 through December 1986. The selection criteria are discussed in Section II. The growth rates are:

GIBES = mean 5-year financial analysts' consensus earnings growth forecast available through Lynch, Jones, and Ryan's *Institutional Brokers Estimate System* (I/B/E/S);[2]

GSB = The projected 5-year normalized growth rate forecasted by Salomon Brothers, Inc. in their publication *Electric Utility Monthly;*

GVLD = The 3 to 5-year forecasted growth in dividends per share as reported in the *Value Line Investment Survey;*

GVLE = The 3 to 5-year forecasted growth in earnings per share as reported in the *Value Line Investment Survey;* and

GHD5 = The 5-year log-linear historical growth in dividends paid per share.[3]

The financial analysts' forecasts GIBES, GSB, GVLD, and GVLE are included in the study for several reasons. First, these growth estimates have been used in previous research to examine electric utilities' cost of equity (e.g., [5, 21]) and are frequently used in rate setting proceedings. Second, for the five years examined in this study, this set of growth estimates permits an appreciably larger sample of utilities than do sets of these estimates combined with other growth estimates (e.g., Merrill Lynch) also available to the authors. Third, although the model in Equation (2) specifies dividend growth, this study uses both dividend and earnings estimates. Theoretically, dividends and earnings per share growth are identical in the constant growth model, and from a practical viewpoint, financial analysts focus on earnings and, therefore, earnings per share data are more readily available. Finally, the historical growth rate GHD5 is included to provide additional insights into the use of analysts' versus historical growth rates. See also [8, 29, 30, 37, 38] for an examination of the use of historical growth rates to estimate the cost of equity.

D. Methodology

The model in Equation (2) is initially estimated using each growth forecast to test hypotheses that each forecast contains all the information contained in all other forecasts. Later, the model in Equation (2) is used to examine the relative informational content of various combinations of forecasts. Similar to all empirical valuation models, a caveat of these tests is that they are really joint tests of each growth rate's informational content and that investors price equity securities in a manner consistent with Equation (2). Maintaining that investors follow Equation (2) in setting security prices, the hypotheses regarding the alternative growth forecasts' informational content are tested using the following variation of Equation (2):

$$\frac{P_0}{E_0} = \varphi + \beta_1 \frac{D_0}{E_0} + \beta_2^{*} g(m) + \beta_2^{**} g(n) + \Sigma\, \alpha_i RISK_i + \epsilon, \qquad (3)$$

for

m and n = GIBES, GSB, GVLD, GVLE, and GHD5, but $m \neq n$.

The informational content of each growth estimate, as depicted in Exhibit 1, is tested by performing pairwise likelihood ratio tests using Equations (2) and (3). See Maddala [25] for details on tests using likelihood ratios. In performing the tests, the basic approach is to compare $g(m)$ and $g(n)$ via two tests. In the first test, Equation (2) is estimated using $g(m)$ and Equation (3) is estimated using $g(m)$ and $g(n)$. The overall fit of Equation (2), as measured by the log of the likelihood function, is then tested against the overall fit of Equation (3). As an example, suppose the test statistic is significant. This indicates that $g(n)$ contains some information not found in $g(m)$. The second test involves estimating Equation (2) using $g(n)$ and comparing its overall fit to Equation (3), again estimated using $g(m)$ and $g(n)$. If the test statistic from the second test is insignificant, then $g(m)$ does not contain any information not already incorporated in $g(n)$. In this case, these results would suggest that $g(n)$ is a better proxy for investor expectations than $g(m)$, again maintaining that

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[2]Use of the I/B/E/S median as opposed to the mean growth forecasts does not alter the study's findings. These results are available from the authors.

[3]Five-year historical growth in earnings per share was also examined. The results for the 5-year historical earnings growth rate show it never contains information not already incorporated in the FAF growth estimates, and that the FAF growth estimates always contain significantly more information than the 5-year historical earnings growth rates. In the interest of space these results are not presented but are available from the authors.

Exhibit 2. Possible Outcomes of Pairwise Likelihood Ratio Tests of the Informational Content of Two Alternative Constant Growth Estimates, $g(m)$ and $g(n)$

Test No.[1]	Significant	Relative Importance
1	Yes	Growth rate $g(m)$ contains all the information in $g(n)$ plus some additional information. See Panel A, Exhibit 1. Growth rate $g(m)$ should be used as an estimate of the constant growth rate.
2	No	
1	No	Growth rate $g(n)$ contains all the information in $g(m)$ plus some additional information. See Panel B, Exhibit 1. Growth rate $g(n)$ should be used as an estimate of the constant growth rate.
2	Yes	
1	Yes	The growth rates $g(m)$ and $g(n)$ contain both unique and overlapping information, or only unique information. See Panels C and D, Exhibit 1. A combination of $g(m)$ and $g(n)$ should be used as an estimate of the constant growth rate.
2	Yes	
1	No	The growth rates $g(m)$ and $g(n)$ contain the same information. See Panel E, Exhibit 1. Either growth rate can be used as an estimate of the constant growth rate.
2	No	

[1]Using Equations (2) and (3). Test No. 1 tests the informational content of $g(m)$ relative to $g(n)$. Test No. 2 tests the informational content of $g(n)$ relative to $g(m)$.

investors follow Equation (2) in setting stock prices. Four outcomes are possible when performing the pairwise likelihood ratio tests using Equations (2) and (3). These outcomes and their interpretation as they relate to the growth estimates' relative informational content are summarized in Exhibit 2.

Exhibit 3. Listing of Electric Utility Companies in Sample

Allegheny Power	Louisville Gas & Elec.
American Elec. Pwr.	MDU Resource Group
Atlantic City Elec.	Minnesota Pwr. & Lt.
Baltimore Gas & Elec.	Nevada Power Co.
Boston Edison	New England Electric
Carolina Pwr. & Lt.	Northeast Utilities
Central & South West	Northern States Power
Central Ill. Pub. Svc.	Ohio Edison
Cilcorp	Oklahoma Gas & Electric
Commonwealth Edison	Orange & Rockland Util.
Commonwealth Energy	Otter Tail Power
Consolidated Edison	PacifiCorp
Dayton Pwr. & Lt.	Pacific Gas & Elec.
Delmarva Pwr. & Lt.	Penn. Pwr. & Lt.
Detroit Edison	Portland General Corp.
Duke Power Co.	Potomac Electric Pwr.
Eastern Utilities	Public Service Ent. Group
El Paso Electric	Public Service New Mexico
Empire District Electric	Puget Sound Pwr. & Lt.
FPL Group	San Diego Gas & Elec.
Hawaiian Electric	Savannah Electric
Houston Industries	Southern Calf. Edison
Idaho Power Co.	Southern Ind. Gas & Elec.
Illinois Power Co.	Southern Company
Interstate Power	TECO Energy
Iowa Electric Lt. & Pwr.	Texas Utilities
Iowa Resources Inc.	Tucson Electric Pwr.
Iowa Southern Utilities	Union Electric
Ipalco Enterprises	Utah Pwr & Lt.
Kansas Pwr. & Lt.	Wisconsin Pwr. & Lt.
Kentucky Utilities	Wisconsin Public Service

II. The Data

A. The Companies

End-of-the year data were collected for 1982–1986 for a sample of investor-owned electric utilities operating in the United States. Several different criteria are imposed in the selection of the sample companies. First, the sample comprises companies for which data are available through I/B/E/S, Salomon Brothers, Inc.'s *Electric Utility Monthly*, and the *Value Line Investment Survey* for each of the five years in the study, and each year's forecasted growth rates are positive for each source. Second, companies were excluded which experienced negative historical dividend growth over 1982–1986 except through stock splits and stock dividends. These criteria exclude companies for which it is believed the constant growth model is not appropriate, since in practice the model is not used to estimate the cost of equity for companies with negative growth rates. Excluded companies are primarily those which have exhibited considerable financial burdens due to nuclear construction programs (e.g., Long Island Lighting, Public Service Indiana, and Public Service New Hampshire). Third, to avoid possible distortions, sample companies are required to have a fiscal year ending December 31. Imposing these criteria results in the sample of 62 utilities listed in Exhibit 3.

B. The Risk Variables

A large number of variables have been used in research and regulatory proceedings to characterize electric utilities' equity risk. (Cragg and Malkiel [8] used risk measures such as equity beta and the variance of the long-term growth forecast [chapter 4], and Vander Weide and Carleton [37, 38] used the firm's pre-tax interest coverage ratio and the stability of the firm's five-year historical earnings per share among others.) The risk measures, $RISK_i$ in Equations (2) and (3), used in this study are defined below.

BETA = The company's equity beta.

BOND1, *BOND2*, and
BOND3 = A dummy variable for the Moody's bond rating. If a company has either an "Aaa" or "Aa" rating, *BOND1* is assigned a value of 1 and *BOND2* and *BOND3* values of 0. For an "A" rating, *BOND2* is assigned a value of 1 and *BOND1* and *BOND3* values of 0. Finally, for a company with a "Baa" rating, *BOND3* is assigned a value of 1 and *BOND1* and *BOND2* values of 0.

NUKE = A dummy variable for the company's nuclear status. *NUKE* is assigned a value of 0 if the company did not exhibit significant nuclear construction/regulatory risk during the 1982–1986 sample period. *NUKE* is assigned a value of 1 if the company did exhibit significant nuclear related construction/regulatory risk during the sample period. The source of data for *NUKE* is discussed below.

A primary consideration in the choice of these risk variables is that they have all been used in academic studies to characterize equity risk.[4] Beta is widely used as a measure of systematic risk, and its theoretical underpinnings are well-known.[5] Studies have shown that bond ratings incorporate numerous measures of risk (e.g., [9, 31, 32]) and that bond ratings are significantly correlated with equity returns (e.g. [20, 33, 39]). The importance of nuclear risk for capital costs became apparent with the Three Mile Island accident on March 28, 1979. Studies have shown that as a result of the accident, both bond risk premiums [2] and stock prices ([3, 22]) for the entire electric utility industry reflected an increased perception of risk, with the risk effect being the greatest for firms with significant nuclear exposure.

C. Data Sources

The sources of data for the growth estimates were described in Section I. The dependent variable P_0/E_0 in Equations (2) and (3) is the end-of-year price-earnings ratio. It equals the closing price on the last trading day of each year divided by earnings per share normalized for the effects of extraordinary items and discontinued operations.[6] Three proxies were used for normalized earnings. They are the estimates for the forthcoming year of primary earning per share before extraordinary items and discontinued operations provided by I/B/E/S, Salomon Brothers, and Value Line.[7] The dividend payout ratio D_0/E_0 equals the end-of-year indicated dividend per share, divided by the proxy for normalized earnings per share. Dividends also exclude the payment of special dividends. The source of data for dividends is *Electric Utility Monthly*. The source of data for BETA is the *Value Line Investment Survey* and bond rating data are obtained from *Moody's Bond Record*. Finally the data for the risk variable NUKE are from various Salomon Brothers publications (e.g., [34]). In these

[4]In an earlier version of this paper, various accounting measures (e.g., debt-to-equity and times-interest-earned) were used, as well as the dispersion of the analysts' forecasts, as measures of equity risk. The results using these measures are consistent with the conclusions associated with the results reported in this paper, that the consensus I/B/E/S consensus forecast does not contain all relevant information and the construction of a consensus forecast requires the judicious choice of the weight to be assigned each analyst's forecast. The authors prefer usage of BETA, BOND, and NUKE because of their intuitive appeal and their apparent ability to parsimoniously represent the information contained in the other risk measurers.

[5]The authors acknowledge that the use of beta to estimate utilities' cost of equity capital continues to be debated in the literature (e.g., [4] and the comments and replies in earlier issues of this journal).

[6]As pointed out by a referee, a caveat to this paper's analyses relates to the comparability of utilities' earnings per share both across companies and through time. The level and quality of earnings may vary across companies due to, for example, differing treatment of allowances for funds used during construction (AFUDC) and the tax effects of normalization versus flow-through accounting (e.g., the treatment of depreciation, tax deferrals, and investment tax credits). Earnings per share may not be directly comparable across time due to changes in accounting conventions. In SFAS 90, for example, it was decided during this study's sample period that plant abandonment and disallowances were no longer extraordinary items for regulated utilities.

Exhibit 4. Mean Values and Standard Deviations (in parentheses) for Sample Utilities[1]

	1982		1983		1984		1985		1986	
	Non-Nuclear Group	Nuclear Group	Non-Nuclear Group	Nuclear Group	Non-Nuclear Group	Nuclear Group	Non-Nuclear Group	Nuclear Group	Non-Nuclear Group	Nuclear Group
P/E^2	6.98	6.78	7.09	6.02	7.41	6.42	9.19	7.42	11.45	9.11
	(0.82)	(1.45)	(1.06)	(0.93)	(1.07)	(0.70)	(1.03)	(0.90)	(1.10)	(1.31)
GIBES	5.23%	5.17%	5.14%	4.99%	4.90%	4.40%	4.67%	4.38%	4.64%	3.94%
	(1.15%)	(1.33%)	(1.29%)	(0.95%)	(1.22%)	(1.23%)	(1.15%)	(1.11%)	(1.05%)	(1.18%)
GVLD	5.89	6.16	5.69	5.09	5.66	4.91	5.53	4.96	4.99	4.30
	(2.62)	(2.33)	(2.50)	(1.78)	(2.62)	(1.49)	(2.23)	(1.58)	(2.05)	(1.72)
GVLE	6.30	6.50	5.65	5.64	5.54	4.75	4.93	4.43	4.44	3.45
	(2.19)	(1.44)	(2.12)	(1.91)	(2.72)	(1.67)	(1.95)	(1.90)	(1.55)	(1.90)
GSB	6.35	6.05	6.31	5.81	6.33	5.50	5.93	5.05	5.61	4.71
	(1.34)	(1.25)	(1.25)	(1.25)	(1.44)	(1.23)	(1.28)	(1.13)	(1.23)	(1.17)
GH5D	6.18	5.70	6.07	5.69	6.03	5.51	5.94	5.22	5.68	4.68
	(3.79)	(3.38)	(2.86)	(3.05)	(2.77)	(2.56)	(2.91)	(2.27)	(3.03)	(2.38)

[1]The growth rates are defined as follows: GIBES, the mean I/B/E/S consensus five-year earnings forecast; GSB, the Salomon Brothers' projected 5-year normalized growth; GVLD, the Value Line 3 to 5-year forecasted growth in dividends; GVLE, the Value Line 3 to 5-year forecasted growth in earnings; and GHD5, 5-year historical growth in dividends.

[2]The price-earnings ratio is calculated for each company using the year-ending closing price divided by the I/B/E/S consensus estimate of primary earnings per share before extraordinary items and discontinued operations for the forthcoming year.

publications, Salomon Brothers categorizes electric utilities into two groups—those with (NUKE = 1) and those without (NUKE = 0) significant nuclear risk based upon the utilities' investment in nuclear construction relative to the value of equity and other factors.

[7]Fortunately, the various sources of projected earnings per share and forecasted growth rates exhibited only slight correlation. Regressing the projected earnings per share on forecasted growth resulted in an average adjusted R-square of approximately 0.15. Thus, the effects of spurious correlation in the regression analysis presented in this paper should be minimal.

The tests were also conducted using several other definitions of earnings per share, including the most recent reported twelve-month earnings per share, which, as of the end of December was for the period from October of the previous year through September of the current year. Assuming perfect foresight, normalized earnings were also defined in an earlier version of this paper as the annual primary earning per share actually reported for the current year. These earnings are generally not available until February or March of the following year. The conclusions drawn from the use of all of these alternative definitions of earnings per share are the same as those reported in this paper. The empirical results using these alternative definitions are available from the authors upon request.

III. Empirical Results

A. Summary Statistics

Exhibit 4 reports the means and standard deviations of the price-earnings ratios and all growth estimates for each year in the study. For comparative purposes the data are reported by nuclear risk classification, i.e., for the Nonnuclear Group the risk variable NUKE = 0 and for the Nuclear Group NUKE = 1. Of particular interest is the appreciable difference between the various FAF's for each group. For example, GSB generally exceeds GIBES for both groups. The difference, approximately 100 basis points, is statistically and potentially economically significant in all years.[8] For example,

[8]For each year statistical tests were conducted to test whether each pair of forecasts was significantly different. These results are available upon request.

Exhibit 5. Estimates of Regression Coefficients for the Price-Earnings Model Using Equation (4)[a]

		Growth Estimate Used in Regression				
Variable	Regression Coefficient	GIBES	GSB	GVLD	GVLE	GHD5
Constant	φ_1	3.09*	-0.99	1.47	3.29*	3.49*
		(0.92)	(0.99)	(0.87)	(0.85)	(0.80)
YR83	φ_2	-0.17	-0.13	-0.09	-0.10	-0.19
		(0.16)	(0.14)	(0.15)	(0.16)	(0.15)
YR84	φ_3	0.38#	0.47*	0.43*	0.41*	0.28
		(0.16)	(0.15)	(0.17)	(0.16)	(0.15)
YR85	φ_4	1.74*	1.97*	1.72*	1.80*	1.62*
		(0.17)	(0.15)	(0.15)	(0.16)	(0.16)
YR86	φ_5	3.68*	3.98*	3.70*	3.80*	3.56*
		(0.17)	(0.16)	(0.15)	(0.17)	(0.16)
D_0/E_0	β_1	6.99*	9.51*	8.84*	6.99*	6.95*
		(0.63)	(0.66)	(0.66)	(0.59)	(0.57)
g	β_2	24.01*	51.37*	22.80*	15.11*	11.70*
		(5.46)	(5.71)	(2.93)	(2.84)	(1.92)
BETA	α_1	-2.40#	-2.23#	-2.06#	-2.14#	-2.19#
		(1.03)	(0.94)	(0.97)	(1.02)	(1.00)
NUKE	α_2	-0.84*	-0.63*	-0.79*	-0.83	-0.87
		(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
BOND2	α_3	-0.49*	-0.28*	-0.50*	-0.61*	-0.41
		(0.11)	(0.10)	(0.10)	(0.11)	(0.11)
BOND3	α_4	-1.12*	-0.62*	-1.19*	-1.32*	-1.04
		(0.17)	(0.17)	(0.16)	(0.17)	(0.17)
Logged Likelihood Function		-388.79	-361.35	-369.86	-384.57	-380.45
Adjusted R^2		0.80	0.83	0.82	0.80	0.80

[a]Standard errors in parentheses.

*Significant at the 0.01 level.

#Significant at the 0.05 level.

a 100 basis point difference in the recommended cost of equity translates into a change in revenue requirements in excess of $2.0 billion per year for the electric utility industry.[9]

B. Estimation

The models in Equations (2) and (3) are estimated by pooling the data across companies and time periods. As is common when pooling cross-section and time-series data, dummy variables are also added to allow the intercept term to vary for each year (e.g., see Maddala [25, Chapter 14]). The dummy variables are included to allow for yearly changes in variables, such as general capital market conditions and investor behavior, which are not explicitly included in Equations (2) and (3), and are maintained to result in an additive shift in the overall level of all firms' price-earnings ratios. With the inclusion of the time dummy variables and the risk variables discussed in Section II, the final formulation of Equation (2) is

$$\frac{P_0}{E_0} = \varphi_1 + \varphi_2 YR83 + \varphi_3 YR84 + \varphi_4 YR85 + \varphi_5 YR86$$
$$+ \beta_1 \frac{D_0}{E_0} + \beta_2 g + \alpha_1 BETA + \alpha_2 NUKE$$
$$+ \alpha_3 BOND2 + \alpha_4 BOND3 + \epsilon . \tag{4}$$

where,

$YR83$ = 1 if 1983, 0 otherwise;
$YR84$ = 1 if 1984, 0 otherwise;
$YR85$ = 1 if 1985, 0 otherwise;
$YR86$ = 1 if 1986, 0 otherwise; and

all other variables are as previously defined.

A reformulation similar to Equation (4) is also applied to Equation (3).

The regression model in Equation (4) is structured such that the intercept term, φ_1, captures the combined effects of a utility with either a "Aaa" or "Aa" bond rating, BOND1 = 1, and a company with no nuclear risk, NUKE = 0. Therefore, the bond rating regression parameters α_3 and α_4 measure, respectively, the mean differences between the price-earnings ratio P_0/E_0 of utilities with "A" and "Baa" rated bonds relative to those with "Aaa" or "Aa" rated bonds holding all else constant. Likewise, the regression parameter α_2 measures the differences between the mean price-earnings ratios of utilities with nuclear risk relative to companies without such risk, again holding all other factors constant.

C. The Results

Exhibit 5 reports selected statistics from estimation of Equation (4) using each of the growth estimates and the I/B/E/S proxy for normalized earnings per share.[10] Only the results using the I/B/E/S proxy for normalized earnings are reported since the conclusions drawn from the empirical findings are the same regardless of the proxy for normalized earnings.[11] The results in Exhibit 5 indicate that Equation (4) is a reasonable model of the electric utilities' price-earning ratios with the signs of all the estimated regression coefficients as expected. For example, β_2 shows that utilities with higher expected growth rates, holding all else constant, have higher price-earnings ratios. Also, the negative coefficient for α_2 indicates that utilities with significant nuclear risk have, on average, price-earnings ratios approximately 0.90 lower than utilities without such risk. The negative coefficients for α_3 and α_4, for "A" and "Baa" rated bonds, respectively, indicate that utilities with lower bond ratings exhibit lower price-earnings ratios (approximately 0.5 lower for "A" and 1.0 lower for "Baa" rated bonds). The results also show that the regression coefficient α_1 for BETA is, as expected, negatively related to the price-earnings ratio. Finally, the coefficients for the yearly dummy variables are consistent with the significantly upward trend in the sample companies' price-earnings ratios over the sample period (see summary statistics for P/E ratio in Exhibit 4).

Exhibit 6 reports the calculated pairwise likelihood ratio tests and is arranged such that the calculated likelihood ratios correspond to tests of the informational content of the growth estimates in Column 1 relative to the growth estimates in Columns 2 through 6. The results in Exhibit 6 show that when the informational content of GIBES is tested relative to all other growth estimates, all calculated likelihood ratios are significant at the 0.01 level (see Row 1). (Because of the serious economic consequences which could result from the incorrect rejection of the null hypotheses and the large number of pairwise tests, the probability of Type I error is set at 0.01.) For example, when the

[9]Salomon Brothers [35] reports \$133 billion of common equity outstanding as of June 30, 1986 for their 100 Electric Utilities. Using a marginal tax rate of 40% (federal and state), a 100 basis point difference in the recommended cost of equity would translate into a \$2.22 billion [(\$133 billion × 1%)/ (1 - 40%)] difference in annual revenue requirements.

[10]The regression estimates for the reformulated version of Equation (4) are available upon request.

[11]The results using the Salomon Brothers and Value Line proxy for normalized earnings are available upon request.

Exhibit 6. Pairwise Likelihood Ratio Tests of the Informational Content of Alternative Proxies for Growth Rate in the Constant Growth Model[1]

	Calculated Likelihood Ratio Tests[2]				
	GIBES	GSB	GVLD	GVLE	GHD5
(1)	(2)	(3)	(4)	(5)	(6)
(1) GIBES	N/A	56.32*	40.20*	11.72*	17.80*
(2) GSB	1.44	N/A	8.12*	10.48*	1.42
(3) GVLD	2.34	25.14*	N/A	3.78	2.18
(4) GVLE	3.28	56.92*	33.20*	N/A	25.44*
(5) GHD5	7.12*	39.62*	23.36*	17.20*	N/A

*Significant at the 0.01 level.

[1]The growth rates are defined as follows: GIBES, the mean I/B/E/S consensus 5-year earnings forecast; GSB, the Salomon Brothers' projected 5-year normalized growth; GVLD, the Value Line 3 to 5-year forecasted growth in dividends; GVLE, the Value Line 3 to 5-year forecasted growth in earnings; and GHD5, 5-year historical growth in dividends.

[2]Significant likelihood ratio tests indicate that the growth rate in Columns (2)–(6) contains information not incorporated in the growth rate in Column (1). The ratio tests are chi-squared distributed with 1 degree of freedom. The critical test values are 3.84 at the 0.05 level of significance, and 6.63 at the 0.01 level.

informational content of GIBES is compared to the Salomon Brothers growth rate, GSB, the calculated likelihood ratio equals 56.32 (see Row 1, Column 3) which is highly significant, indicating that GSB contains information not incorporated in GIBES. Conversely, when the informational content of all the other growth estimates is tested relative to GIBES (see Column 2), only GHD5 is significant. For example, when testing the hypothesis that GIBES contains information not found in GSB, the calculated likelihood ratio equals 1.44 (see Row 2, Column 2), which is insignificant. This suggests that the I/B/E/S growth estimate does not contain any information not already found in GSB. The overall results indicate that all alternative growth estimates contained information not incorporated in GIBES (Row 1), whereas GIBES only contained some information not in GHD5 (Column 2). Consequently, maintaining that Equation (2) represents investors' pricing behavior for the sample utilities, the results suggest that GIBES was not the best proxy.

If the set of all possible growth estimates is restricted to only those analyzed in this study, the results suggest that for the sample utilities, investor expectations are best proxied from some combination of GSB and GVLD. The hypothesis that GSB contained all information included in other growth rates is rejected when tested relative to GVLE and GVLD, whereas the hypotheses for all growth rates are rejected when tested relative to GSB. In addition, the hypothesis that GVLE includes all information is rejected when tested against all other growth estimates including GVLD, whereas the hypothesis the GVLD contains all information is not rejected when tested against GVLE. This finding provides supports, therefore, for the use of some type of combined financial analyst forecast for estimating the constant growth term.[12]

Additional analyses were performed comparing the combined informational content of GSB and GVLD relative to the information contained in various combinations of GIBES, GVLE, and GHD5. When testing the hypothesis that the combination of GSB and GVLD contains more information than the combinations of *(i)* GIBES and GVLE, *(ii)* GIBES and GHD5, and *(iii)* GVLE and GHD5, the calculated likelihood ratios are 56.66, 39.56, and 34.28, respectively, which are all highly significant. In testing the hypotheses that these three combined forecasts contain information not already incorporated in GSB and GVLD, all likelihood ratio tests were insignificant. As an additional test, the hypothesis that the combination of GSB and GVLD contains more information than the combination of GIBES, GVLE, and GHD5 was also tested resulting in a likelihood ratio of 34.10, which is again highly significant. Finally, the combination of GIBES, GVLE, and GHD5 was found not to contain any information in addition to that incorporated in GSB and GVLD.

D. Performance of the I/B/E/S Consensus Forecast

The performance of the consensus forecast, GIBES, is possibly explained by several factors. First, GIBES

[12]Insights into the weights to assign to GSB and GVLD to derive the optimal growth estimate, g^*, are provided from the estimated regression coefficients, β_2^* for GSB and β_2^{**} for GVLD, from the reformulated version of Equation (4) by letting $g^* = wGSB + (1 - w)GVLD$, and maintaining the hypothesis that $\beta_2^* = w\beta_2$ and $\beta_2^{**} = (1 - w)\beta_2$. The estimate for w is $(\beta_2^*/\beta_2^{**})/(1 + \beta_2^*/\beta_2^{**})$. The estimated coefficients for β_2^* and β_2^{**} equal 37.54 and 10.50, respectively, resulting in an estimate of w of approximately 80% for GSB and 20% $(1 - w)$ for GVLD.

equally weights each individual analyst's forecast to obtain the consensus forecast. However, studies (e.g., [13, 19]) of other economic variables indicate that in an optimal forecast the weights assigned to individual forecasts are usually unequal. Since GSB and GVLE are often included in the derivation of GIBES, the results suggest that it may be that the equal weighting scheme is suboptimal. Furthermore, the finding that an individual forecast such as GSB comes close to including all information found in the other forecasts is consistent with the findings in the other studies (e.g., [16, 26]) that have examined forecasts of macroeconomic variables. These studies show that in cases where the combined forecast is derived using incorrect weights, it is possible for a good individual forecast to actually outperform the combined forecast.

Another possible limitation of the I/B/E/S consensus data which has been noted in the literature (e.g., [17, 21]) is that the forecasts contained in the I/B/E/S consensus forecast may not represent each source's most recent forecast. To the extent that there is a lag in collecting the most recent forecasts, GIBES may not incorporate all relevant current information.

The I/B/E/S data used in this study were usually made publicly available the Thursday of the third week of December. The Salomon Brothers forecast, GSB, was prepared at the end of each November and was published in the *Electric Utility Monthly* usually within the first week of December. Since this study uses end-of-month December price and earnings data, the published GSB was approximately one month old and may not have represented Salomon Brothers most recent unpublished forecast. (See [1] for an examination of the impact on stock prices from releasing revisions of analysts' forecasts to select clients before making them available to the general public.) Also, for some of the utilities in the sample the Value Line forecasts were approximately two months old. Hence, considering the timing of the release of the Salomon Brothers and Value Line data, the performance of GIBES relative to GSB and GVLE cannot be fully explained by the possibility that the I/B/E/S consensus data did not contain all the most recent forecasts.[13]

E. Financial Analysts' Forecast vs. Historical Growth

The results in Exhibit 6 also provide additional evidence of the superiority of FAF's over historical growth based forecasts. The results show that all financial analysts' forecasts contain a significant amount of information used by investors in the determination of share prices not found in the historical growth rate GHD5. However, the historical growth rate, GHD5, also contains information not incorporated in GIBES and GVLE.

It seems somewhat paradoxical that the financial analysts' forecasts GIBES and GVLE would not contain all the information found in the readily available historical growth rate GHD5. However both GIBES and GVLE are forecasts of growth in earnings, not dividends. The information incorporated in a rational earnings forecast need not include information found in historical dividend growth, even if such information is incorporated in stock prices, unless historical dividend growth also contains information pertaining to future growth in earnings. However, it would be expected that a rational forecast of future growth in dividends would at least incorporate any information found in historical dividend growth rates. Exhibit 6 shows that the Value Line's forecasted dividend growth rate, GVLD, contains all the information in the historical growth rate, GHD5, and more.

Finally, GSB always contains information not found in GHD5 and GHD5 does not contain information not already incorporated in GSB. Since GSB is, for the sample companies, a part of the appropriate proxy for g, the results indicate that an estimate comprised wholly of FAF's is preferable to one based solely on historical growth rates, or a combination of historical growth rates and FAF's. These findings are consistent with those in [8, 37]. However Newbold, Zumwalt, and Kannan [30] compared ARIMA model forecasts to Value Line's, and found that combining forecasts increased forecasting ability.

IV. Summary and Conclusion

Consensus analysts' forecasts are being increasingly used as proxies for investor expectations. Exclusive use of a consensus forecast assumes that it incorporates all information relating to equity valuation contained in alternative proxies. This assumption is of critical im-

[13] As pointed out by a referee, the I/B/E/S consensus growth forecasts are a mixture of both arithmetic and geometric growth rates and, therefore, it may be argued that their comparison to individual analyst's forecasts is unfair. However, as also noted by the referee, such criticism is moot since I/B/E/S forecasts are purchased by analysts, regulators, and companies who use I/B/E/S as an alternative to other forecasts.

portance both in investor research and in regulatory rate setting proceedings where consensus forecasts are often used to establish cost of equity recommendations. Using an approximation to a constant growth valuation model, this study examined the informational content of the commonly used I/B/E/S consensus growth forecast relative to selected individual analyst's forecasts provided by Salomon Brothers and Value Line. Historical growth rates were also examined. The analyses were performed for a group of electric utilities.

Within the limitations of the empirical pricing model used in the study the results indicate, for the sample of utilities examined, that the I/B/E/S consensus forecast did not contain all relevant information. Instead, the selected individual analysts' forecasts consistently contained significant amounts of information not reflected in the consensus data. The results demonstrate that in research and regulatory proceedings, analyses similar to that performed in this study should be conducted to establish the adequacy of forecasts used as proxies for growth. Finally, the results provide additional evidence that historical growth rates are poor proxies for investor expectations; hence, they should not be used to estimate utilities' cost of equity capital.

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Investor growth expectations: Analysts vs. history

Analysts' growth forecasts dominate past trends in predicting stock prices.

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For the purposes of implementing the Discounted Cash Flow (DCF) cost of equity model, the analyst must know which growth estimate is embodied in the firm's stock price. A study by Cragg and Malkiel (1982) suggests that the stock valuation process embodies analysts' forecasts rather than historically based growth figures such as the ten-year historical growth in dividends per share or the five-year growth in book value per share. The Cragg and Malkiel study is based on data for the 1960s, however, a decade that was considerably more stable than the recent past.

As the issue of which growth rate to use in implementing the DCF model is so important to applications of the model, we decided to investigate whether the Cragg and Malkiel conclusions continue to hold in more recent periods. This paper describes the results of our study.

STATISTICAL MODEL

The DCF model suggests that the firm's stock price is equal to the present value of the stream of dividends that investors expect to receive from owning the firm's shares. Under the assumption that investors expect dividends to grow at a constant rate, g, in perpetuity, the stock price is given by the following simple expression:

$$P_S = \frac{D\,(1 + g)}{k - g} \qquad (1)$$

where:

P_S = current price per share of the firm's stock;

D = current annual dividend per share;

g = expected constant dividend growth rate; and

k = required return on the firm's stock.

Dividing both sides of Equation (1) by the firm's current earnings, E, we obtain:

$$\frac{P_S}{E} = \frac{D}{E} \cdot \frac{(1 + g)}{k - g} \qquad (2)$$

Thus, the firm's price/earnings (P/E) ratio is a nonlinear function of the firm's dividend payout ratio (D/E), the expected growth in dividends (g), and the required rate of return.

To investigate what growth expectation is embodied in the firm's current stock price, it is more convenient to work with a linear approximation to Equation (2). Thus, we will assume that:

$$P/E = a_0(D/E) + a_1 g + a_2 k. \qquad (3)$$

(Cragg and Malkiel found this assumption to be reasonable throughout their investigation.)

Furthermore, we will assume that the required

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Financial support for this project was provided by BellSouth and Pacific Telesis. The authors wish to thank Paul Blalock at BellSouth, Mohan Gyani at Pacific Telesis, Bill Keck at Southern Bell, and John Carlson, their programmer, for help with this project.

rate of return, k, in Equation (3) depends on the values of the risk variables B, Cov, Rsq, and Sa, where B is the firm's Value Line beta; Cov is the firm's pretax interest coverage ratio; Rsq is a measure of the stability of the firm's five-year historical EPS; and Sa is the standard deviation of the consensus analysts' five-year EPS growth forecast for the firm. Finally, as the linear form of the P/E equation is only an approximation to the true P/E equation, and B, Cov, Rsq, and Sa are only proxies for k, we will add an error term, e, that represents the degree of approximation to the true relationship.

With these assumptions, the final form of our P/E equation is as follows:

$$P/E = a_0(D/E) + a_1 g + a_2 B + a_3 Cov + a_4 Rsq + a_5 Sa + e. \quad (4)$$

The purpose of our study is to use more recent data to determine which of the popular approaches for estimating future growth in the Discounted Cash Flow model is embodied in the market price of the firm's shares.

We estimated Equation (4) to determine which estimate of future growth, g, when combined with the payout ratio, D/E, and risk variables B, Cov, Rsq, and Sa, provides the best predictor of the firm's P/E ratio. To paraphrase Cragg and Malkiel, we would expect that growth estimates found in the best-fitting equation more closely approximate the expectation used by investors than those found in poorer-fitting equations.

DESCRIPTION OF DATA

Our data sets include both historically based measures of future growth and the consensus analysts' forecasts of five-year earnings growth supplied by the Institutional Brokers Estimate System of Lynch, Jones & Ryan (IBES). The data also include the firm's dividend payout ratio and various measures of the firm's risk. We include the latter items in the regression, along with earnings growth, to account for other variables that may affect the firm's stock price.

The data include:

Earnings Per Share. Because our goal is to determine which earnings variable is embodied in the firm's market price, we need to define this variable with care. Financial analysts who study a firm's financial results in detail generally prefer to "normalize" the firm's reported earnings for the effect of extraordinary items, such as write-offs of discontinued operations, or mergers and acquisitions. They also attempt, to the extent possible, to state earnings for different firms using a common set of accounting conventions.

We have defined "earnings" as the consensus analyst estimate (as reported by IBES) of the firm's earnings for the forthcoming year.[1] This definition approximates the normalized earnings that investors most likely have in mind when they make stock purchase and sell decisions. It implicitly incorporates the analysts' adjustments for differences in accounting treatment among firms and the effects of the business cycle on each firm's results of operations. Although we thought at first that this earnings estimate might be highly correlated with the analysts' five-year earnings growth forecasts, that was not the case. Thus, we avoided a potential spurious correlation problem.

Price/Earnings Ratio. Corresponding to our definition of "earnings," the price/earnings ratio (P/E) is calculated as the closing stock price for the year divided by the consensus analyst earnings forecast for the forthcoming fiscal year.

Dividends. Dividends per share represent the common dividends declared per share during the calendar year, after adjustment for all stock splits and stock dividends). The firm's dividend payout ratio is then defined as common dividends per share divided by the consensus analyst estimate of the earnings per share for the forthcoming calendar year (D/E). Although this definition has the deficiency that it is obviously biased downward — it divides this year's dividend by next year's earnings — it has the advantage that it implicitly uses a "normalized" figure for earnings. We believe that this advantage outweighs the deficiency, especially when one considers the flaws of the apparent alternatives. Furthermore, we have verified that the results are insensitive to reasonable alternative definitions (see footnote 1).

Growth. In comparing historically based and consensus analysts' forecasts, we calculated forty-one different historical growth measures. These included the following: 1) the past growth rate in EPS as determined by a log-linear least squares regression for the latest year,[2] two years, three years, . . ., and ten years; 2) the past growth rate in DPS for the latest year, two years, three years, . . ., and ten years; 3) the past growth rate in book value per share (computed as the ratio of common equity to the outstanding common equity shares) for the latest year, two years, three years, . . ., and ten years; 4) the past growth rate in cash flow per share (computed as the ratio of pretax income, depreciation, and deferred taxes to the outstanding common equity shares) for the latest year, two years, three years, . . ., and ten years; and 5) plowback growth (computed as the firm's retention ratio for the current year times the firm's latest annual return on common equity).

We also used the five-year forecast of earnings per share growth compiled by IBES and reported in mid-January of each year. This number represents the consensus (i.e., mean) forecast produced by analysts from the research departments of leading Wall Street and regional brokerage firms over the preceding three months. IBES selects the contributing brokers "because of the superior quality of their research, professional reputation, and client demand" (IBES *Monthly Summary Book*).

Risk Variables. Although many risk factors could potentially affect the firm's stock price, most of these factors are highly correlated with one another. As shown above in Equation (4), we decided to restrict our attention to four risk measures that have intuitive appeal and are followed by many financial analysts: 1) B, the firm's beta as published by Value Line; 2) Cov, the firm's pretax interest coverage ratio (obtained from Standard & Poor's Compustat); 3) Rsq, the stability of the firm's five-year historical EPS (measured by the R^2 from a log-linear least squares regression); and 4) Sa, the standard deviation of the consensus analysts' five-year EPS growth forecast (mean forecast) as computed by IBES.

After careful analysis of the data used in our study, we felt that we could obtain more meaningful results by imposing six restrictions on the companies included in our study:

1. Because of the need to calculate ten-year historical growth rates, and because we studied three different time periods, 1981, 1982, and 1983, our study requires data for the thirteen-year period 1971-1983. We included only companies with at least a thirteen-year operating history in our study.
2. As our historical growth rate calculations were based on log-linear regressions, and the logarithm of a negative number is not defined, we excluded all companies that experienced negative EPS during any of the years 1971-1983.
3. For similar reasons, we also eliminated companies that did not pay a dividend during any one of the years 1971-1983.
4. To insure comparability of time periods covered by each consensus earnings figure in the P/E ratios, we eliminated all companies that did not have a December 31 fiscal year-end.
5. To eliminate distortions caused by highly unusual events that distort current earnings but not expected future earnings, and thus the firm's price/earnings ratio, we eliminated any firm with a price/earnings ratio greater than 50.
6. As the evaluation of analysts' forecasts is a major part of this study, we eliminated all firms that IBES did not follow.

Our final sample consisted of approximately sixty-five utility firms.[3]

RESULTS

To keep the number of calculations in our study to a reasonable level, we performed the study in two stages. In Stage 1, all forty-one historically oriented approaches for estimating future growth were correlated with each firm's P/E ratio. In Stage 2, the historical growth rate with the highest correlation to the P/E ratio was compared to the consensus analyst growth rate in the multiple regression model described by Equation (4) above. We performed our regressions for each of three recent time periods, because we felt the results of our study might vary over time.

First-Stage Correlation Study

Table 1 gives the results of our first-stage correlation study for each group of companies in each of the years 1981, 1982, and 1983. The values in this table measure the correlation between the historically oriented growth rates for the various time periods and the firm's end-of-year P/E ratio.

The four variables for which historical growth rates were calculated are shown in the left-hand column: EPS indicates historical earnings per share growth, DPS indicates historical dividend per share growth, BVPS indicates historical book value per share growth, and CFPS indicates historical cash flow per share growth. The term "plowback" refers to the product of the firm's retention ratio in the currennt year and its return on book equity for that year. In all, we calculated forty-one historically oriented growth rates for each group of firms in each study period.

The goal of the first-stage correlation analysis was to determine which historically oriented growth rate is most highly correlated with each group's year-end P/E ratio. Eight-year growth in CFPS has the highest correlation with P/E in 1981 and 1982, and ten-year growth in CFPS has the highest correlation with year-end P/E in 1983. In all cases, the plowback estimate of future growth performed poorly, indicating that — contrary to generally held views — plowback is not a factor in investor expectations of future growth.

Second-Stage Regression Study

In the second stage of our regression study, we ran the regression in Equation (4) using two different measures of future growth, g: 1) the best historically oriented growth rate (g_h) from the first-stage correlation study, and 2) the consensus analysts' forecast (g_a) of five-year EPS growth. The regression results, which are shown in Table 2, support at least

TABLE 1

Correlation Coefficients of All Historically Based Growth Estimates by Group and by Year with P/E

Current Year	*Historical Growth Rate Period in Years* 1	2	3	4	5	6	7	8	9	10
1981										
EPS	−0.02	0.07	0.03	0.01	0.03	0.12	0.08	0.09	0.09	0.09
DPS	0.05	0.18	0.14	0.15	0.14	0.15	0.19	0.23	0.23	0.23
BVPS	0.01	0.11	0.13	0.13	0.16	0.18	0.15	0.15	0.15	0.15
CFPS	−0.05	0.04	0.13	0.22	0.28	0.31	0.30	0.31	−0.57	−0.54
Plowback	0.19									
1982										
EPS	−0.10	−0.13	−0.06	−0.02	−0.02	−0.01	−0.03	−0.03	0.00	0.00
DPS	−0.19	−0.10	0.03	0.05	0.07	0.08	0.09	0.11	0.13	0.13
BVPS	0.07	0.08	0.11	0.11	0.09	0.10	0.11	0.11	0.09	0.09
CFPS	−0.02	−0.08	0.00	0.10	0.16	0.19	0.23	0.25	0.24	0.07
Plowback	0.04									
1983										
EPS	−0.06	−0.25	−0.25	−0.24	−0.16	−0.11	−0.05	0.00	0.02	0.02
DPS	0.03	−0.10	−0.03	0.08	0.15	0.21	0.21	0.21	0.22	0.24
BVPS	0.03	0.10	0.04	0.09	0.15	0.16	0.19	0.21	0.22	0.21
CFPS	−0.08	0.01	0.02	0.08	0.20	0.29	0.35	0.38	0.40	0.42
Plowback	−0.08									

two general conclusions regarding the pricing of equity securities.

First, we found overwhelming evidence that the consensus analysts' forecast of future growth is superior to historically oriented growth measures in predicting the firm's stock price. In every case, the R^2 in the regression containing the consensus analysts' forecast is higher than the R^2 in the regression containing the historical growth measure. The regression coefficients in the equation containing the consensus analysts' forecast also are considerably more significant than they are in the alternative regression. These results are consistent with those found by Cragg and Malkiel for data covering the period 1961-1968. Our results also are consistent with the hypothesis that investors use analysts' forecasts, rather than historically oriented growth calculations, in making stock buy-and-sell decisions.

TABLE 2

Regression Results
Model I

Part A: *Historical*

$P/E = a_0 + a_1 D/E + a_2 g_h + a_3 B + a_4 Cov + a_5 Rsq + a_6 Sa$

Year	$\hat{a}_0$	$\hat{a}_1$	$\hat{a}_2$	$\hat{a}_3$	$\hat{a}_4$	$\hat{a}_5$	$\hat{a}_6$	R^2	F Ratio
1981	−6.42*	10.31*	7.67*	3.24	0.54*	1.42*	57.43	0.83	46.49
	(5.50)	(14.79)	(2.20)	(2.86)	(2.50)	(2.85)	(4.07)		
1982	−2.90*	9.32*	8.49*	2.85	0.45*	−0.42	3.63	0.86	65.53
	(2.75)	(18.52)	(4.18)	(2.83)	(2.60)	(0.05)	(0.26)		
1983	−5.96*	10.20*	19.78*	4.85	0.44*	0.33	32.49	0.82	45.26
	(3.70)	(12.20)	(4.83)	(2.95)	(1.89)	(0.50)	(1.29)		

Part B: *Analysis*

$P/E = a_0 + a_1 D/E + a_2 g_a + a_3 B + a_4 Cov + a_5 Rsq + a_6 Sa$

Year	$\hat{a}_0$	$\hat{a}_1$	$\hat{a}_2$	$\hat{a}_3$	$\hat{a}_4$	$\hat{a}_5$	$\hat{a}_6$	R^2	F Ratio
1981	−4.97*	10.62*	54.85*	−0.61	0.33*	0.63*	4.34	0.91	103.10
	(6.23)	(21.57)	(8.56)	(0.68)	(2.28)	(1.74)	(0.37)		
1982	−2.16*	9.47*	50.71*	−1.07	0.36*	−0.31	119.05*	0.90	97.62
	(2.59)	(22.46)	(9.31)	(1.14)	(2.53)	(1.09)	(1.60)		
1983	−8.47*	11.96*	79.05*	2.16	0.56*	0.20	−34.43	0.87	69.81
	(7.07)	(16.48)	(7.84)	(1.55)	(3.08)	(0.38)	(1.44)		

Notes:
* Coefficient is significant at the 5% level (using a one-tailed test) and has the correct sign. T-statistic in parentheses.

Second, there is some evidence that investors tend to view risk in traditional terms. The interest coverage variable is statistically significant in all but one of our samples, and the stability of the operating income variable is statistically significant in six of the twelve samples we studied. On the other hand, the beta is never statistically significant, and the standard deviation of the analysts' five-year growth forecasts is statistically significant in only two of our twelve samples. This evidence is far from conclusive, however, because, as we demonstrate later, a significant degree of cross-correlation among our four risk variables makes any general inference about risk extremely hazardous.

Possible Misspecification of Risk

The stock valuation theory says nothing about which risk variables are most important to investors. Therefore, we need to consider the possibility that the risk variables of our study are only proxies for the "true" risk variables used by investors. The inclusion of proxy variables may increase the variance of the parameters of most concern, which in this case are the coefficients of the growth variables.[4]

To allow for the possibility that the use of risk proxies has caused us to draw incorrect conclusions concerning the relative importance of analysts' growth forecasts and historical growth extrapolations, we have also estimated Equation (4) with the risk variables excluded. The results of these regressions are shown in Table 3.

Again, there is overwhelming evidence that the consensus analysts' growth forecast is superior to the historically oriented growth measures in predicting the firm's stock price. The R^2 and t-statistics are higher in every case.

CONCLUSION

The relationship between growth expectations and share prices is important in several major areas of finance. The data base of analysts' growth forecasts collected by Lynch, Jones & Ryan provides a unique opportunity to test the hypothesis that investors rely more heavily on analysts' growth forecasts than on historical growth extrapolations in making security buy-and-sell decisions. With the help of this data base, our studies affirm the superiority of analysts' forecasts over simple historical growth extrapolations in the stock price formation process. Indirectly, this finding lends support to the use of valuation models whose input includes expected growth rates.

TABLE 3

Regression Results
Model II

Part A: *Historical*

$P/E = a_0 + a_1 D/E + a_2 g_h$

Year	$\hat{a}_0$	$\hat{a}_1$	$\hat{a}_2$	R^2	F Ratio
1981	−1.05	9.59	21.20	0.73	82.95
	(1.61)	(12.13)	(7.05)		
1982	0.54	8.92	12.18	0.83	167.97
	(1.38)	(17.73)	(6.95)		
1983	−0.75	8.92	12.18	0.77	107.82
	(1.13)	(12.38)	(7.94)		

Part B: *Analysis*

$P/E + a_0 + a_1 D/E + a_2 g_a$

Year	$\hat{a}_0$	$\hat{a}_1$	$\hat{a}_2$	R^2	F Ratio
1981	3.96	10.07	60.53	0.90	274.16
	(8.31)	(8.31)	(20.91)	(15.79)	
1982	−1.75	9.19	44.92	0.88	246.36
	(4.00)	(4.00)	(21.35)	(11.06)	
1983	−4.97	10.95	82.02	0.83	168.28
	(6.93)	(6.93)	(15.93)	(11.02)	

Notes:
* Coefficient is significant at the 5% level (using a one-tailed test) and has the correct sign. T-statistic in parentheses.

[1] We also tried several other definitions of "earnings," including the firm's most recent primary earnings per share prior to any extraordinary items or discontinued operations. As our results were insensitive to reasonable alternative definitions of "earnings" we report only the results for the IBES consensus.

[2] For the latest year, we actually employed a point-to-point growth calculation because there were only two available observations.

[3] We use the word "approximately," because the set of available firms varied each year. In any case, the number varied only from zero to three firms on either side of the figures cited here.

[4] See Maddala (1977).

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Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 224
Witness: Don Murry

Data Request:

With respect to page 30, lines 12-23 and DAM-16 and DAM-17, please provide all data used in the study of dividend and dividend announcements. Please provide the data in both paper and electronic (Microsoft Excel) formats. For the electronic version, please keep all data and equations intact.

Response:

Please reference the provided documentation and zip file attached to this response as AG DR1-224 ATT1 and AG DR1-224 ATT2, as well as the response to item 231 of the Attorney General's Initial Data Request.

Positive Earnings Surprise

Case of Significantly positive EPS surprises: about 10% or higher

Event Date	t-9	t-8	t-7	t-6	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5	t+6	t+7	t+8	t+9
ATG																			
7/25/2002	-0.008	-0.001	-0.022	0.020	-0.034	-0.034	0.009	-0.022	0.027	0.072	0.011	0.028	0.013	0.004	-0.016	-0.021	-0.004	-0.006	0.008
10/17/2002	-0.033	0.011	0.010	-0.048	0.046	-0.013	-0.002	0.004	-0.012	0.013	0.013	0.005	-0.007	0.006	0.003	-0.001	-0.028	0.005	-0.003
NJR																			
1/23/2002	0.002	0.000	0.013	-0.008	-0.005	0.000	-0.003	0.003	-0.006	0.011	0.003	-0.002	-0.009	0.012	0.012	-0.012	0.0091	-0.0065	-0.0105
1/28/2003	-0.003	-0.008	-0.003	-0.016	0.004	0.005	0.014	0.002	-0.009	0.052	-0.008	0.001	0.000	-0.014	0.012	-0.007	0.009	-0.0068	0.0009
4/24/2003	-0.007	0.007	-0.011	-0.002	0.004	0.003	0.003	0.006	-0.011	-0.004	-0.004	0.003	-0.015	0.002	-0.011	0.000	0.000	-0.005	-0.0123
GAS																			
10/18/2001	-0.010	0.001	-0.006	0.007	0.003	-0.016	-0.002	0.017	0.013	-0.019	0.026	0.013	-0.006	-0.021	0.001	-0.007	0.001	0.006	0.000
NWN																			
4/24/2002	0.000	0.031	-0.013	-0.007	-0.015	0.007	0.013	0.001	-0.005	-0.005	-0.014	-0.008	0.007	-0.006	-0.004	0.026	0.017	0.003	0.005
7/24/2002	-0.017	-0.003	0.002	-0.011	0.005	-0.003	-0.021	0.000	-0.028	0.060	0.030	0.036	0.002	0.012	-0.035	0.026	-0.036	0.023	0.009
7/29/2003	-0.003	-0.007	-0.001	-0.010	0.000	-0.003	-0.005	-0.006	-0.002	0.029	0.005	0.015	-0.033	-0.004	0.001	-0.009	0.012	-0.003	0.009
PGL																			
4/25/2003	-0.001	-0.006	-0.005	-0.002	0.009	-0.004	0.009	-0.014	0.000	0.027	0.001	-0.005	-0.006	0.002	-0.007	0.011	0.012	-0.0023	0.004
PNY																			
8/23/2002	0.013	-0.031	0.030	-0.003	0.003	-0.006	0.005	0.008	0.003	-0.017	0.022	-0.014	-0.006	0.006	-0.001	0.018	-0.001	0.016	0.0093
WGL																			
1/29/2003	0.002	-0.001	-0.002	0.003	-0.012	0.032	0.002	-0.029	0.020	0.009	0.030	0.017	0.010	-0.004	-0.010	0.007	-0.020	0.024	-0.017
AAR	-0.005	-0.001	-0.001	-0.006	0.000	-0.003	0.002	-0.002	-0.001	0.019	0.009	0.007	-0.004	0.000	-0.005	0.003	-0.002	0.004	0.000
CAAR_E	-0.005	-0.006	-0.007	-0.013	-0.013	-0.015	-0.013	-0.016	-0.017	0.003	0.012	0.020	0.016	0.015	0.010	0.013	0.010	0.014	0.015

Positive Dividend Surprise

Case of Positive Dividend Surprises

	t-9	t-8	t-7	t-6	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5	t+6	t+7	t+8	t+9
ATG																			
Event Date																			
4/16/2003	0.003	-0.003	-0.007	0.013	-0.002	-0.001	-0.008	-0.003	-0.001	0.008	0.004	0.004	-0.003	0.007	0.008	-0.003	0.005	0.00349	-0.0072
NJR																			
2/3/2003	0.004	0.005	0.014	0.002	-0.009	0.052	-0.008	0.001	0.000	-0.014	0.012	-0.007	0.009	-0.007	0.001	-0.006	-0.007	0.0168	0.00985
10/28/2003	-0.009	-0.006	-0.008	0.000	-0.002	-0.015	-0.006	-0.001	0.009	0.007	0.002	-0.002	0.015	0.016	-0.002	0.008	-0.005	-0.004	-0.006
Gas																			
3/21/2002	-0.008	0.015	-0.010	0.003	0.003	-0.003	0.001	-0.002	0.000	0.018	0.003	0.010	0.005	0.006	-0.004	0.013	-0.001	-0.0031	-0.0008
4/30/2003	0.005	-0.003	0.013	-0.032	0.005	-0.007	-0.004	-0.006	0.003	-0.001	-0.005	-0.002	-0.019	-0.010	0.005	-0.023	0.019	-0.009	-0.010
NWN																			
10/2/2003	-0.014	0.007	0.005	0.003	-0.013	-0.006	0.008	-0.006	0.018	0.008	0.005	0.000	0.004	-0.023	0.007	-0.003	0.004	-0.001	-0.003
PGL																			
2/5/2003	0.010	-0.020	-0.013	-0.001	0.021	-0.009	-0.008	0.009	-0.009	-0.002	0.006	-0.012	0.007	-0.006	0.000	0.010	-0.010	0.00798	0.0166
WGL																			
3/5/2003	0.017	0.009	-0.006	0.023	-0.017	0.007	-0.010	0.011	-0.005	0.010	0.006	0.007	0.016	-0.013	-0.008	0.001	-0.004	-0.002	0.004
AAR	0.001	0.000	-0.001	0.001	-0.002	0.002	-0.004	0.000	0.002	0.004	0.004	0.000	0.004	-0.004	0.001	0.000	0.000	0.001	0.000
CAAR_D	0.001	0.001	0.000	0.001	0.000	0.002	-0.003	-0.002	-0.001	0.004	0.008	0.007	0.012	0.008	0.009	0.009	0.009	0.010	0.010

Event Date	t-9	t-8	t-7	t-6	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5	t+6	t+7	t+8	t+9
CAAR_D	0.1%	0.1%	0.0%	0.1%	0.0%	0.2%	-0.3%	-0.2%	-0.1%	0.4%	0.8%	0.7%	1.2%	0.8%	0.9%	0.9%	0.9%	1.0%	1.0%
CAAR_E_Adjus	1.1%	1.0%	0.9%	0.3%	0.3%	0.1%	0.3%	0.0%	-0.1%	1.9%	2.8%	3.6%	3.2%	3.1%	2.6%	2.9%	2.6%	3.0%	3.1%
CAAR_E	-0.005	-0.006	-0.007	-0.013	-0.013	-0.015	-0.013	-0.016	-0.017 -0.016	0.003	0.012	0.020	0.016	0.015	0.010	0.013	0.010	0.014	0.015

AGL Resources - ATG

Date	Dividends	Earnings		Expectation	Difference
1/28/2004	0.280			0.280	0.000
1/28/2004		2.010	annual	2.000	0.010
11/3/2003	0.280			0.280	0.000
10/30/2003		0.340		0.480	(0.140)
7/31/2003		0.290		0.250	0.040
7/30/2003	0.280			0.280	0.000
4/22/2003		0.980		0.900	0.080
4/16/2003	0.280			0.270	0.010
1/31/2003		1.820		1.750	0.070
10/17/2002		0.170		0.150	0.020
7/25/2002		0.220		0.200	0.020
4/30/2002		0.890		1.200	(0.310)
2/1/2002	0.270			0.270	0.000
1/24/2002		0.450		0.410	0.040
10/25/2001		1.620	annual	1.500	0.120

New Jersey Resources - NJR

Date	Dividends	Earnings		Expectatior	Difference
1/28/2004		0.87		0.85	0.020
10/28/2003	0.325			0.31	0.015
10/28/2003		2.38	annual	2.35	0.030
7/24/2003		0.16		0.15	0.010
6/10/2003	0.31			0.31	0.000
4/24/2003		1.52		1.36	0.160
2/3/2003	0.31			0.3	0.010
1/28/2003		0.86		0.77	0.090
10/30/2002		2.12	annual	2.12	0.000
7/24/2002		0.18		0.2	(0.020)
6/5/2002	0.3			0.3	0.000
4/24/2002		1.3		1.35	(0.050)
3/6/2002	0.3			0.3	0.000
1/23/2002		1.1		1	0.100
10/25/2001		2.95	annual	2.95	0.000

NICOR- GAS

Date	Dividends	Earnings	Expectation	Difference
2/9/2004		2.38 annual	2.1	0.280
11/20/2003	0.465		0.465	0.000
10/30/2003		0.01	0.33	(0.320)
7/31/2003		0.54	0.25	0.290
7/17/2003	0.465		0.465	0.000
5/1/2003		1.04	1.1	(0.060)
4/30/2003	0.465		0.46	0.005
3/20/2003	0.465		0.46	0.005
3/4/2003		2.88 annual	2.65	0.230
11/21/2002	0.46		0.46	0.000
8/14/2002		0.46	0.64	(0.180)
7/18/2002	0.46		0.46	0.000
4/18/2002	0.46		0.46	0.000
4/17/2002		0.9	0.85	0.050
3/21/2002	0.46		0.455	0.005
1/23/2002		3.01 annual	3.05	(0.040)
11/15/2001	0.44		0.44	0.000
10/18/2001		0.61	0.55	0.060

Northwest Natural- NWN

Date	Dividends	Earnings	Expectatior	Difference
1/29/2004		1.76 annual	1.75	0.010
1/5/2004	0.325		0.325	0.000
11/4/2003		0.25	0.3	(0.050)
10/2/2003	0.325		0.315	0.010
7/29/2003		0.17	0.1	0.070
7/2/2003	0.315		0.315	0.000
5/1/2003		1.01	1.1	(0.090)
4/1/2003	0.315		0.315	0.000
2/4/2003		1.62 annual	1.7	(0.080)
1/3/2003	0.315		0.315	0.000
11/4/2002		-0.22	-0.25	0.030
10/3/2002	0.315		0.315	0.000
7/24/2002		0.18	0.14	0.040
7/5/2002	0.315		0.315	0.000
4/24/2002		1.32	1.15	0.170
4/5/2002	0.315		0.315	0.000
3/1/2002		1.88 annual	1.75	0.130
1/3/2002	0.315		0.315	0.000

Peoples Energy- PGL

Date	Dividends	Earnings		Expectation	Difference
1/23/2004		0.85		0.88	(0.030)
12/5/2003	0.53			0.53	0.000
10/31/2003		2.87 annual		2.9	(0.030)
8/6/2003	0.53			0.53	0.000
7/25/2003		0.22		0.3	(0.080)
6/4/2003	0.53			0.53	0.000
4/25/2003		1.77		1.5	0.270
2/5/2003	0.53			0.52	0.010
1/24/2003		0.87	mia		#VALUE!
12/4/2002	0.52		mia		#VALUE!
10/25/2002		2.8 annual		2.75	0.050
8/7/2002	0.52			0.52	0.000
7/26/2002		0.04		0.28	(0.240)
5/22/2002	0.52			0.52	0.000
4/26/2002		1.55		1.52	0.030
2/6/2002	0.52			0.52	0.000
1/25/2002		0.88		1.05	(0.170)

Piedmont - PNY

Date	Dividends	Earnings		Expectation	Difference	
12/12/2003	0.415			0.415	0.000	
12/12/2003		2.22	annual	2.15	0.070	
8/22/2003	0.415			0.415	0.000	
8/22/2003		-0.29		1.3	(1.590)	Changes in recording revenues ar
5/30/2003	0.415			0.415	0.000	
5/30/2003		0.93		1.3	(0.370)	
2/28/2003	0.415			0.4	0.015	
2/28/2003		1.74		1.55	0.190	
12/13/2002	0.4			0.4	0.000	
12/13/2002		1.9	annual	2.75	(0.850)	
8/23/2002	0.4			0.4	0.000	
8/23/2002		-0.027		-0.33	0.303	
5/31/2002	0.4			0.4	0.000	
5/31/2002		1.27		1.27	0.000	
2/22/2002	0.4			0.4	0.000	
2/22/2002		1.26		1.6	(0.340)	
12/7/2001	0.385			0.385	0.000	
12/7/2001		2.01	annual	2.05	(0.040)	

PNY

ıd COG

WGL Holdings, Inc.

Date	Dividends	Earnings		Expectatior	Difference
1/28/2004		0.81		0.8	0.010
12/19/2003	0.32			0.32	0.000
11/3/2003		2.3	annual	2.2	0.100
9/24/2003	0.32			0.32	0.000
7/30/2003		-0.05		0.15	(0.200)
6/25/2003	0.32			0.32	0.000
4/30/2003		1.66		1.6	0.060
3/5/2003	0.32			0.318	0.002
1/29/2003		1.06		0.9	0.160
12/20/2002	0.3175			0.318	(0.001)
11/4/2002		-0.47		-0.41	(0.060)
9/25/2002	0.3175			0.3175	0.000
8/2/2002		-0.29		-0.1	(0.190)
6/26/2002	0.3175			0.3175	0.000
5/1/2002		0.94		1.2	(0.260)
2/25/2002	0.3175			0.3175	0.000
1/30/2002		0.62		0.85	(0.230)
12/14/2001	0.315			0.315	0.000
10/31/2001		-0.48		-0.37	(0.110)
9/26/2001	0.315			0.315	0.000

STOCK PRICE

DATE	ATG	NJR	GAS	NWN	PGL	PNY	WGL	Index
2000:01:03	13.37	20.66	5.85	16.99	5.81	23.93	21.46	5.59
2000:01:04	13.37	20.18	6	16.69	5.96	24.19	21.50	89.81
2000:01:05	13.87	20.39	6.72	16.89	6.42	24.44	21.55	93.99
2000:01:06	13.87	20.35	7.13	16.94	6.26	24.55	21.50	87.53
2000:01:07	14.02	20.49	7.75	17.04	6.56	24.34	21.45	76.22
2000:01:10	13.67	20.46	7.7	17.34	6.11	24.14	21.39	86.41
2000:01:11	13.62	20.25	7.64	17.09	5.86	23.88	20.98	77.36
2000:01:12	13.82	20.39	8	16.84	6.01	24.29	21.04	76.62
2000:01:13	13.97	20.52	8.41	16.65	5.91	24.65	21.04	79.05
2000:01:14	13.92	20.80	7.9	17.09	6.36	24.09	20.98	81.67
2000:01:17	NA	NA	NA	NA	NA	NA	NA	NA
2000:01:18	13.77	20.52	7.8	17.04	5.86	24.24	21.09	80.14
2000:01:19	13.77	20.73	7.44	16.74	6.06	24.24	21.09	80.37
2000:01:20	14.12	20.80	8.26	16.45	5.76	24.6	21.14	87.64
2000:01:21	13.92	20.70	8.57	16.40	6.51	24.5	21.19	95.52
2000:01:24	13.82	20.93	8.05	15.75	5.76	24.65	21.34	88.9
2000:01:25	13.82	21.52	7.7	15.65	5.46	24.29	20.77	84.53
2000:01:26	13.82	21.24	7.9	15.90	5.46	24.19	20.83	86.79
2000:01:27	13.67	20.76	7.49	16.44	5.46	24.03	20.98	86.69
2000:01:28	13.57	20.90	7.49	16.26	4.4	23.83	21.04	76.74
2000:01:31	13.72	20.70	8.11	16.83	5.11	23.42	20.77	94.92
2000:02:01	13.52	21.00	8.11	16.98	5.35	23.83	21.09	93.41
2000:02:02	13.42	20.87	8.46	17.49	5.35	23.88	20.93	94.77
2000:02:03	13.67	21.24	9.23	17.75	5.91	24.03	20.88	98.81
2000:02:04	13.57	21.21	8.16	18.06	5.2	23.67	20.88	97.26
2000:02:07	13.47	21.11	7.8	16.42	5.06	23.37	20.72	96.35
2000:02:08	13.67	20.76	7.95	16.72	4.86	23.06	20.93	98.71
2000:02:09	13.52	20.63	7.39	17.03	4.75	22.9	20.88	92.57
2000:02:10	13.86	20.59	7.34	17.03	4.45	22.8	20.62	92.92
2000:02:11	13.55	20.80	7.08	17.13	4.4	22.54	20.00	84.59
2000:02:14	13.55	20.83	7.49	16.67	4.4	21.72	20.26	85.63
2000:02:15	13.71	20.56	7.75	16.67	4.35	21.36	20.31	83.16
2000:02:16	13.55	20.90	7.39	16.83	4.15	21.26	20.26	79.39
2000:02:17	13.86	20.66	7.39	16.88	4	21.31	20.52	80.84
2000:02:18	13.55	20.80	7.03	16.98	3.35	20.85	20.21	67.75
2000:02:21	NA	NA	NA	NA	NA	NA	NA	NA
2000:02:22	13.55	20.28	6.87	16.62	3.65	19.51	19.64	68.8
2000:02:23	NA	NA	NA	NA	3.3	NA	18.97	64.75
2000:02:24	13.45	20.15	4.72	15.90	2.79	20.18	18.70	61.71
2000:02:25	13.71	19.98	4.57	15.80	2.09	20.18	19.12	61.53
2000:02:28	13.65	20.11	5.03	15.83	2.94	20.49	19.23	67.47
2000:02:29	14.07	20.32	4.93	16.01	3.25	20.34	19.74	75.59
2000:03:01	14.22	20.18	4.87	15.49	3.15	19.93	19.74	1.58
2000:03:02	14.43	20.25	4.77	15.29	2.99	20.03	19.64	13.8
2000:03:03	14.48	20.25	5.85	15.18	3.35	20.08	19.80	19.96
2000:03:06	14.12	20.42	4.46	15.24	2.29	20.8	19.74	18.27
2000:03:07	14.48	20.39	4.62	15.18	2.34	20.85	19.80	4.06
2000:03:08	14.43	20.73	5.13	15.08	3.35	21.06	19.90	4.23
2000:03:09	14.48	21.28	5.08	15.24	2.79	21.06	19.74	12.92
2000:03:10	14.27	20.70	4.72	15.39	2.09	20.49	19.80	9.71
2000:03:13	14.32	20.88	4.72	15.18	2.29	20.44	19.69	3.35

STOCK PRICE

2000:03:14	14.38	20.98	4.87	15.29	2.14	20.49	19.64	97.68
2000:03:15	14.53	21.05	5.03	15.34	2.19	20.49	19.85	98.81
2000:03:16	14.99	21.90	6.31	16.01	2.7	21.57	20.77	12.61
2000:03:17	14.58	21.34	5.8	15.88	2.29	21.11	20.47	13.89
2000:03:20	14.63	21.23	6.05	15.85	2.75	21.36	20.62	10.36
2000:03:21	14.58	21.12	6.11	15.85	2.34	21.62	20.26	13.79
2000:03:22	14.43	21.27	5.85	15.44	2.29	22.24	20.42	3.24
2000:03:23	14.38	21.02	5.8	15.29	2.6	22.13	20.31	11.38
2000:03:24	14.43	21.16	5.23	15.39	2.34	21.5	20.77	12.47
2000:03:27	14.32	21.20	5.85	15.90	2.45	21.6	20.77	18.5
2000:03:28	13.96	21.51	6.26	15.60	2.24	21.39	20.00	11.86
2000:03:29	14.17	21.93	7.02	15.80	2.24	21.76	20.47	14.11
2000:03:30	14.22	22.29	7.33	15.90	2.29	21.66	20.98	4.73
2000:03:31	15.15	24.08	7.38	16.01	2.45	22.03	22.48	9.35
2000:04:03	14.38	23.94	6.81	16.16	1.93	22.45	21.45	9.04
2000:04:04	14.58	23.52	7.18	16.08	2.24	22.18	21.29	4.24
2000:04:05	14.79	23.10	7.28	16.16	2.45	22.55	21.81	5.86
2000:04:06	14.74	23.10	7.12	16.42	2.6	22.98	21.76	13.41
2000:04:07	14.84	22.53	6.97	16.26	3.11	22.71	21.50	14.22
2000:04:10	14.48	22.78	7.02	16.36	3.32	22.61	21.23	9.75
2000:04:11	14.43	22.32	7.02	16.36	3.57	22.45	21.18	9.12
2000:04:12	14.38	22.39	7.28	16.72	3.68	22.82	21.39	1.13
2000:04:13	14.48	22.50	7.9	16.88	4.59	23.24	21.65	97.41
2000:04:14	14.43	22.43	7.64	16.36	4.8	22.4	21.91	78.81
2000:04:17	14.63	22.25	8.27	16.21	5.77	22.82	21.81	80.59
2000:04:18	14.63	22.18	8.11	16.42	5.31	22.71	21.60	93.64
2000:04:19	14.38	22.01	7.96	16.42	5.46	22.82	21.71	99.64
2000:04:20	14.12	22.04	8.16	16.21	5.66	22.87	21.60	98.18
2000:04:21	NA	NA	NA	NA	NA	NA	NA	NA
2000:04:24	14.12	21.97	7.96	16.31	5.93	22.71	21.34	96.85
2000:04:25	14.53	22.11	8.68	16.47	6.07	23.5	21.50	13.37
2000:04:26	14.48	22.25	8.37	17.09	6.07	23.61	21.55	12.84
2000:04:27	14.27	21.97	7.96	17.40	5.66	23.29	21.81	9.45
2000:04:28	14.43	22.67	8.16	18.34	5.41	23.87	21.44	5.31
2000:05:01	14.74	22.78	8.48	17.92	5.52	23.45	22.33	12.13
2000:05:02	14.74	22.85	8.01	18.03	5.31	23.5	21.96	97.13
2000:05:03	14.58	22.78	7.85	17.77	4.95	23.19	21.65	89.65
2000:05:04	14.94	22.81	8.01	17.98	5.36	23.45	22.12	91.06
2000:05:05	14.74	23.03	7.85	18.24	5.26	23.5	22.01	92.44
2000:05:08	14.69	22.53	7.54	18.03	5.98	23.4	22.01	91.08
2000:05:09	13.91	22.32	7.49	17.51	5.46	23.13	22.17	85.53
2000:05:10	13.91	22.15	7.9	17.56	5.31	23.66	22.22	82.62
2000:05:11	13.91	22.67	8.73	17.72	6.07	24.61	22.75	90.87
2000:05:12	13.76	22.32	8.58	18.16	5.98	24.4	22.43	91.43
2000:05:15	13.86	22.50	9.77	17.92	6.38	24.56	22.54	2.16
2000:05:16	13.86	22.64	9.77	17.82	6.13	24.88	22.69	1.59
2000:05:17	13.83	22.53	9.1	17.51	5.98	24.72	22.27	96.12
2000:05:18	13.83	22.15	9.57	17.35	6.07	24.56	21.96	88.69
2000:05:19	13.51	21.97	9.15	16.88	5.62	24.09	21.71	76.71
2000:05:22	13.56	22.08	9.83	16.99	6.18	23.82	21.81	72.81
2000:05:23	13.41	22.15	9.83	17.35	6.34	23.93	21.65	66.27
2000:05:24	13.46	22.04	0.76	17.25	6.54	23.87	22.06	69.91

STOCK PRICE

2000:05:25	13.3	21.90	0.19	17.82	6.43	23.87	21.91	67.28
2000:05:26	13.72	22.11	0.35	18.13	7.15	24.77	22.38	76.16
2000:05:29	NA	NA	NA	NA	NA	NA	NA	NA
2000:05:30	13.93	22.29	0.35	18.39	7.2	24.93	22.69	87.85
2000:05:31	13.93	21.83	0.5	18.13	7.77	25.14	22.27	88.15
2000:06:01	13.93	22.46	0.71	18.24	7.77	26.41	22.64	97.02
2000:06:02	NA	NA	NA	NA	7.97	NA	22.69	3.72
2000:06:05	13.62	22.18	9.05	18.13	6.84	25.35	22.01	97.81
2000:06:06	13.77	22.50	9.51	18.45	8.13	25.35	21.96	0.96
2000:06:07	13.56	22.11	9.41	18.13	8.07	25.46	21.96	3.29
2000:06:08	13.35	21.90	9.05	18.86	7.77	25.09	21.65	4.8
2000:06:09	NA	NA	NA	NA	8.02	NA	21.71	4.22
2000:06:12	13.56	21.90	8.84	18.55	8.13	25.19	21.65	2.57
2000:06:13	13.56	21.91	9.31	19.07	7.97	25.41	21.65	10.32
2000:06:14	13.41	21.91	9.41	19.07	7.72	25.35	21.65	6.98
2000:06:15	13.72	21.84	9.41	18.86	8.27	25.78	22.33	9.03
2000:06:16	13.56	22.30	9.07	18.97	8	25.83	22.12	5.87
2000:06:19	13.41	22.63	9.31	19.12	8.18	25.72	22.12	11.33
2000:06:20	13.46	23.02	9.31	19.28	8.13	25.25	21.76	10.04
2000:06:21	13.46	23.63	9.05	19.62	8.18	25.13	21.76	13.75
2000:06:22	13.25	23.49	8.63	19.64	7.6	24.6	21.34	10.3
2000:06:23	13.25	22.88	8.32	19.23	7.92	24.49	20.92	5.01
2000:06:26	13.51	23.16	8.22	19.70	8.18	24.33	20.92	2.5
2000:06:27	13.2	22.41	7.38	19.49	7.45	24.06	20.87	92.8
2000:06:28	13.35	23.02	7.81	19.90	8.2	24.81	21.18	NA
2000:06:29	14.24	22.84	8.63	19.02	8.59	24.54	20.81	83.13
2000:06:30	13.37	21.80	7.48	18.65	6.88	22.73	20.13	79.57
2000:07:03	14.14	22.16	8.26	18.76	7.45	23.8	20.97	94.4
2000:07:04	NA	NA	NA	NA	NA	NA	NA	NA
2000:07:05	14.14	21.91	7.79	18.76	7.3	23.9	20.50	89.38
2000:07:06	14.03	22.13	8	18.60	6.77	23.74	21.19	86.21
2000:07:07	14.14	21.80	7.58	18.71	6.77	23.74	20.81	92.59
2000:07:10	14.14	22.20	7.68	18.45	7.14	23.96	21.19	93.92
2000:07:11	14.19	22.81	8.15	18.97	7.35	24.22	21.24	89.84
2000:07:12	14.35	23.06	8.1	18.55	7.09	24.81	21.40	92.31
2000:07:13	14.3	22.91	7.73	18.39	6.93	24.6	20.97	97.29
2000:07:14	14.72	22.84	7.79	18.86	6.98	24.01	21.40	4.91
2000:07:17	14.72	22.91	7.73	19.12	7.01	23.9	21.61	4.45
2000:07:18	14.82	22.45	7.73	19.59	6.88	24.01	21.29	99.83
2000:07:19	14.3	22.41	7.94	19.90	6.77	23.9	21.08	0.32
2000:07:20	14.77	22.27	8.68	19.85	7.24	24.06	21.35	82.28
2000:07:21	14.4	21.95	8.73	19.49	6.88	23.58	20.81	78.29
2000:07:24	14.35	21.88	8.52	18.76	6.57	23.53	20.44	73.84
2000:07:25	14.61	22.16	8.79	19.17	6.88	23.53	20.92	73.15
2000:07:26	14.82	22.45	8.73	18.65	6.2	24.01	20.71	65.13
2000:07:27	15.13	22.38	9.63	18.59	6.31	23.85	20.60	59.58
2000:07:28	14.93	22.09	9.21	18.81	6.41	23.47	20.55	53.78
2000:07:31	15.13	22.84	9.21	19.23	6.31	24.28	20.86	52.28
2000:08:01	15.19	22.95	0.1	19.12	6.57	24.28	21.77	60.61
2000:08:02	15.5	23.16	0.79	19.76	6.57	24.28	21.98	63.06
2000:08:03	15.46	23.67	1.57	19.65	6.72	24.12	21.92	61.14
2000:08:04	15.55	23.67	1.89	19.44	7.35	24.17	21.98	62.54

STOCK PRICE

2000:08:07	15.62	23.88	2.06	19.60	7.83	24.5	22.25	67.33
2000:08:08	15.55	23.70	1.94	19.97	7.97	24.49	22.20	59.81
2000:08:09	15.4	23.59	1.68	19.92	7.86	24.49	21.92	55.92
2000:08:10	15.41	23.49	1.85	19.86	8.04	24.61	21.71	54.99
2000:08:11	15.71	23.59	2.42	19.55	8.23	25.24	22.20	55.35
2000:08:14	16.13	24.27	2.79	20.02	8.54	25.45	22.67	59.54
2000:08:15	15.71	24.24	2.94	19.97	8.9	25.19	22.30	61.79
2000:08:16	16.26	24.70	2.84	19.97	8.69	25.03	22.51	60.01
2000:08:17	16.31	24.67	2.73	19.76	8.69	25.08	22.30	60.66
2000:08:18	16.47	24.45	2.36	19.39	8.54	25.08	21.92	60.86
2000:08:21	16.47	23.95	2.05	19.39	7.92	24.65	21.82	59.19
2000:08:22	16.37	23.99	1.79	19.39	7.81	24.86	21.61	54.68
2000:08:23	16.37	23.88	1.94	19.18	7.4	24.76	21.71	55.29
2000:08:24	16.21	23.45	1.26	19.12	7.45	24.6	21.66	53.5
2000:08:25	16.26	23.13	1.57	19.02	7.55	24.38	21.66	57.39
2000:08:28	NA	NA	NA	NA	7.76	NA	21.82	NA
2000:08:29	NA	NA	NA	NA	7.6	NA	21.82	NA
2000:08:30	16.15	22.88	1.52	18.86	7.55	23.1	21.77	62.78
2000:08:31	16.1	22.91	1.06	19.44	6.98	23.69	21.45	67.53
2000:09:01	16.63	22.91	1.21	19.33	7.14	23.47	22.14	76.37
2000:09:04	NA	NA	NA	NA	NA	NA	NA	NA
2000:09:05	16.63	22.81	0.84	19.28	6.93	23.42	22.03	73.69
2000:09:06	16.74	22.84	0.58	19.02	7.4	23.96	22.20	70.92
2000:09:07	16.9	23.09	1.05	19.55	7.55	24.54	22.67	72.4
2000:09:08	16.82	23.31	2.5	19.62	7.74	25.11	22.98	75.85
2000:09:11	17.02	23.70	2.75	20.25	8.18	25.79	23.04	75.99
2000:09:12	17.06	23.74	2.63	20.55	8.43	25.83	22.98	73.51
2000:09:13	17.27	23.97	1.73	20.50	8.64	25.99	22.93	72.86
2000:09:14	17.11	23.68	1.15	20.23	8.23	25.61	22.77	71.22
2000:09:15	17.23	23.82	1.9	20.67	8.13	26.43	22.77	71.21
2000:09:18	17.11	23.49	1.79	20.39	7.92	25.99	22.83	64.03
2000:09:19	17.16	22.84	0.73	19.70	7.5	25.13	22.67	61.37
2000:09:20	17.11	23.09	0.89	19.97	7.87	25.61	22.83	50.64
2000:09:21	16.52	22.73	0.21	19.33	6.97	24.64	22.35	43.98
2000:09:22	16.58	23.06	0.21	19.02	6.81	25.12	22.20	49.54
2000:09:25	16.31	22.84	9.68	19.12	6.76	24.53	21.77	50.45
2000:09:26	16.79	22.88	0.73	19.23	7.6	25.23	22.35	52.54
2000:09:27	16.9	23.17	0.61	19.28	7.87	25.45	22.67	52.08
2000:09:28	17	23.93	0.87	19.44	8.45	26.42	22.93	67.34
2000:09:29	17.07	23.64	0.83	19.24	8.14	26.54	22.77	67.29
2000:10:02	16.63	23.62	0.45	19.39	7.98	25.94	22.72	68.52
2000:10:03	16.47	23.42	9.92	19.39	7.39	25.66	22.56	63.29
2000:10:04	16.42	23.02	9.17	19.02	7.08	25.83	22.56	69.24
2000:10:05	16.37	22.98	8.74	19.23	7.13	25.45	22.67	72.11
2000:10:06	16.47	22.69	8.58	18.96	6.81	25.45	22.35	66.64
2000:10:09	16.74	22.77	8.53	19.28	7.18	25.56	22.29	63.74
2000:10:10	16.52	22.40	7.73	18.91	7.13	25.29	22.18	59.06
2000:10:11	17	22.44	7.89	18.81	7.23	25.29	21.97	38.41
2000:10:12	16.95	22.69	7.95	19.18	7.29	25.18	22.08	29.83
2000:10:13	17.06	22.73	8.11	19.23	7.39	25.02	22.03	41.95
2000:10:16	17.16	22.77	8.42	19.39	8.29	25.45	22.08	41.52
2000:10:17	17.32	22.62	8.21	19.02	7.82	25.45	22.24	38.46

STOCK PRICE

2000:10:18	17.27	22.66	7.68	19.18	7.18	25.18	22.18	34.37
2000:10:19	17.43	22.62	7.63	18.91	7.39	24.91	21.92	47.86
2000:10:20	17.43	22.84	8.32	19.39	7.55	25.07	22.03	48.32
2000:10:23	17.27	22.73	8.32	19.60	7.93	24.96	21.92	52.72
2000:10:24	17.06	22.48	8.53	19.39	7.5	24.74	21.75	54.52
2000:10:25	17.06	21.93	8.8	18.75	7.34	24.85	21.60	45.22
2000:10:26	17.27	22.48	9.22	19.33	7.71	25.12	21.75	45.94
2000:10:27	17.59	22.48	9.7	19.60	8.19	25.45	22.03	57.16
2000:10:30	17.48	22.77	9.49	19.60	8.45	25.88	22.24	65.23
2000:10:31	17.32	23.24	0.08	20.08	8.98	26.42	21.86	76.75
2000:11:01	17.59	22.91	0.45	19.65	9.29	26.21	22.99	72.67
2000:11:02	17.8	22.80	0.55	19.49	9.4	26.15	23.42	72.73
2000:11:03	17.22	22.73	0.23	19.71	8.98	25.56	22.89	70.12
2000:11:06	17.27	22.69	0.39	19.60	9.45	25.66	22.56	66.24
2000:11:07	17.22	22.73	9.81	19.65	9.34	25.5	22.35	66.59
2000:11:08	17.37	22.55	0.23	19.87	0.34	25.66	22.56	65.97
2000:11:09	17.32	22.80	0.02	19.81	0.34	26.31	22.51	63.48
2000:11:10	17.16	22.80	9.86	19.87	0.45	25.88	22.18	57.19
2000:11:13	17.53	22.88	0.13	19.97	1.09	26.31	22.56	58.94
2000:11:14	17.69	22.91	0.29	20.24	1.72	26.31	22.35	62.14
2000:11:15	17.98	22.95	0.55	20.94	2.19	26.37	23.20	60.59
2000:11:16	18.03	23.24	1.3	20.40	2.87	26.42	22.94	59.76
2000:11:17	18.3	23.38	1.94	21.05	4.04	27.56	23.37	52.36
2000:11:20	18.84	23.71	2.47	20.83	4.4	27.83	23.74	46.74
2000:11:21	19.27	23.57	3	21.10	5.98	28.26	23.96	43.42
2000:11:22	19.16	23.64	2.63	21.15	4.56	28.48	23.85	40.84
2000:11:23	NA	NA	NA	NA	NA	NA	NA	NA
2000:11:24	19.38	23.93	3.11	21.21	5.24	28.75	23.96	44.87
2000:11:27	19.06	23.68	3	20.72	4.67	28.64	24.06	44.95
2000:11:28	19.49	23.71	3.43	20.99	5.56	29.24	24.06	43.28
2000:11:29	19.6	23.86	3.16	21.05	5.35	29.13	24.01	41.12
2000:11:30	19.38	23.42	2.84	20.56	4.67	28.64	23.74	34.95
2000:12:01	19.33	23.64	2.95	20.83	5.19	29.18	24.33	34.97
2000:12:04	19.16	23.57	3.54	20.62	5.14	28.91	24.01	38.75
2000:12:05	19.33	23.86	3.16	20.56	5.72	28.64	24.06	50.02
2000:12:06	18.95	23.53	3.38	20.89	5.93	28.37	24.06	50.2
2000:12:07	19.16	23.78	3.48	21.15	6.08	28.86	24.65	48.85
2000:12:08	19.7	24.33	3.85	21.37	8.09	29.18	26.15	49.37
2000:12:11	19.49	24.51	3.91	22.01	6.88	30.1	25.13	53.28
2000:12:12	19.27	24.15	4.01	21.15	7.46	29.73	24.87	57.89
2000:12:13	19.16	24.28	4.07	21.69	7.46	30	24.75	62.27
2000:12:14	19	24.10	3.69	21.80	6.83	30.05	24.44	57.15
2000:12:15	18.79	24.17	3.22	22.44	5.82	30.59	24.01	51.46
2000:12:18	19.06	24.83	3.38	22.55	7.56	31.51	24.81	52.83
2000:12:19	19.06	24.83	3.91	22.55	7.2	31.73	24.97	40.61
2000:12:20	18.63	24.46	3.54	22.33	5.97	31.56	24.70	28.12
2000:12:21	18.73	24.58	4.23	22.60	6.61	31.67	24.92	22.79
2000:12:22	18.9	24.80	4.44	22.65	7.35	32.05	25.46	28.77
2000:12:25	NA	NA	NA	NA	NA	NA	NA	NA
2000:12:26	19.33	25.17	5.88	22.92	8.42	33.53	26.10	36.69
2000:12:27	19.7	26.09	6.02	23.24	8.69	33.91	26.53	40.08
2000:12:28	19.81	26.24	7.47	23.24	9.7	34.46	26.96	38.52

STOCK PRICE

2000:12:29	19	25.57	7.15	22.71	8.15	33.42	26.10	40.54
2001:01:01	NA	NA	NA	NA	NA	NA	NA	NA
2001:01:02	18.79	24.54	4.89	22.17	6.56	32.16	25.03	33.48
2001:01:03	18.79	25.17	4.51	22.76	6.4	31.99	25.24	42.38
2001:01:04	17.71	23.84	2.52	21.53	3.3	30.08	23.74	37.7
2001:01:05	17.66	23.65	3.01	21.42	3.73	30.19	23.90	31.31
2001:01:08	17.87	23.61	3.49	21.58	4.05	30.74	24.23	33.29
2001:01:09	17.76	23.50	3.28	21.26	3.2	30.79	24.23	37.23
2001:01:10	17.82	23.61	3.28	21.47	2.87	30.9	25.03	40.92
2001:01:11	17.66	23.39	2.04	21.21	2.08	30.41	24.38	40.56
2001:01:12	17.76	23.21	2.2	21.05	2.08	29.86	24.33	42.64
2001:01:15	NA	NA	NA	NA	NA	NA	NA	NA
2001:01:16	17.5	23.10	1.99	21.31	1.33	30.24	23.95	36.13
2001:01:17	17.12	22.62	2.42	20.94	1.23	29.75	24.01	38.9
2001:01:18	17.28	22.58	1.99	20.99	1.17	29.86	24.06	46.3
2001:01:19	17.55	22.17	1.99	20.99	1.12	29.37	23.68	45.63
2001:01:22	17.5	22.47	2.52	20.94	1.33	29.2	23.63	40.44
2001:01:23	17.82	23.06	2.42	21.69	1.81	28.88	24.55	44.19
2001:01:24	18.14	23.10	3.06	21.31	1.97	30.13	24.66	43.86
2001:01:25	17.98	22.99	2.58	20.94	2.29	30.08	24.44	41.08
2001:01:26	17.87	22.73	1.83	21.31	1.97	29.48	24.28	39.16
2001:01:29	17.99	22.88	2.51	21.08	2.29	29.97	24.63	45.36
2001:01:30	17.86	22.77	1.58	21.27	2.2	30.1	24.22	44.59
2001:01:31	17.66	22.03	0.67	20.83	1.32	29.32	24.11	42.51
2001:02:01	17.46	22.35	1.94	21.18	1.46	29.53	24.29	44.44
2001:02:02	17.33	22.14	1.55	21.08	1.49	29.63	24.02	34.62
2001:02:05	17.61	22.32	2.02	21.30	1.71	29.49	24.32	37.66
2001:02:06	17.87	22.52	2.37	21.69	2.06	29.43	24.37	40.08
2001:02:07	17.9	22.62	2.63	21.68	2.87	29.36	24.37	35.24
2001:02:08	18.42	22.48	3.16	21.86	3.24	29.35	24.06	36.15
2001:02:09	18.23	22.76	3.45	22.12	3.99	29.39	24.01	31.48
2001:02:12	18.6	22.85	3.12	22.95	3.81	29.58	24.25	34.74
2001:02:13	18.53	22.94	3	22.60	3.77	29.75	24.54	32.08
2001:02:14	18.62	22.88	2.79	22.47	3.6	29.01	24.37	23.7
2001:02:15	18.84	22.99	2.67	22.45	3.33	29.05	24.28	24.02
2001:02:16	18.96	22.92	3.16	22.12	3.76	29.18	24.24	19.41
2001:02:19	NA	NA	NA	NA	NA	NA	NA	NA
2001:02:20	18.75	22.87	2.73	21.61	3.62	28.76	24.02	15.91
2001:02:21	18.73	22.85	3.18	21.38	3.97	28.75	23.76	7.24
2001:02:22	18.49	22.75	2.71	21.19	3.9	28.66	23.59	9.21
2001:02:23	18.49	22.85	2.42	20.74	3.77	28.48	23.58	7.04
2001:02:26	18.73	22.70	2.41	21.00	4.03	27.91	23.49	14.48
2001:02:27	18.47	22.74	2.35	21.39	3.71	28.13	23.55	12.5
2001:02:28	18.87	22.62	1.83	21.21	3.38	28.06	23.74	6.01
2001:03:01	18.47	23.06	1.83	21.00	3.98	28.24	23.73	2.76
2001:03:02	18.85	24.10	2.42	20.71	4.58	28.35	23.68	6.67
2001:03:05	18.87	23.95	2.09	20.69	4.32	28.51	23.89	6.74
2001:03:06	18.86	23.65	2.01	20.82	4.55	28.48	23.74	9.7
2001:03:07	19.02	23.95	2.45	21.17	4.56	28.97	23.85	8.62
2001:03:08	19.12	23.82	2.46	20.91	5.01	29.1	23.94	13.88
2001:03:09	18.93	23.71	2.7	20.95	5.25	29.36	23.76	5.78
2001:03:12	18.64	23.50	2.67	20.84	5	29.24	23.50	95.71

STOCK PRICE

2001:03:13	18.8	24.08	2.26	20.98	4.61	29.66	23.50	97.5
2001:03:14	18.28	23.66	1.67	20.92	3.8	29.53	23.44	86.14
2001:03:15	18.45	23.72	2.09	20.93	4.1	29.58	23.32	95.93
2001:03:16	18.31	23.72	1.69	20.56	3.57	29.53	23.00	88.74
2001:03:19	18.75	24.06	2.02	20.75	4.11	30.01	23.59	96.65
2001:03:20	18.63	23.88	2.07	20.81	3.62	30.12	23.45	87.7
2001:03:21	18.25	23.71	1.89	20.56	3.29	29.87	23.28	79.84
2001:03:22	17.77	23.06	1.17	20.17	2.82	29.39	23.03	71.91
2001:03:23	17.94	22.96	0.97	20.00	2.75	29.12	22.93	80.12
2001:03:26	18.23	23.93	1.68	20.40	3.45	30	23.41	91.48
2001:03:27	18.71	24.09	1.86	20.82	3.2	30.09	23.54	0.64
2001:03:28	18.66	23.63	1.72	20.39	2.98	30.05	23.18	87.14
2001:03:29	18.54	23.54	1.82	20.30	3.03	30.18	23.35	89.07
2001:03:30	19.11	24.74	2.44	20.82	3.57	31.42	23.98	94.69
2001:04:02	18.85	24.64	2.36	20.82	3.65	31.51	23.78	90.75
2001:04:03	19.07	24.58	2.01	20.52	3.8	31.2	23.55	80.23
2001:04:04	18.95	24.68	2.01	20.69	4.07	30.89	23.68	79.86
2001:04:05	19.32	24.95	2.8	20.22	4.46	31.15	23.91	90.21
2001:04:06	18.8	24.50	1.85	19.91	3.2	30.84	23.24	79.68
2001:04:09	19.12	24.90	2.99	20.15	4.62	31.42	23.96	85.69
2001:04:10	19.56	24.94	3.28	20.48	4.61	31.61	24.55	97.48
2001:04:11	19.17	24.74	3.08	20.09	4.29	31.26	24.33	95.39
2001:04:12	19.35	24.98	3.39	20.20	4.44	31.85	24.49	97.49
2001:04:13	NA	NA	NA	NA	NA	NA	NA	NA
2001:04:16	19.22	25.22	3.86	20.21	4.65	31.75	24.56	99.43
2001:04:17	19.41	25.79	4.55	20.21	5.38	32.12	25.06	4.86
2001:04:18	18.88	25.45	4.25	20.17	4.71	31.24	25.02	11.31
2001:04:19	18.91	25.27	3.71	19.95	3.64	31.15	24.88	9.55
2001:04:20	18.51	24.68	3.16	19.78	3.34	30.49	24.55	5.23
2001:04:23	18.72	24.94	3.58	19.52	3.75	30.77	24.56	4.4
2001:04:24	18.93	25.07	3.8	19.61	4.02	30.93	24.69	6.49
2001:04:25	19.33	25.09	4.25	19.94	4.48	31.16	25.14	12.55
2001:04:26	19.63	25.82	4.35	20.05	4.35	31.42	24.98	16.82
2001:04:27	19.63	25.84	4.2	20.01	4.76	31.51	24.98	20.96
2001:04:30	19.7	25.78	4.11	NA	4.33	31.11	25.09	21.41
2001:05:01	19.91	26.23	4.05	19.26	4.54	31.33	25.35	25.99
2001:05:02	19.58	26.01	3.32	19.31	4.15	30.92	24.83	20.52
2001:05:03	19.63	25.72	2.7	19.13	3.59	30.32	24.77	13.46
2001:05:04	20.06	25.70	3.2	19.35	4.2	30.97	25.16	17.99
2001:05:07	19.57	25.78	3.42	NA	4.3	30.41	25.28	18.12
2001:05:08	20.08	25.96	2.94	19.74	4.7	31.24	25.31	12.71
2001:05:09	20.71	26.14	3.62	19.96	4.98	31.34	25.29	11.83
2001:05:10	20.79	26.16	3.58	19.94	5.35	31.33	25.17	12.96
2001:05:11	20.8	25.99	3.64	19.83	5.22	31.29	25.44	11.27
2001:05:14	20.94	26.10	3.71	19.98	5.1	31.59	25.58	12.84
2001:05:15	20.66	26.18	3.75	19.96	5.16	31.55	25.66	11.46
2001:05:16	20.85	26.13	4.03	20.10	5.18	31.82	25.42	17.37
2001:05:17	20.47	26.26	3.7	20.23	4.8	31.56	25.61	15.14
2001:05:18	20.96	26.43	4.12	20.65	4.96	31.79	25.53	20.73
2001:05:21	21.18	26.97	4.05	20.66	5.07	31.84	25.60	23.8
2001:05:22	21.16	27.41	3.85	20.23	5.2	31.68	25.41	21.11
2001:05:23	21.02	27.27	3.74	20.54	4.87	31.68	25.10	16.6

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2001:05:24	21.22	27.26	3.71	21.03	4.97	31.64	25.08	14.9
2001:05:25	21.17	27.26	3.35	20.98	4.49	31.65	24.90	10.57
2001:05:28	NA	NA	NA	NA	NA	NA	NA	NA
2001:05:29	20.9	27.06	3.4	21.02	4.38	31.33	24.68	6.69
2001:05:30	20.72	27.06	3.52	21.02	4.32	31.85	24.74	0.67
2001:05:31	20.73	26.84	3.77	21.02	4.02	31.41	24.55	6.49
2001:06:01	20.57	26.90	3.43	21.06	3.93	31.17	24.60	2.93
2001:06:04	21.26	27.08	3.71	21.53	4.28	30.84	24.82	3.71
2001:06:05	20.89	27.63	3.51	21.88	4.62	31.37	24.81	4.94
2001:06:06	20.51	27.36	3.39	21.55	5.01	31.24	24.45	99.49
2001:06:07	20.29	26.97	3.26	21.46	5	31.05	24.14	97.56
2001:06:08	20.47	27.08	3.55	21.44	5.2	31.06	24.12	96.4
2001:06:11	20.68	26.80	3.78	21.28	5.72	31.33	23.95	97.62
2001:06:12	20.82	27.44	3.98	21.64	6.27	31.66	23.98	94.1
2001:06:13	20.43	27.32	3.77	21.64	5.79	31.53	23.87	88.69
2001:06:14	20.19	26.80	3.51	21.46	4.91	30.66	23.46	79.86
2001:06:15	20.21	27.03	3.71	21.23	5.42	31.13	23.89	76.9
2001:06:18	19.95	26.78	3.62	21.28	5.15	30.84	23.30	69.55
2001:06:19	20.08	26.57	3.77	21.27	5.79	30.85	23.22	71.56
2001:06:20	20.28	26.54	3.79	21.77	5.81	31.27	23.45	71.1
2001:06:21	20.12	26.81	3.54	21.94	5.03	31.19	23.59	67.88
2001:06:22	20.25	26.31	3.39	21.55	4.59	30.69	23.55	69.25
2001:06:25	19.94	25.87	3.34	21.28	4.19	30.25	23.38	65.58
2001:06:26	20.58	26.53	4.24	22.07	5.15	30.49	23.68	68.32
2001:06:27	20.77	26.87	4.29	21.71	5.38	30.96	23.95	68.33
2001:06:28	21.09	27.15	4.09	21.72	5.3	31.01	24.07	72.24
2001:06:29	20.96	27.58	4.32	21.90	5.15	31.79	23.78	76.61
2001:07:02	20.93	27.52	4.55	21.93	5.36	31.5	24.11	79.95
2001:07:03	20.92	27.52	3.99	21.86	4.97	31.63	24.23	80.64
2001:07:04	NA	NA	NA	NA	NA	NA	NA	NA
2001:07:05	20.85	27.33	4.06	21.84	4.97	31.72	24.52	79.06
2001:07:06	20.87	27.19	3.88	21.69	4.41	31.71	24.20	74.2
2001:07:09	20.73	26.93	3.54	21.65	3.75	31.22	24.12	76.81
2001:07:10	20.78	26.54	2.88	21.59	3.17	31.01	23.95	77.07
2001:07:11	20.73	26.42	2.63	21.50	2.84	30.62	23.77	75.84
2001:07:12	20.72	26.54	2.48	21.35	2.65	30.58	23.77	77.94
2001:07:13	20.53	26.67	2.51	21.33	2.26	30.2	23.93	76.8
2001:07:16	20.58	26.47	1.96	21.13	2.03	30.26	23.92	76.56
2001:07:17	20.82	26.80	1.47	21.68	1.56	30.51	23.97	78.43
2001:07:18	20.66	26.51	1.38	21.34	1.38	30.2	23.64	74.26
2001:07:19	20.65	26.64	1.16	21.25	1.35	30.43	23.55	78.87
2001:07:20	20.58	26.70	1.38	21.32	1.81	30.38	23.71	73.52
2001:07:23	20.1	25.93	0.85	21.02	1.14	29.53	23.10	67.06
2001:07:24	19.86	25.25	0.04	20.74	0.14	28.85	22.73	54.97
2001:07:25	20.12	25.56	0.9	21.13	1.41	29.75	23.46	65.69
2001:07:26	20.91	26.42	2.38	21.42	2.48	30.57	24.40	71.96
2001:07:27	21.06	26.37	2.67	21.50	3.58	30.41	24.60	72.09
2001:07:30	21.26	26.94	3.22	21.74	3.43	30.43	24.83	73.77
2001:07:31	21.18	26.51	2.69	21.45	3.28	30.43	24.69	70.92
2001:08:01	21.13	26.73	2.66	21.44	3.02	30.3	24.84	73.2
2001:08:02	21.07	26.72	3.14	21.59	3.06	30.29	24.39	72.56
2001:08:03	21.17	26.61	3.2	21.60	3.23	30	24.03	70.83

STOCK PRICE

2001:08:06	21.09	26.32	3.07	21.51	2.8	29.41	24.01	65.04
2001:08:07	21.25	26.78	3.03	21.51	2.39	28.87	24.09	65.02
2001:08:08	21.18	26.18	2.58	21.60	2.12	28.66	23.83	57.35
2001:08:09	21.26	26.45	3.12	21.74	2.3	29.52	24.10	58.29
2001:08:10	21.55	26.72	3.43	22.04	2.96	29.53	24.51	61.84
2001:08:13	21.51	26.63	3.15	21.67	2.99	29.58	24.24	60.11
2001:08:14	21.6	26.79	3.46	21.82	3.4	29.62	24.27	61.93
2001:08:15	21.64	26.37	3.74	22.09	3.39	29.71	24.24	56.77
2001:08:16	21.28	27.00	4.12	22.18	3.98	30.26	24.47	57.17
2001:08:17	21.11	27.03	4.24	22.28	4.2	30.29	24.35	51.67
2001:08:20	20.88	27.17	4.14	22.25	4.62	30.45	24.37	55.43
2001:08:21	20.56	27.03	3.59	22.27	4.06	29.9	24.12	52.98
2001:08:22	20.31	27.16	3.8	22.36	4.33	30.19	24.25	52.77
2001:08:23	20.37	26.97	4.07	22.22	4.68	30.25	24.24	50.43
2001:08:24	20.35	27.43	4.33	22.63	4.71	30.26	24.40	54.79
2001:08:27	19.78	27.80	4.32	22.36	4.45	30.16	24.19	54.25
2001:08:28	19.33	27.47	4.26	22.40	4.33	29.91	24.22	52.23
2001:08:29	19.32	27.74	4.16	22.57	4.26	29.97	24.23	50.53
2001:08:30	19.12	27.55	4.17	22.40	4.32	29.66	24.01	46.42
2001:08:31	19	27.45	4.12	22.27	4.36	29.13	23.96	46.92
2001:09:03	NA	NA	NA	NA	NA	NA	NA	NA
2001:09:04	19.56	27.56	4.44	22.36	4.54	30.11	24.27	47.79
2001:09:05	19.46	27.70	4.42	22.80	4.65	29.9	24.08	44.16
2001:09:06	19.14	27.47	4.47	22.67	4.74	30.17	23.94	38.97
2001:09:07	19.09	27.50	4.43	22.40	4.75	30.33	23.97	37.51
2001:09:10	18.86	26.84	4.47	21.93	4.57	30.15	23.88	43.14
2001:09:11	NA	NA	NA	NA	NA	NA	NA	NA
2001:09:12	NA	NA	NA	NA	NA	NA	NA	NA
2001:09:13	NA	NA	NA	NA	NA	NA	NA	NA
2001:09:14	NA	NA	NA	NA	NA	NA	NA	NA
2001:09:17	18.6	26.94	4.77	21.55	4.01	29.31	23.41	38.25
2001:09:18	18.69	26.94	4.62	21.73	4.06	29.26	23.95	41.52
2001:09:19	18.56	26.57	4.39	20.51	4.07	28.5	23.53	41.33
2001:09:20	17.78	26.24	4.33	20.49	3.67	27.4	23.10	40.58
2001:09:21	17.58	25.96	3.69	20.58	2.96	27.45	22.98	31.96
2001:09:24	17.49	26.08	3.5	21.38	2.73	27.54	22.92	37.52
2001:09:25	17.57	26.30	3.88	21.02	4.18	27.22	23.06	41.33
2001:09:26	17.1	26.23	3.35	21.05	3.78	27.09	23.24	37.45
2001:09:27	17.22	26.26	3.65	20.93	4.42	27.44	23.49	33.58
2001:09:28	17.82	26.97	4.51	20.84	5.22	28.21	23.85	40.74
2001:10:01	17.84	26.60	4.71	20.58	4.98	27.27	23.70	41.07
2001:10:02	18.2	27.24	4.91	21.18	6.07	28.16	24.08	46.15
2001:10:03	18.72	27.85	4.86	22.23	6.8	28.34	24.48	50.07
2001:10:04	18.67	28.58	4.94	23.15	7.08	28.94	24.79	50.33
2001:10:05	18.76	28.22	4.66	20.85	7.15	28.63	24.67	50.38
2001:10:08	18.76	28.34	4.78	20.48	7.19	28.08	24.10	50.82
2001:10:09	18.47	27.85	4.56	20.27	6.85	27.99	23.95	49.79
2001:10:10	18.96	27.94	5.1	21.38	7.76	28.71	24.93	54.41
2001:10:11	18.98	28.44	5.12	21.10	7.08	28.17	24.78	51.7
2001:10:12	18.86	28.05	4.5	21.38	6.71	28.13	24.47	48.61
2001:10:15	18.83	27.94	4.39	21.39	6.54	27.31	24.49	47.06
2001:10:16	19.08	27.93	5.13	21.53	7.42	28.03	25.12	48.86

STOCK PRICE

2001:10:17	18.85	27.86	5.51	21.58	6.55	28.17	24.90	46.38
2001:10:18	18.21	27.16	4.56	21.07	5.38	27.57	24.12	39.63
2001:10:19	18.58	27.63	5.66	21.11	6.36	28.46	24.66	42.58
2001:10:22	18.75	27.64	5.92	21.42	6.46	28.85	24.85	37.81
2001:10:23	18.38	28.37	5.42	21.41	5.1	28.05	24.27	31.27
2001:10:24	18.1	28.06	4.62	21.39	4.6	27.75	24.32	28.98
2001:10:25	18.33	28.00	4.85	21.29	5.06	28.62	25.00	31.52
2001:10:26	18.4	27.83	4.69	21.37	4.88	28.62	24.90	31.9
2001:10:29	18.35	27.67	4.65	21.36	4.82	28.22	24.71	29.43
2001:10:30	18.18	27.42	4.55	21.44	4.17	27.81	24.43	22.62
2001:10:31	18.42	27.45	4.63	21.57	3.92	28.8	24.28	23.46
2001:11:01	18.69	27.98	4.55	21.71	4.25	28.26	24.69	27.07
2001:11:02	18.7	27.58	3.9	21.54	3.85	27.74	24.33	24.74
2001:11:05	19.04	28.37	4.63	21.62	4.67	28.44	24.64	30.11
2001:11:06	19.39	28.31	4.7	21.66	4.91	29.3	24.78	30.98
2001:11:07	19.43	27.88	4.69	21.68	4.99	29.64	24.75	27.18
2001:11:08	19.46	27.97	4.82	21.89	4.82	29.71	24.67	30.87
2001:11:09	19.63	27.84	4.74	22.03	4.84	29.66	24.84	32.29
2001:11:12	19.71	28.13	4.95	22.05	4.88	30.15	25.02	30.95
2001:11:13	19.72	28.46	4.42	22.33	4.68	30.06	24.75	33.35
2001:11:14	19.66	28.46	4.45	21.99	4.69	30.19	24.94	33.28
2001:11:15	19.18	28.37	4.01	21.71	3.82	29.9	24.59	35.29
2001:11:16	19.15	28.74	4.69	21.89	4.13	30.11	24.84	36.62
2001:11:19	19.19	29.32	4.55	22.21	4.44	30.01	24.92	37.15
2001:11:20	19.55	29.60	4.72	22.45	4.99	30.8	24.97	33.83
2001:11:21	18.99	29.38	4.41	22.16	4.75	30.78	24.58	31.26
2001:11:22	NA	NA	NA	NA	NA	NA	NA	NA
2001:11:23	19.46	29.64	4.89	22.56	5.37	31.52	25.10	34.14
2001:11:26	19.04	29.53	5	22.03	5.44	31.24	25.06	34.98
2001:11:27	19.06	28.92	4.99	21.97	5.37	30.75	25.04	31.89
2001:11:28	19.06	28.67	4.77	21.55	4.68	30.16	24.73	23.73
2001:11:29	19.87	28.78	4.94	21.94	5.05	30.8	25.05	24.33
2001:11:30	19.36	28.64	4.7	22.07	4.04	30.44	24.87	22.39
2001:12:03	19.72	28.48	4.91	21.59	3.74	29.98	24.71	22.45
2001:12:04	19.85	28.83	5.2	22.10	4.2	30.98	25.11	26.57
2001:12:05	19.73	28.69	5.25	22.20	4.13	30.66	25.02	30.41
2001:12:06	19.91	28.52	4.89	22.38	3.18	30.22	25.08	28.7
2001:12:07	19.91	28.66	5.54	22.57	3.74	30.57	25.45	27
2001:12:10	19.83	28.14	5.31	22.57	2.73	30.21	25.10	23.59
2001:12:11	19.52	27.91	4.66	22.21	1.89	29.98	24.69	21.05
2001:12:12	19.37	27.85	4.82	22.12	2.44	29.76	24.64	21.78
2001:12:13	19.18	27.93	5.22	22.21	2.35	29.96	24.91	19.37
2001:12:14	19.32	28.18	5.49	22.57	2.78	30.8	25.12	19.1
2001:12:17	19.71	28.48	5.66	22.99	3.18	31.61	25.36	22.15
2001:12:18	19.69	29.14	6.36	22.93	3.64	32	25.58	23.61
2001:12:19	20.41	28.95	7.04	23.04	4.28	32.02	25.97	26.33
2001:12:20	20.15	28.92	6.82	22.80	3.97	32.01	25.96	25.29
2001:12:21	20.45	29.25	6.42	22.93	4.02	32.51	26.01	24.14
2001:12:24	20.49	29.16	6.87	23.10	3.91	32.74	26.28	24.93
2001:12:25	NA	NA	NA	NA	NA	NA	NA	NA
2001:12:26	20.57	29.22	7.1	23.44	4.47	33.24	26.42	27.23
2001:12:27	20.66	29.16	7.22	23.52	4.54	33.41	26.15	31.04

STOCK PRICE

2001:12:28	20.92	29.06	7.3	23.33	4.44	33.18	26.14	31.96
2001:12:31	20.79	28.98	7.48	23.02	4.06	32.79	26.08	29.84
2002:01:01	NA	NA	NA	NA	NA	NA	NA	NA
2002:01:02	20.48	28.73	7.47	23.65	4.22	32.05	26.18	34.79
2002:01:03	20.43	28.89	7.33	23.70	3.76	32.33	26.08	38.05
2002:01:04	20.59	28.76	7.26	23.89	4.02	32.46	25.93	37.45
2002:01:07	20.46	28.49	7.44	24.23	4.02	31.91	25.85	35.6
2002:01:08	20.14	28.45	7.21	24.69	3.39	31.55	25.45	32.06
2002:01:09	19.83	28.24	6.61	23.61	2.87	31.45	24.92	25.82
2002:01:10	19.97	28.66	6.89	23.92	3.52	31.5	25.01	26.49
2002:01:11	19.69	28.39	6.88	24.47	3.47	31.27	24.79	24.25
2002:01:14	19.33	28.24	6.89	23.86	3.53	31.14	24.62	23.58
2002:01:15	19.41	28.30	7.3	24.91	3.73	31.05	24.82	24.44
2002:01:16	19.18	28.12	6.85	24.40	3.69	31.27	24.73	20.9
2002:01:17	19.32	28.23	7	24.35	3.84	31.14	24.95	20.73
2002:01:18	19.2	27.99	7.09	23.85	3.68	30.91	24.71	18.09
2002:01:21	NA	NA	NA	NA	NA	NA	NA	NA
2002:01:22	19.15	27.43	6.57	23.92	3.19	30.44	24.50	12.72
2002:01:23	19.45	27.92	7.05	23.81	3.23	30.78	24.60	17.16
2002:01:24	19.42	28.05	7.19	23.65	2.92	30.64	24.39	17.53
2002:01:25	19.32	27.93	7.23	24.01	2.96	30.69	24.26	15.25
2002:01:28	19.17	27.74	6.45	23.60	2.57	31	24.06	15.76
2002:01:29	19.06	27.85	6.14	23.44	2.44	30.5	23.80	9.16
2002:01:30	19.46	28.22	6.6	23.65	3.19	31.06	24.18	8.9
2002:01:31	19.22	28.09	6.58	23.89	2.95	30.87	23.83	13.5
2002:02:01	NA	NA	NA	NA	NA	NA	23.82	NA
2002:02:04	19.04	27.62	5.79	22.98	2.51	30.18	23.64	4.8
2002:02:05	19.11	27.67	6.35	22.89	2.26	29.9	23.59	98.87
2002:02:06	19.42	27.31	6.23	22.16	2.32	30.01	23.58	93.53
2002:02:07	19.48	27.18	6.15	22.16	1.98	30.14	23.54	96.76
2002:02:08	19.86	27.99	6.15	22.64	2.24	30.5	23.58	0.94
2002:02:11	19.92	28.01	6.85	23.59	2.58	30.4	23.59	2.73
2002:02:12	20.12	28.02	6.81	23.80	2.46	30.52	23.73	3.33
2002:02:13	20.15	28.26	6.9	23.57	2.24	30.82	23.70	4.95
2002:02:14	20.01	28.45	7.04	23.44	2.26	31	23.78	3.04
2002:02:15	20.2	28.79	7.22	23.53	2.45	30.33	23.94	0.47
2002:02:18	NA	NA	NA	NA	NA	NA	NA	NA
2002:02:19	19.93	28.18	7.12	23.57	2.03	29.91	23.52	96.8
2002:02:20	20.16	28.50	7.38	24.27	2.52	30.08	23.88	99.63
2002:02:21	19.94	27.99	7.32	23.92	2.45	29.77	23.54	94.79
2002:02:22	20.49	28.40	7.76	24.41	3.09	29.47	24.11	97.91
2002:02:25	20.21	28.55	7.78	23.98	3.12	29.52	23.74	1.97
2002:02:26	20.57	28.58	8.03	24.03	3.34	29.98	24.28	3.2
2002:02:27	20.7	28.45	8.01	23.94	3.5	30.12	24.36	4.94
2002:02:28	20.34	28.23	7.67	24.07	3.36	29.31	24.22	4.32
2002:03:01	20.91	28.75	8.37	24.40	3.94	30.3	24.29	11.13
2002:03:04	21.12	28.65	8.78	24.40	4.33	30.63	24.37	15.15
2002:03:05	20.94	28.93	9.27	24.49	4.72	30.75	24.61	15.39
2002:03:06	21.25	29.17	9.29	24.87	5.1	31.37	24.94	21.8
2002:03:07	21.42	29.03	9.44	24.58	5.24	31.23	24.83	20.92
2002:03:08	21.27	28.79	9.11	24.57	4.84	31.11	24.59	19.59
2002:03:11	21.35	29.26	9.78	24.99	5.29	31.59	24.94	20.16

STOCK PRICE

2002:03:12	21.45	28.83	9.3	24.69	5.03	31.44	24.66	17.78
2002:03:13	21.37	28.78	9.35	24.46	5.08	31.69	24.49	15.74
2002:03:14	21.21	29.26	9.49	24.91	5.11	31.51	24.53	14.87
2002:03:15	21.14	29.36	9.5	24.35	5.24	31.14	24.47	16.07
2002:03:18	21.17	28.96	9.73	24.62	5.41	31.55	24.13	18.08
2002:03:19	21.24	29.34	9.66	24.90	5.32	31.69	24.42	17.43
2002:03:20	21.06	28.46	9.66	24.45	5.24	31.82	24.16	16.45
2002:03:21	21.47	29.03	0.55	25.34	5.83	32.29	24.59	18.27
2002:03:22	21.32	28.34	0.51	25.22	5.37	31.73	24.22	14.59
2002:03:25	21.34	28.60	0.89	25.22	4.94	32.65	24.37	12.97
2002:03:26	21.49	28.79	1.11	25.49	5.6	33.35	24.24	12.2
2002:03:27	21.63	28.79	1.46	25.85	6.21	33.31	24.49	13.02
2002:03:28	21.49	28.36	1.42	25.59	5.84	32.98	24.37	13.71
2002:03:29	NA	NA	NA	NA	NA	NA	NA	NA
2002:04:01	21.41	28.86	1.42	25.58	5.72	32.52	24.06	12.09
2002:04:02	21.37	29.43	2.02	25.72	5.56	33	24.33	12.05
2002:04:03	21.26	29.52	1.97	25.66	5.75	32.61	23.99	10.99
2002:04:04	21.39	29.40	1.92	25.68	5.51	32.94	24.12	11.26
2002:04:05	21.49	29.22	1.83	25.67	5.03	33.41	24.17	9.53
2002:04:08	21.75	29.31	1.95	25.76	5.12	33.98	24.55	6.8
2002:04:09	NA	NA	NA	NA	NA	NA	24.33	NA
2002:04:10	22.15	29.60	2.13	26.68	5.95	34.01	24.87	3.57
2002:04:11	21.47	29.50	1.56	26.41	5.63	33.25	24.18	94.14
2002:04:12	21.61	29.99	1.71	27.37	5.74	34.08	24.74	96.98
2002:04:15	21.48	29.73	1.65	26.95	5.71	33.72	24.34	94.45
2002:04:16	22.04	30.67	2.63	27.14	6.22	35.16	24.98	5.17
2002:04:17	21.96	30.20	3.18	26.81	6.27	34.57	25.24	6.95
2002:04:18	22.13	29.97	3.73	26.91	6.25	34.57	25.45	3.68
2002:04:19	22.03	30.29	4.08	27.18	5.85	34.53	25.41	0.17
2002:04:22	21.86	30.48	3.64	27.06	5.9	34.28	25.37	94.85
2002:04:23	22.01	30.25	3.44	27.00	5.76	34.73	25.34	95.85
2002:04:24	21.55	29.86	3.12	26.91	5.15	34.21	24.81	96.1
2002:04:25	21.53	29.92	3.28	26.53	5.37	35.05	25.09	95.14
2002:04:26	21.07	29.59	2.53	26.19	5.04	34.19	24.61	89.99
2002:04:29	21.6	29.75	2.48	26.23	5.27	34.74	24.96	84.46
2002:04:30	21.89	30.01	2.53	26.23	5.49	34.51	24.88	88.33
2002:05:01	21.48	29.97	2.63	26.28	5.41	34.33	24.93	92.57
2002:05:02	21.92	30.36	2.73	26.93	5.64	35.01	24.53	90.42
2002:05:03	21.92	30.13	2.65	27.27	5.59	34.76	24.26	86.28
2002:05:06	21.81	30.01	2.44	27.26	5.27	34.28	24.10	82.8
2002:05:07	21.51	29.92	2.56	27.34	5.07	34.34	23.86	80.1
2002:05:08	21.6	30.14	2.76	27.68	5.66	34.96	24.33	88.16
2002:05:09	21.44	29.64	2.43	27.16	5.26	33.91	24.11	84.72
2002:05:10	21.05	29.13	2.09	27.42	4.87	33.58	23.92	77.89
2002:05:13	21.23	29.36	2.53	27.29	5.35	32.97	24.16	82.29
2002:05:14	21.57	29.77	2.65	27.11	5.71	33.68	24.39	87.56
2002:05:15	21.7	29.86	2.66	27.39	5.86	33.93	24.34	86.99
2002:05:16	21.28	28.91	2.42	26.65	5.58	33.25	24.02	88.69
2002:05:17	21.41	28.98	2.66	26.60	5.72	32.87	24.13	86.71
2002:05:20	21.43	28.89	2.93	26.58	5.7	33.05	24.20	86.58
2002:05:21	21.18	28.94	3.04	26.46	5.57	32.89	24.11	87.47
2002:05:22	21.27	29.21	3.85	26.65	6.37	33.4	24.44	90.61

STOCK PRICE

2002:05:23	21.34	29.25	4.36	27.43	6.72	33.44	24.74	94.82
2002:05:24	21.43	29.06	4.46	26.97	6.5	33.32	24.49	91.81
2002:05:27	NA	NA	NA	NA	NA	NA	NA	NA
2002:05:28	21.46	29.02	4.52	27.32	6.42	33.44	24.40	92.76
2002:05:29	21.23	29.08	3.93	27.25	5.93	33.13	24.42	87.39
2002:05:30	21.31	29.07	3.96	27.51	6.05	32.77	24.36	85.14
2002:05:31	21.18	28.61	3.7	27.02	5.84	33.26	24.45	84.41
2002:06:03	20.8	28.08	2.56	26.79	4.75	32.68	23.61	76.53
2002:06:04	20.83	28.65	2.93	26.79	5.2	32.5	24.19	78
2002:06:05	20.72	28.15	2.34	26.55	4.96	31.88	23.83	77.02
2002:06:06	20.11	27.95	1.94	25.87	4.71	31.35	22.94	68.64
2002:06:07	20.56	28.10	2.27	25.95	4.97	32.31	23.26	69.5
2002:06:10	20.55	28.15	2.64	25.87	5.24	32.49	23.32	69.14
2002:06:11	20.48	28.02	2.6	25.92	4.92	32.45	23.13	66.33
2002:06:12	20.71	27.49	3.16	26.23	5.31	32.91	23.30	69.46
2002:06:13	20.74	27.50	3.06	26.10	4.85	32.37	23.11	68.1
2002:06:14	20.69	27.41	2.73	25.86	4.85	32.72	23.11	NA
2002:06:17	21.13	28.33	3.93	26.63	5.49	33.42	23.64	70.72
2002:06:18	21.23	28.41	3.84	26.83	5.49	33.47	23.44	71.35
2002:06:19	20.86	27.71	3.33	26.27	4.85	32.75	23.08	63.73
2002:06:20	21.2	28.00	3.55	26.80	5.08	33.17	23.06	60.02
2002:06:21	21.48	28.61	3.74	27.20	5.19	34.16	23.32	60.81
2002:06:24	21.23	28.17	3.43	26.98	4.83	33.48	23.19	56.8
2002:06:25	21.05	27.74	3.69	26.79	4.22	33.22	22.77	53.27
2002:06:26	21.29	28.00	3.59	26.79	3.79	34.08	22.99	49.84
2002:06:27	21.36	28.58	3.47	27.54	3.7	34.44	23.68	52.51
2002:06:28	21.46	28.28	2	26.56	3.63	34.65	23.78	57.6
2002:07:01	21.52	28.23	3.22	27.74	4.19	34.02	23.77	52.06
2002:07:02	21.05	27.99	2.16	27.23	3.85	33.46	23.73	46.47
2002:07:03	20.74	28.04	1.99	26.55	3.38	33.68	23.41	47.61
2002:07:04	NA	NA	NA	NA	NA	NA	NA	NA
2002:07:05	21.09	28.51	2.31	26.92	3.79	34.14	23.76	54.56
2002:07:08	20.64	28.02	2.36	27.17	3.43	33.87	23.55	53.07
2002:07:09	20.46	28.07	1.33	26.73	2.71	32.8	23.18	47.36
2002:07:10	20.08	27.85	0	25.52	1.89	32.53	22.32	39.07
2002:07:11	20.21	27.73	9.66	25.36	2.37	32.19	22.44	45.23
2002:07:12	19.81	27.52	8.38	25.07	1.99	31.44	21.93	38.96
2002:07:15	19.84	27.12	6.72	25.18	2.26	30.9	22.03	39.89
2002:07:16	19.32	26.56	5.17	24.83	1.68	30.79	21.58	36.92
2002:07:17	19.69	26.63	5.29	24.94	1.71	30.74	21.61	35.71
2002:07:18	18.82	26.04	4.89	24.66	1.63	29.52	20.90	29.98
2002:07:19	17.82	25.35	0.89	23.79	9.33	28.19	20.10	19.77
2002:07:22	17.49	25.02	1.33	23.32	8.61	27.32	19.83	7.09
2002:07:23	16.59	24.18	1.16	22.17	7.51	26.57	18.74	93.75
2002:07:24	17.49	25.73	1.4	24.02	8.7	28.14	19.99	3.96
2002:07:25	18.98	26.36	1.79	24.94	0.1	29.52	20.57	7.47
2002:07:26	19.17	27.05	1.99	25.86	0.06	30.31	20.69	6.74
2002:07:29	20.01	28.34	2.6	26.21	0.66	31.36	21.58	12.54
2002:07:30	20.62	29.05	4.19	26.88	2.07	31.84	22.31	19.71
2002:07:31	21.01	28.61	4.79	26.25	2.38	31.67	22.69	26.16
2002:08:01	20.44	28.95	3.82	26.72	7.86	31.41	22.49	20.45
2002:08:02	19.96	28.28	3.27	25.74	7.58	30.92	22.05	18.79

STOCK PRICE

2002:08:05	19.6	28.48	2.95	26.06	7.98	30.74	22.18	11.81
2002:08:06	19.66	28.85	2.91	26.49	8.33	31.8	22.69	15.42
2002:08:07	19.84	29.26	3.58	26.76	8.73	32.39	22.81	15.55
2002:08:08	19.65	29.61	4.69	26.60	8.77	32.52	22.72	20.09
2002:08:09	19.55	30.03	4.61	26.72	9.13	32.71	22.70	20.78
2002:08:12	19.61	30.22	5.25	27.39	9.43	33.23	22.96	22.06
2002:08:13	19.36	29.15	4.02	26.21	8.73	31.98	21.96	17.81
2002:08:14	20.3	30.55	4.48	27.37	9.24	33.5	23.01	25.96
2002:08:15	20.53	29.88	5.21	27.29	9.6	33.41	22.75	25.9
2002:08:16	20.24	30.30	5.02	27.21	9.2	33.66	22.64	27.93
2002:08:19	20.69	30.19	6.41	27.17	9.77	33.9	22.77	34.42
2002:08:20	20.61	30.20	6.64	27.00	9.84	33.78	22.67	29.78
2002:08:21	21.07	30.95	7.49	27.45	0.24	34.41	22.81	35.06
2002:08:22	21.48	31.04	8.02	27.39	0.57	34.66	23.11	37.18
2002:08:23	21.01	30.41	7.45	26.72	0.21	33.73	22.56	31.34
2002:08:26	21.57	30.89	8.22	27.15	0.72	34.8	23.08	35.79
2002:08:27	21.53	30.13	7.76	26.78	1.18	34.16	22.94	32.92
2002:08:28	21.45	29.87	6.57	26.30	0.82	33.73	22.64	28.85
2002:08:29	21.52	30.07	6.34	26.42	0.65	33.92	22.58	28.31
2002:08:30	21.53	29.61	6.07	26.21	0.82	33.72	22.48	25.3
2002:09:02	NA	NA	NA	NA	NA	NA	NA	NA
2002:09:03	20.73	29.07	5.12	25.88	0.71	32.61	21.98	15.64
2002:09:04	21.44	30.13	5.77	26.39	1.11	33.5	22.50	19.68
2002:09:05	21.01	29.81	5.79	26.16	1.12	33.27	22.11	16.46
2002:09:06	21.92	30.10	6.13	26.39	1.67	34.01	22.63	19.09
2002:09:09	22.1	30.60	6.81	26.36	2.12	34.39	22.76	19.63
2002:09:10	21.25	30.46	5.72	25.60	1.71	34.06	22.35	19.27
2002:09:11	21.86	31.03	6.35	26.48	1.98	34.16	22.63	22.93
2002:09:12	21.08	30.12	5.43	25.61	1.88	33.5	21.85	17.42
2002:09:13	21.75	31.08	6.19	26.19	2.5	34.2	22.51	17.06
2002:09:16	21.7	31.11	6.75	26.63	2.3	33.93	22.33	16.17
2002:09:17	20.78	30.09	5.59	26.72	1.74	32.88	21.84	10.97
2002:09:18	21.37	30.82	6.19	26.85	2.33	33.57	22.26	11.95
2002:09:19	20.58	30.55	5.53	26.02	1.67	32.34	21.69	6.48
2002:09:20	20.47	30.07	5.97	26.02	1.27	32.52	22.00	5.51
2002:09:23	20.77	29.70	5.37	25.80	1.29	32.23	21.65	1.96
2002:09:24	20.32	29.78	4.93	26.02	1.06	32.36	21.39	97.13
2002:09:25	20.83	30.60	5.85	26.67	1.37	33.42	21.97	0.76
2002:09:26	21.35	31.41	6.94	27.56	2.14	34.24	22.74	4.29
2002:09:27	20.79	31.22	6.23	27.09	1.49	33.56	22.18	97.29
2002:09:30	20.7	31.46	6.32	27.43	1.55	33.63	22.22	95.59
2002:10:01	21.34	31.60	6.84	28.45	1.98	34.41	22.88	3.13
2002:10:02	20.92	31.03	6.44	28.26	1.37	33.82	22.66	0.01
2002:10:03	21.36	31.12	6.01	27.82	1.75	33.96	23.15	4.35
2002:10:04	20.5	30.62	4.63	27.13	0.76	33.11	22.35	0.7
2002:10:07	20.57	30.72	4.19	27.56	0.58	33.09	22.60	97.06
2002:10:08	20.63	30.31	3.88	27.73	0.65	33.28	22.32	93.61
2002:10:09	19.32	28.94	3.29	27.00	9.67	31.51	21.13	86.41
2002:10:10	20.72	29.98	5.5	27.89	1.29	33.12	22.37	95.57
2002:10:11	20.8	29.76	5.86	27.56	1.38	32.86	22.52	1.9
2002:10:14	20.73	29.61	6.46	27.67	1.85	32.74	22.65	0.94
2002:10:15	21.11	30.11	6.96	28.00	2.5	32.51	22.90	6.64

STOCK PRICE

2002:10:16	20.61	29.55	5.92	27.01	1.67	31.65	22.29	1.14
2002:10:17	21.22	30.12	6.07	27.32	2.52	31	22.68	7.4
2002:10:18	21.56	30.12	6.29	27.11	2.79	31.9	22.59	8.16
2002:10:21	22	30.93	7.9	27.93	3.83	32.93	23.40	14.25
2002:10:22	22.01	30.17	7.3	27.56	3.09	32.38	22.78	17.22
2002:10:23	22.16	30.34	7.86	28.12	3.83	33.08	23.24	17.11
2002:10:24	22.25	30.16	7.69	27.84	3.68	33.16	23.01	17.28
2002:10:25	22.3	30.12	7.97	27.54	3.43	33.56	23.24	18.31
2002:10:28	21.92	30.23	7.75	27.71	3.85	33.66	23.18	22.64
2002:10:29	21.88	30.12	8.28	27.76	3.48	33.43	22.94	18.91
2002:10:30	22.12	30.45	9.3	28.42	3.85	33.96	22.37	24.77
2002:10:31	22.02	30.20	8.97	28.31	4.04	33.9	21.78	22.68
2002:11:01	22.6	30.45	9.86	28.47	4.28	33.86	22.61	27.6
2002:11:04	22.38	30.22	0.29	26.44	4.82	33.85	22.40	32.95
2002:11:05	22.25	29.97	0.74	26.63	4.56	33.56	22.61	33.14
2002:11:06	22.61	30.18	0.98	26.54	4.74	33.11	22.31	33.69
2002:11:07	21.87	29.16	9.47	25.51	3.68	32.14	21.66	27.14
2002:11:08	21.95	29.64	8.7	25.78	3.3	32.04	21.83	25.16
2002:11:11	21.71	29.12	8.49	25.06	3.46	31.7	21.54	20.11
2002:11:12	21.46	28.85	8.15	25.15	3.11	31.19	21.08	19.87
2002:11:13	21.69	29.16	8.17	25.00	3.71	31.4	21.49	18.24
2002:11:14	22.17	29.83	8.46	25.26	2.22	31.96	21.76	21.81
2002:11:15	22.35	29.85	8.78	25.30	2.2	32.11	22.26	26.06
2002:11:18	22.27	29.44	8.8	24.86	2	32.01	21.65	25.29
2002:11:19	22.38	29.21	8.77	24.86	1.87	31.84	21.66	23.78
2002:11:20	22.6	29.40	8.87	24.54	2.17	32.24	21.75	28.57
2002:11:21	22.54	29.59	9.02	24.62	2.68	32.33	21.61	34.66
2002:11:22	22.75	30.16	9.51	24.83	3.62	32.75	22.01	36.73
2002:11:25	23.15	30.46	0.07	25.02	3.94	33.37	22.18	40.64
2002:11:26	22.88	30.06	9.11	24.65	3.22	33	21.63	34.01
2002:11:27	23.13	30.45	9.53	24.63	3.85	33.53	21.85	39.59
2002:11:28	NA	NA	NA	NA	NA	NA	NA	NA
2002:11:29	22.86	30.07	9.41	24.17	3.7	32.53	21.77	39.13
2002:12:02	22.76	30.41	9.53	24.32	3.57	33.02	21.58	38.68
2002:12:03	22.81	30.75	9.32	24.65	3.53	33.09	21.74	35.34
2002:12:04	22.71	30.74	9.15	24.69	3.53	33.09	21.64	32.2
2002:12:05	22.78	31.12	8.95	24.50	3.73	32.94	21.65	30.25
2002:12:06	22.96	31.15	8.93	24.46	3.8	33.42	21.66	32.35
2002:12:09	22.86	30.89	9.04	24.69	3.81	33.48	21.82	27.27
2002:12:10	22.86	31.27	9.67	25.22	4.4	34.04	21.96	28.8
2002:12:11	23.04	31.55	0.61	25.26	5	34.14	22.32	29.21
2002:12:12	23.25	32.24	1.54	25.83	5.46	34.45	22.56	29.78
2002:12:13	23	31.62	1.49	25.78	5.53	34.03	22.51	30.45
2002:12:16	23.7	31.99	2.12	26.04	5.63	34.61	22.84	36.16
2002:12:17	23.33	32.05	1.96	26.06	5.45	34.5	22.65	36.59
2002:12:18	23.09	31.52	1.89	25.59	5.94	34.33	22.62	34.59
2002:12:19	23.15	31.32	1.63	25.33	5.26	34.27	22.53	33.77
2002:12:20	23.09	30.84	1.93	25.65	6.32	34.45	22.75	37.27
2002:12:23	23.22	30.74	2.62	25.78	6.34	34.49	22.90	37.06
2002:12:24	23.14	30.81	2.38	25.73	6.24	34.56	22.70	35.62
2002:12:25	NA	NA	NA	NA	NA	NA	NA	NA
2002:12:26	23.25	30.86	2.74	25.89	6.92	34.7	22.78	36.72

STOCK PRICE

2002:12:27	22.88	30.30	2.27	25.43	6.13	34.45	22.37	32.46
2002:12:30	23.14	30.94	2.35	25.73	7.02	34.28	22.71	33.25
2002:12:31	23.04	30.49	2.18	25.55	6.7	33.89	22.53	33.08
2003:01:01	NA	NA	NA	NA	NA	NA	NA	NA
2003:01:02	23.38	31.26	3.09	26.06	7.03	34.51	22.75	41.48
2003:01:03	23.28	31.54	3.16	25.71	7.07	34.09	22.87	42.35
2003:01:06	23.87	32.10	3.55	26.67	8.23	35.18	23.69	55.79
2003:01:07	23.29	31.47	2.82	26.11	7.7	34.2	22.85	51.32
2003:01:08	23.2	31.53	2.85	25.73	8.07	34.2	22.79	45.53
2003:01:09	23.14	30.89	2.81	25.68	7.97	34.22	23.32	46.84
2003:01:10	23.13	30.83	2.62	25.54	7.67	34.18	23.52	45.63
2003:01:13	22.97	30.71	2.54	25.50	7.7	34.22	23.27	44.35
2003:01:14	22.59	30.65	2	25.45	7.27	34.04	23.45	47.23
2003:01:15	22.52	30.40	1.74	25.40	7	33.44	23.29	43.76
2003:01:16	22.6	29.82	1.9	25.22	6.98	33.47	23.14	41.09
2003:01:17	22.29	29.73	1.42	25.26	6.46	33.18	23.03	36.65
2003:01:20	NA	NA	NA	NA	NA	NA	NA	NA
2003:01:21	22.39	29.25	0.79	25.02	6.01	33.06	22.90	32.42
2003:01:22	22.31	29.38	0.79	24.73	6.12	32.93	22.60	31.7
2003:01:23	22.63	29.64	1.08	24.93	6.27	33.22	23.20	28.45
2003:01:24	22.19	29.41	0.57	24.47	5.15	32.98	22.98	22.62
2003:01:27	21.8	29.01	9.31	24.18	4.51	32.55	22.19	19.51
2003:01:28	22.26	30.74	9.6	24.71	4.66	33.25	22.75	21.77
2003:01:29	22.27	30.62	0.06	24.74	5.52	32.97	23.05	23.37
2003:01:30	22	30.47	9.78	24.47	4.97	32.81	23.59	19.86
2003:01:31	21.66	30.71	9.74	24.87	4.95	33.31	24.17	23.27
2003:02:03	21.63	30.49	0.27	24.44	5.5	33.28	24.57	26.24
2003:02:04	21.79	30.79	0.37	24.37	5.08	33.14	24.40	24.65
2003:02:05	21.44	30.48	0.17	24.28	4.89	33.04	24.07	22.63
2003:02:06	21.48	30.66	0.06	24.03	4.97	32.98	24.15	20.55
2003:02:07	21.29	30.36	9.47	23.70	4.44	32.34	23.58	18.42
2003:02:10	21.05	30.41	9.8	23.80	4.7	32.78	24.15	18.23
2003:02:11	21.01	30.07	9.17	23.56	4.28	32.59	23.60	14.91
2003:02:12	21.19	29.59	8.46	23.23	3.94	32.11	23.43	10.07
2003:02:13	21.31	30.12	9.14	23.49	4.31	32.51	23.74	10.01
2003:02:14	21.48	30.72	9.02	23.38	4.32	32.63	23.71	14.37
2003:02:17	NA	NA	NA	NA	NA	NA	NA	NA
2003:02:18	21.62	30.43	9.13	23.69	3.97	32.77	23.85	17.62
2003:02:19	21.51	30.55	8.89	23.66	4	32.88	23.63	13.87
2003:02:20	21.6	30.71	9.07	23.50	4.23	33.1	23.80	8.9
2003:02:21	21.93	30.99	9.26	23.77	4.6	33.55	24.13	11.04
2003:02:24	21.58	31.13	9.18	23.88	4.59	33.43	23.92	9.62
2003:02:25	21.58	31.16	9.57	24.26	4.54	33.56	24.56	11.21
2003:02:26	21.35	30.50	8.45	23.86	3.94	32.98	23.96	7.56
2003:02:27	21.47	30.86	8.75	23.80	4.47	33.51	24.21	9.06
2003:02:28	21.26	30.96	8.46	23.42	3.99	32.99	23.99	9.03
2003:03:03	21.54	31.14	9.45	23.80	4.17	33.69	24.29	9.43
2003:03:04	21.69	30.77	9.9	23.42	4.17	33.44	24.05	7.12
2003:03:05	21.78	31.81	7.94	23.59	4.26	33.26	24.41	9.12
2003:03:06	21.67	31.23	6.89	23.52	3.94	33.44	24.44	6.87
2003:03:07	21.72	31.73	5.75	23.46	4.14	33.42	24.67	7.64
2003:03:10	21.41	31.73	2.55	23.35	3.74	33.18	24.75	1.82

STOCK PRICE

2003:03:11	21.43	31.72	3.8	23.51	3.3	32.86	24.40	0.96
2003:03:12	21.38	31.09	3.79	23.06	3.5	32.4	24.30	2.52
2003:03:13	21.77	31.42	4.23	23.54	3.57	32.97	24.66	8.4
2003:03:14	21.6	31.42	3.82	23.40	3.6	32.5	24.66	9.99
2003:03:17	21.96	31.71	4.45	23.89	4.22	33.12	24.91	15.41
2003:03:18	21.68	31.56	5.11	23.89	4.46	33.35	25.03	15.64
2003:03:19	21.94	31.60	5.41	24.01	4.5	33.69	25.19	16.95
2003:03:20	22.16	31.71	5.5	24.10	4.58	34.03	25.36	17.34
2003:03:21	22.46	32.84	6.37	24.45	5	34.67	25.65	20.97
2003:03:24	22.12	32.01	5.57	24.28	4.51	34.1	25.32	14.06
2003:03:25	22.36	31.90	6.07	24.18	4.5	34.27	25.50	16.68
2003:03:26	22.1	31.61	6.02	23.94	4.43	34.14	25.16	15.84
2003:03:27	22.34	32.13	6.02	24.27	4.11	34.48	25.50	15.96
2003:03:28	22.5	32.11	6.07	24.10	3.97	34.63	25.62	14.97
2003:03:31	22.68	31.82	6.28	23.99	4.47	34.58	25.28	12.74
2003:04:01	22.77	32.38	6.59	24.51	4.54	34.73	25.56	16.54
2003:04:02	22.97	32.34	6.83	23.98	4.77	34.46	25.61	20.81
2003:04:03	22.92	32.47	6.74	24.11	4.93	34.45	25.59	17.9
2003:04:04	22.92	32.74	7.17	24.18	5.66	34.74	25.54	18.96
2003:04:07	22.8	32.64	8.04	23.86	5.92	34.47	25.58	19.15
2003:04:08	23.01	32.74	7.61	24.02	6	34.99	26.01	16.95
2003:04:09	22.88	32.42	7.28	23.96	5.53	34.78	25.93	14.94
2003:04:10	22.93	32.74	7.1	24.07	5.61	34.81	25.87	15.98
2003:04:11	22.71	32.34	7.26	23.85	5.36	34.95	25.58	14.98
2003:04:14	22.86	32.55	7.79	24.13	5.48	35.12	25.84	18.61
2003:04:15	22.91	32.77	8.09	24.12	5.5	35.1	25.78	19.67
2003:04:16	22.97	32.69	8.53	24.21	5.62	35.23	25.65	16.58
2003:04:17	23.22	32.99	8.29	24.22	5.66	35.39	25.89	18.95
2003:04:18	NA	NA	NA	NA	NA	NA	NA	NA
2003:04:21	23.29	33.03	8.32	24.47	5.77	35.65	25.98	18.04
2003:04:22	23.52	33.42	8.87	24.63	6.28	35.94	26.27	20.3
2003:04:23	23.81	33.52	8.99	24.49	6.28	36.11	26.37	26.85
2003:04:24	24.04	33.46	9.03	24.47	6.38	36.04	26.25	27.65
2003:04:25	24.16	33.24	8.7	24.83	7.28	35.99	25.98	25.85
2003:04:28	24.37	33.67	9.07	24.80	7.7	36.25	26.51	30.68
2003:04:29	24.52	33.21	8.94	24.65	7.55	36.03	26.01	30.74
2003:04:30	24.7	33.38	8.92	24.99	7.43	36.24	26.06	32.06
2003:05:01	24.48	32.97	8.14	25.01	7.44	35.76	25.60	30.74
2003:05:02	24.48	33.18	9.65	25.19	7.42	35.97	25.60	33.81
2003:05:05	24.35	33.13	9.91	25.58	7.78	36.04	25.60	32.66
2003:05:06	24.37	33.12	9.96	25.35	8.4	36.23	25.55	34.65
2003:05:07	24.16	32.64	9.34	25.58	8.2	35.84	25.41	32.79
2003:05:08	23.97	32.55	9.58	25.16	8.23	35.7	25.49	30.79
2003:05:09	24.02	32.56	0.15	25.61	8.45	35.88	25.46	34.18
2003:05:12	24.04	32.48	0.03	25.64	8.4	35.88	25.40	36.73
2003:05:13	24	32.44	0.2	25.64	8.32	35.74	25.46	36.12
2003:05:14	24.19	32.35	0.35	25.58	8.53	35.73	25.41	36.64
2003:05:15	24.32	32.21	0.81	25.88	8.91	35.78	25.54	38.53
2003:05:16	24.12	31.77	1.61	25.35	9.26	35.6	25.21	40.06
2003:05:19	24.03	32.16	0.86	25.49	9.09	35.82	25.10	35.74
2003:05:20	24.22	32.35	0.96	25.63	9.54	36.05	25.34	36.65
2003:05:21	24.31	32.48	1.21	25.55	9.76	36.61	25.47	36.94

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2003:05:22	24.66	33.07	1.85	25.42	0.32	36.92	25.74	40.16
2003:05:23	25.32	33.82	3.28	26.33	2.36	37.84	26.54	46.23
2003:05:26	NA	NA	NA	NA	NA	NA	NA	NA
2003:05:27	25.83	34.28	4.76	27.24	1.98	37.66	27.03	49
2003:05:28	25.58	34.31	4.43	26.81	1.41	37.78	26.89	47.83
2003:05:29	25.27	34.28	3.92	27.06	0.87	38.12	26.73	45.77
2003:05:30	25.36	34.47	4.25	26.94	1.09	38.05	26.81	48.91
2003:06:02	25.33	34.54	4	27.04	1.25	38.3	26.89	51.51
2003:06:03	25.62	34.82	4.75	27.04	2.33	38.79	27.06	52.09
2003:06:04	26.08	35.31	5.61	27.19	2.66	39.08	27.66	55.14
2003:06:05	25.96	35.03	6.07	27.28	2.98	38.8	27.54	54.97
2003:06:06	25.62	34.99	6.42	27.44	2.74	38.76	27.36	53.15
2003:06:09	25.52	34.92	5.69	27.57	3.06	38.74	27.19	50.71
2003:06:10	25.32	35.11	6.01	27.78	3.27	38.67	27.12	51.86
2003:06:11	25.39	35.17	6.36	27.38	3.48	38.77	27.10	54.04
2003:06:12	25.42	35.38	7.03	27.51	3.17	39.37	27.53	55.76
2003:06:13	25.04	34.76	6.49	27.24	2.45	39.04	26.67	52.24
2003:06:16	25.42	35.52	7.16	27.34	3.11	39.38	27.04	56.6
2003:06:17	25.42	35.63	7.48	27.48	3.12	39.49	27.00	56.24
2003:06:18	25.31	35.53	7.59	27.33	2.91	39.37	26.76	57.11
2003:06:19	25.29	35.58	7.61	27.09	2.81	39.53	26.56	56.27
2003:06:20	25.34	35.48	7.53	26.98	2.37	39.49	26.38	57.88
2003:06:23	25.12	34.85	7.42	26.73	2.33	38.86	26.23	54.58
2003:06:24	24.8	34.73	7.47	26.64	2.26	38.51	25.96	54.76
2003:06:25	24.78	34.69	7.13	26.68	2.04	38.43	25.92	53.19
2003:06:26	24.73	34.87	6.95	26.70	2.27	38.66	25.98	55.05
2003:06:27	24.9	34.75	6.41	26.79	2.05	38.43	26.05	52.35
2003:06:30	24.69	34.89	6.13	26.36	1.82	38.03	25.79	51.91
2003:07:01	24.89	35.04	5.94	26.70	2.03	38.17	26.13	53.09
2003:07:02	25.17	35.85	6.29	26.85	2.52	38.59	26.31	56.42
2003:07:03	25.04	35.76	5.79	26.82	2.6	38.54	26.32	54.13
2003:07:04	NA	NA	NA	NA	NA	NA	NA	NA
2003:07:07	25.38	36.05	6.29	27.24	3.07	38.71	26.66	55.56
2003:07:08	25.06	36.01	6.58	27.21	2.13	38.53	26.31	54.01
2003:07:09	25.16	35.88	6.41	27.38	2.11	38.61	26.04	51.76
2003:07:10	25.05	35.53	5.74	27.03	1.39	38.25	25.72	47.11
2003:07:11	25.71	35.48	5.5	27.37	1.6	38.54	25.91	49.33
2003:07:14	25.87	35.44	5.59	27.57	1.6	38.56	25.82	48.28
2003:07:15	25.46	35.36	4.81	27.48	1.03	38.1	25.33	45.58
2003:07:16	26.03	35.18	5.04	27.27	0.78	37.92	25.27	41.85
2003:07:17	25.9	34.97	4.71	26.92	0.68	37.4	25.07	37.23
2003:07:18	25.98	35.39	5.26	27.06	1.13	37.63	25.50	40.66
2003:07:21	25.78	34.91	4.98	26.61	0.75	37.23	25.21	35.37
2003:07:22	26.13	34.73	5.03	26.83	1.02	37.18	25.40	39.93
2003:07:23	26.01	34.64	5.23	26.74	1.04	37.03	25.13	38.83
2003:07:24	26.34	34.16	5.14	26.59	1.09	37.18	25.16	37.67
2003:07:25	26.23	34.25	5.11	26.55	0.87	37.18	25.05	40.04
2003:07:28	26.07	34.65	5.23	26.56	0.41	36.87	25.00	40.78
2003:07:29	26.03	34.40	5.38	27.31	0.27	36.96	24.93	39.18
2003:07:30	26.37	34.20	5.3	27.43	0.35	37.31	25.00	38.21
2003:07:31	26.62	34.28	5.32	27.86	9.97	37.46	24.93	37.65
2003:08:01	26.41	33.89	4.62	26.92	0.23	37.04	25.00	36.1

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2003:08:04	26.37	33.41	4.21	26.92	9.97	36.94	24.97	38.23
2003:08:05	26.2	33.47	3.15	26.81	9.38	36.57	24.90	34.3
2003:08:06	26.09	33.37	3.11	26.67	9.38	36.75	24.79	36.1
2003:08:07	26.47	33.68	3.47	27.01	9.13	36.9	24.88	35.71
2003:08:08	26.61	34.00	3.13	26.97	8.76	36.85	25.27	36.01
2003:08:11	26.78	34.11	3.19	27.28	8.7	36.81	25.51	36.82
2003:08:12	26.99	34.27	3.31	27.64	8.98	37.29	25.77	39.09
2003:08:13	26.69	34.16	3.01	27.31	8.89	37.24	25.73	37.25
2003:08:14	26.75	34.46	3.05	27.60	8.84	37.09	25.68	37.98
2003:08:15	27.11	34.30	3.11	27.75	9.2	37.34	25.60	38.4
2003:08:18	26.97	34.85	3.11	27.92	9.27	37.34	25.63	38.98
2003:08:19	26.99	35.48	2.75	27.99	9.1	37.5	25.85	39.58
2003:08:20	27.19	35.39	3.31	28.25	9.31	37.91	26.06	41.05
2003:08:21	27.29	35.38	3.51	28.38	9.33	38.24	25.90	41.72
2003:08:22	26.9	35.17	3.02	28.02	8.98	37.53	25.70	38.23
2003:08:25	26.82	35.19	3.14	28.14	9	37.34	25.81	37.23
2003:08:26	26.98	35.42	3.16	28.01	9.01	37.34	25.99	38.88
2003:08:27	27.03	35.34	3.08	28.08	9.05	37.56	25.95	38.65
2003:08:28	27.04	35.57	3.12	28.05	8.96	37.77	25.95	39.63
2003:08:29	27.29	35.48	3.09	27.88	9.15	37.92	26.28	39.42
2003:09:01	NA	NA	NA	NA	NA	NA	NA	NA
2003:09:02	27.44	36.18	3.72	28.92	9.75	38.28	26.92	42.1
2003:09:03	27.52	36.12	4.13	28.99	0.18	38.61	27.23	44.46
2003:09:04	27.87	36.32	4.14	28.94	0.39	38.65	27.08	45.23
2003:09:05	27.55	36.02	3.86	28.73	0.52	38.47	26.78	44.46
2003:09:08	27.68	36.14	4.42	28.88	1.05	39.15	27.24	45.81
2003:09:09	27.51	35.63	4.03	28.82	0.71	38.55	27.17	43.04
2003:09:10	27.53	35.64	3.98	28.73	0.63	38.52	26.97	43.34
2003:09:11	27.61	36.09	3.88	29.07	0.65	38.39	27.10	43.23
2003:09:12	27.71	35.98	4.03	28.89	1.08	38.68	27.23	44.52
2003:09:15	27.7	35.96	3.89	29.09	1.01	38.74	27.11	42.73
2003:09:16	27.78	36.45	4.56	29.46	1.46	38.97	26.97	45.31
2003:09:17	27.7	36.43	4.75	29.31	1.43	38.89	26.82	44.86
2003:09:18	27.74	36.75	4.76	28.97	1.8	38.9	26.87	48.45
2003:09:19	27.81	36.93	4.87	28.56	1.7	38.95	27.17	47.64
2003:09:22	27.75	36.46	4.7	28.68	1.15	38.9	27.00	44.81
2003:09:23	27.78	36.78	5.03	28.77	1.32	38.79	27.06	42.59
2003:09:24	27.6	36.04	4.82	28.73	1.29	38.62	26.86	39.07
2003:09:25	27.59	36.00	4.71	28.38	1.37	38.44	26.68	39.01
2003:09:26	27.77	35.74	4.74	28.25	1.12	38.38	26.49	39.18
2003:09:29	27.73	36.28	4.79	28.58	1.05	38.76	26.87	41.1
2003:09:30	27.62	35.73	4.67	28.38	0.86	38.62	26.95	39.89
2003:10:01	28.01	36.52	5.17	29.07	1.26	38.74	27.01	43.35
2003:10:02	28.06	36.65	5.43	29.36	1.53	39.11	27.02	44.2
2003:10:03	28.41	37.11	5.8	29.63	1.92	39.36	27.21	46.26
2003:10:06	28.47	37.62	5.9	29.71	2.11	39.51	27.45	47.41
2003:10:07	28.4	37.67	6.13	29.85	1.67	39.55	27.41	46.88
2003:10:08	27.9	37.29	5.32	29.09	0.91	38.89	27.27	44.48
2003:10:09	27.8	37.24	5.4	29.36	1.22	39.06	27.36	45.12
2003:10:10	27.75	37.15	5.66	29.31	1.34	39.02	27.57	45.07
2003:10:13	27.92	37.28	5.63	29.45	1.13	39.22	27.73	44.58
2003:10:14	27.82	37.08	5.63	29.42	0.93	39.29	27.73	43.92

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2003:10:15	27.6	36.78	5.06	29.35	0.5	39.19	27.83	43.92
2003:10:16	27.51	36.68	5.01	29.28	0.35	39.49	27.99	45.05
2003:10:17	27.38	36.38	4.78	29.09	0.5	39.4	27.95	44.21
2003:10:20	27.44	36.54	5.07	28.77	0.21	39.32	27.92	45.82
2003:10:21	27.35	36.46	4.95	28.30	0.34	39.39	27.85	44.81
2003:10:22	27.11	36.00	4.86	28.19	0.23	39.19	27.73	45.55
2003:10:23	27.1	35.89	4.76	28.22	0.18	39.22	27.65	46.36
2003:10:24	26.81	35.89	4.66	28.11	9.94	38.75	27.54	46.43
2003:10:27	26.98	36.32	4.89	28.19	9.72	38.86	27.54	47.38
2003:10:28	27.02	36.68	5.19	28.38	9.93	38.92	27.22	48.13
2003:10:29	27.06	36.83	4.73	28.66	9.98	38.87	27.18	48.72
2003:10:30	27.57	36.83	4.53	28.55	9.58	39.15	27.23	49.13
2003:10:31	27.6	37.52	3.81	28.70	9.94	39.35	27.33	50.29
2003:11:03	27.78	38.26	3.92	29.45	0.24	39.89	27.84	51.87
2003:11:04	27.68	38.07	3.37	29.55	9.86	39.61	26.89	49.49
2003:11:05	27.84	38.37	3	29.72	9.92	39.19	26.63	48.95
2003:11:06	27.72	38.17	2.75	29.99	9.9	39.16	26.19	48.05
2003:11:07	27.94	38.01	2.09	29.79	9.56	39.43	25.97	47.42
2003:11:10	27.81	37.84	2.11	29.77	9.48	39.59	25.99	47.9
2003:11:11	27.84	37.62	2.54	29.73	9.47	39.73	26.11	47.54
2003:11:12	28.29	37.76	2.23	29.99	9.48	39.83	26.31	48.91
2003:11:13	28.15	37.80	2.65	30.15	9.53	40.08	26.58	48.14
2003:11:14	28.21	37.52	2.56	29.90	9.62	40.22	26.60	48.85
2003:11:17	28.16	37.49	2.57	30.12	9.29	40.26	26.59	47.02
2003:11:18	27.67	36.78	2.41	29.62	8.7	39.77	26.03	44.47
2003:11:19	27.77	36.88	2.2	29.68	8.97	39.89	26.27	45.51
2003:11:20	27.43	36.23	1.78	29.45	8.43	39.63	25.98	44.22
2003:11:21	27.32	37.02	1.82	29.69	8.61	39.62	26.05	45.44
2003:11:24	28.01	38.22	2.1	30.16	9.36	40.25	26.34	47.85
2003:11:25	28.09	38.49	1.98	30.34	9.44	40.36	26.43	49.67
2003:11:26	28.21	38.37	2.17	30.24	9.71	40.56	26.52	50.39
2003:11:27	NA	NA	NA	NA	NA	NA	NA	NA
2003:11:28	28.13	38.07	2.33	30.19	9.7	40.58	26.42	50.48
2003:12:01	28.47	38.47	2.72	30.09	0.08	40.97	26.49	51.98
2003:12:02	28.43	38.42	2.98	30.23	0.18	41.29	26.80	51.95
2003:12:03	28.3	37.46	3.15	29.70	9.7	40.69	26.59	50.91
2003:12:04	28.37	37.92	3.29	29.62	9.82	40.66	26.56	53.8
2003:12:05	28.17	37.69	3.35	29.69	9.84	40.82	26.53	54.04
2003:12:08	28.45	38.17	3.64	30.16	0.46	41.3	26.98	54.24
2003:12:09	28.32	37.67	3.35	29.95	0.28	40.96	26.77	51.86
2003:12:10	28.52	37.36	2.93	29.70	0.23	40.86	26.69	52.71
2003:12:11	28.5	37.89	2.78	29.60	0.26	41.08	26.77	55.06
2003:12:12	28.55	38.60	3.39	29.94	0.69	41.5	26.94	54.89
2003:12:15	28.4	38.02	3.54	29.99	1.22	41.2	26.74	54.83
2003:12:16	28.31	37.86	3.58	29.69	1.75	41.2	26.95	55.28
2003:12:17	28.24	37.98	3.29	29.90	1.68	42.3	26.96	56.67
2003:12:18	28.67	38.69	3.54	30.13	1.8	42.42	27.47	59.46
2003:12:19	28.85	38.18	3.55	30.15	1.7	42.6	27.63	59.48
2003:12:22	28.81	38.88	3.8	30.12	1.9	43.03	27.72	60.95
2003:12:23	28.88	39.28	3.96	30.72	1.88	43.35	27.74	61.53
2003:12:24	28.93	38.68	4.01	30.59	1.84	43.08	27.91	60.89
2003:12:25	NA	NA	NA	NA	NA	NA	NA	NA

STOCK PRICE

2003:12:26	28.92	39.07	4.05	30.75	1.9	43.36	27.88	60.98
2003:12:29	28.8	39.08	4.35	30.78	2.15	43.38	27.97	63.93
2003:12:30	28.78	39.07	4.06	30.90	2.17	43.43	27.68	65.58
2003:12:31	28.82	38.51	4.04	30.44	2.04	43.46	27.47	65.58
2004:01:01	NA	NA	NA	NA	NA	NA	NA	NA
2004:01:02	28.71	38.78	3.69	30.36	1.95	43.22	27.70	66.37
2004:01:05	28.72	38.66	3.87	30.34	1.94	43.1	27.68	70.67
2004:01:06	28.55	38.02	3.92	30.19	1.81	42.65	27.48	71.54
2004:01:07	28.49	38.39	3.58	30.44	1.8	42.75	27.43	72.26
2004:01:08	28.63	38.50	3.35	30.26	1.67	42.6	27.37	76.43
2004:01:09	28.59	38.13	3.56	30.03	1.47	42.3	27.35	NA
2004:01:12	28.61	38.66	3.05	30.21	1.64	42.32	27.45	NA
2004:01:13	28.69	38.60	2.5	30.44	1.63	42.62	27.24	NA
2004:01:14	28.83	39.15	2.91	30.54	2.12	43.33	27.65	NA
2004:01:15	29	38.80	2.89	30.34	1.89	43.36	27.75	NA
2004:01:16	29.03	38.41	2.9	30.30	1.95	42.7	27.54	NA
2004:01:19	NA	NA	NA	NA	NA	NA	NA	NA
2004:01:20	29.46	39.04	2.79	30.56	2.38	42.5	27.74	NA
2004:01:21	29.48	38.90	3.11	30.88	2.54	42.16	27.78	NA
2004:01:22	29.44	38.58	3.18	30.81	2.29	42.12	27.92	NA
2004:01:23	29.5	38.90	3.63	31.41	2.76	42.09	28	NA
2004:01:26	29.58	39.27	3.7	31.59	2.89	42.16	28.33	NA
2004:01:27	29.53	38.80	3.82	31.61	2.89	41.95	28.45	NA
2004:01:28	29.27	38.40	3.4	31.25	2.8	41.6	28.05	NA
2004:01:29	29.36	38.57	3.31	30.85	2.79	41.7	27.93	NA
2004:01:30	29.08	38.59	3.15	30.80	2.46	41.81	27.95	NA
2004:02:02	29.11	38.77	3.77	30.61	3.19	41.86	28.5	NA
2004:02:03	28.84	38.82	3.76	30.80	3.45	41.5	28.65	NA
2004:02:04	28.27	37.77	3.15	30.10	2.9	41.06	28.3	NA
2004:02:05	28.2	37.80	2.55	30.30	2.68	40.68	28.03	NA
2004:02:06	28.64	39.59	3.12	30.79	3.14	41.2	28.43	NA
2004:02:09	28.6	39.51	2.8	30.70	3.17	41.04	28.31	NA
2004:02:10	28.72	39.90	3.65	31.30	3.16	41.4	28.57	NA
2004:02:11	28.93	40.00	3.37	31.35	3.35	41.52	28.57	NA
2004:02:12	28.85	39.50	3.65	31.20	3.14	41.43	28.36	NA
2004:02:13	28.68	38.80	3.92	31.17	3.18	41.3	28.4	NA

Case of Positive Dividend Surprises

	t-9	t-8	t-7	t-6	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5	t+6	t+7	t+8	t+9
ATG																			
Event Date																			
04/16/2003	0.003	-0.003	-0.007	0.013	-0.002	-0.001	-0.008	-0.003	-0.001	0.008	0.004	0.004	-0.003	0.007	0.008	-0.003	0.005	0.00349	-0.0072
NJR																			
02/03/2003	0.004	0.005	0.014	0.002	-0.009	0.052	-0.008	0.001	0.000	-0.014	0.012	-0.007	0.009	-0.007	0.001	-0.006	-0.007	0.0168	0.00985
10/28/2003	-0.009	-0.006	-0.008	0.000	-0.002	-0.015	-0.006	-0.001	0.009	0.007	0.002	-0.002	0.015	0.016	-0.002	0.008	-0.005	-0.004	-0.006
Gas																			
03/21/2002	-0.008	0.015	-0.010	0.003	0.003	-0.003	0.001	-0.002	0.000	0.018	0.003	0.010	0.005	0.006	-0.004	0.013	-0.001	-0.0031	-0.0008
04/30/2003	0.005	-0.003	0.013	-0.032	0.005	-0.007	-0.004	-0.006	0.003	-0.001	-0.005	-0.002	-0.019	-0.010	0.005	-0.023	0.019	-0.009	-0.010
NWN																			
10/02/2003	-0.014	0.007	0.005	0.003	-0.013	-0.006	0.008	-0.006	0.018	0.008	0.005	0.000	0.004	-0.023	0.007	-0.003	0.004	-0.001	-0.003
PGL																			
02/05/2003	0.010	-0.020	-0.013	-0.001	0.021	-0.009	-0.008	0.009	-0.009	-0.002	0.006	-0.012	0.007	-0.006	0.000	0.010	-0.010	0.00798	0.0166
WGL																			
03/05/2003	0.017	0.009	-0.006	0.023	-0.017	0.007	-0.010	0.011	-0.005	0.010	0.006	0.007	0.016	-0.013	-0.008	0.001	-0.004	-0.002	0.004
AAR	0.001	0.000	-0.001	0.001	-0.002	0.002	-0.004	0.000	0.002	0.004	0.004	0.000	0.004	-0.004	0.001	0.000	0.000	0.001	0.000
CAAR_D	0.001	0.001	0.000	0.001	0.000	0.002	-0.003	-0.002	-0.001	0.004	0.008	0.007	0.012	0.008	0.009	0.009	0.009	0.010	0.010

Event Date	t-9	t-8	t-7	t-6	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5	t+6	t+7	t+8	t+9
CAAR_D	0.1%	0.1%	0.0%	0.1%	0.0%	0.2%	-0.3%	-0.2%	-0.1%	0.4%	0.8%	0.7%	1.2%	0.8%	0.9%	0.9%	0.9%	1.0%	1.0%
CAAR_E_Adjust	1.1%	1.0%	0.9%	0.3%	0.3%	0.1%	0.3%	0.0%	-0.1%	1.9%	2.8%	3.6%	3.2%	3.1%	2.6%	2.9%	2.6%	3.0%	3.1%
CAAR_E	-0.005	-0.006	-0.007	-0.013	-0.013	-0.015	-0.013	-0.016	-0.017 -0.016	0.003	0.012	0.020	0.016	0.015	0.010	0.013	0.010	0.014	0.015

AGL Resources - ATG

Date	Dividends	Earnings		Expectation	Difference
01/28/2004	0.280			0.280	0.000
01/28/2004		2.010	annual	2.000	0.010
11/03/2003	0.280			0.280	0.000
10/30/2003		0.340		0.480	(0.140)
07/31/2003		0.290		0.250	0.040
07/30/2003	0.280			0.280	0.000
04/22/2003		0.980		0.900	0.080
04/16/2003	0.280			0.270	0.010
01/31/2003		1.820		1.750	0.070
10/17/2002		0.170		0.150	0.020
07/25/2002		0.220		0.200	0.020
04/30/2002		0.890		1.200	(0.310)
02/01/2002	0.270			0.270	0.000
01/24/2002		0.450		0.410	0.040
10/25/2001		1.620	annual	1.500	0.120

New Jersey Resources - NJR

Date	Dividends	Earnings	Expectatior	Difference
01/28/2004		0.87	0.85	0.020
10/28/2003	0.325		0.31	0.015
10/28/2003		2.38 annual	2.35	0.030
07/24/2003		0.16	0.15	0.010
06/10/2003	0.31		0.31	0.000
04/24/2003		1.52	1.36	0.160
02/03/2003	0.31		0.3	0.010
01/28/2003		0.86	0.77	0.090
10/30/2002		2.12 annual	2.12	0.000
07/24/2002		0.18	0.2	(0.020)
06/05/2002	0.3		0.3	0.000
04/24/2002		1.3	1.35	(0.050)
03/06/2002	0.3		0.3	0.000
01/23/2002		1.1	1	0.100
10/25/2001		2.95 annual	2.95	0.000

NICOR- GAS

Date	Dividends	Earnings		Expectation	Difference
02/09/2004		2.38	annual	2.1	0.280
11/20/2003	0.465			0.465	0.000
10/30/2003		0.01		0.33	(0.320)
07/31/2003		0.54		0.25	0.290
07/17/2003	0.465			0.465	0.000
05/01/2003		1.04		1.1	(0.060)
04/30/2003	0.465			0.46	0.005
03/20/2003	0.465			0.46	0.005
03/04/2003		2.88	annual	2.65	0.230
11/21/2002	0.46			0.46	0.000
08/14/2002		0.46		0.64	(0.180)
07/18/2002	0.46			0.46	0.000
04/18/2002	0.46			0.46	0.000
04/17/2002		0.9		0.85	0.050
03/21/2002	0.46			0.455	0.005
01/23/2002		3.01	annual	3.05	(0.040)
11/15/2001	0.44			0.44	0.000
10/18/2001		0.61		0.55	0.060

Northwest Natural- NWN

Date	Dividends	Earnings		Expectatior	Difference
01/29/2004		1.76	annual	1.75	0.010
01/05/2004	0.325			0.325	0.000
11/04/2003		0.25		0.3	(0.050)
10/02/2003	0.325			0.315	0.010
07/29/2003		0.17		0.1	0.070
07/02/2003	0.315			0.315	0.000
05/01/2003		1.01		1.1	(0.090)
04/01/2003	0.315			0.315	0.000
02/04/2003		1.62	annual	1.7	(0.080)
01/03/2003	0.315			0.315	0.000
11/04/2002		-0.22		-0.25	0.030
10/03/2002	0.315			0.315	0.000
07/24/2002		0.18		0.14	0.040
07/05/2002	0.315			0.315	0.000
04/24/2002		1.32		1.15	0.170
04/05/2002	0.315			0.315	0.000
03/01/2002		1.88	annual	1.75	0.130
01/03/2002	0.315			0.315	0.000

Peoples Energy- PGL

Date	Dividends	Earnings		Expectation	Difference
01/23/2004		0.85		0.88	(0.030)
12/05/2003	0.53			0.53	0.000
10/31/2003		2.87 annual		2.9	(0.030)
08/06/2003	0.53			0.53	0.000
07/25/2003		0.22		0.3	(0.080)
06/04/2003	0.53			0.53	0.000
04/25/2003		1.77		1.5	0.270
02/05/2003	0.53			0.52	0.010
01/24/2003		0.87	mia		#VALUE!
12/04/2002	0.52		mia		#VALUE!
10/25/2002		2.8 annual		2.75	0.050
08/07/2002	0.52			0.52	0.000
07/26/2002		0.04		0.28	(0.240)
05/22/2002	0.52			0.52	0.000
04/26/2002		1.55		1.52	0.030
02/06/2002	0.52			0.52	0.000
01/25/2002		0.88		1.05	(0.170)

Piedmont - PNY

Date	Dividends	Earnings		Expectation	Difference	
12/12/2003	0.415			0.415	0.000	
12/12/2003		2.22	annual	2.15	0.070	
08/22/2003	0.415			0.415	0.000	
08/22/2003		-0.29		1.3	(1.590)	Changes in recording revenues and COG
05/30/2003	0.415			0.415	0.000	
05/30/2003		0.93		1.3	(0.370)	
02/28/2003	0.415			0.4	0.015	
02/28/2003		1.74		1.55	0.190	
12/13/2002	0.4			0.4	0.000	
12/13/2002		1.9	annual	2.75	(0.850)	
08/23/2002	0.4			0.4	0.000	
08/23/2002		-0.027		-0.33	0.303	
05/31/2002	0.4			0.4	0.000	
05/31/2002		1.27		1.27	0.000	
02/22/2002	0.4			0.4	0.000	
02/22/2002		1.26		1.6	(0.340)	
12/07/2001	0.385			0.385	0.000	
12/07/2001		2.01	annual	2.05	(0.040)	

WGL Holdings, Inc.

Date	Dividends	Earnings		Expectatior	Difference
01/28/2004		0.81		0.8	0.010
12/19/2003	0.32			0.32	0.000
11/03/2003		2.3	annual	2.2	0.100
09/24/2003	0.32			0.32	0.000
07/30/2003		-0.05		0.15	(0.200)
06/25/2003	0.32			0.32	0.000
04/30/2003		1.66		1.6	0.060
03/05/2003	0.32			0.318	0.002
01/29/2003		1.06		0.9	0.160
12/20/2002	0.3175			0.318	(0.001)
11/04/2002		-0.47		-0.41	(0.060)
09/25/2002	0.3175			0.3175	0.000
08/02/2002		-0.29		-0.1	(0.190)
06/26/2002	0.3175			0.3175	0.000
05/01/2002		0.94		1.2	(0.260)
02/25/2002	0.3175			0.3175	0.000
01/30/2002		0.62		0.85	(0.230)
12/14/2001	0.315			0.315	0.000
10/31/2001		-0.48		-0.37	(0.110)
09/26/2001	0.315			0.315	0.000

DATE	ATG	NJR	GAS	NWN	PGL	PNY	WGL	Index
2000:01:03	13.37	20.66	25.85	16.99	25.81	23.93	21.46	317.98
2000:01:04	13.37	20.18	26	16.69	25.96	24.19	21.50	312.51
2000:01:05	13.87	20.39	26.72	16.89	26.42	24.44	21.55	310.2
2000:01:06	13.87	20.35	27.13	16.94	26.26	24.55	21.50	316.12
2000:01:07	14.02	20.49	27.75	17.04	26.56	24.34	21.45	314.8
2000:01:10	13.67	20.46	27.7	17.34	26.11	24.14	21.39	318.48
2000:01:11	13.62	20.25	27.64	17.09	25.86	23.88	20.98	319.83
2000:01:12	13.82	20.39	28	16.84	26.01	24.29	21.04	316.76
2000:01:13	13.97	20.52	28.41	16.65	25.91	24.65	21.04	318.61
2000:01:14	13.92	20.80	27.9	17.09	26.36	24.09	20.98	320.59
2000:01:17	NA	NA	NA	NA	NA	NA	NA	NA
2000:01:18	13.77	20.52	27.8	17.04	25.86	24.24	21.09	319.98
2000:01:19	13.77	20.73	27.44	16.74	26.06	24.24	21.09	318.12
2000:01:20	14.12	20.80	28.26	16.45	25.76	24.6	21.14	320.09
2000:01:21	13.92	20.70	28.57	16.40	26.51	24.5	21.19	321.41
2000:01:24	13.82	20.93	28.05	15.75	25.76	24.65	21.34	326.72
2000:01:25	13.82	21.52	27.7	15.65	25.46	24.29	20.77	327.81
2000:01:26	13.82	21.24	27.9	15.90	25.46	24.19	20.83	NA
2000:01:27	13.67	20.76	27.49	16.44	25.46	24.03	20.98	324.32
2000:01:28	13.57	20.90	27.49	16.26	24.4	23.83	21.04	321.65
2000:01:31	13.72	20.70	28.11	16.83	25.11	23.42	20.77	317.4
2000:02:01	13.52	21.00	28.11	16.98	25.35	23.83	21.09	321.3
2000:02:02	13.42	20.87	28.46	17.49	25.35	23.88	20.93	322.57
2000:02:03	13.67	21.24	29.23	17.75	25.91	24.03	20.88	322.41
2000:02:04	13.57	21.21	28.16	18.06	25.2	23.67	20.88	328.19
2000:02:07	13.47	21.11	27.8	16.42	25.06	23.37	20.72	325.7
2000:02:08	13.67	20.76	27.95	16.72	24.86	23.06	20.93	324.22
2000:02:09	13.52	20.63	27.39	17.03	24.75	22.9	20.88	325.4
2000:02:10	13.86	20.59	27.34	17.03	24.45	22.8	20.62	322.18
2000:02:11	13.55	20.80	27.08	17.13	24.4	22.54	20.00	319.49
2000:02:14	13.55	20.83	27.49	16.67	24.4	21.72	20.26	317.25
2000:02:15	13.71	20.56	27.75	16.67	24.35	21.36	20.31	318.65
2000:02:16	13.55	20.90	27.39	16.83	24.15	21.26	20.26	318.7
2000:02:17	13.86	20.66	27.39	16.88	24	21.31	20.52	318.7
2000:02:18	13.55	20.80	27.03	16.98	23.35	20.85	20.21	318.52
2000:02:21	NA	NA	NA	NA	NA	NA	NA	NA
2000:02:22	13.55	20.28	26.87	16.62	23.65	19.51	19.64	312.89
2000:02:23	NA	NA	NA	NA	23.3	NA	18.97	311.57
2000:02:24	13.45	20.15	24.72	15.90	22.79	20.18	18.70	310.54
2000:02:25	13.71	19.98	24.57	15.80	22.09	20.18	19.12	304.31
2000:02:28	13.65	20.11	25.03	15.83	22.94	20.49	19.23	302.66
2000:02:29	14.07	20.32	24.93	16.01	23.25	20.34	19.74	293.99
2000:03:01	14.22	20.18	24.87	15.49	23.15	19.93	19.74	307.95
2000:03:02	14.43	20.25	24.77	15.29	22.99	20.03	19.64	308.49
2000:03:03	14.48	20.25	25.85	15.18	23.35	20.08	19.80	311.08
2000:03:06	14.12	20.42	24.46	15.24	22.29	20.8	19.74	314.03
2000:03:07	14.48	20.39	24.62	15.18	22.34	20.85	19.80	308.53
2000:03:08	14.43	20.73	25.13	15.08	23.35	21.06	19.90	307.45
2000:03:09	14.48	21.28	25.08	15.24	22.79	21.06	19.74	309.03
2000:03:10	14.27	20.70	24.72	15.39	22.09	20.49	19.80	311.57
2000:03:13	14.32	20.88	24.72	15.18	22.29	20.44	19.69	311.98
2000:03:14	14.38	20.98	24.87	15.29	22.14	20.49	19.64	309.41
2000:03:15	14.53	21.05	25.03	15.34	22.19	20.49	19.85	308.17
2000:03:16	14.99	21.90	26.31	16.01	22.7	21.57	20.77	312.7
2000:03:17	14.58	21.34	25.8	15.88	22.29	21.11	20.47	323.88

DATE	ATG	NJR	GAS	NWN	PGL	PNY	WGL	Index
2000:03:20	14.63	21.23	26.05	15.85	22.75	21.36	20.62	321.09
2000:03:21	14.58	21.12	26.11	15.85	22.34	21.62	20.26	320.69
2000:03:22	14.43	21.27	25.85	15.44	22.29	22.24	20.42	320.41
2000:03:23	14.38	21.02	25.8	15.29	22.6	22.13	20.31	317.57
2000:03:24	14.43	21.16	25.23	15.39	22.34	21.5	20.77	320.68
2000:03:27	14.32	21.20	25.85	15.90	22.45	21.6	20.77	321.86
2000:03:28	13.96	21.51	26.26	15.60	22.24	21.39	20.00	323.38
2000:03:29	14.17	21.93	27.02	15.80	22.24	21.76	20.47	320.26
2000:03:30	14.22	22.29	27.33	15.90	22.29	21.66	20.98	321.85
2000:03:31	15.15	24.08	27.38	16.01	22.45	22.03	22.48	321.85
2000:04:03	14.38	23.94	26.81	16.16	21.93	22.45	21.45	324.81
2000:04:04	14.58	23.52	27.18	16.08	22.24	22.18	21.29	322.71
2000:04:05	14.79	23.10	27.28	16.16	22.45	22.55	21.81	322.27
2000:04:06	14.74	23.10	27.12	16.42	22.6	22.98	21.76	325.42
2000:04:07	14.84	22.53	26.97	16.26	23.11	22.71	21.50	325.04
2000:04:10	14.48	22.78	27.02	16.36	23.32	22.61	21.23	325.23
2000:04:11	14.43	22.32	27.02	16.36	23.57	22.45	21.18	324.95
2000:04:12	14.38	22.39	27.28	16.72	23.68	22.82	21.39	325.71
2000:04:13	14.48	22.50	27.9	16.88	24.59	23.24	21.65	325.26
2000:04:14	14.43	22.43	27.64	16.36	24.8	22.4	21.91	328.85
2000:04:17	14.63	22.25	28.27	16.21	25.77	22.82	21.81	320.23
2000:04:18	14.63	22.18	28.11	16.42	25.31	22.71	21.60	320.98
2000:04:19	14.38	22.01	27.96	16.42	25.46	22.82	21.71	324.04
2000:04:20	14.12	22.04	28.16	16.21	25.66	22.87	21.60	322.56
2000:04:21	NA	NA	NA	NA	NA	NA	NA	NA
2000:04:24	14.12	21.97	27.96	16.31	25.93	22.71	21.34	323.11
2000:04:25	14.53	22.11	28.68	16.47	26.07	23.5	21.50	324.28
2000:04:26	14.48	22.25	28.37	17.09	26.07	23.61	21.55	331.54
2000:04:27	14.27	21.97	27.96	17.40	25.66	23.29	21.81	334.09
2000:04:28	14.43	22.67	28.16	18.34	25.41	23.87	21.44	331.42
2000:05:01	14.74	22.78	28.48	17.92	25.52	23.45	22.33	330.56
2000:05:02	14.74	22.85	28.01	18.03	25.31	23.5	21.96	333.13
2000:05:03	14.58	22.78	27.85	17.77	24.95	23.19	21.65	326.33
2000:05:04	14.94	22.81	28.01	17.98	25.36	23.45	22.12	323.36
2000:05:05	14.74	23.03	27.85	18.24	25.26	23.5	22.01	326.21
2000:05:08	14.69	22.53	27.54	18.03	25.98	23.4	22.01	326.05
2000:05:09	13.91	22.32	27.49	17.51	25.46	23.13	22.17	327.16
2000:05:10	13.91	22.15	27.9	17.56	25.31	23.66	22.22	322.02
2000:05:11	13.91	22.67	28.73	17.72	26.07	24.61	22.75	320.95
2000:05:12	13.76	22.32	28.58	18.16	25.98	24.4	22.43	327.06
2000:05:15	13.86	22.50	29.77	17.92	26.38	24.56	22.54	324.99
2000:05:16	13.86	22.64	29.77	17.82	26.13	24.88	22.69	328.89
2000:05:17	13.83	22.53	29.1	17.51	25.98	24.72	22.27	328.36
2000:05:18	13.83	22.15	29.57	17.35	26.07	24.56	21.96	321.95
2000:05:19	13.51	21.97	29.15	16.88	25.62	24.09	21.71	321.51
2000:05:22	13.56	22.08	29.83	16.99	26.18	23.82	21.81	317.45
2000:05:23	13.41	22.15	29.83	17.35	26.34	23.93	21.65	318.47
2000:05:24	13.46	22.04	30.76	17.25	26.54	23.87	22.06	314.53
2000:05:25	13.3	21.90	30.19	17.82	26.43	23.87	21.91	317.85
2000:05:26	13.72	22.11	30.35	18.13	27.15	24.77	22.38	315.62
2000:05:29	NA	NA	NA	NA	NA	NA	NA	NA
2000:05:30	13.93	22.29	30.35	18.39	27.2	24.93	22.69	318.9
2000:05:31	13.93	21.83	30.5	18.13	27.77	25.14	22.27	322.94
2000:06:01	13.93	22.46	30.71	18.24	27.77	26.41	22.64	323.4
2000:06:02	NA	NA	NA	NA	27.97	NA	22.69	327.56

DATE	ATG	NJR	GAS	NWN	PGL	PNY	WGL	Index
2000:06:05	13.62	22.18	29.05	18.13	26.84	25.35	22.01	330.33
2000:06:06	13.77	22.50	29.51	18.45	28.13	25.35	21.96	324.62
2000:06:07	13.56	22.11	29.41	18.13	28.07	25.46	21.96	326.48
2000:06:08	13.35	21.90	29.05	18.86	27.77	25.09	21.65	326.96
2000:06:09	NA	NA	NA	NA	28.02	NA	21.71	324.53
2000:06:12	13.56	21.90	28.84	18.55	28.13	25.19	21.65	329.19
2000:06:13	13.56	21.91	29.31	19.07	27.97	25.41	21.65	329.19
2000:06:14	13.41	21.91	29.41	19.07	27.72	25.35	21.65	330.65
2000:06:15	13.72	21.84	29.41	18.86	28.27	25.78	22.33	327.73
2000:06:16	13.56	22.30	29.07	18.97	28	25.83	22.12	331.64
2000:06:19	13.41	22.63	29.31	19.12	28.18	25.72	22.12	330.61
2000:06:20	13.46	23.02	29.31	19.28	28.13	25.25	21.76	329.77
2000:06:21	13.46	23.63	29.05	19.62	28.18	25.13	21.76	328.77
2000:06:22	13.25	23.49	28.63	19.64	27.6	24.6	21.34	328.14
2000:06:23	13.25	22.88	28.32	19.23	27.92	24.49	20.92	323.23
2000:06:26	13.51	23.16	28.22	19.70	28.18	24.33	20.92	322.73
2000:06:27	13.2	22.41	27.38	19.49	27.45	24.06	20.87	324.2
2000:06:28	13.35	23.02	27.81	19.90	28.2	24.81	21.18	318.95
2000:06:29	14.24	22.84	28.63	19.02	28.59	24.54	20.81	323.19
2000:06:30	13.37	21.80	27.48	18.65	26.88	22.73	20.13	319.6
2000:07:03	14.14	22.16	28.26	18.76	27.45	23.8	20.97	312.96
2000:07:04	NA	NA	NA	NA	NA	NA	NA	NA
2000:07:05	14.14	21.91	27.79	18.76	27.3	23.9	20.50	320.95
2000:07:06	14.03	22.13	28	18.60	26.77	23.74	21.19	320.35
2000:07:07	14.14	21.80	27.58	18.71	26.77	23.74	20.81	324.04
2000:07:10	14.14	22.20	27.68	18.45	27.14	23.96	21.19	325.01
2000:07:11	14.19	22.81	28.15	18.97	27.35	24.22	21.24	326.88
2000:07:12	14.35	23.06	28.1	18.55	27.09	24.81	21.40	327.44
2000:07:13	14.3	22.91	27.73	18.39	26.93	24.6	20.97	328.89
2000:07:14	14.72	22.84	27.79	18.86	26.98	24.01	21.40	328.86
2000:07:17	14.72	22.91	27.73	19.12	27.01	23.9	21.61	329.29
2000:07:18	14.82	22.45	27.73	19.59	26.88	24.01	21.29	328.64
2000:07:19	14.3	22.41	27.94	19.90	26.77	23.9	21.08	327.16
2000:07:20	14.77	22.27	28.68	19.85	27.24	24.06	21.35	327.86
2000:07:21	14.4	21.95	28.73	19.49	26.88	23.58	20.81	328.92
2000:07:24	14.35	21.88	28.52	18.76	26.57	23.53	20.44	327.01
2000:07:25	14.61	22.16	28.79	19.17	26.88	23.53	20.92	323.44
2000:07:26	14.82	22.45	28.73	18.65	26.2	24.01	20.71	326.02
2000:07:27	15.13	22.38	29.63	18.59	26.31	23.85	20.60	324.59
2000:07:28	14.93	22.09	29.21	18.81	26.41	23.47	20.55	322.4
2000:07:31	15.13	22.84	29.21	19.23	26.31	24.28	20.86	318.88
2000:08:01	15.19	22.95	30.1	19.12	26.57	24.28	21.77	320.88
2000:08:02	15.5	23.16	30.79	19.76	26.57	24.28	21.98	322.93
2000:08:03	15.46	23.67	31.57	19.65	26.72	24.12	21.92	325.94
2000:08:04	15.55	23.67	31.89	19.44	27.35	24.17	21.98	329.01
2000:08:07	15.62	23.88	32.06	19.60	27.83	24.5	22.25	330.75
2000:08:08	15.55	23.70	31.94	19.97	27.97	24.49	22.20	335.16
2000:08:09	15.4	23.59	31.68	19.92	27.86	24.49	21.92	335.26
2000:08:10	15.41	23.49	31.85	19.86	28.04	24.61	21.71	333.08
2000:08:11	15.71	23.59	32.42	19.55	28.23	25.24	22.20	333.15
2000:08:14	16.13	24.27	32.79	20.02	28.54	25.45	22.67	336.48
2000:08:15	15.71	24.24	32.94	19.97	28.9	25.19	22.30	338.4
2000:08:16	16.26	24.70	32.84	19.97	28.69	25.03	22.51	338.92
2000:08:17	16.31	24.67	32.73	19.76	28.69	25.08	22.30	339.26
2000:08:18	16.47	24.45	32.36	19.39	28.54	25.08	21.92	339.68

DATE	ATG	NJR	GAS	NWN	PGL	PNY	WGL	Index
2000:08:21	16.47	23.95	32.05	19.39	27.92	24.65	21.82	338.49
2000:08:22	16.37	23.99	31.79	19.39	27.81	24.86	21.61	336.12
2000:08:23	16.37	23.88	31.94	19.18	27.4	24.76	21.71	NA
2000:08:24	16.21	23.45	31.26	19.12	27.45	24.6	21.66	334.35
2000:08:25	16.26	23.13	31.57	19.02	27.55	24.38	21.66	333.18
2000:08:28	NA	NA	NA	NA	27.76	NA	21.82	332.8
2000:08:29	NA	NA	NA	NA	27.6	NA	21.82	334.19
2000:08:30	16.15	22.88	31.52	18.86	27.55	23.1	21.77	NA
2000:08:31	16.1	22.91	31.06	19.44	26.98	23.69	21.45	333.75
2000:09:01	16.63	22.91	31.21	19.33	27.14	23.47	22.14	336.52
2000:09:04	NA	NA	NA	NA	NA	NA	NA	NA
2000:09:05	16.63	22.81	30.84	19.28	26.93	23.42	22.03	339.86
2000:09:06	16.74	22.84	30.58	19.02	27.4	23.96	22.20	341.98
2000:09:07	16.9	23.09	31.05	19.55	27.55	24.54	22.67	343.58
2000:09:08	16.82	23.31	32.5	19.62	27.74	25.11	22.98	345.51
2000:09:11	17.02	23.70	32.75	20.25	28.18	25.79	23.04	348.26
2000:09:12	17.06	23.74	32.63	20.55	28.43	25.83	22.98	351.32
2000:09:13	17.27	23.97	31.73	20.50	28.64	25.99	22.93	351.88
2000:09:14	17.11	23.68	31.15	20.23	28.23	25.61	22.77	351.45
2000:09:15	17.23	23.82	31.9	20.67	28.13	26.43	22.77	350.11
2000:09:18	17.11	23.49	31.79	20.39	27.92	25.99	22.83	350.96
2000:09:19	17.16	22.84	30.73	19.70	27.5	25.13	22.67	345.59
2000:09:20	17.11	23.09	30.89	19.97	27.87	25.61	22.83	340.28
2000:09:21	16.52	22.73	30.21	19.33	26.97	24.64	22.35	336.23
2000:09:22	16.58	23.06	30.21	19.02	26.81	25.12	22.20	332.13
2000:09:25	16.31	22.84	29.68	19.12	26.76	24.53	21.77	336.27
2000:09:26	16.79	22.88	30.73	19.23	27.6	25.23	22.35	335.31
2000:09:27	16.9	23.17	30.61	19.28	27.87	25.45	22.67	337.85
2000:09:28	17	23.93	30.87	19.44	28.45	26.42	22.93	339.67
2000:09:29	17.07	23.64	30.83	19.24	28.14	26.54	22.77	343.55
2000:10:02	16.63	23.82	30.45	19.39	27.98	25.94	22.72	344.85
2000:10:03	16.47	23.42	29.92	19.39	27.39	25.66	22.56	343.07
2000:10:04	16.42	23.02	29.17	19.02	27.08	25.83	22.56	338.97
2000:10:05	16.37	22.98	28.74	19.23	27.13	25.45	22.67	337.36
2000:10:06	16.47	22.69	28.58	18.96	26.81	25.45	22.35	335.2
2000:10:09	16.74	22.77	28.53	19.28	27.18	25.56	22.29	334.76
2000:10:10	16.52	22.40	27.73	18.91	27.13	25.29	22.18	334.68
2000:10:11	17	22.44	27.89	18.81	27.23	25.29	21.97	335.05
2000:10:12	16.95	22.69	27.95	19.18	27.29	25.18	22.08	332.11
2000:10:13	17.06	22.73	28.11	19.23	27.39	25.02	22.03	328.41
2000:10:16	17.16	22.77	28.42	19.39	28.29	25.45	22.08	336.07
2000:10:17	17.32	22.62	28.21	19.02	27.82	25.45	22.24	335.08
2000:10:18	17.27	22.66	27.68	19.18	27.18	25.18	22.18	330.74
2000:10:19	17.43	22.62	27.63	18.91	27.39	24.91	21.92	326.27
2000:10:20	17.43	22.84	28.32	19.39	27.55	25.07	22.03	330.69
2000:10:23	17.27	22.73	28.32	19.60	27.93	24.96	21.92	330.51
2000:10:24	17.06	22.48	28.53	19.39	27.5	24.74	21.75	331.89
2000:10:25	17.06	21.93	28.8	18.75	27.34	24.85	21.60	332.54
2000:10:26	17.27	22.48	29.22	19.33	27.71	25.12	21.75	326.46
2000:10:27	17.59	22.48	29.7	19.60	28.19	25.45	22.03	326.56
2000:10:30	17.48	22.77	29.49	19.60	28.45	25.88	22.24	332.64
2000:10:31	17.32	23.24	30.08	20.08	28.98	26.42	21.86	337.93
2000:11:01	17.59	22.91	30.45	19.65	29.29	26.21	22.99	341.82
2000:11:02	17.8	22.80	30.55	19.49	29.4	26.15	23.42	342.5
2000:11:03	17.22	22.73	30.23	19.71	28.98	25.56	22.89	340.72

DATE	ATG	NJR	GAS	NWN	PGL	PNY	WGL	Index
2000:11:06	17.27	22.69	30.39	19.60	29.45	25.66	22.56	338.52
2000:11:07	17.22	22.73	29.81	19.65	29.34	25.5	22.35	337.06
2000:11:08	17.37	22.55	30.23	19.87	30.34	25.66	22.56	337.49
2000:11:09	17.32	22.80	30.02	19.81	30.34	26.31	22.51	337.22
2000:11:10	17.16	22.80	29.86	19.87	30.45	25.88	22.18	335.9
2000:11:13	17.53	22.88	30.13	19.97	31.09	26.31	22.56	332.91
2000:11:14	17.69	22.91	30.29	20.24	31.72	26.31	22.35	334.26
2000:11:15	17.98	22.95	30.55	20.94	32.19	26.37	23.20	335.91
2000:11:16	18.03	23.24	31.3	20.40	32.87	26.42	22.94	337.5
2000:11:17	18.3	23.38	31.94	21.05	34.04	27.56	23.37	338.31
2000:11:20	18.84	23.71	32.47	20.83	34.4	27.83	23.74	340.23
2000:11:21	19.27	23.57	33	21.10	35.98	28.26	23.96	338.6
2000:11:22	19.16	23.64	32.63	21.15	34.56	28.48	23.85	338.21
2000:11:23	NA	NA	NA	NA	NA	NA	NA	NA
2000:11:24	19.38	23.93	33.11	21.21	35.24	28.75	23.96	335.23
2000:11:27	19.06	23.68	33	20.72	34.67	28.64	24.06	338.82
2000:11:28	19.49	23.71	33.43	20.99	35.56	29.24	24.06	337.59
2000:11:29	19.6	23.86	33.16	21.05	35.35	29.13	24.01	335.97
2000:11:30	19.38	23.42	32.84	20.56	34.67	28.64	23.74	336.76
2000:12:01	19.33	23.64	32.95	20.83	35.19	29.18	24.33	334.4
2000:12:04	19.16	23.57	33.54	20.62	35.14	28.91	24.01	336.49
2000:12:05	19.33	23.86	33.16	20.56	35.72	28.64	24.06	336.3
2000:12:06	18.95	23.53	33.38	20.89	35.93	28.37	24.06	338.98
2000:12:07	19.16	23.78	33.48	21.15	36.08	28.86	24.65	337.63
2000:12:08	19.7	24.33	33.85	21.37	38.09	29.18	26.15	337.96
2000:12:11	19.49	24.51	33.91	22.01	36.88	30.1	25.13	342.28
2000:12:12	19.27	24.15	34.01	21.15	37.46	29.73	24.87	344.39
2000:12:13	19.16	24.28	34.07	21.69	37.46	30	24.75	343
2000:12:14	19	24.10	33.69	21.80	36.83	30.05	24.44	344.27
2000:12:15	18.79	24.17	33.22	22.44	35.82	30.59	24.01	340.54
2000:12:18	19.06	24.83	33.38	22.55	37.56	31.51	24.81	339.02
2000:12:19	19.06	24.83	33.91	22.55	37.2	31.73	24.97	342.4
2000:12:20	18.63	24.46	33.54	22.33	35.97	31.56	24.70	340.98
2000:12:21	18.73	24.58	34.23	22.60	36.61	31.67	24.92	337
2000:12:22	18.9	24.80	34.44	22.65	37.35	32.05	25.46	336
2000:12:25	NA	NA	NA	NA	NA	NA	NA	NA
2000:12:26	19.33	25.17	35.88	22.92	38.42	33.53	26.10	340.16
2000:12:27	19.7	26.09	36.02	23.24	38.69	33.91	26.53	343.99
2000:12:28	19.81	26.24	37.47	23.24	39.7	34.46	26.96	347.2
2000:12:29	19	25.57	37.15	22.71	38.15	33.42	26.10	350.03
2001:01:01	NA	NA	NA	NA	NA	NA	NA	NA
2001:01:02	18.79	24.54	34.89	22.17	36.56	32.16	25.03	348.32
2001:01:03	18.79	25.17	34.51	22.76	36.4	31.99	25.24	339.66
2001:01:04	17.71	23.84	32.52	21.53	33.3	30.08	23.74	343.37
2001:01:05	17.66	23.65	33.01	21.42	33.73	30.19	23.90	330.2
2001:01:08	17.87	23.61	33.49	21.58	34.05	30.74	24.23	326.32
2001:01:09	17.76	23.50	33.28	21.26	33.2	30.79	24.23	328.83
2001:01:10	17.82	23.61	33.28	21.47	32.87	30.9	25.03	330.06
2001:01:11	17.66	23.39	32.04	21.21	32.08	30.41	24.38	334.39
2001:01:12	17.76	23.21	32.2	21.05	32.08	29.86	24.33	329.86
2001:01:15	NA	NA	NA	NA	NA	NA	NA	NA
2001:01:16	17.5	23.10	31.99	21.31	31.33	30.24	23.95	332.09
2001:01:17	17.12	22.62	32.42	20.94	31.23	29.75	24.01	330.63
2001:01:18	17.28	22.58	31.99	20.99	31.17	29.86	24.06	329.86
2001:01:19	17.55	22.17	31.99	20.99	31.12	29.37	23.68	332.83

DATE	ATG	NJR	GAS	NWN	PGL	PNY	WGL	Index
2001:01:22	17.5	22.47	32.52	20.94	31.33	29.2	23.63	333.26
2001:01:23	17.82	23.06	32.42	21.69	31.81	28.88	24.55	332.93
2001:01:24	18.14	23.10	33.06	21.31	31.97	30.13	24.66	336.64
2001:01:25	17.98	22.99	32.58	20.94	32.29	30.08	24.44	337.62
2001:01:26	17.87	22.73	31.83	21.31	31.97	29.48	24.28	337.89
2001:01:29	17.99	22.88	32.51	21.08	32.29	29.97	24.63	336.73
2001:01:30	17.86	22.77	31.58	21.27	32.2	30.1	24.22	340.87
2001:01:31	17.66	22.03	30.67	20.83	31.32	29.32	24.11	341.74
2001:02:01	17.46	22.35	31.94	21.18	31.46	29.53	24.29	336.74
2001:02:02	17.33	22.14	31.55	21.08	31.49	29.63	24.02	336.01
2001:02:05	17.61	22.32	32.02	21.30	31.71	29.49	24.32	332.37
2001:02:06	17.87	22.52	32.37	21.69	32.06	29.43	24.37	334.28
2001:02:07	17.9	22.62	32.63	21.68	32.87	29.36	24.37	335.01
2001:02:08	18.42	22.48	33.16	21.86	33.24	29.35	24.06	333.85
2001:02:09	18.23	22.76	33.45	22.12	33.99	29.39	24.01	333.51
2001:02:12	18.6	22.85	33.12	22.95	33.81	29.58	24.25	333.61
2001:02:13	18.53	22.94	33	22.60	33.77	29.75	24.54	337.38
2001:02:14	18.62	22.88	32.79	22.47	33.6	29.01	24.37	334.8
2001:02:15	18.84	22.99	32.67	22.45	33.33	29.05	24.28	332.87
2001:02:16	18.96	22.92	33.16	22.12	33.76	29.18	24.24	332.11
2001:02:19	NA	NA	NA	NA	NA	NA	NA	NA
2001:02:20	18.75	22.87	32.73	21.61	33.62	28.76	24.02	329.68
2001:02:21	18.73	22.85	33.18	21.38	33.97	28.75	23.76	328.16
2001:02:22	18.49	22.75	32.71	21.19	33.9	28.66	23.59	326.38
2001:02:23	18.49	22.85	32.42	20.74	33.77	28.48	23.58	327.58
2001:02:26	18.73	22.70	32.41	21.00	34.03	27.91	23.49	325.95
2001:02:27	18.47	22.74	32.35	21.39	33.71	28.13	23.55	331.39
2001:02:28	18.87	22.62	31.83	21.21	33.38	28.06	23.74	329.26
2001:03:01	18.47	23.06	31.83	21.00	33.98	28.24	23.73	328.39
2001:03:02	18.85	24.10	32.42	20.71	34.58	28.35	23.68	327.42
2001:03:05	18.87	23.95	32.09	20.69	34.32	28.51	23.89	328.69
2001:03:06	18.86	23.65	32.01	20.82	34.55	28.48	23.74	NA
2001:03:07	19.02	23.95	32.45	21.17	34.56	28.97	23.85	330.54
2001:03:08	19.12	23.82	32.46	20.91	35.01	29.1	23.94	331.33
2001:03:09	18.93	23.71	32.7	20.95	35.25	29.36	23.76	331.66
2001:03:12	18.64	23.50	32.67	20.84	35	29.24	23.50	328.5
2001:03:13	18.8	24.08	32.26	20.98	34.61	29.66	23.50	322.6
2001:03:14	18.28	23.66	31.67	20.92	33.8	29.53	23.44	324.41
2001:03:15	18.45	23.72	32.09	20.93	34.1	29.58	23.32	317.92
2001:03:16	18.31	23.72	31.69	20.56	33.57	29.53	23.00	320.65
2001:03:19	18.75	24.06	32.02	20.75	34.11	30.01	23.59	315.41
2001:03:20	18.63	23.88	32.07	20.81	33.62	30.12	23.45	318.73
2001:03:21	18.25	23.71	31.89	20.56	33.29	29.87	23.28	314.63
2001:03:22	17.77	23.06	31.17	20.17	32.82	29.39	23.03	309.58
2001:03:23	17.94	22.96	30.97	20.00	32.75	29.12	22.93	302.43
2001:03:26	18.23	23.93	31.68	20.40	33.45	30	23.41	305.01
2001:03:27	18.71	24.09	31.86	20.82	33.2	30.09	23.54	313.58
2001:03:28	18.66	23.63	31.72	20.39	32.98	30.05	23.18	320.19
2001:03:29	18.54	23.54	31.82	20.30	33.03	30.18	23.35	315.22
2001:03:30	19.11	24.74	32.44	20.82	33.57	31.42	23.98	317.98
2001:04:02	18.85	24.64	32.36	20.82	33.65	31.51	23.78	320.97
2001:04:03	19.07	24.58	32.01	20.52	33.8	31.2	23.55	318.08
2001:04:04	18.95	24.68	32.01	20.69	34.07	30.89	23.68	311
2001:04:05	19.32	24.95	32.8	20.22	34.46	31.15	23.91	310.82
2001:04:06	18.8	24.50	31.85	19.91	33.2	30.84	23.24	317.58

DATE	ATG	NJR	GAS	NWN	PGL	PNY	WGL	Index
2001:04:09	19.12	24.90	32.99	20.15	34.62	31.42	23.96	307.1
2001:04:10	19.56	24.94	33.28	20.48	34.61	31.61	24.55	313.2
2001:04:11	19.17	24.74	33.08	20.09	34.29	31.26	24.33	322.93
2001:04:12	19.35	24.98	33.39	20.20	34.44	31.85	24.49	321.51
2001:04:13	NA	NA	NA	NA	NA	NA	NA	NA
2001:04:16	19.22	25.22	33.86	20.21	34.65	31.75	24.56	322.95
2001:04:17	19.41	25.79	34.55	20.21	35.38	32.12	25.06	322.38
2001:04:18	18.88	25.45	34.25	20.17	34.71	31.24	25.02	325.08
2001:04:19	18.91	25.27	33.71	19.95	33.64	31.15	24.88	325.43
2001:04:20	18.51	24.68	33.16	19.78	33.34	30.49	24.55	325.43
2001:04:23	18.72	24.94	33.58	19.52	33.75	30.77	24.56	321.61
2001:04:24	18.93	25.07	33.8	19.61	34.02	30.93	24.69	321.12
2001:04:25	19.33	25.09	34.25	19.94	34.48	31.16	25.14	322.84
2001:04:26	19.63	25.82	34.35	20.05	34.35	31.42	24.98	325.94
2001:04:27	19.63	25.84	34.2	20.01	34.76	31.51	24.98	329.05
2001:04:30	19.7	25.78	34.11	NA	34.33	31.11	25.09	330.09
2001:05:01	19.91	26.23	34.05	19.26	34.54	31.33	25.35	331.21
2001:05:02	19.58	26.01	33.32	19.31	34.15	30.92	24.83	332.4
2001:05:03	19.63	25.72	32.7	19.13	33.59	30.32	24.77	331.22
2001:05:04	20.06	25.70	33.2	19.35	34.2	30.97	25.16	326.51
2001:05:07	19.57	25.78	33.42	NA	34.3	30.41	25.28	330.83
2001:05:08	20.08	25.96	32.94	19.74	34.7	31.24	25.31	329.38
2001:05:09	20.71	26.14	33.62	19.96	34.98	31.34	25.29	327.58
2001:05:10	20.79	26.16	33.58	19.94	35.35	31.33	25.17	328.19
2001:05:11	20.8	25.99	33.64	19.83	35.22	31.29	25.44	328.47
2001:05:14	20.94	26.10	33.71	19.98	35.1	31.59	25.58	328.28
2001:05:15	20.66	26.18	33.75	19.96	35.16	31.55	25.66	329.59
2001:05:16	20.85	26.13	34.03	20.10	35.18	31.82	25.42	329.59
2001:05:17	20.47	26.26	33.7	20.23	34.8	31.56	25.61	333.88
2001:05:18	20.96	26.43	34.12	20.65	34.96	31.79	25.53	334.58
2001:05:21	21.18	26.97	34.05	20.66	35.07	31.84	25.60	334.92
2001:05:22	21.16	27.41	33.85	20.23	35.2	31.68	25.41	337.66
2001:05:23	21.02	27.27	33.74	20.54	34.87	31.68	25.10	337.15
2001:05:24	21.22	27.26	33.71	21.03	34.97	31.64	25.08	334.42
2001:05:25	21.17	27.26	33.35	20.98	34.49	31.65	24.90	335.22
2001:05:28	NA	NA	NA	NA	NA	NA	NA	NA
2001:05:29	20.9	27.06	33.4	21.02	34.38	31.33	24.68	332.23
2001:05:30	20.72	27.06	33.52	21.02	34.32	31.85	24.74	328.6
2001:05:31	20.73	26.84	33.77	21.02	34.02	31.41	24.55	324.84
2001:06:01	20.57	26.90	33.43	21.06	33.93	31.17	24.60	327.17
2001:06:04	21.26	27.08	33.71	21.53	34.28	30.84	24.82	325.36
2001:06:05	20.89	27.63	33.51	21.88	34.62	31.37	24.81	326.36
2001:06:06	20.51	27.36	33.39	21.55	35.01	31.24	24.45	327.17
2001:06:07	20.29	26.97	33.26	21.46	35	31.05	24.14	323.91
2001:06:08	20.47	27.08	33.55	21.44	35.2	31.06	24.12	322.6
2001:06:11	20.68	26.80	33.78	21.28	35.72	31.33	23.95	321.97
2001:06:12	20.82	27.44	33.98	21.64	36.27	31.66	23.98	322.95
2001:06:13	20.43	27.32	33.77	21.64	35.79	31.53	23.87	324.06
2001:06:14	20.19	26.80	33.51	21.46	34.91	30.66	23.46	319.74
2001:06:15	20.21	27.03	33.71	21.23	35.42	31.13	23.89	313.42
2001:06:18	19.95	26.78	33.62	21.28	35.15	30.84	23.30	313.85
2001:06:19	20.08	26.57	33.77	21.27	35.79	30.85	23.22	307.75
2001:06:20	20.28	26.54	33.79	21.77	35.81	31.27	23.45	307.12
2001:06:21	20.12	26.81	33.54	21.94	35.03	31.19	23.59	308.15
2001:06:22	20.25	26.31	33.39	21.55	34.59	30.69	23.55	305.78

DATE	ATG	NJR	GAS	NWN	PGL	PNY	WGL	Index
2001:06:25	19.94	25.87	33.34	21.28	34.19	30.25	23.38	305.67
2001:06:26	20.58	26.53	34.24	22.07	35.15	30.49	23.68	304.43
2001:06:27	20.77	26.87	34.29	21.71	35.38	30.96	23.95	307.74
2001:06:28	21.09	27.15	34.09	21.72	35.3	31.01	24.07	310
2001:06:29	20.96	27.58	34.32	21.90	35.15	31.79	23.78	312.5
2001:07:02	20.93	27.52	34.55	21.93	35.36	31.5	24.11	314.38
2001:07:03	20.92	27.52	33.99	21.86	34.97	31.63	24.23	315.77
2001:07:04	NA	NA	NA	NA	NA	NA	NA	NA
2001:07:05	20.85	27.33	34.06	21.84	34.97	31.72	24.52	315.71
2001:07:06	20.87	27.19	33.88	21.69	34.41	31.71	24.20	314.82
2001:07:09	20.73	26.93	33.54	21.65	33.75	31.22	24.12	313.24
2001:07:10	20.78	26.54	32.88	21.59	33.17	31.01	23.95	312.8
2001:07:11	20.73	26.42	32.63	21.50	32.84	30.62	23.77	312.28
2001:07:12	20.72	26.54	32.48	21.35	32.65	30.58	23.77	309.07
2001:07:13	20.53	26.67	32.51	21.33	32.26	30.2	23.93	309.92
2001:07:16	20.58	26.47	31.96	21.13	32.03	30.26	23.92	309.09
2001:07:17	20.82	26.80	31.47	21.68	31.56	30.51	23.97	308.06
2001:07:18	20.66	26.51	31.38	21.34	31.38	30.2	23.64	308.45
2001:07:19	20.65	26.64	31.16	21.25	31.35	30.43	23.55	305.06
2001:07:20	20.58	26.70	31.38	21.32	31.81	30.38	23.71	305.42
2001:07:23	20.1	25.93	30.85	21.02	31.14	29.53	23.10	300.93
2001:07:24	19.86	25.25	30.04	20.74	30.14	28.85	22.73	294.46
2001:07:25	20.12	25.56	30.9	21.13	31.41	29.75	23.46	287.23
2001:07:26	20.91	26.42	32.38	21.42	32.48	30.57	24.40	293.03
2001:07:27	21.06	26.37	32.67	21.50	33.58	30.41	24.60	297.45
2001:07:30	21.26	26.94	33.22	21.74	33.43	30.43	24.83	296.63
2001:07:31	21.18	26.51	32.69	21.45	33.28	30.43	24.69	298.09
2001:08:01	21.13	26.73	32.66	21.44	33.02	30.3	24.84	297.81
2001:08:02	21.07	26.72	33.14	21.59	33.06	30.29	24.39	299.08
2001:08:03	21.17	26.61	33.2	21.60	33.23	30	24.03	299.56
2001:08:06	21.09	26.32	33.07	21.51	32.8	29.41	24.01	299.96
2001:08:07	21.25	26.78	33.03	21.51	32.39	28.87	24.09	295.46
2001:08:08	21.18	26.18	32.58	21.60	32.12	28.66	23.83	296.36
2001:08:09	21.26	26.45	33.12	21.74	32.3	29.52	24.10	291.73
2001:08:10	21.55	26.72	33.43	22.04	32.96	29.53	24.51	293.5
2001:08:13	21.51	26.63	33.15	21.67	32.99	29.58	24.24	294.93
2001:08:14	21.6	26.79	33.46	21.82	33.4	29.62	24.27	294.34
2001:08:15	21.64	26.37	33.74	22.09	33.39	29.71	24.24	295.52
2001:08:16	21.28	27.00	34.12	22.18	33.98	30.26	24.47	NA
2001:08:17	21.11	27.03	34.24	22.28	34.2	30.29	24.35	294.54
2001:08:20	20.88	27.17	34.14	22.25	34.62	30.45	24.37	292.17
2001:08:21	20.56	27.03	33.59	22.27	34.06	29.9	24.12	294.91
2001:08:22	20.31	27.16	33.8	22.36	34.33	30.19	24.25	292.56
2001:08:23	20.37	26.97	34.07	22.22	34.68	30.25	24.24	293.13
2001:08:24	20.35	27.43	34.33	22.63	34.71	30.26	24.40	291.32
2001:08:27	19.78	27.80	34.32	22.36	34.45	30.16	24.19	294.14
2001:08:28	19.33	27.47	34.26	22.40	34.33	29.91	24.22	293.71
2001:08:29	19.32	27.74	34.16	22.57	34.26	29.97	24.23	291.87
2001:08:30	19.12	27.55	34.17	22.40	34.32	29.66	24.01	291.24
2001:08:31	19	27.45	34.12	22.27	34.36	29.13	23.96	289.36
2001:09:03	NA	NA	NA	NA	NA	NA	NA	NA
2001:09:04	19.56	27.56	34.44	22.36	34.54	30.11	24.27	289.76
2001:09:05	19.46	27.70	34.42	22.80	34.65	29.9	24.08	290.02
2001:09:06	19.14	27.47	34.47	22.67	34.74	30.17	23.94	288.11
2001:09:07	19.09	27.50	34.43	22.40	34.75	30.33	23.97	284.43

DATE	ATG	NJR	GAS	NWN	PGL	PNY	WGL	Index
2001:09:10	18.86	26.84	34.47	21.93	34.57	30.15	23.88	281.9
2001:09:11	NA	NA	NA	NA	NA	NA	NA	NA
2001:09:12	NA	NA	NA	NA	NA	NA	NA	NA
2001:09:13	NA	NA	NA	NA	NA	NA	NA	NA
2001:09:14	NA	NA	NA	NA	NA	NA	NA	NA
2001:09:17	18.6	26.94	34.77	21.55	34.01	29.31	23.41	280.85
2001:09:18	18.69	26.94	34.62	21.73	34.06	29.26	23.95	273.99
2001:09:19	18.56	26.57	34.39	20.51	34.07	28.5	23.53	273.37
2001:09:20	17.78	26.24	34.33	20.49	33.67	27.4	23.10	270.39
2001:09:21	17.58	25.96	33.69	20.58	32.96	27.45	22.98	266.94
2001:09:24	17.49	26.08	33.5	21.38	32.73	27.54	22.92	264.13
2001:09:25	17.57	26.30	33.88	21.02	34.18	27.22	23.06	267.39
2001:09:26	17.1	26.23	33.35	21.05	33.78	27.09	23.24	266.26
2001:09:27	17.22	26.26	33.65	20.93	34.42	27.44	23.49	261.7
2001:09:28	17.82	26.97	34.51	20.84	35.22	28.21	23.85	260.57
2001:10:01	17.84	26.60	34.71	20.58	34.98	27.27	23.70	266.62
2001:10:02	18.2	27.24	34.91	21.18	36.07	28.16	24.08	265.18
2001:10:03	18.72	27.85	34.86	22.23	36.8	28.34	24.48	NA
2001:10:04	18.67	28.58	34.94	23.15	37.08	28.94	24.79	275.44
2001:10:05	18.76	28.22	34.66	20.85	37.15	28.63	24.67	273.92
2001:10:08	18.76	28.34	34.78	20.48	37.19	28.08	24.10	273.65
2001:10:09	18.47	27.85	34.56	20.27	36.85	27.99	23.95	272.15
2001:10:10	18.96	27.94	35.1	21.38	37.76	28.71	24.93	NA
2001:10:11	18.98	28.44	35.12	21.10	37.08	28.17	24.78	273.13
2001:10:12	18.86	28.05	34.5	21.38	36.71	28.13	24.47	274.41
2001:10:15	18.83	27.94	34.39	21.39	36.54	27.31	24.49	273.49
2001:10:16	19.08	27.93	35.13	21.53	37.42	28.03	25.12	273.2
2001:10:17	18.85	27.86	35.51	21.58	36.55	28.17	24.90	276.28
2001:10:18	18.21	27.16	34.56	21.07	35.38	27.57	24.12	273.9
2001:10:19	18.58	27.63	35.66	21.11	36.36	28.46	24.66	269.71
2001:10:22	18.75	27.64	35.92	21.42	36.46	28.85	24.85	271.99
2001:10:23	18.38	28.37	35.42	21.41	35.1	28.05	24.27	271.13
2001:10:24	18.1	28.06	34.62	21.39	34.6	27.75	24.32	268.64
2001:10:25	18.33	28.00	34.85	21.29	35.06	28.62	25.00	266.2
2001:10:26	18.4	27.83	34.69	21.37	34.88	28.62	24.90	269.47
2001:10:29	18.35	27.67	34.65	21.36	34.82	28.22	24.71	269
2001:10:30	18.18	27.42	34.55	21.44	34.17	27.81	24.43	267.06
2001:10:31	18.42	27.45	34.63	21.57	33.92	28.8	24.28	263.65
2001:11:01	18.69	27.98	34.55	21.71	34.25	28.26	24.69	264.97
2001:11:02	18.7	27.58	33.9	21.54	33.85	27.74	24.33	266.43
2001:11:05	19.04	28.37	34.63	21.62	34.67	28.44	24.64	264.02
2001:11:06	19.39	28.31	34.7	21.66	34.91	29.3	24.78	268.86
2001:11:07	19.43	27.88	34.69	21.68	34.99	29.64	24.75	270.49
2001:11:08	19.46	27.97	34.82	21.89	34.82	29.71	24.67	268.21
2001:11:09	19.63	27.84	34.74	22.03	34.84	29.66	24.84	270.84
2001:11:12	19.71	28.13	34.95	22.05	34.88	30.15	25.02	271.5
2001:11:13	19.72	28.46	34.42	22.33	34.68	30.06	24.75	271.72
2001:11:14	19.66	28.46	34.45	21.99	34.69	30.19	24.94	273.72
2001:11:15	19.18	28.37	34.01	21.71	33.82	29.9	24.59	273.47
2001:11:16	19.15	28.74	34.69	21.89	34.13	30.11	24.84	271.84
2001:11:19	19.19	29.32	34.55	22.21	34.44	30.01	24.92	273.09
2001:11:20	19.55	29.60	34.72	22.45	34.99	30.8	24.97	274.47
2001:11:21	18.99	29.38	34.41	22.16	34.75	30.78	24.58	274.85
2001:11:22	NA	NA	NA	NA	NA	NA	NA	NA
2001:11:23	19.46	29.64	34.89	22.56	35.37	31.52	25.10	274.85

DATE	ATG	NJR	GAS	NWN	PGL	PNY	WGL	Index
2001:11:26	19.04	29.53	35	22.03	35.44	31.24	25.06	274.97
2001:11:27	19.06	28.92	34.99	21.97	35.37	30.75	25.04	275.86
2001:11:28	19.06	28.67	34.77	21.55	34.68	30.16	24.73	275.07
2001:11:29	19.87	28.78	34.94	21.94	35.05	30.8	25.05	270.04
2001:11:30	19.36	28.64	34.7	22.07	34.04	30.44	24.87	271.3
2001:12:03	19.72	28.48	34.91	21.59	33.74	29.98	24.71	NA
2001:12:04	19.85	28.83	35.2	22.10	34.2	30.98	25.11	NA
2001:12:05	19.73	28.69	35.25	22.20	34.13	30.66	25.02	NA
2001:12:06	19.91	28.52	34.89	22.38	33.18	30.22	25.08	271.95
2001:12:07	19.91	28.66	35.54	22.57	33.74	30.57	25.45	272.08
2001:12:10	19.83	28.14	35.31	22.57	32.73	30.21	25.10	273.5
2001:12:11	19.52	27.91	34.66	22.21	31.89	29.98	24.69	269.56
2001:12:12	19.37	27.85	34.82	22.12	32.44	29.76	24.64	265.98
2001:12:13	19.18	27.93	35.22	22.21	32.35	29.96	24.91	266.41
2001:12:14	19.32	28.18	35.49	22.57	32.78	30.8	25.12	264.69
2001:12:17	19.71	28.48	35.66	22.99	33.18	31.61	25.36	265.58
2001:12:18	19.69	29.14	36.36	22.93	33.64	32	25.58	266.74
2001:12:19	20.41	28.95	37.04	23.04	34.28	32.02	25.97	269.53
2001:12:20	20.15	28.92	36.82	22.80	33.97	32.01	25.96	271.51
2001:12:21	20.45	29.25	36.42	22.93	34.02	32.51	26.01	269.93
2001:12:24	20.49	29.16	36.87	23.10	33.91	32.74	26.28	271.24
2001:12:25	NA	NA	NA	NA	NA	NA	NA	NA
2001:12:26	20.57	29.22	37.1	23.44	34.47	33.24	26.42	272.3
2001:12:27	20.66	29.16	37.22	23.52	34.54	33.41	26.15	274.1
2001:12:28	20.92	29.06	37.3	23.33	34.44	33.18	26.14	275.84
2001:12:31	20.79	28.98	37.48	23.02	34.06	32.79	26.08	NA
2002:01:01	NA	NA	NA	NA	NA	NA	NA	NA
2002:01:02	20.48	28.73	37.47	23.65	34.22	32.05	26.18	276.25
2002:01:03	20.43	28.89	37.33	23.70	33.76	32.33	26.08	278.58
2002:01:04	20.59	28.76	37.26	23.89	34.02	32.46	25.93	279.02
2002:01:07	20.46	28.49	37.44	24.23	34.02	31.91	25.85	278.81
2002:01:08	20.14	28.45	37.21	24.69	33.39	31.55	25.45	277.08
2002:01:09	19.83	28.24	36.61	23.61	32.87	31.45	24.92	275.46
2002:01:10	19.97	28.66	36.89	23.92	33.52	31.5	25.01	273.19
2002:01:11	19.69	28.39	36.88	24.47	33.47	31.27	24.79	273.38
2002:01:14	19.33	28.24	36.89	23.86	33.53	31.14	24.62	271.44
2002:01:15	19.41	28.30	37.3	24.91	33.73	31.05	24.82	270.23
2002:01:16	19.18	28.12	36.85	24.40	33.69	31.27	24.73	271.89
2002:01:17	19.32	28.23	37	24.35	33.84	31.14	24.95	269.29
2002:01:18	19.2	27.99	37.09	23.85	33.68	30.91	24.71	269.73
2002:01:21	NA	NA	NA	NA	NA	NA	NA	NA
2002:01:22	19.15	27.43	36.57	23.92	33.19	30.44	24.50	267.08
2002:01:23	19.45	27.92	37.05	23.81	33.23	30.78	24.60	264.27
2002:01:24	19.42	28.05	37.19	23.65	32.92	30.64	24.39	266.32
2002:01:25	19.32	27.93	37.23	24.01	32.96	30.69	24.26	266.02
2002:01:28	19.17	27.74	36.45	23.60	32.57	31	24.06	265.72
2002:01:29	19.06	27.85	36.14	23.44	32.44	30.5	23.80	264.98
2002:01:30	19.46	28.22	36.6	23.65	33.19	31.06	24.18	260.96
2002:01:31	19.22	28.09	36.58	23.89	32.95	30.87	23.83	261.3
2002:02:01	NA	NA	NA	NA	NA	NA	23.82	262.22
2002:02:04	19.04	27.62	35.79	22.98	32.51	30.18	23.64	262.09
2002:02:05	19.11	27.67	36.35	22.89	32.26	29.9	23.59	258.5
2002:02:06	19.42	27.31	36.23	22.16	32.32	30.01	23.58	255.87
2002:02:07	19.48	27.18	36.15	22.16	31.98	30.14	23.54	251.46
2002:02:08	19.86	27.99	36.15	22.64	32.24	30.5	23.58	251.29

DATE	ATG	NJR	GAS	NWN	PGL	PNY	WGL	Index
2002:02:11	19.92	28.01	36.85	23.59	32.58	30.4	23.59	254.07
2002:02:12	20.12	28.02	36.81	23.80	32.46	30.52	23.73	254.61
2002:02:13	20.15	28.26	36.9	23.57	32.24	30.82	23.70	255.27
2002:02:14	20.01	28.45	37.04	23.44	32.26	31	23.78	255.93
2002:02:15	20.2	28.79	37.22	23.53	32.45	30.33	23.94	253.92
2002:02:18	NA	NA	NA	NA	NA	NA	NA	NA
2002:02:19	19.93	28.18	37.12	23.57	32.03	29.91	23.52	252.61
2002:02:20	20.16	28.50	37.38	24.27	32.52	30.08	23.88	249.31
2002:02:21	19.94	27.99	37.32	23.92	32.45	29.77	23.54	250.89
2002:02:22	20.49	28.40	37.76	24.41	33.09	29.47	24.11	248.13
2002:02:25	20.21	28.55	37.78	23.98	33.12	29.52	23.74	251.32
2002:02:26	20.57	28.58	38.03	24.03	33.34	29.98	24.28	251.22
2002:02:27	20.7	28.45	38.01	23.94	33.5	30.12	24.36	251.59
2002:02:28	20.34	28.23	37.67	24.07	33.36	29.31	24.22	253.75
2002:03:01	20.91	28.75	38.37	24.40	33.94	30.3	24.29	253.28
2002:03:04	21.12	28.65	38.78	24.40	34.33	30.63	24.37	256.96
2002:03:05	20.94	28.93	39.27	24.49	34.72	30.75	24.61	260.28
2002:03:06	21.25	29.17	39.29	24.87	35.1	31.37	24.94	261.57
2002:03:07	21.42	29.03	39.44	24.58	35.24	31.23	24.83	267.44
2002:03:08	21.27	28.79	39.11	24.57	34.84	31.11	24.59	266.98
2002:03:11	21.35	29.26	39.78	24.99	35.29	31.59	24.94	267.29
2002:03:12	21.45	28.83	39.3	24.69	35.03	31.44	24.66	267.81
2002:03:13	21.37	28.78	39.35	24.46	35.08	31.69	24.49	265.33
2002:03:14	21.21	29.26	39.49	24.91	35.11	31.51	24.53	263.74
2002:03:15	21.14	29.36	39.5	24.35	35.24	31.14	24.47	263.9
2002:03:18	21.17	28.96	39.73	24.62	35.41	31.55	24.13	264.26
2002:03:19	21.24	29.34	39.66	24.90	35.32	31.69	24.42	265.72
2002:03:20	21.06	28.46	39.66	24.45	35.24	31.82	24.16	265.66
2002:03:21	21.47	29.03	40.55	25.34	35.83	32.29	24.59	264.7
2002:03:22	21.32	28.34	40.51	25.22	35.37	31.73	24.22	268.78
2002:03:25	21.34	28.60	40.89	25.22	34.94	32.65	24.37	267.66
2002:03:26	21.49	28.79	41.11	25.49	35.6	33.35	24.24	NA
2002:03:27	21.63	28.79	41.46	25.85	36.21	33.31	24.49	266.14
2002:03:28	21.49	28.36	41.42	25.59	35.84	32.98	24.37	267.67
2002:03:29	NA	NA	NA	NA	NA	NA	NA	NA
2002:04:01	21.41	28.86	41.42	25.58	35.72	32.52	24.06	267.85
2002:04:02	21.37	29.43	42.02	25.72	35.56	33	24.33	265.61
2002:04:03	21.26	29.52	41.97	25.66	35.75	32.61	23.99	265.38
2002:04:04	21.39	29.40	41.92	25.68	35.51	32.94	24.12	264.67
2002:04:05	21.49	29.22	41.83	25.67	35.03	33.41	24.17	265.19
2002:04:08	21.75	29.31	41.95	25.76	35.12	33.98	24.55	263.3
2002:04:09	NA	NA	NA	NA	NA	NA	24.33	253.76
2002:04:10	22.15	29.60	42.13	26.68	35.95	34.01	24.87	261.33
2002:04:11	21.47	29.50	41.56	26.41	35.63	33.25	24.18	253.51
2002:04:12	21.61	29.99	41.71	27.37	35.74	34.08	24.74	258.94
2002:04:15	21.48	29.73	41.65	26.95	35.71	33.72	24.34	262.26
2002:04:16	22.04	30.67	42.63	27.14	36.22	35.16	24.98	260.49
2002:04:17	21.96	30.20	43.18	26.81	36.27	34.57	25.24	267.52
2002:04:18	22.13	29.97	43.73	26.91	36.25	34.57	25.45	268.52
2002:04:19	22.03	30.29	44.08	27.18	35.85	34.53	25.41	267.61
2002:04:22	21.86	30.48	43.64	27.06	35.9	34.28	25.37	266.79
2002:04:23	22.01	30.25	43.44	27.00	35.76	34.73	25.34	264.17
2002:04:24	21.55	29.86	43.12	26.91	35.15	34.21	24.81	263.75
2002:04:25	21.53	29.92	43.28	26.53	35.37	35.05	25.09	262.62
2002:04:26	21.07	29.59	42.53	26.19	35.04	34.19	24.61	262.23

DATE	ATG	NJR	GAS	NWN	PGL	PNY	WGL	Index
2002:04:29	21.6	29.75	42.48	26.23	35.27	34.74	24.96	258.3
2002:04:30	21.89	30.01	42.53	26.23	35.49	34.51	24.88	255.59
2002:05:01	21.48	29.97	42.63	26.28	35.41	34.33	24.93	258.2
2002:05:02	21.92	30.36	42.73	26.93	35.64	35.01	24.53	257.7
2002:05:03	21.92	30.13	42.65	27.27	35.59	34.76	24.26	256.96
2002:05:06	21.81	30.01	42.44	27.26	35.27	34.28	24.10	256.23
2002:05:07	21.51	29.92	42.56	27.34	35.07	34.34	23.86	253.99
2002:05:08	21.6	30.14	42.76	27.68	35.66	34.96	24.33	253.93
2002:05:09	21.44	29.64	42.43	27.16	35.26	33.91	24.11	257.98
2002:05:10	21.05	29.13	42.09	27.42	34.87	33.58	23.92	254.41
2002:05:13	21.23	29.36	42.53	27.29	35.35	32.97	24.16	248.97
2002:05:14	21.57	29.77	42.65	27.11	35.71	33.68	24.39	249.27
2002:05:15	21.7	29.86	42.66	27.39	35.86	33.93	24.34	252.06
2002:05:16	21.28	28.91	42.42	26.65	35.58	33.25	24.02	251.25
2002:05:17	21.41	28.98	42.66	26.60	35.72	32.87	24.13	247.91
2002:05:20	21.43	28.89	42.93	26.58	35.7	33.05	24.20	247.4
2002:05:21	21.18	28.94	43.04	26.46	35.57	32.89	24.11	248.51
2002:05:22	21.27	29.21	43.85	26.65	36.37	33.4	24.44	247.21
2002:05:23	21.34	29.25	44.36	27.43	36.72	33.44	24.74	249.88
2002:05:24	21.43	29.06	44.46	26.97	36.5	33.32	24.49	253.1
2002:05:27	NA	NA	NA	NA	NA	NA	NA	NA
2002:05:28	21.46	29.02	44.52	27.32	36.42	33.44	24.40	252.1
2002:05:29	21.23	29.08	43.93	27.25	35.93	33.13	24.42	251.59
2002:05:30	21.31	29.07	43.96	27.51	36.05	32.77	24.36	248.16
2002:05:31	21.18	28.61	43.7	27.02	35.84	33.26	24.45	247.29
2002:06:03	20.8	28.08	42.56	26.79	34.75	32.68	23.61	246.8
2002:06:04	20.83	28.65	42.93	26.79	35.2	32.5	24.19	240.74
2002:06:05	20.72	28.15	42.34	26.55	34.96	31.88	23.83	241.93
2002:06:06	20.11	27.95	41.94	25.87	34.71	31.35	22.94	239.31
2002:06:07	20.56	28.10	42.27	25.95	34.97	32.31	23.26	234.01
2002:06:10	20.55	28.15	42.64	25.87	35.24	32.49	23.32	236.15
2002:06:11	20.48	28.02	42.6	25.92	34.92	32.45	23.13	235.43
2002:06:12	20.71	27.49	43.16	26.23	35.31	32.91	23.30	233.17
2002:06:13	20.74	27.50	43.06	26.10	34.85	32.37	23.11	234.04
2002:06:14	20.69	27.41	42.73	25.86	34.85	32.72	23.11	232.54
2002:06:17	21.13	28.33	43.93	26.63	35.49	33.42	23.64	231.07
2002:06:18	21.23	28.41	43.84	26.83	35.49	33.47	23.44	235.24
2002:06:19	20.86	27.71	43.33	26.27	34.85	32.75	23.08	236.25
2002:06:20	21.2	28.00	43.55	26.80	35.08	33.17	23.06	232.36
2002:06:21	21.48	28.61	43.74	27.20	35.19	34.16	23.32	230.93
2002:06:24	21.23	28.17	43.43	26.98	34.83	33.48	23.19	232.12
2002:06:25	21.05	27.74	43.69	26.79	34.22	33.22	22.77	228.89
2002:06:26	21.29	28.00	43.59	26.79	33.79	34.08	22.99	227.61
2002:06:27	21.36	28.58	43.47	27.54	33.7	34.44	23.68	223.73
2002:06:28	21.46	28.28	42	26.56	33.63	34.65	23.78	226.55
2002:07:01	21.52	28.23	43.22	27.74	34.19	34.02	23.77	229.1
2002:07:02	21.05	27.99	42.16	27.23	33.85	33.46	23.73	217.34
2002:07:03	20.74	28.04	41.99	26.55	33.38	33.68	23.41	213.59
2002:07:04	NA	NA	NA	NA	NA	NA	NA	NA
2002:07:05	21.09	28.51	42.31	26.92	33.79	34.14	23.76	214
2002:07:08	20.64	28.02	42.36	27.17	33.43	33.87	23.55	218.4
2002:07:09	20.46	28.07	41.33	26.73	32.71	32.8	23.18	216.37
2002:07:10	20.08	27.85	40	25.52	31.89	32.53	22.32	212.77
2002:07:11	20.21	27.73	39.66	25.36	32.37	32.19	22.44	204.74
2002:07:12	19.81	27.52	38.38	25.07	31.99	31.44	21.93	206.77

DATE	ATG	NJR	GAS	NWN	PGL	PNY	WGL	Index
2002:07:15	19.84	27.12	36.72	25.18	32.26	30.9	22.03	202.1
2002:07:16	19.32	26.56	35.17	24.83	31.68	30.79	21.58	202.2
2002:07:17	19.69	26.63	35.29	24.94	31.71	30.74	21.61	199.26
2002:07:18	18.82	26.04	34.89	24.66	31.63	29.52	20.90	199.67
2002:07:19	17.82	25.35	20.89	23.79	29.33	28.19	20.10	196.2
2002:07:22	17.49	25.02	21.33	23.32	28.61	27.32	19.83	187.35
2002:07:23	16.59	24.18	21.16	22.17	27.51	26.57	18.74	182.91
2002:07:24	17.49	25.73	21.4	24.02	28.7	28.14	19.99	170.89
2002:07:25	18.98	26.36	21.79	24.94	30.1	29.52	20.57	178.88
2002:07:26	19.17	27.05	21.99	25.86	30.06	30.31	20.69	183.24
2002:07:29	20.01	28.34	22.6	26.21	30.66	31.36	21.58	182.15
2002:07:30	20.62	29.05	24.19	26.88	32.07	31.84	22.31	186.61
2002:07:31	21.01	28.61	24.79	26.25	32.38	31.67	22.69	193.25
2002:08:01	20.44	28.95	23.82	26.72	27.86	31.41	22.49	194.38
2002:08:02	19.96	28.28	23.27	25.74	27.58	30.92	22.05	191.19
2002:08:05	19.6	28.48	22.95	26.06	27.98	30.74	22.18	188.18
2002:08:06	19.66	28.85	22.91	26.49	28.33	31.8	22.69	185.49
2002:08:07	19.84	29.26	23.58	26.76	28.73	32.39	22.81	190.08
2002:08:08	19.65	29.61	24.69	26.60	28.77	32.52	22.72	192.14
2002:08:09	19.55	30.03	24.61	26.72	29.13	32.71	22.70	194.66
2002:08:12	19.61	30.22	25.25	27.39	29.43	33.23	22.96	194.56
2002:08:13	19.36	29.15	24.02	26.21	28.73	31.98	21.96	196.7
2002:08:14	20.3	30.55	24.48	27.37	29.24	33.5	23.01	190.65
2002:08:15	20.53	29.88	25.21	27.29	29.6	33.41	22.75	196.57
2002:08:16	20.24	30.30	25.02	27.21	29.2	33.66	22.64	195
2002:08:19	20.69	30.19	26.41	27.17	29.77	33.9	22.77	195.15
2002:08:20	20.61	30.20	26.64	27.00	29.84	33.78	22.67	198.71
2002:08:21	21.07	30.95	27.49	27.45	30.24	34.41	22.81	198.45
2002:08:22	21.48	31.04	28.02	27.39	30.57	34.66	23.11	203.17
2002:08:23	21.01	30.41	27.45	26.72	30.21	33.73	22.56	202.71
2002:08:26	21.57	30.89	28.22	27.15	30.72	34.8	23.08	202.71
2002:08:27	21.53	30.13	27.76	26.78	31.18	34.16	22.94	207.17
2002:08:28	21.45	29.87	26.57	26.30	30.82	33.73	22.64	204.59
2002:08:29	21.52	30.07	26.34	26.42	30.65	33.92	22.58	201.15
2002:08:30	21.53	29.61	26.07	26.21	30.82	33.72	22.48	201.06
2002:09:02	NA	NA	NA	NA	NA	NA	NA	NA
2002:09:03	20.73	29.07	25.12	25.88	30.71	32.61	21.98	199.81
2002:09:04	21.44	30.13	25.77	26.39	31.11	33.5	22.50	192.92
2002:09:05	21.01	29.81	25.79	26.16	31.12	33.27	22.11	195.75
2002:09:06	21.92	30.10	26.13	26.39	31.67	34.01	22.63	192.96
2002:09:09	22.1	30.60	26.81	26.36	32.12	34.39	22.76	195.31
2002:09:10	21.25	30.46	25.72	25.60	31.71	34.06	22.35	194.6
2002:09:11	21.86	31.03	26.35	26.48	31.98	34.16	22.63	192.89
2002:09:12	21.08	30.12	25.43	25.61	31.88	33.5	21.85	194.7
2002:09:13	21.75	31.08	26.19	26.19	32.5	34.2	22.51	190.33
2002:09:16	21.7	31.11	26.75	26.63	32.3	33.93	22.33	193
2002:09:17	20.78	30.09	25.59	26.72	31.74	32.88	21.84	191.98
2002:09:18	21.37	30.82	26.19	26.85	32.33	33.57	22.26	187.2
2002:09:19	20.58	30.55	25.53	26.02	31.67	32.34	21.69	189.29
2002:09:20	20.47	30.07	25.97	26.02	31.27	32.52	22.00	184.19
2002:09:23	20.77	29.70	25.37	25.80	31.29	32.23	21.65	183.11
2002:09:24	20.32	29.78	24.93	26.02	31.06	32.36	21.39	180.51
2002:09:25	20.83	30.60	25.85	26.67	31.37	33.42	21.97	177.36
2002:09:26	21.35	31.41	26.94	27.56	32.14	34.24	22.74	181.4
2002:09:27	20.79	31.22	26.23	27.09	31.49	33.56	22.18	186.06

DATE	ATG	NJR	GAS	NWN	PGL	PNY	WGL	Index
2002:09:30	20.7	31.46	26.32	27.43	31.55	33.63	22.22	181.13
2002:10:01	21.34	31.60	26.84	28.45	31.98	34.41	22.88	181.42
2002:10:02	20.92	31.03	26.44	28.26	31.37	33.82	22.66	185.34
2002:10:03	21.36	31.12	26.01	27.82	31.75	33.96	23.15	181.89
2002:10:04	20.5	30.62	24.63	27.13	30.76	33.11	22.35	181.95
2002:10:07	20.57	30.72	24.19	27.56	30.58	33.09	22.60	176.89
2002:10:08	20.63	30.31	23.88	27.73	30.65	33.28	22.32	174.54
2002:10:09	19.32	28.94	23.29	27.00	29.67	31.51	21.13	169.43
2002:10:10	20.72	29.98	25.5	27.89	31.29	33.12	22.37	161.18
2002:10:11	20.8	29.76	25.86	27.56	31.38	32.86	22.52	168.94
2002:10:14	20.73	29.61	26.46	27.67	31.85	32.74	22.65	171.81
2002:10:15	21.11	30.11	26.96	28.00	32.5	32.51	22.90	170.96
2002:10:16	20.61	29.55	25.92	27.01	31.67	31.65	22.29	174.53
2002:10:17	21.22	30.12	26.07	27.32	32.52	31	22.68	168.57
2002:10:18	21.56	30.12	26.29	27.11	32.79	31.9	22.59	172.42
2002:10:21	22	30.93	27.9	27.93	33.83	32.93	23.40	172.45
2002:10:22	22.01	30.17	27.3	27.56	33.09	32.38	22.78	178.1
2002:10:23	22.16	30.34	27.86	28.12	33.83	33.08	23.24	176.79
2002:10:24	22.25	30.16	27.69	27.84	33.68	33.16	23.01	179.67
2002:10:25	22.3	30.12	27.97	27.54	33.43	33.56	23.24	179.79
2002:10:28	21.92	30.23	27.75	27.71	33.85	33.66	23.18	181.61
2002:10:29	21.88	30.12	28.28	27.76	33.48	33.43	22.94	183.48
2002:10:30	22.12	30.45	29.3	28.42	33.85	33.96	22.37	182.87
2002:10:31	22.02	30.20	28.97	28.31	34.04	33.9	21.78	185.72
2002:11:01	22.6	30.45	29.86	28.47	34.28	33.86	22.61	185.07
2002:11:04	22.38	30.22	30.29	26.44	34.82	33.85	22.40	187.67
2002:11:05	22.25	29.97	30.74	26.63	34.56	33.56	22.61	190.82
2002:11:06	22.61	30.18	30.98	26.54	34.74	33.11	22.31	190.36
2002:11:07	21.87	29.16	29.47	25.51	33.68	32.14	21.66	191.92
2002:11:08	21.95	29.64	28.7	25.78	33.3	32.04	21.83	186.07
2002:11:11	21.71	29.12	28.49	25.06	33.46	31.7	21.54	182.96
2002:11:12	21.46	28.85	28.15	25.15	33.11	31.19	21.08	181.03
2002:11:13	21.69	29.16	28.17	25.00	33.71	31.4	21.49	180.29
2002:11:14	22.17	29.83	28.46	25.26	32.22	31.96	21.76	180.62
2002:11:15	22.35	29.85	28.78	25.30	32.2	32.11	22.26	182.82
2002:11:18	22.27	29.44	28.8	24.86	32	32.01	21.65	184.61
2002:11:19	22.38	29.21	28.77	24.86	31.87	31.84	21.66	183.5
2002:11:20	22.6	29.40	28.87	24.54	32.17	32.24	21.75	180.75
2002:11:21	22.54	29.59	29.02	24.62	32.68	32.33	21.61	183.22
2002:11:22	22.75	30.16	29.51	24.83	33.62	32.75	22.01	185.52
2002:11:25	23.15	30.46	30.07	25.02	33.94	33.37	22.18	188.46
2002:11:26	22.88	30.06	29.11	24.65	33.22	33	21.63	190.71
2002:11:27	23.13	30.45	29.53	24.63	33.85	33.53	21.85	187.19
2002:11:28	NA	NA	NA	NA	NA	NA	NA	NA
2002:11:29	22.86	30.07	29.41	24.17	33.7	32.53	21.77	189.56
2002:12:02	22.76	30.41	29.53	24.32	33.57	33.02	21.58	188.8
2002:12:03	22.81	30.75	29.32	24.65	33.53	33.09	21.74	188.73
2002:12:04	22.71	30.74	29.15	24.69	33.53	33.09	21.64	188.09
2002:12:05	22.78	31.12	28.95	24.50	33.73	32.94	21.65	185.59
2002:12:06	22.96	31.15	28.93	24.46	33.8	33.42	21.66	185.2
2002:12:09	22.86	30.89	29.04	24.69	33.81	33.48	21.82	185.42
2002:12:10	22.86	31.27	29.67	25.22	34.4	34.04	21.96	184.31
2002:12:11	23.04	31.55	30.61	25.26	35	34.14	22.32	186.99
2002:12:12	23.25	32.24	31.54	25.83	35.46	34.45	22.56	188.02
2002:12:13	23	31.62	31.49	25.78	35.53	34.03	22.51	188.94

DATE	ATG	NJR	GAS	NWN	PGL	PNY	WGL	Index
2002:12:16	23.7	31.99	32.12	26.04	35.63	34.61	22.84	188.13
2002:12:17	23.33	32.05	31.96	26.06	35.45	34.5	22.65	190.64
2002:12:18	23.09	31.52	31.89	25.59	35.94	34.33	22.62	191.44
2002:12:19	23.15	31.32	31.63	25.33	35.26	34.27	22.53	190.3
2002:12:20	23.09	30.84	31.93	25.65	36.32	34.45	22.75	189.78
2002:12:23	23.22	30.74	32.62	25.78	36.34	34.49	22.90	190.9
2002:12:24	23.14	30.81	32.38	25.73	36.24	34.56	22.70	190.53
2002:12:25	NA	NA	NA	NA	NA	NA	NA	NA
2002:12:26	23.25	30.86	32.74	25.89	36.92	34.7	22.78	189.9
2002:12:27	22.88	30.30	32.27	25.43	36.13	34.45	22.37	190.71
2002:12:30	23.14	30.94	32.35	25.73	37.02	34.28	22.71	188.5
2002:12:31	23.04	30.49	32.18	25.55	36.7	33.89	22.53	189.11
2003:01:01	NA	NA	NA	NA	NA	NA	NA	NA
2003:01:02	23.38	31.26	33.09	26.06	37.03	34.51	22.75	189.69
2003:01:03	23.28	31.54	33.16	25.71	37.07	34.09	22.87	193.64
2003:01:06	23.87	32.10	33.55	26.67	38.23	35.18	23.69	194.25
2003:01:07	23.29	31.47	32.82	26.11	37.7	34.2	22.85	201.37
2003:01:08	23.2	31.53	32.85	25.73	38.07	34.2	22.79	197.69
2003:01:09	23.14	30.89	32.81	25.68	37.97	34.22	23.32	197.13
2003:01:10	23.13	30.83	32.62	25.54	37.67	34.18	23.52	197.77
2003:01:13	22.97	30.71	32.54	25.50	37.7	34.22	23.27	197.67
2003:01:14	22.59	30.65	32	25.45	37.27	34.04	23.45	196.29
2003:01:15	22.52	30.40	31.74	25.40	37	33.44	23.29	196.88
2003:01:16	22.6	29.82	31.9	25.22	36.98	33.47	23.14	195.67
2003:01:17	22.29	29.73	31.42	25.26	36.46	33.18	23.03	194.45
2003:01:20	NA	NA	NA	NA	NA	NA	NA	NA
2003:01:21	22.39	29.25	30.79	25.02	36.01	33.06	22.90	191.83
2003:01:22	22.31	29.38	30.79	24.73	36.12	32.93	22.60	189.2
2003:01:23	22.63	29.64	31.08	24.93	36.27	33.22	23.20	187.75
2003:01:24	22.19	29.41	30.57	24.47	35.15	32.98	22.98	NA
2003:01:27	21.8	29.01	29.31	24.18	34.51	32.55	22.19	183.66
2003:01:28	22.26	30.74	29.6	24.71	34.66	33.25	22.75	179.39
2003:01:29	22.27	30.62	30.06	24.74	35.52	32.97	23.05	181.87
2003:01:30	22	30.47	29.78	24.47	34.97	32.81	23.59	181.63
2003:01:31	21.66	30.71	29.74	24.87	34.95	33.31	24.17	178.91
2003:02:03	21.63	30.49	30.27	24.44	35.5	33.28	24.57	180.96
2003:02:04	21.79	30.79	30.37	24.37	35.08	33.14	24.40	NA
2003:02:05	21.44	30.48	30.17	24.28	34.89	33.04	24.07	180.04
2003:02:06	21.48	30.66	30.06	24.03	34.97	32.98	24.15	178.88
2003:02:07	21.29	30.36	29.47	23.70	34.44	32.34	23.58	177.35
2003:02:10	21.05	30.41	29.8	23.80	34.7	32.78	24.15	174.86
2003:02:11	21.01	30.07	29.17	23.56	34.28	32.59	23.60	175.87
2003:02:12	21.19	29.59	28.46	23.23	33.94	32.11	23.43	173.4
2003:02:13	21.31	30.12	29.14	23.49	34.31	32.51	23.74	170.43
2003:02:14	21.48	30.72	29.02	23.38	34.32	32.63	23.71	171.44
2003:02:17	NA	NA	NA	NA	NA	NA	NA	NA
2003:02:18	21.62	30.43	29.13	23.69	33.97	32.77	23.85	173.15
2003:02:19	21.51	30.55	28.89	23.66	34	32.88	23.63	174.85
2003:02:20	21.6	30.71	29.07	23.50	34.23	33.1	23.80	173.34
2003:02:21	21.93	30.99	29.26	23.77	34.6	33.55	24.13	172.78
2003:02:24	21.58	31.13	29.18	23.88	34.59	33.43	23.92	174.67
2003:02:25	21.58	31.16	29.57	24.26	34.54	33.56	24.56	172.52
2003:02:26	21.35	30.50	28.45	23.86	33.94	32.98	23.96	173.96
2003:02:27	21.47	30.86	28.75	23.80	34.47	33.51	24.21	170.53
2003:02:28	21.26	30.96	28.46	23.42	33.99	32.99	23.99	191.6

DATE	ATG	NJR	GAS	NWN	PGL	PNY	WGL	Index
2003:03:03	21.54	31.14	29.45	23.80	34.17	33.69	24.29	171.54
2003:03:04	21.69	30.77	29.9	23.42	34.17	33.44	24.05	171.74
2003:03:05	21.78	31.81	27.94	23.59	34.26	33.26	24.41	170.41
2003:03:06	21.67	31.23	26.89	23.52	33.94	33.44	24.44	171.59
2003:03:07	21.72	31.73	25.75	23.46	34.14	33.42	24.67	170.56
2003:03:10	21.41	31.73	22.55	23.35	33.74	33.18	24.75	170.34
2003:03:11	21.43	31.72	23.8	23.51	33.3	32.86	24.40	166.83
2003:03:12	21.38	31.09	23.79	23.06	33.5	32.4	24.30	165.58
2003:03:13	21.77	31.42	24.23	23.54	33.57	32.97	24.66	165.53
2003:03:14	21.6	31.42	23.82	23.40	33.6	32.5	24.66	168.83
2003:03:17	21.96	31.71	24.45	23.89	34.22	33.12	24.91	169.4
2003:03:18	21.68	31.56	25.11	23.89	34.46	33.35	25.03	173.22
2003:03:19	21.94	31.60	25.41	24.01	34.5	33.69	25.19	173.91
2003:03:20	22.16	31.71	25.5	24.10	34.58	34.03	25.36	173.99
2003:03:21	22.46	32.84	26.37	24.45	35	34.67	25.65	175.26
2003:03:24	22.12	32.01	25.57	24.28	34.51	34.1	25.32	178.28
2003:03:25	22.36	31.90	26.07	24.18	34.5	34.27	25.50	174.5
2003:03:26	22.1	31.61	26.02	23.94	34.43	34.14	25.16	176.44
2003:03:27	22.34	32.13	26.02	24.27	34.11	34.48	25.50	175.29
2003:03:28	22.5	32.11	26.07	24.10	33.97	34.63	25.62	175.64
2003:03:31	22.68	31.82	26.28	23.99	34.47	34.58	25.28	176
2003:04:01	22.77	32.38	26.59	24.51	34.54	34.73	25.56	174.77
2003:04:02	22.97	32.34	26.83	23.98	34.77	34.46	25.61	177.17
2003:04:03	22.92	32.47	26.74	24.11	34.93	34.45	25.59	178.92
2003:04:04	22.92	32.74	27.17	24.18	35.66	34.74	25.54	177.6
2003:04:07	22.8	32.64	28.04	23.86	35.92	34.47	25.58	178.67
2003:04:08	23.01	32.74	27.61	24.02	36	34.99	26.01	179
2003:04:09	22.88	32.42	27.28	23.96	35.53	34.78	25.93	179.16
2003:04:10	22.93	32.74	27.1	24.07	35.61	34.81	25.87	178.86
2003:04:11	22.71	32.34	27.26	23.85	35.36	34.95	25.58	179.18
2003:04:14	22.86	32.55	27.79	24.13	35.48	35.12	25.84	178.55
2003:04:15	22.91	32.77	28.09	24.12	35.5	35.1	25.78	180.78
2003:04:16	22.97	32.69	28.53	24.21	35.62	35.23	25.65	181.81
2003:04:17	23.22	32.99	28.29	24.22	35.66	35.39	25.89	180.71
2003:04:18	NA	NA	NA	NA	NA	NA	NA	NA
2003:04:21	23.29	33.03	28.32	24.47	35.77	35.65	25.98	182.03
2003:04:22	23.52	33.42	28.87	24.63	36.28	35.94	26.27	182.09
2003:04:23	23.81	33.52	28.99	24.49	36.28	36.11	26.37	183.94
2003:04:24	24.04	33.46	29.03	24.47	36.38	36.04	26.25	185.85
2003:04:25	24.16	33.24	28.7	24.83	37.28	35.99	25.98	186.25
2003:04:28	24.37	33.67	29.07	24.80	37.7	36.25	26.51	185.28
2003:04:29	24.52	33.21	28.94	24.65	37.55	36.03	26.01	188.11
2003:04:30	24.7	33.38	28.92	24.99	37.43	36.24	26.06	187.66
2003:05:01	24.48	32.97	28.14	25.01	37.44	35.76	25.60	188.56
2003:05:02	24.48	33.18	29.65	25.19	37.42	35.97	25.60	186.77
2003:05:05	24.35	33.13	29.91	25.58	37.78	36.04	25.60	188.65
2003:05:06	24.37	33.12	29.96	25.35	38.4	36.23	25.55	189.36
2003:05:07	24.16	32.64	29.34	25.58	38.2	35.84	25.41	190.36
2003:05:08	23.97	32.55	29.58	25.16	38.23	35.7	25.49	189.08
2003:05:09	24.02	32.56	30.15	25.61	38.45	35.88	25.46	188.5
2003:05:12	24.04	32.48	30.03	25.64	38.4	35.88	25.40	190.58
2003:05:13	24	32.44	30.2	25.64	38.32	35.74	25.46	191.22
2003:05:14	24.19	32.35	30.35	25.58	38.53	35.73	25.41	191.74
2003:05:15	24.32	32.21	30.81	25.88	38.91	35.78	25.54	192.43
2003:05:16	24.12	31.77	31.61	25.35	39.26	35.6	25.21	195.26

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2003:05:19	24.03	32.16	30.86	25.49	39.09	35.82	25.10	196.77
2003:05:20	24.22	32.35	30.96	25.63	39.54	36.05	25.34	194.4
2003:05:21	24.31	32.48	31.21	25.55	39.76	36.61	25.47	195.41
2003:05:22	24.66	33.07	31.85	25.42	40.32	36.92	25.74	196.09
2003:05:23	25.32	33.82	33.28	26.33	42.36	37.84	26.54	198.71
2003:05:26	NA	NA	NA	NA	NA	NA	NA	NA
2003:05:27	25.83	34.28	34.76	27.24	41.98	37.66	27.03	204.74
2003:05:28	25.58	34.31	34.43	26.81	41.41	37.78	26.89	207.51
2003:05:29	25.27	34.28	33.92	27.06	40.87	38.12	26.73	206.6
2003:05:30	25.36	34.47	34.25	26.94	41.09	38.05	26.81	204.72
2003:06:02	25.33	34.54	34	27.04	41.25	38.3	26.89	207.04
2003:06:03	25.62	34.82	34.75	27.04	42.33	38.79	27.06	208.38
2003:06:04	26.08	35.31	35.61	27.19	42.66	39.08	27.66	209.06
2003:06:05	25.96	35.03	36.07	27.28	42.98	38.8	27.54	211.64
2003:06:06	25.62	34.99	36.42	27.44	42.74	38.76	27.36	210.74
2003:06:09	25.52	34.92	35.69	27.57	43.06	38.74	27.19	209.25
2003:06:10	25.32	35.11	36.01	27.78	43.27	38.67	27.12	207.8
2003:06:11	25.39	35.17	36.36	27.38	43.48	38.77	27.10	208.84
2003:06:12	25.42	35.38	37.03	27.51	43.17	39.37	27.53	210.48
2003:06:13	25.04	34.76	36.49	27.24	42.45	39.04	26.67	211.69
2003:06:16	25.42	35.52	37.16	27.34	43.11	39.38	27.04	208.91
2003:06:17	25.42	35.63	37.48	27.48	43.12	39.49	27.00	213.13
2003:06:18	25.31	35.53	37.59	27.33	42.91	39.37	26.76	212.73
2003:06:19	25.29	35.58	37.61	27.09	42.81	39.53	26.56	213.14
2003:06:20	25.34	35.48	37.53	26.98	42.37	39.49	26.38	212.53
2003:06:23	25.12	34.85	37.42	26.73	42.33	38.86	26.23	212.18
2003:06:24	24.8	34.73	37.47	26.64	42.26	38.51	25.96	209.25
2003:06:25	24.78	34.69	37.13	26.68	42.04	38.43	25.92	208.62
2003:06:26	24.73	34.87	36.95	26.70	42.27	38.66	25.98	208.27
2003:06:27	24.9	34.75	36.41	26.79	42.05	38.43	26.05	209
2003:06:30	24.69	34.89	36.13	26.36	41.82	38.03	25.79	207.89
2003:07:01	24.89	35.04	35.94	26.70	42.03	38.17	26.13	207.48
2003:07:02	25.17	35.85	36.29	26.85	42.52	38.59	26.31	208.24
2003:07:03	25.04	35.76	35.79	26.82	42.6	38.54	26.32	210.74
2003:07:04	NA	NA	NA	NA	NA	NA	NA	NA
2003:07:07	25.38	36.05	36.29	27.24	43.07	38.71	26.66	209.1
2003:07:08	25.06	36.01	36.58	27.21	42.13	38.53	26.31	210.8
2003:07:09	25.16	35.88	36.41	27.38	42.11	38.61	26.04	209.71
2003:07:10	25.05	35.53	35.74	27.03	41.39	38.25	25.72	208.51
2003:07:11	25.71	35.48	35.5	27.37	41.6	38.54	25.91	205.38
2003:07:14	25.87	35.44	35.59	27.57	41.6	38.56	25.82	206.88
2003:07:15	25.46	35.36	34.81	27.48	41.03	38.1	25.33	207.01
2003:07:16	26.03	35.18	35.04	27.27	40.78	37.92	25.27	204.49
2003:07:17	25.9	34.97	34.71	26.92	40.68	37.4	25.07	202.32
2003:07:18	25.98	35.39	35.26	27.06	41.13	37.63	25.50	199.73
2003:07:21	25.78	34.91	34.98	26.61	40.75	37.23	25.21	202.14
2003:07:22	26.13	34.73	35.03	26.83	41.02	37.18	25.40	199.01
2003:07:23	26.01	34.64	35.23	26.74	41.04	37.03	25.13	201.59
2003:07:24	26.34	34.16	35.14	26.59	41.09	37.18	25.16	201.26
2003:07:25	26.23	34.25	35.11	26.55	40.87	37.18	25.05	201.39
2003:07:28	26.07	34.65	35.23	26.56	40.41	36.87	25.00	202.48
2003:07:29	26.03	34.40	35.38	27.31	40.27	36.96	24.93	202.41
2003:07:30	26.37	34.20	35.3	27.43	40.35	37.31	25.00	201.47
2003:07:31	26.62	34.28	35.32	27.86	39.97	37.46	24.93	200.96
2003:08:01	26.41	33.89	34.62	26.92	40.23	37.04	25.00	200.83

DATE	ATG	NJR	GAS	NWN	PGL	PNY	WGL	Index
2003:08:04	26.37	33.41	34.21	26.92	39.97	36.94	24.97	198.85
2003:08:05	26.2	33.47	33.15	26.81	39.38	36.57	24.90	198.46
2003:08:06	26.09	33.37	33.11	26.67	39.38	36.75	24.79	195.58
2003:08:07	26.47	33.68	33.47	27.01	39.13	36.9	24.88	195.99
2003:08:08	26.61	34.00	33.13	26.97	38.76	36.85	25.27	196.03
2003:08:11	26.78	34.11	33.19	27.28	38.7	36.81	25.51	196.36
2003:08:12	26.99	34.27	33.31	27.64	38.98	37.29	25.77	197.36
2003:08:13	26.69	34.16	33.01	27.31	38.89	37.24	25.73	199.65
2003:08:14	26.75	34.46	33.05	27.60	38.84	37.09	25.68	198.61
2003:08:15	27.11	34.30	33.11	27.75	39.2	37.34	25.60	NA
2003:08:18	26.97	34.85	33.11	27.92	39.27	37.34	25.63	202.89
2003:08:19	26.99	35.48	32.75	27.99	39.1	37.5	25.85	203.13
2003:08:20	27.19	35.39	33.31	28.25	39.31	37.91	26.06	203.65
2003:08:21	27.29	35.38	33.51	28.38	39.33	38.24	25.90	204.89
2003:08:22	26.9	35.17	33.02	28.02	38.98	37.53	25.70	206.55
2003:08:25	26.82	35.19	33.14	28.14	39	37.34	25.81	203.85
2003:08:26	26.98	35.42	33.16	28.01	39.01	37.34	25.99	204.01
2003:08:27	27.03	35.34	33.08	28.08	39.05	37.56	25.95	205.22
2003:08:28	27.04	35.57	33.12	28.05	38.96	37.77	25.95	204.93
2003:08:29	27.29	35.48	33.09	27.88	39.15	37.92	26.28	206.05
2003:09:01	NA	NA	NA	NA	NA	NA	NA	NA
2003:09:02	27.44	36.18	33.72	28.92	39.75	38.28	26.92	206.34
2003:09:03	27.52	36.12	34.13	28.99	40.18	38.61	27.23	209.17
2003:09:04	27.87	36.32	34.14	28.94	40.39	38.65	27.08	210.3
2003:09:05	27.55	36.02	33.86	28.73	40.52	38.47	26.78	210.52
2003:09:08	27.68	36.14	34.42	28.88	41.05	39.15	27.24	210.52
2003:09:09	27.51	35.63	34.03	28.82	40.71	38.55	27.17	209.55
2003:09:10	27.53	35.64	33.98	28.73	40.63	38.52	26.97	211.13
2003:09:11	27.61	36.09	33.88	29.07	40.65	38.39	27.10	209.97
2003:09:12	27.71	35.98	34.03	28.89	41.08	38.68	27.23	210.1
2003:09:15	27.7	35.96	33.89	29.09	41.01	38.74	27.11	211.05
2003:09:16	27.78	36.45	34.56	29.46	41.46	38.97	26.97	210.3
2003:09:17	27.7	36.43	34.75	29.31	41.43	38.89	26.82	209.96
2003:09:18	27.74	36.75	34.76	28.97	41.8	38.9	26.87	208.9
2003:09:19	27.81	36.93	34.87	28.56	41.7	38.95	27.17	211.09
2003:09:22	27.75	36.46	34.7	28.68	41.15	38.9	27.00	211.84
2003:09:23	27.78	36.78	35.03	28.77	41.32	38.79	27.06	210.42
2003:09:24	27.6	36.04	34.82	28.73	41.29	38.62	26.86	210.99
2003:09:25	27.59	36.00	34.71	28.38	41.37	38.44	26.68	208.71
2003:09:26	27.77	35.74	34.74	28.25	41.12	38.38	26.49	207.47
2003:09:29	27.73	36.28	34.79	28.58	41.05	38.76	26.87	207.77
2003:09:30	27.62	35.73	34.67	28.38	40.86	38.62	26.95	209.86
2003:10:01	28.01	36.52	35.17	29.07	41.26	38.74	27.01	208.35
2003:10:02	28.06	36.65	35.43	29.36	41.53	39.11	27.02	211.76
2003:10:03	28.41	37.11	35.8	29.63	41.92	39.36	27.21	212.53
2003:10:06	28.47	37.62	35.9	29.71	42.11	39.51	27.45	214.32
2003:10:07	28.4	37.67	36.13	29.85	41.67	39.55	27.41	215.05
2003:10:08	27.9	37.29	35.32	29.09	40.91	38.89	27.27	215.06
2003:10:09	27.8	37.24	35.4	29.36	41.22	39.06	27.36	213.39
2003:10:10	27.75	37.15	35.66	29.31	41.34	39.02	27.57	214.63
2003:10:13	27.92	37.28	35.63	29.45	41.13	39.22	27.73	214.16
2003:10:14	27.82	37.08	35.63	29.42	40.93	39.29	27.73	214.63
2003:10:15	27.6	36.78	35.06	29.35	40.5	39.19	27.83	215.2
2003:10:16	27.51	36.68	35.01	29.28	40.35	39.49	27.99	214
2003:10:17	27.38	36.38	34.78	29.09	40.5	39.4	27.95	215.02

DATE	ATG	NJR	GAS	NWN	PGL	PNY	WGL	Index
2003:10:20	27.44	36.54	35.07	28.77	40.21	39.32	27.92	213.71
2003:10:21	27.35	36.46	34.95	28.30	40.34	39.39	27.85	214.59
2003:10:22	27.11	36.00	34.86	28.19	40.23	39.19	27.73	214.69
2003:10:23	27.1	35.89	34.76	28.22	40.18	39.22	27.65	213.44
2003:10:24	26.81	35.89	34.66	28.11	39.94	38.75	27.54	212.86
2003:10:27	26.98	36.32	34.89	28.19	39.72	38.86	27.54	212.68
2003:10:28	27.02	36.68	35.19	28.38	39.93	38.92	27.22	213.78
2003:10:29	27.06	36.83	34.73	28.66	39.98	38.87	27.18	214.61
2003:10:30	27.57	36.83	34.53	28.55	39.58	39.15	27.23	215.11
2003:10:31	27.6	37.52	33.81	28.70	39.94	39.35	27.33	217.19
2003:11:03	27.78	38.26	33.92	29.45	40.24	39.89	27.84	217.03
2003:11:04	27.68	38.07	33.37	29.55	39.86	39.61	26.89	219.34
2003:11:05	27.84	38.37	33	29.72	39.92	39.19	26.63	217.93
2003:11:06	27.72	38.17	32.75	29.99	39.9	39.16	26.19	217.38
2003:11:07	27.94	38.01	32.09	29.79	39.56	39.43	25.97	217.6
2003:11:10	27.81	37.84	32.11	29.77	39.48	39.59	25.99	217.47
2003:11:11	27.84	37.62	32.54	29.73	39.47	39.73	26.11	216.98
2003:11:12	28.29	37.76	32.23	29.99	39.48	39.83	26.31	216.51
2003:11:13	28.15	37.80	32.65	30.15	39.53	40.08	26.58	217.98
2003:11:14	28.21	37.52	32.56	29.90	39.62	40.22	26.60	217.65
2003:11:17	28.16	37.49	32.57	30.12	39.29	40.26	26.59	216.72
2003:11:18	27.67	36.78	32.41	29.62	38.7	39.77	26.03	215.18
2003:11:19	27.77	36.88	32.2	29.68	38.97	39.89	26.27	212.69
2003:11:20	27.43	36.23	31.78	29.45	38.43	39.63	25.98	214.61
2003:11:21	27.32	37.02	31.82	29.69	38.61	39.62	26.05	213.57
2003:11:24	28.01	38.22	32.1	30.16	39.36	40.25	26.34	214.52
2003:11:25	28.09	38.49	31.98	30.34	39.44	40.36	26.43	218.1
2003:11:26	28.21	38.37	32.17	30.24	39.71	40.56	26.52	219.13
2003:11:27	NA	NA	NA	NA	NA	NA	NA	NA
2003:11:28	28.13	38.07	32.33	30.19	39.7	40.58	26.42	220.01
2003:12:01	28.47	38.47	32.72	30.09	40.08	40.97	26.49	220.16
2003:12:02	28.43	38.42	32.98	30.23	40.18	41.29	26.80	221.68
2003:12:03	28.3	37.46	33.15	29.70	39.7	40.69	26.59	223.48
2003:12:04	28.37	37.92	33.29	29.62	39.82	40.66	26.56	222.19
2003:12:05	28.17	37.69	33.35	29.69	39.84	40.82	26.53	223.15
2003:12:08	28.45	38.17	33.64	30.16	40.46	41.3	26.98	222.54
2003:12:09	28.32	37.67	33.35	29.95	40.28	40.96	26.77	223.77
2003:12:10	28.52	37.36	32.93	29.70	40.23	40.86	26.69	221.98
2003:12:11	28.5	37.89	32.78	29.60	40.26	41.08	26.77	221.65
2003:12:12	28.55	38.60	33.39	29.94	40.69	41.5	26.94	223.77
2003:12:15	28.4	38.02	33.54	29.99	41.22	41.2	26.74	224.27
2003:12:16	28.31	37.86	33.58	29.69	41.75	41.2	26.95	222.95
2003:12:17	28.24	37.98	33.29	29.90	41.68	42.3	26.96	223.59
2003:12:18	28.67	38.69	33.54	30.13	41.8	42.42	27.47	224.03
2003:12:19	28.85	38.18	33.55	30.15	41.7	42.6	27.63	226.15
2003:12:22	28.81	38.88	33.8	30.12	41.9	43.03	27.72	226.53
2003:12:23	28.88	39.28	33.96	30.72	41.88	43.35	27.74	227.7
2003:12:24	28.93	38.68	34.01	30.59	41.84	43.08	27.91	229.2
2003:12:25	NA	NA	NA	NA	NA	NA	NA	NA
2003:12:26	28.92	39.07	34.05	30.75	41.9	43.36	27.88	229.15
2003:12:29	28.8	39.08	34.35	30.78	42.15	43.38	27.97	229.43
2003:12:30	28.78	39.07	34.06	30.90	42.17	43.43	27.68	231.52
2003:12:31	28.82	38.51	34.04	30.44	42.04	43.46	27.47	232.32
2004:01:01	NA	NA	NA	NA	NA	NA	NA	NA
2004:01:02	28.71	38.78	33.69	30.36	41.95	43.22	27.70	231.32

DATE	ATG	NJR	GAS	NWN	PGL	PNY	WGL	Index
2004:01:05	28.72	38.66	33.87	30.34	41.94	43.1	27.68	232.93
2004:01:06	28.55	38.02	33.92	30.19	41.81	42.65	27.48	233.28
2004:01:07	28.49	38.39	33.58	30.44	41.8	42.75	27.43	232.96
2004:01:08	28.63	38.50	33.35	30.26	41.67	42.6	27.37	233.7
2004:01:09	28.59	38.13	33.56	30.03	41.47	42.3	27.35	234.83
2004:01:12	28.61	38.66	33.05	30.21	41.64	42.32	27.45	233.59
2004:01:13	28.69	38.60	32.5	30.44	41.63	42.62	27.24	233.94
2004:01:14	28.83	39.15	32.91	30.54	42.12	43.33	27.65	233.58
2004:01:15	29	38.80	32.89	30.34	41.89	43.36	27.75	235.26
2004:01:16	29.03	38.41	32.9	30.30	41.95	42.7	27.54	234.42
2004:01:19	NA	NA	NA	NA	NA	NA	NA	NA
2004:01:20	29.46	39.04	32.79	30.56	42.38	42.5	27.74	234.42
2004:01:21	29.48	38.90	33.11	30.88	42.54	42.16	27.78	236.48
2004:01:22	29.44	38.58	33.18	30.81	42.29	42.12	27.92	238.5
2004:01:23	29.5	38.90	33.63	31.41	42.76	42.09	28	238.41
2004:01:26	29.58	39.27	33.7	31.59	42.89	42.16	28.33	238.36
2004:01:27	29.53	38.80	33.82	31.61	42.89	41.95	28.45	237.55
2004:01:28	29.27	38.40	33.4	31.25	42.8	41.6	28.05	236.75
2004:01:29	29.36	38.57	33.31	30.85	42.79	41.7	27.93	235.48
2004:01:30	29.08	38.59	33.15	30.80	42.46	41.81	27.95	234.95
2004:02:02	29.11	38.77	33.77	30.61	43.19	41.86	28.5	234.4
2004:02:03	28.84	38.82	33.76	30.80	43.45	41.5	28.65	235.08
2004:02:04	28.27	37.77	33.15	30.10	42.9	41.06	28.3	235.56
2004:02:05	28.2	37.80	32.55	30.30	42.68	40.68	28.03	232.15
2004:02:06	28.64	39.59	33.12	30.79	43.14	41.2	28.43	231.99
2004:02:09	28.6	39.51	32.8	30.70	43.17	41.04	28.31	235.16
2004:02:10	28.72	39.90	33.65	31.30	43.16	41.4	28.57	235.56
2004:02:11	28.93	40.00	33.37	31.35	43.35	41.52	28.57	238.17
2004:02:12	28.85	39.50	33.65	31.20	43.14	41.43	28.36	238.86
2004:02:13	28.68	38.80	33.92	31.17	43.18	41.3	28.4	237.66

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 225
Witness: Don Murry

Data Request:

With respect to page 31, lines 21-22, please provide copies of all documents that (a) discuss how analysts use projected economic growth as a check on earnings' forecasts, and (b) demonstrate the relationship between projected economic growth and earnings' growth rate forecasts.

Response:

a. Existing and expected economic conditions affect the earnings expectations of various companies in a variety of ways. Dr. Murry does not maintain a file of studies that discuss how projected economic growth might serve as a check on earning's forecasts for any group of companies.

b. In general, faster economic growth will stimulate the growth in earnings of individual companies more than slower economic growth, but, of course, all companies will not be affected equally.

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 226
Witness: Don Murry

Data Request:

With respect to page 33, lines 1-9, and Schedules DAM-20 and DAM-21, please provide the theoretical and empirical justification for using 2000-02 to 2009-11 as the appropriate time period for measuring EPS growth in the DCF model.

Response:

The 2009-11 period is a common forecast period for Value Line. The historical 2000-02 period reduces the likelihood of a single-year anomalous EPS resulting in a misleading growth calculation over the entire period.

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 227
Witness: Don Murry

Data Request:

With respect to page 36, footnote 10, please provide copies of all material from the Ibbotson Associates which are used in determining the size premium, including a copy of Chapter 7 of the cited document. This would include written discussions on the topic as well as data. With respect to the data, please provide raw company return and size data, and not just Ibbotson summary return data. Please provide the data in both paper and electronic (Microsoft Excel) formats. For the electronic version, please keep all data and equations intact.

Response:

Please reference AG DR1-227 ATT1 attached hereto. Dr. Murry does not have the raw company data and size data in his possession. Dr. Murry also does not have the requested information in electronic form in his possession.

Chapter 7

Firm Size and Return

The Firm Size Phenomenon

One of the most remarkable discoveries of modern finance is that of a relationship between firm size and return. The relationship cuts across the entire size spectrum but is most evident among smaller companies, which have higher returns on average than larger ones. Many studies have looked at the effect of firm size on return.[1] In this chapter, the returns across the entire range of firm size are examined.

Construction of the Decile Portfolios

The portfolios used in this chapter are those created by the Center for Research in Security Prices (CRSP) at the University of Chicago's Graduate School of Business. CRSP has refined the methodology of creating size-based portfolios and has applied this methodology to the entire universe of NYSE/AMEX/NASDAQ-listed securities going back to 1926.

The New York Stock Exchange universe excludes closed-end mutual funds, preferred stocks, real estate investment trusts, foreign stocks, American Depository Receipts, unit investment trusts, and Americus Trusts. All companies on the NYSE are ranked by the combined market capitalization of their eligible equity securities. The companies are then split into 10 equally populated groups, or deciles. Eligible companies traded on the American Stock Exchange (AMEX) and the Nasdaq National Market (NASDAQ) are then assigned to the appropriate deciles according to their capitalization in relation to the NYSE breakpoints. The portfolios are rebalanced, using closing prices for the last trading day of March, June, September, and December. Securities added during the quarter are assigned to the appropriate portfolio when two consecutive month-end prices are available. If the final NYSE price of a security that becomes delisted is a month-end price, then that month's return is included in the quarterly return of the security's portfolio. When a month-end NYSE price is missing, the month-end value of the security is derived from merger terms, quotations on regional exchanges, and other sources. If a month-end value still is not determined, the last available daily price is used.

Base security returns are monthly holding period returns. All distributions are added to the month-end prices, and appropriate price adjustments are made to account for stock splits and dividends. The return on a portfolio for one month is calculated as the weighted average of the returns for its individual stocks. Annual portfolio returns are calculated by compounding the monthly portfolio returns.

Size of the Deciles

Table 7-1 reveals that the top three deciles of the NYSE/AMEX/NASDAQ account for most of the total market value of its stocks. Nearly two-thirds of the market value is represented by the first decile, which currently consists of 169 stocks, while the smallest decile accounts for just over

1 Rolf W. Banz was the first to document this phenomenon. See Banz, Rolf W. "The Relationship Between Returns and Market Value of Common Stocks," *Journal of Financial Economics*, Vol. 9, 1981, pp. 3–18.

one percent of the market value. The data in the second column of Table 7-1 are averages across all 80 years. Of course, the proportion of market value represented by the various deciles varies from year to year.

Columns three and four give recent figures on the number of companies and their market capitalization, presenting a snapshot of the structure of the deciles near the end of 2005.

Table 7-1

Size-Decile Portfolios of the NYSE/AMEX/NASDAQ Size and Composition
1926 through September 30, 2005

Decile	Historical Average Percentage of Total Capitalization	Recent Number of Companies	Recent Decile Market Capitalization (in thousands)	Recent Percentage of Total Capitalization
1-largest	63.29%	169	$8,869,801,117	60.92%
2	13.97%	182	2,025,323,685	13.91%
3	7.57%	195	1,074,448,763	7.38%
4	4.74%	206	656,297,080	4.51%
5	3.24%	207	452,329,097	3.11%
6	2.37%	238	389,595,517	2.68%
7	1.73%	299	319,642,175	2.20%
8	1.28%	352	287,783,718	1.98%
9	0.99%	693	268,738,291	1.85%
10-Smallest	0.81%	1,746	216,334,858	1.49%
Mid-Cap 3-5	15.55%	608	2,183,074,940	14.99%
Low-Cap 6-8	5.39%	889	997,021,410	6.85%
Micro-Cap 9-10	1.80%	2,439	485,073,149	3.33%

Source: © 200603 CRSP® Center for Research in Security Prices. Graduate School of Business, The University of Chicago. Used with permission. All rights reserved. www.crsp.uchicago.edu.

Historical average percentage of total capitalization shows the average, over the last 80 years, of the decile market values as a percentage of the total NYSE/AMEX/NASDAQ calculated each month. Number of companies in deciles, recent market capitalization of deciles, and recent percentage of total capitalization are as of September 30, 2005.

Table 7-2 gives the current breakpoints that define the composition of the NYSE/AMEX/NASDAQ size deciles. The largest company and its market capitalization are presented for each decile. Table 7-3 shows the historical breakpoints for each of the three size groupings presented throughout this chapter. Mid-cap stocks are defined here as the aggregate of deciles 3–5. Based on the most recent data (Table 7-2), companies within this mid-cap range have market capitalizations at or below $7,187,244,000 but greater than $1,728,888,000. Low-cap stocks include deciles 6–8 and currently include all companies in the NYSE/AMEX/NASDAQ with market capitalizations at or below $1,728,888,000 but greater than $586,393,000. Micro-cap stocks include deciles 9–10 and include companies with market capitalizations at or below $586,393,000. The market capitalization of the smallest company included in the micro-capitalization group is currently $1,079,000.

Table 7-2

Size-Decile Portfolios of the NYSE/AMEX/NASDAQ, Largest Company and Its Market Capitalization by Decile

September 30, 2005

Decile	Market Capitalization of Largest Company (in thousands)	Company Name
1-Largest	$367,495,144	General Electric Co.
2	16,016,450	Entergy Corp.
3	7,187,244	Chesapeake Energy Corp.
4	3,961,425	Ball Corp.
5	2,519,280	Celenese Corp.
6	1,728,888	AGCO Corp.
7	1,280,966	ESCO Technologies Inc.
8	872,103	West Pharmaceutical Services Inc.
9	586,393	General Cable Corp.
10-Smallest	264,981	4Kids Entertainment Inc.

Source: Center for Research in Security Prices, University of Chicago.

Presentation of the Decile Data

Summary statistics of annual returns of the 10 deciles over 1926–2005 are presented in Table 7-4. Note from this exhibit that both the average return and the total risk, or standard deviation of annual returns, tend to increase as one moves from the largest decile to the smallest. Furthermore, the serial correlations of returns are near zero for all but the smallest two deciles. Serial correlations and their significance will be discussed in detail later in this chapter.

Graph 7-1 depicts the growth of one dollar invested in each of three NYSE/AMEX/NASDAQ groups broken down into mid-cap, low-cap, and micro-cap stocks. The index value of the entire NYSE/AMEX/NASDAQ is also included. All returns presented are value-weighted based on the market capitalizations of the deciles contained in each subgroup. The sheer magnitude of the size effect in some years is noteworthy. While the largest stocks actually declined 9 percent in 1977, the smallest stocks rose more than 20 percent. A more extreme case occurred in the depression-recovery year of 1933, when the difference between the first and tenth decile returns was far more substantial, with the largest stocks rising 46 percent, and the smallest stocks rising 224 percent. This divergence in the performance of small and large company stocks is a common occurrence.

Table 7-3

Size-Decile Portfolios of the NYSE/AMEX/NASDAQ
Largest and Smallest Company by Size Group

from 1926 to1965

	Capitalization of Largest Company (in thousands)			Capitalization of Smallest Company (in thousands)		
Date (Sept 30)	Mid-Cap 3-5	Low-Cap 6-8	Micro-Cap 9-10	Mid-Cap 3-5	Low-Cap 6-8	Micro-Cap 9-10
1926	$61,490	$14,040	$4,305	$14,100	$4,325	$43
1927	$65,281	$14,746	$4,450	$15,311	$4,496	$72
1928	$81,998	$18,975	$5,074	$19,050	$5,119	$135
1929	$107,085	$24,328	$5,875	$24,480	$5,915	$126
1930	$67,808	$13,050	$3,219	$13,068	$3,264	$30
1931	$42,607	$8,142	$1,905	$8,222	$1,927	$15
1932	$12,431	$2,170	$473	$2,196	$477	$19
1933	$40,298	$7,210	$1,830	$7,280	$1,875	$100
1934	$38,129	$6,669	$1,669	$6,734	$1,673	$68
1935	$37,631	$6,519	$1,350	$6,549	$1,383	$38
1936	$46,920	$11,505	$2,660	$11,526	$2,668	$98
1937	$51,750	$13,601	$3,500	$13,635	$3,539	$68
1938	$36,102	$8,325	$2,125	$8,372	$2,145	$60
1939	$35,784	$7,367	$1,697	$7,389	$1,800	$75
1940	$31,050	$7,990	$1,861	$8,007	$1,872	$51
1941	$31,744	$8,316	$2,086	$8,336	$2,087	$72
1942	$26,135	$6,870	$1,779	$6,875	$1,788	$82
1943	$43,218	$11,475	$3,847	$11,480	$3,903	$395
1944	$46,621	$13,066	$4,800	$13,068	$4,812	$309
1945	$55,268	$17,325	$6,413	$17,575	$6,428	$225
1946	$79,158	$24,192	$10,013	$24,199	$10,051	$829
1947	$57,830	$17,735	$6,373	$17,872	$6,380	$747
1948	$67,238	$19,575	$7,313	$19,651	$7,329	$784
1949	$55,506	$14,549	$5,037	$14,577	$5,108	$379
1950	$65,881	$18,675	$6,176	$18,750	$6,201	$303
1951	$82,517	$22,750	$7,567	$22,860	$7,598	$668
1952	$97,936	$25,452	$8,428	$25,532	$8,480	$480
1953	$98,595	$25,374	$8,156	$25,395	$8,168	$459
1954	$125,834	$29,645	$8,484	$29,707	$8,488	$463
1955	$170,829	$41,445	$12,353	$41,681	$12,366	$553
1956	$183,434	$46,805	$13,481	$46,886	$13,524	$1,122
1957	$192,861	$47,658	$13,844	$48,509	$13,848	$925
1958	$196,083	$46,774	$13,789	$46,871	$13,816	$550
1959	$253,644	$64,221	$19,500	$64,372	$19,548	$1,804
1960	$246,202	$61,485	$19,344	$61,529	$19,385	$831
1961	$296,261	$79,058	$23,562	$79,422	$23,613	$2,455
1962	$250,433	$58,866	$18,952	$59,143	$18,968	$1,018
1963	$308,438	$71,846	$23,819	$71,971	$23,822	$296
1964	$344,033	$79,343	$25,594	$79,508	$25,595	$223
1965	$363,759	$84,479	$28,365	$84,600	$28,375	$250

Source: Center for Research in Security Prices, University of Chicago.

Table 7-3 (continued)

Size-Decile Portfolios of the NYSE/AMEX/NASDAQ
Largest and Smallest Company by Size Group

from 1966 to 2005

	Capitalization of Largest Company (in thousands)			Capitalization of Smallest Company (in thousands)		
Date (Sept 30)	Mid-Cap 3-5	Low-Cap 6-8	Micro-Cap 9-10	Mid-Cap 3-5	Low-Cap 6-8	Micro-Cap 9-10
1966	$399,455	$99,578	$34,884	$99,935	$34,966	$381
1967	$459,170	$117,985	$42,267	$118,329	$42,313	$381
1968	$528,326	$149,261	$60,351	$150,128	$60,397	$592
1969	$517,452	$144,770	$54,273	$145,684	$54,280	$2,119
1970	$380,246	$94,025	$29,910	$94,047	$29,916	$822
1971	$542,517	$145,340	$45,571	$145,673	$45,589	$865
1972	$545,211	$139,647	$46,728	$139,710	$46,757	$1,031
1973	$424,584	$94,809	$29,601	$95,378	$29,606	$561
1974	$344,013	$75,272	$22,475	$75,853	$22,481	$444
1975	$465,763	$96,954	$28,140	$97,266	$28,144	$540
1976	$551,071	$116,184	$31,987	$116,212	$32,002	$564
1977	$573,084	$135,804	$39,192	$137,323	$39,254	$513
1978	$572,967	$159,778	$46,621	$160,524	$46,629	$830
1979	$661,336	$174,480	$49,088	$174,517	$49,172	$948
1980	$754,562	$194,012	$48,671	$194,241	$48,953	$549
1981	$954,665	$259,028	$71,276	$261,059	$71,289	$1,446
1982	$762,028	$205,590	$54,675	$206,536	$54,883	$1,060
1983	$1,200,680	$352,698	$103,443	$352,944	$103,530	$2,025
1984	$1,068,972	$314,650	$90,419	$315,214	$90,659	$2,093
1985	$1,432,342	$367,413	$93,810	$368,249	$94,000	$760
1986	$1,857,621	$444,827	$109,956	$445,648	$109,975	$706
1987	$2,059,143	$467,430	$112,035	$468,948	$112,125	$1,277
1988	$1,957,926	$420,257	$94,268	$421,340	$94,302	$696
1989	$2,147,608	$480,975	$100,285	$483,623	$100,384	$96
1990	$2,164,185	$472,003	$93,627	$474,065	$93,750	$132
1991	$2,129,863	$457,958	$87,586	$458,853	$87,733	$278
1992	$2,428,671	$500,346	$103,352	$501,050	$103,500	$510
1993	$2,711,068	$608,520	$137,945	$608,825	$137,987	$602
1994	$2,497,073	$601,552	$149,435	$602,552	$149,532	$598
1995	$2,793,761	$653,178	$158,011	$654,019	$158,063	$89
1996	$3,150,685	$763,377	$195,188	$763,812	$195,326	$1,043
1997	$3,511,132	$818,299	$230,472	$821,028	$230,554	$480
1998	$4,216,707	$934,264	$253,329	$936,727	$253,336	$1,671
1999	$4,251,741	$875,309	$218,336	$875,582	$218,368	$1,502
2000	$4,143,902	$840,000	$192,598	$840,730	$192,721	$1,462
2001	$5,252,063	$1,114,792	$269,275	$1,115,200	$270,391	$443
2002	$5,012,705	$1,143,845	$314,042	$1,144,452	$314,174	$501
2003	$4,794,027	$1,166,799	$330,608	$1,167,040	$330,797	$332
2004	$6,241,953	$1,607,854	$505,437	$1,607,931	$506,410	$1,393
2005	$7,187,244	$1,728,888	$586,393	$1,729,364	$587,243	$1,079

Source: *Center for Research in Security Prices, University of Chicago.*

Table 7-4

Size-Decile Portfolios of the NYSE/AMEX/NASDAQ, Summary Statistics of Annual Returns
1926–2005

Decile	Geometric Mean	Arithmetic Mean	Standard Deviation	Serial Correlation
1-Largest	9.5	11.3	19.17	0.09
2	10.9	13.2	21.86	0.03
3	11.3	13.8	23.66	-0.02
4	11.3	14.3	25.94	-0.02
5	11.6	14.9	26.78	-0.02
6	11.8	15.3	27.84	0.04
7	11.6	15.6	29.99	0.01
8	11.8	16.6	33.47	0.04
9	12.0	17.5	36.55	0.05
10-Smallest	14.0	21.6	45.44	0.15
Mid-Cap, 3-5	11.4	14.2	24.74	-0.02
Low-Cap, 6-8	11.7	15.7	29.52	0.03
Micro-Cap, 9-10	12.7	18.8	39.16	0.08
NYSE/AMEX/NASDAQ Total Value-Weighted Index	10.1	12.0	20.21	0.03

Source: Center for Research in Security Prices, University of Chicago.

Aspects of the Firm Size Effect

The firm size phenomenon is remarkable in several ways. First, the greater risk of small stocks does not, in the context of the capital asset pricing model (CAPM), fully account for their higher returns over the long term. In the CAPM only systematic, or beta risk, is rewarded; small company stocks have had returns in excess of those implied by their betas.

Second, the calendar annual return differences between small and large companies are serially correlated. This suggests that past annual returns may be of some value in predicting future annual returns. Such serial correlation, or autocorrelation, is practically unknown in the market for large stocks and in most other equity markets but is evident in the size premia.

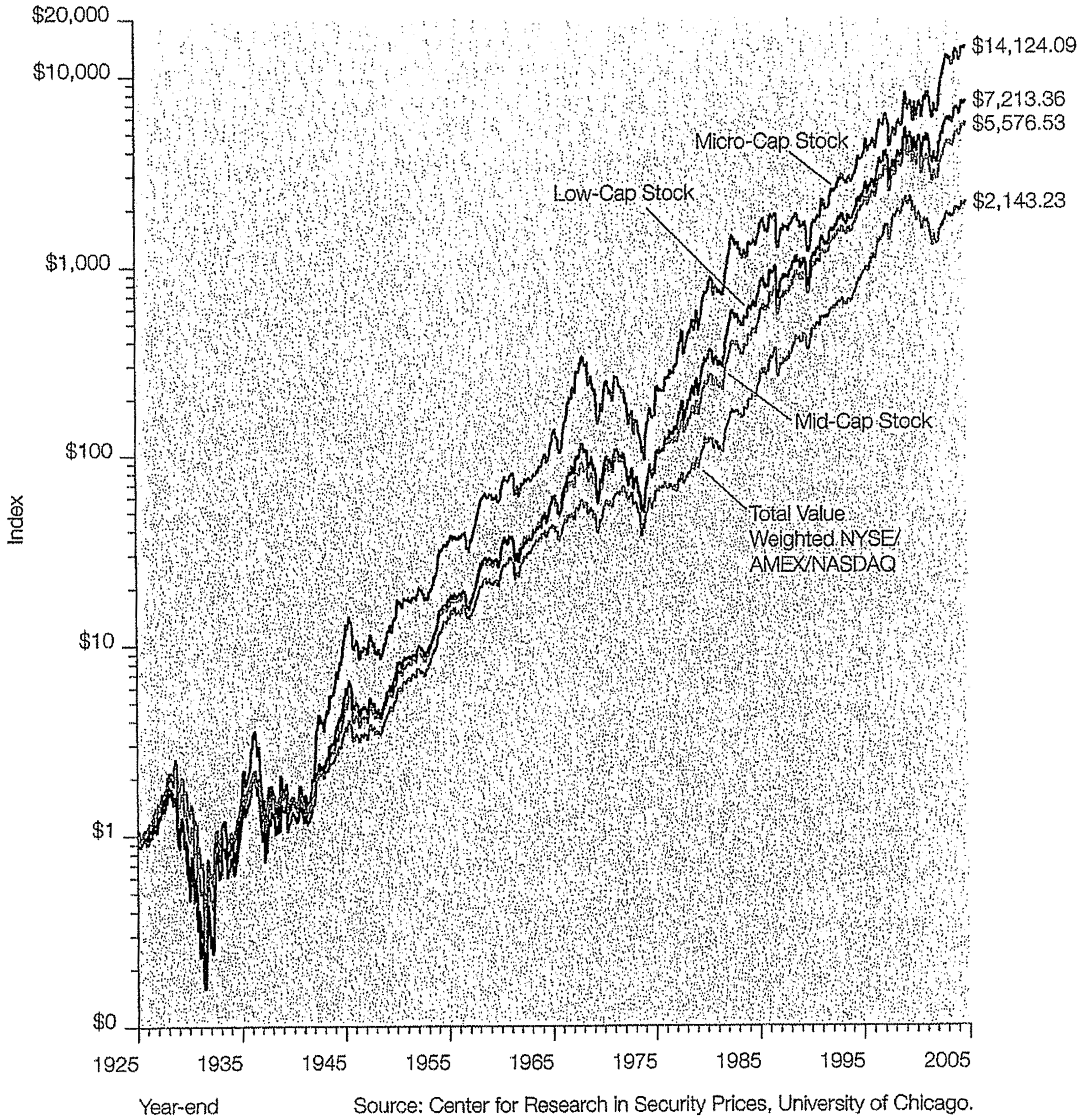
Third, the firm size effect is seasonal. For example, small company stocks outperformed large company stocks in the month of January in a large majority of the years. Such predictability is surprising and suspicious in light of modern capital market theory. These three aspects of the firm size effect—long-term returns in excess of systematic risk, serial correlation, and seasonality—will be analyzed thoroughly in the following sections.

Graph 7-1

Size-Decile Portfolios of the NYSE/AMEX/NASDAQ: Wealth Indices of Investments in Mid-, Low-, Micro- and Total Capitalization Stocks

1925–2005

Year-end 1925 = $1.00



Source: Center for Research in Security Prices, University of Chicago.

Long-Term Returns in Excess of Systematic Risk

The capital asset pricing model (CAPM) does not fully account for the higher returns of small company stocks. Table 7-5 shows the returns in excess of systematic risk over the past 80 years for each decile of the NYSE/AMEX/NASDAQ. Recall that the CAPM is expressed as follows:

$$k_s = r_f + (\beta_s \times ERP)$$

Table 7-5 uses the CAPM to estimate the return in excess of the riskless rate and compares this estimate to historical performance. According to the CAPM, the expected return on a security should consist of the riskless rate plus an additional return to compensate for the systematic risk of the security. The return in excess of the riskless rate is estimated in the context of the CAPM by multiplying the equity risk premium by β (beta). The equity risk premium is the return that compensates investors for taking on risk equal to the risk of the market as a whole (systematic risk).[2] Beta measures the extent to which a security or portfolio is exposed to systematic risk.[3] The beta of each decile indicates the degree to which the decile's return moves with that of the overall market.

A beta greater than one indicates that the security or portfolio has greater systematic risk than the market; according to the CAPM equation, investors are compensated for taking on this additional risk. Yet, Table 7-5 illustrates that the smaller deciles have had returns that are not fully explained by their higher betas. This return in excess of that predicted by CAPM increases as one moves from the largest companies in decile 1 to the smallest in decile 10. The excess return is especially pronounced for micro-cap stocks (deciles 9–10). This size-related phenomenon has prompted a revision to the CAPM, which includes a size premium. Chapter 4 presents this modified CAPM theory and its application in more detail.

This phenomenon can also be viewed graphically, as depicted in the Graph 7-2. The security market line is based on the pure CAPM without adjustment for the size premium. Based on the risk (or beta) of a security, the expected return lies on the security market line. However, the actual historic returns for the smaller deciles of the NYSE/AMEX/NASDAQ lie above the line, indicating that these deciles have had returns in excess of that which is appropriate for their systematic risk.

2 The equity risk premium is estimated by the 80-year arithmetic mean return on large company stocks, 12.30 percent, less the 80-year arithmetic mean income-return component of 20-year government bonds as the historical riskless rate, in this case 5.22 percent. (It is appropriate, however, to match the maturity, or duration, of the riskless asset with the investment horizon.) See Chapter 5 for more detail on equity risk premium estimation.

3 Historical betas were calculated using a simple regression of the monthly portfolio (decile) total returns in excess of the 30-day U.S. Treasury bill total returns versus the S&P 500 total returns in excess of the 30-day U.S. Treasury bill, January 1926–December 2005. See Chapter 6 for more detail on beta estimation.

Table 7-5

Long-Term Returns in Excess of CAPM Estimation for Decile Portfolios of the NYSE/AMEX/NASDAQ
1926–2005

Decile	Beta*	Arithmetic Mean Return	Realized Return in Excess of Riskless Rate**	Estimated Return in Excess of Riskless Rate†	Size Premium (Return in Excess of CAPM)
1-Largest	0.91	11.29%	6.07%	6.45%	-0.37%
2	1.04	13.22%	8.00%	7.33%	0.67%
3	1.10	13.84%	8.62%	7.77%	0.85%
4	1.13	14.31%	9.09%	7.98%	1.10%
5	1.16	14.91%	9.69%	8.20%	1.49%
6	1.18	15.33%	10.11%	8.38%	1.73%
7	1.23	15.62%	10.40%	8.73%	1.67%
8	1.28	16.60%	11.38%	9.05%	2.33%
9	1.34	17.48%	12.26%	9.50%	2.76%
10-Smallest	1.41	21.59%	16.37%	10.01%	6.36%
Mid-Cap, 3-5	1.12	14.15%	8.94%	7.91%	1.02%
Low-Cap, 6-8	1.22	15.66%	10.44%	8.63%	1.81%
Micro-Cap, 9-10	1.36	18.77%	13.55%	9.61%	3.95

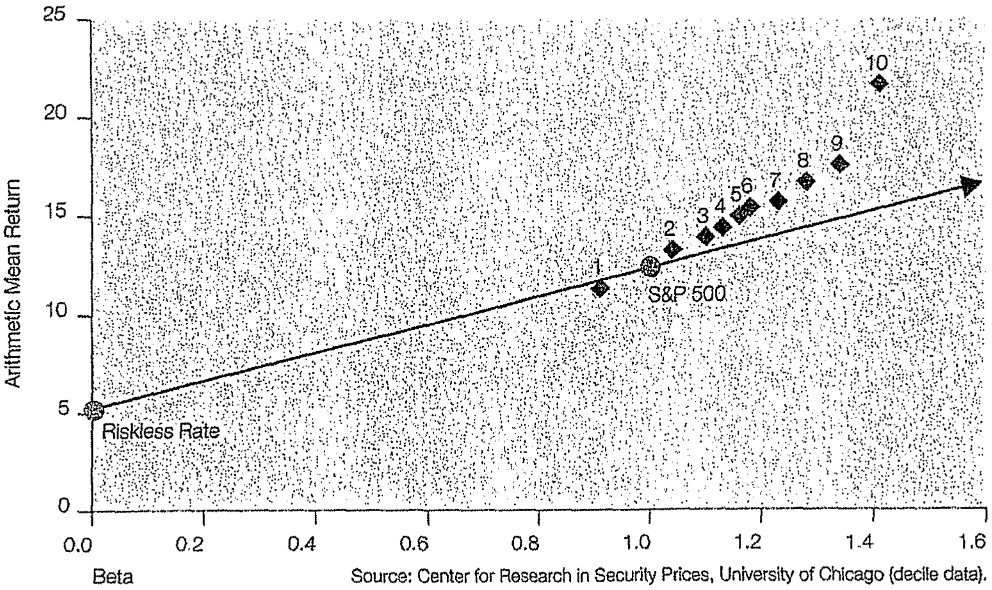
*Betas are estimated from monthly portfolio total returns in excess of the 30-day U.S. Treasury bill total return versus the S&P 500 total returns in excess of the 30-day U.S. Treasury bill, January 1926–December 2005.

**Historical riskless rate is measured by the 80-year arithmetic mean income return component of 20-year government bonds (5.22 percent).

†Calculated in the context of the CAPM by multiplying the equity risk premium by beta. The equity risk premium is estimated by the arithmetic mean total return of the S&P 500 (12.30 percent) minus the arithmetic mean income return component of 20-year government bonds (5.22 percent) from 1926–2005.

Graph 7-2

Security Market Line versus Size-Decile Portfolios of the NYSE/AMEX/NASDAQ
1926–2005



Source: Center for Research in Security Prices, University of Chicago (decile data).

Further Analysis of the 10th Decile

The size premia presented thus far do a great deal to explain the return due solely to size in publicly traded companies. However, by splitting the 10th decile into two size groupings we can get a closer look at the smallest companies. This magnification of the smallest companies will demonstrate whether the company size to size premia relationship continues to hold true.

As previously discussed, the method for determining the size groupings for size premia analysis was to take the stocks traded on the NYSE and break them up into 10 deciles, after which stocks traded on the AMEX and NASDAQ were allocated into the same size groupings. This same methodology was used to split the 10th decile into two parts: 10a and 10b, with 10b being the smaller of the two. This is equivalent to breaking the stocks down into 20 size groupings, with portfolios 19 and 20 representing 10a and 10b.

Table 7-7 shows that the pattern continues; as companies get smaller their size premium increases. There is a noticeable increase in size premium from 10a to 10b, which can also be demonstrated visually in Graph 7-3. This can be useful in valuing companies that are extremely small. Table 7-6 presents the size, composition, and breakpoints of deciles 10a and 10b. First, the recent number of companies and total decile market capitalization are presented. Then the largest company and its market capitalization are presented.

Breaking the smallest decile down lowers the significance of the results compared to results for the 10th decile taken as a whole, however. The same holds true for comparing the 10th decile with the Micro-Cap aggregation of the 9th and 10th deciles. The more stocks included in a sample the more significance can be placed on the results. While this is not as much of a factor with the recent years of data, these size premia are constructed with data back to 1926. By breaking the 10th decile down into smaller components we have cut the number of stocks included in each grouping. The change over time of the number of stocks included in the 10th decile for the NYSE/AMEX/NASDAQ is presented in Table 7-8. With fewer stocks included in the analysis early on, there is a strong possibility that just a few stocks can dominate the returns for those early years.

While the number of companies included in the 10th decile for the early years of our analysis is low, it is not too low to still draw meaningful results even when broken down into subdivisions 10a and 10b. All things considered, size premia developed for deciles 10a and 10b are significant and can be used in cost of capital analysis. These size premia should greatly enhance the development of cost of capital analysis for very small companies.

Table 7-6

Size-Decile Portfolios 10a and 10b of the NYSE/AMEX/NASDAQ, Largest Company and Its Market Capitalization
September 30, 2005

Decile	Recent Number of Companies	Recent Decile Market Capitalization (in thousands)	Market Capitalization of Largest Company (in thousands)	Company Name
10a	483	$108,194,821	$264,981	4Kids Entertaint Inc.
10b	1,279	$102,157,012	$169,195	Quaker Chemical Corp.

Note: These numbers may not aggregate to equal decile 10 figures.
Source: Center for Research in Security Prices, University of Chicago.

Table 7-7

Long-Term Returns in Excess of CAPM Estimation for Decile Portfolios of the NYSE/AMEX/NASDAQ, with 10th Decile Split
1926–2005

	Beta*	Arithmetic Mean Return	Realized Return in Excess of Riskless Rate**	Estimated Return in Excess of Riskless Rate†	Size Premium (Return in Excess of CAPM)
1-Largest	0.91	11.29%	6.07%	6.45%	-0.37%
2	1.04	13.22%	8.00%	7.33%	0.67%
3	1.10	13.84%	8.62%	7.77%	0.85%
4	1.13	14.31%	9.09%	7.98%	1.10%
5	1.16	14.91%	9.69%	8.20%	1.49%
6	1.18	15.33%	10.11%	8.38%	1.73%
7	1.23	15.62%	10.40%	8.73%	1.67%
8	1.28	16.60%	11.38%	9.05%	2.33%
9	1.34	17.48%	12.26%	9.50%	2.76%
10a	1.43	19.71%	14.49%	10.10%	4.39%
10b-Smallest	1.39	24.87%	19.65%	9.82%	9.83%
Mid-Cap, 3-5	1.12	14.15%	8.94%	7.91%	1.02%
Low-Cap, 6-8	1.22	15.66%	10.44%	8.63%	1.81%
Micro-Cap, 9-10	1.36	18.77%	13.55%	9.61%	3.95%

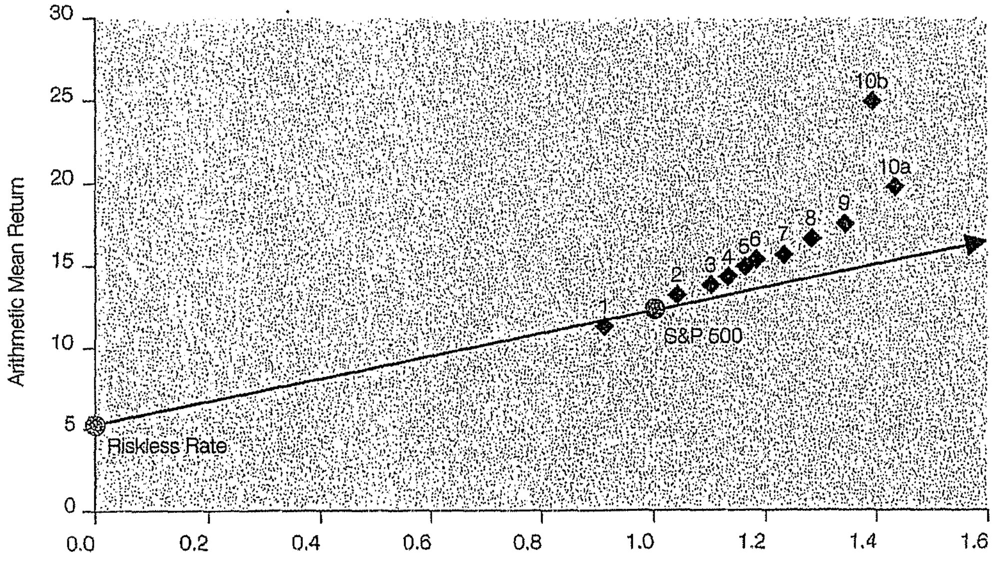
*Betas are estimated from monthly portfolio total returns in excess of the 30-day U.S. Treasury bill total return versus the S&P 500 total returns in excess of the 30-day U.S. Treasury bill, January 1926–December 2005.

**Historical riskless rate is measured by the 80-year arithmetic mean income return component of 20-year government bonds (5.22 percent).

†Calculated in the context of the CAPM by multiplying the equity risk premium by beta. The equity risk premium is estimated by the arithmetic mean total return of the S&P 500 (12.30 percent) minus the arithmetic mean income return component of 20-year government bonds (5.22 percent) from 1926–2005.

Graph 7-3

Security Market Line versus Size-Decile Portfolios of the NYSE/AMEX/NASDAQ, with 10th Decile Split
1926–2005



Source: Center for Research in Security Prices, University of Chicago (decile data).

Table 7-8

Historical Number of Companies for NYSE/AMEX/NASDAQ Decile 10

Sept.	Number of Companies
1926	52*
1930	72
1940	78
1950	100
1960	109
1970	865
1980	685
1990	1,814
2000	1,927
2005	1,746

*The fewest number of companies was 49 in March, 1926

Source: Center for Research in Security Prices, University of Chicago.

Alternative Methods of Calculating the Size Premia

The size premia estimation method presented above makes several assumptions with respect to the market benchmark and the measurement of beta. The impact of these assumptions can best be examined by looking at some alternatives. In this section we will examine the impact on the size premia of using a different market benchmark for estimating the equity risk premia and beta. We will also examine the effect on the size premia study of using sum beta or an annual beta.[4]

Changing the Market Benchmark

In the original size premia study, the S&P 500 is used as the market benchmark in the calculation of the realized historical equity risk premium and of each size group's beta. The NYSE total value-weighted index is a common alternative market benchmark used to calculate beta. Table 7-9 uses this market benchmark in the calculation of beta. In order to isolate the size effect, we require an equity risk premium based on a large company stock benchmark. The NYSE deciles 1–2 large company index offers a mutually exclusive set of portfolios for the analysis of the smaller company groups: mid-cap deciles 3–5, low-cap deciles 6–8, and micro-cap deciles 9–10. The size premia analyses using these benchmarks are summarized in Table 7-9 and depicted graphically in Graph 7-4.

For the entire period analyzed, 1926–2005, the betas obtained using the NYSE total value-weighted index are higher than those obtained using the S&P 500. Since smaller companies had higher betas using the NYSE benchmark, one would expect the size premia to shrink. However, as was illustrated in Chapter 5, the equity risk premium calculated using the NYSE deciles 1–2 benchmark results in a value of 6.33, as opposed to 7.08 when using the S&P 500. The effect of the higher betas and lower equity risk premium cancel each other out, and the resulting size premia in Table 7-9 are slightly higher than those resulting from the original study.

4 Sum beta is the method of beta estimation described in Chapter 6 that was developed to better account for the lagged reaction of small stocks to market movements. The sum beta methodology was developed for the same reason that the size premia were developed; small company betas were too small to account for all of their excess returns.

Table 7-9

Long-Term Returns in Excess of CAPM Estimation for Decile Portfolios of the NYSE/AMEX/NASDAQ, with NYSE Market Benchmarks
1926–2005

Decile	Beta*	Arithmetic Mean Return	Realized Return in Excess of Riskless Rate**	Estimated Return in Excess of Riskless Rate†	Size Premium (Return in Excess of CAPM)
1-Largest	0.94	11.29%	6.07%	5.98%	0.10%
2	1.09	13.22%	8.00%	6.91%	1.09%
3	1.16	13.84%	8.62%	7.32%	1.30%
4	1.20	14.31%	9.09%	7.57%	1.52%
5	1.23	14.91%	9.69%	7.77%	1.92%
6	1.26	15.33%	10.11%	7.98%	2.14%
7	1.32	15.62%	10.40%	8.34%	2.06%
8	1.37	16.60%	11.38%	8.68%	2.70%
9	1.44	17.48%	12.26%	9.11%	3.15%
10-Smallest	1.52	21.59%	16.37%	9.63%	6.74%
Mid-Cap, 3-5	1.18	14.15%	8.94%	7.47%	1.46%
Low-Cap, 6-8	1.30	15.66%	10.44%	8.23%	2.21%
Micro-Cap, 9-10	1.46	18.77%	13.55%	9.22%	4.33%

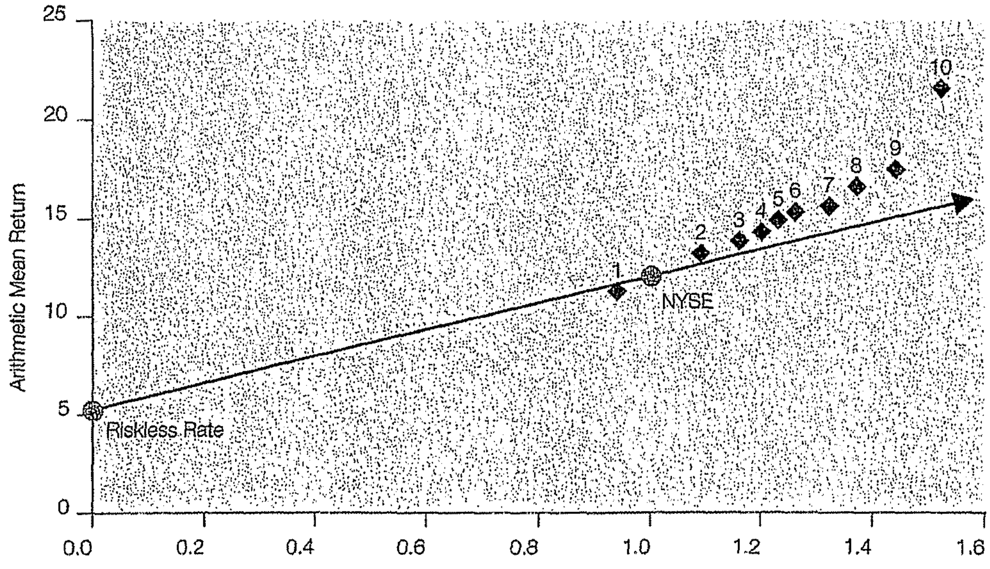
*Betas are estimated from monthly portfolio total returns in excess of the 30-day U.S. Treasury bill total return versus the NYSE total capitalization-weighted index total returns in excess of the 30-day U.S. Treasury bill, January 1926–December 2005.

**Historical riskless rate is measured by the 80-year arithmetic mean income return component of 20-year government bonds (5.22 percent).

†Calculated in the context of the CAPM by multiplying the equity risk premium by beta. The equity risk premium is estimated by the arithmetic mean total return of the NYSE deciles 1–2 (11.55 percent) minus the arithmetic mean income return component of 20-year government bonds (5.22 percent) from 1926–2005.

Graph 7-4

Security Market Line versus Size-Decile Portfolios of the NYSE/AMEX/NASDAQ with NYSE Market Benchmarks
1926-2005



Source: Center for Research in Security Prices, University of Chicago (decile data).

Measuring Beta with Sum Beta

The sum beta method attempts to provide a better measure of beta for small stocks by taking into account their lagged price reaction to movements in the market. [See Chapter 6.] Table 7-10 shows that using this method of beta estimation results in larger betas for the smaller size deciles of the NYSE/AMEX/NASDAQ while those of the larger size deciles remain relatively stable. From these results, it appears that the sum beta method corrects for possible errors that are made when estimating small company betas without adjusting for the lagged price reaction of small stocks. However, the sum beta, when applied to the CAPM, still does not account for all of the returns in excess of the riskless rate historically found for small stocks. Table 7-10 demonstrates that a size premium is still necessary to estimate the expected returns using sum beta in conjunction with the CAPM, though the premium is smaller than that needed when using the typical calculation of beta.

Graph 7-5 compares the 10 deciles of the NYSE/AMEX/NASDAQ to the security market line. There are two sets of decile portfolios—one set is plotted using the single variable regression method of calculating beta, as in Graph 7-2, and the second set uses the sum beta method. The portfolios plotted using sum beta more closely resemble the security market line. Again, this demonstrates that the sum beta method results in the desired effect: a higher estimate of returns for small companies. Yet the smaller portfolios still lie above the security market line, indicating that an additional premium may be required.

Table 7-10

Long-Term Returns in Excess of CAPM for Decile Portfolios of the NYSE/AMEX/NASDAQ, with Sum Beta
1926–2005

Decile	Sum Beta*	Arithmetic Mean Return	Realized Return in Excess of Riskless Rate**	Estimated Return in Excess of Riskless Rate†	Size Premium (Return in Excess of CAPM)
1-Largest	0.91	11.29%	6.07%	6.45%	-0.38%
2	1.06	13.22%	8.00%	7.50%	0.51%
3	1.13	13.84%	8.62%	8.00%	0.62%
4	1.20	14.31%	9.09%	8.49%	0.60%
5	1.24	14.91%	9.69%	8.77%	0.92%
6	1.30	15.33%	10.11%	9.24%	0.87%
7	1.38	15.62%	10.40%	9.76%	0.64%
8	1.48	16.60%	11.38%	10.50%	0.88%
9	1.55	17.48%	12.26%	11.00%	1.26%
10-Smallest	1.71	21.59%	16.37%	12.12%	4.26%
Mid-Cap, 3-5	1.17	14.15%	8.94%	8.28%	0.65%
Low-Cap, 6-8	1.36	15.66%	10.44%	9.66%	0.78%
Micro-Cap, 9-10	1.60	18.77%	13.55%	11.31%	2.24%

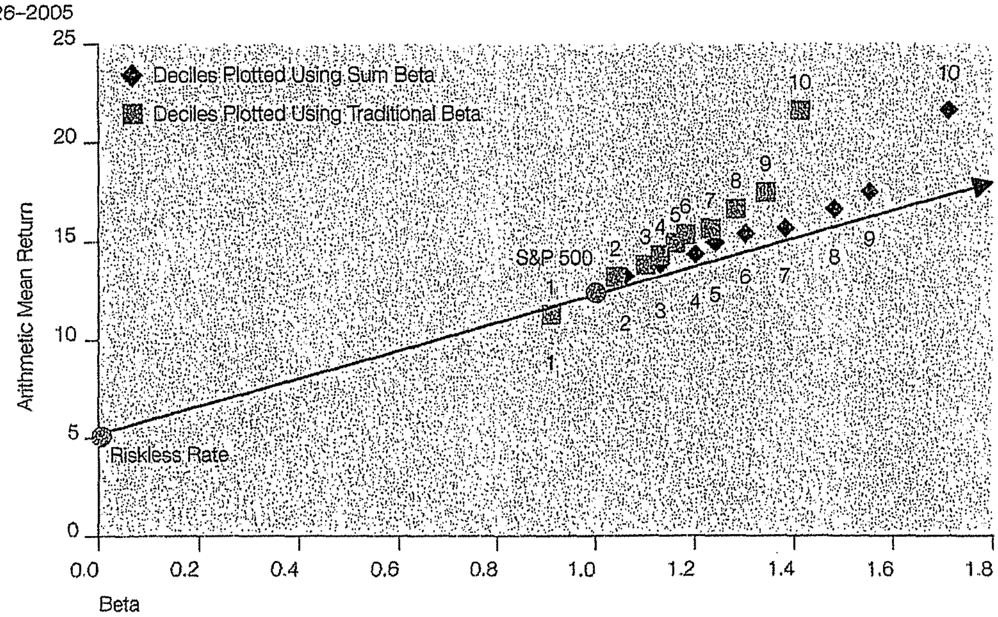
*Betas are estimated from monthly portfolio total returns in excess of the 30-day U.S. Treasury bill total return versus the S&P 500 index total returns in excess of the 30-day U.S. Treasury bill, January 1926–December 2005.

**Historical riskless rate is measured by the 80-year arithmetic mean income return component of 20-year government bonds (5.22 percent).

†Calculated in the context of the CAPM by multiplying the equity risk premium by beta. The equity risk premium is estimated by the arithmetic mean total return of the S&P 500 (12.30 percent) minus the arithmetic mean income return component of 20-year government bonds (5.22 percent) from 1926–2005.

Graph 7-5

Security Market Line versus Size-Decile Portfolios of the NYSE/AMEX/NASDAQ, Sum Beta (with Lag) versus Unadjusted Beta (without Lag)
1926–2005



Annual Data versus Monthly Data

Another potential way to correct for the low beta estimates of small company stocks is to calculate the long-term beta with annual data instead of monthly data. Using annual data may eliminate the infrequent trading argument because of the long period of time covered. However, Table 7-11 and Graph 7-6 illustrate that the size premium is still present when estimating beta with annual data.

Table 7-11

Long-Term Returns in Excess of CAPM Estimation for Decile Portfolios of the NYSE/AMEX/NASDAQ, with Annual Beta
1926–2005

Decile	Annual Beta*	Arithmetic Mean Return	Realized Return in Excess of Riskless Rate**	Estimated Return in Excess of Riskless Rate†	Size Premium (Return in Excess of CAPM)
1-Largest	0.94	11.29%	6.07%	6.65%	-0.58%
2	1.04	13.22%	8.00%	7.38%	0.62%
3	1.08	13.84%	8.62%	7.68%	0.94%
4	1.17	14.31%	9.09%	8.27%	0.82%
5	1.20	14.91%	9.69%	8.51%	1.19%
6	1.20	15.33%	10.11%	8.51%	1.60%
7	1.30	15.62%	10.40%	9.21%	1.19%
8	1.37	16.60%	11.38%	9.67%	1.71%
9	1.46	17.48%	12.26%	10.31%	1.95%
10-Smallest	1.65	21.59%	16.37%	11.69%	4.69%
Mid-Cap, 3-5	1.13	14.15%	8.94%	8.01%	0.93%
Low-Cap, 6-8	1.27	15.66%	10.44%	8.98%	1.46%
Micro-Cap, 9-10	1.51	18.77%	13.55%	10.72%	2.83%

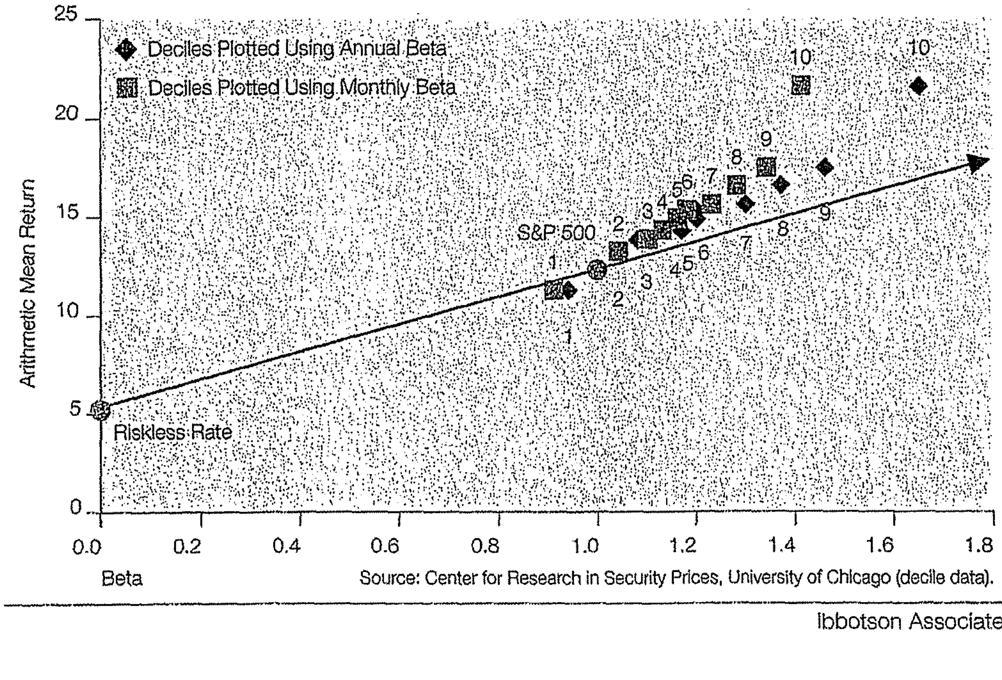
*Betas are estimated from annual portfolio total returns in excess of the 30-day U.S. Treasury bill total return versus the S&P 500 index total returns in excess of the 30-day U.S. Treasury bill, January 1926–December 2005.

**Historical riskless rate is measured by the 80-year arithmetic mean income return component of 20-year government bonds (5.22 percent).

†Calculated in the context of the CAPM by multiplying the equity risk premium by beta. The equity risk premium is estimated by the arithmetic mean total return of the S&P 500 (12.30 percent) minus the arithmetic mean income return component of 20-year government bonds (5.22 percent) from 1926–2005.

Graph 7-6

Security Market Line versus Size-Decile Portfolios of the NYSE/AMEX/NASDAQ Annual Beta versus Monthly Beta
1926–2005



Source: Center for Research in Security Prices, University of Chicago (decile data).

Serial Correlation in Small Company Stock Returns

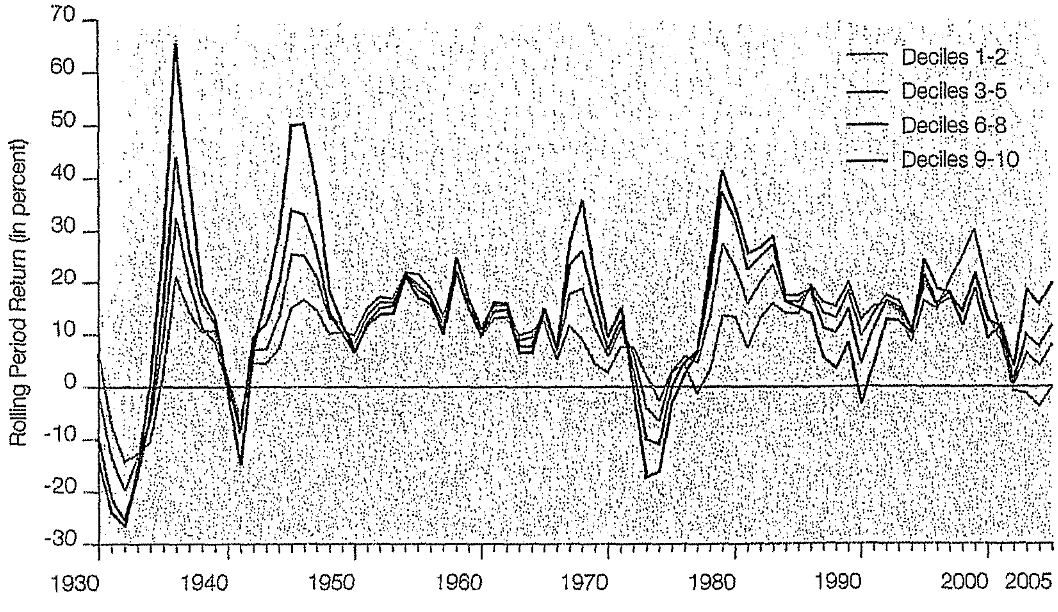
In five of the last ten years, large-capitalization stocks have outperformed small-capitalization stocks. This recent role reversal has led some to speculate that there is no size premium, but statistical evidence suggests that periods of underperformance should be expected.

History tells us that small companies are riskier than large companies. Table 7-4 shows the standard deviation (a measure of risk) for each decile of the NYSE/AMEX/NASDAQ. As one moves from larger to smaller deciles, the standard deviation of return grows. Investors are compensated for taking on this additional risk by the higher returns provided by small companies. It is important to note, however, that the risk/return profile is over the long term. If small companies did not provide higher long-term returns, investors would be more inclined to invest in the less risky stocks of large companies.

The increased risk faced by investors in small stocks is quite real. The long-term expected return for any asset class is quite different than short-term expected returns, and investors in small-capitalization stocks should expect losses and periods of underperformance. Graph 7-7 shows five-year rolling period returns of four size groups: large-cap (deciles 1–2), mid-cap (deciles 3–5), low-cap (deciles 6–8), and micro-cap (deciles 9–10). There have been a number of five-year periods in which the large-cap group outperformed some or all of the small-cap groups.

Graph 7-7

Five-Year Rolling Period Returns for the Size-Decile Portfolios of the NYSE/AMEX/NASDAQ
1926–2005



Source: Center for Research in Security Prices, University of Chicago.

Serial correlation, or first-order autocorrelation, measures the degree to which the return of a given series is related from period to period. Serial correlation, like cross-correlation, ranges from positive one to negative one. A positive serial correlation can be an indicator of a trend in a return series. A serial correlation of positive one indicates that returns from one period have a perfectly positive relationship to the returns of the next period; returns are therefore perfectly predictable from one period to the next. A negative serial correlation can be an indicator of a cycle in a return series. A serial correlation of negative one indicates that returns from one period have a perfectly negative relationship to the next period. A serial correlation near zero indicates that returns are random or unpredictable.

If stock returns have a positive or a negative serial correlation, one can gain some information about future performance based on prior period returns. The serial correlation of returns on large-capitalization stocks is near zero. [See Table 7-4.] For the smallest deciles of stocks, the serial correlation is near or above 0.1. This observation bears further examination.

To remove the randomizing effect of the market as a whole, the returns for decile 1 are geometrically subtracted from the returns for each decile 2 through 10. The result illustrates that these series in excess of decile 1 exhibit greater serial correlation than the individual decile series themselves. Table 7-12 presents the serial correlations of the excess returns for deciles 2 through 10. These serial correlations suggest some predictability of smaller company excess returns; however, caution is necessary. The serial correlation of small company excess returns for non-calendar years (February through January, etc.) do not always confirm the results shown here for calendar years (January through December). Therefore, predicting small company excess returns may not be easy.

Table 7-12

Size-Decile Portfolios of the NYSE/AMEX/NASDAQ, Serial Correlation of Annual Returns in Excess of Decile 1 Returns

1926–2005

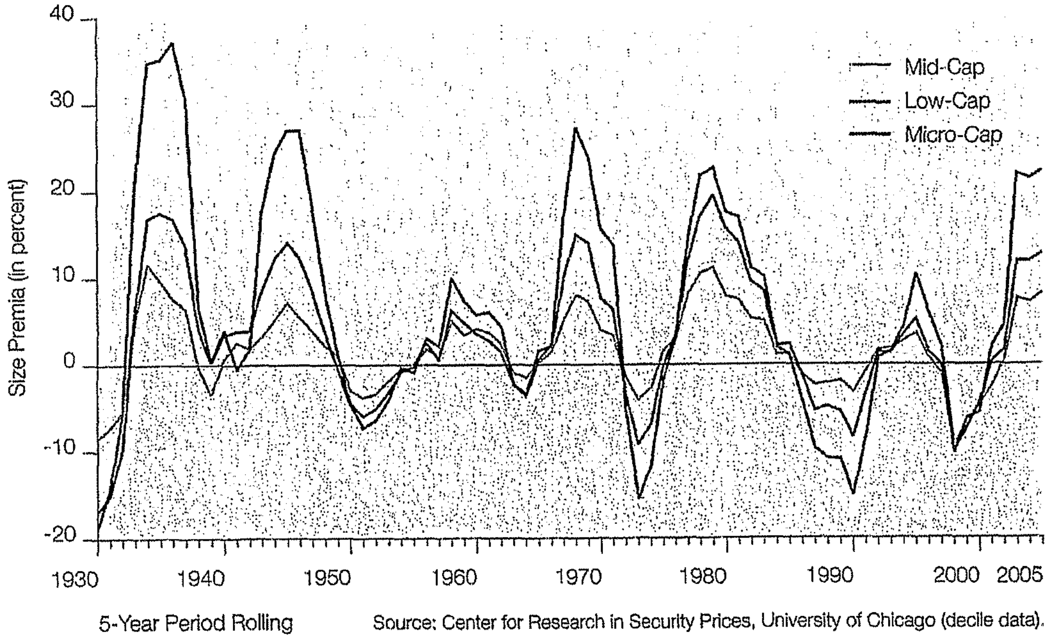
Decile	Serial Correlation of Annual Returns in Excess of Decile 1 Returns
2	0.27
3	0.31
4	0.24
5	0.27
6	0.35
7	0.28
8	0.34
9	0.32
10	0.40

Source: Center for Research in Security Prices, University of Chicago.

The size premia developed in this chapter also remove the randomizing effect of the market as a whole and appear to be serially correlated. Graph 7-8 shows the size premia for rolling five-year periods for each of the three size groups: mid-cap, low-cap, and micro-cap. (A five-year period is necessary to calculate the beta for each portfolio, which is then used to calculate the size premia.) There are periods in which the size premia are positive and periods in which they are negative. However, none of these periods appears to continue for an extended time. Basing a long-term estimate of the size premia on the most recent periods would therefore be inappropriate.

Graph 7-8

Five-Year Rolling Period Size Premia for Decile Portfolios of the NYSE/AMEX/NASDAQ
1926–2005

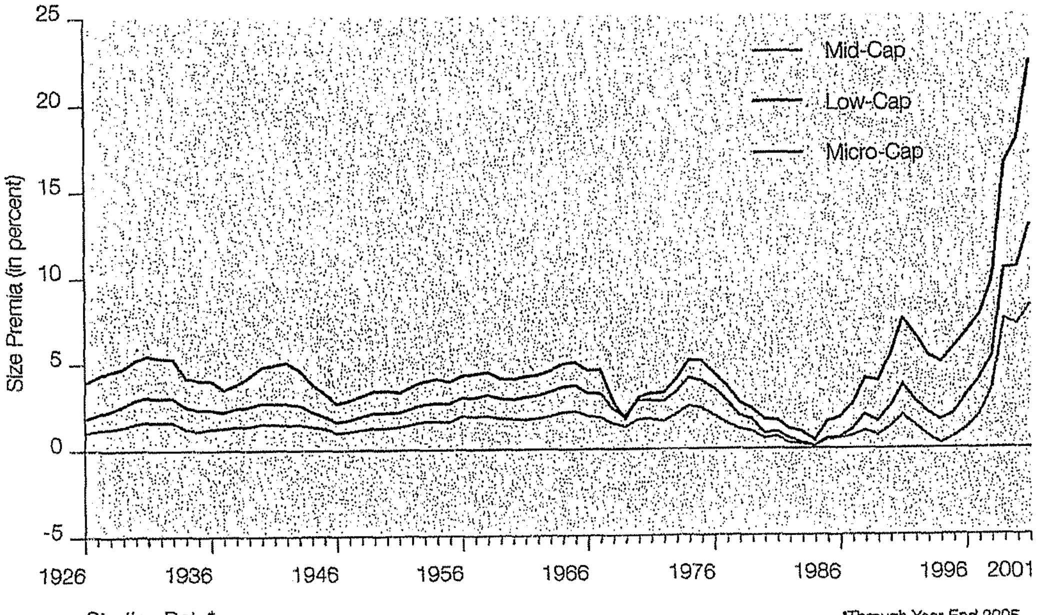


Source: Center for Research in Security Prices, University of Chicago (decile data).

The logic behind using a long history to estimate the size premia is similar to the argument for using a long history in estimating the equity risk premium (see Chapter 5). Longer historical periods provide more stable estimates of the size premia because unique events are not weighted heavily, and the probability of such events occurring is better represented by an average that covers a long period of time. Graph 7-9 demonstrates the calculation of the size premia using different starting dates. It shows the realized size premia for a series of time periods through 2005. In other words, the first value on the graph represents the average realized size premium over the period 1926–2005. The next value on the graph represents the average realized size premium over the period 1927–2005, and so on, with the last value representing the average over the most recent five years, 2000–2005. Concentrating on the left side of Graph 7-9, one notices that the realized size premia, when measured over long periods of time, are relatively stable. The increased volatility of the size premia in more recent periods is due to their cyclical nature.

Graph 7-9

Size Premia for Decile Portfolios of the NYSE/AMEX/NASDAQ Calculated with Different Starting Dates
1926–2005



Source: Center for Research in Security Prices, University of Chicago (decile data).

Seasonality

Unlike the returns on large company stocks, the returns on small company stocks appear to be seasonal. The January effect denotes the empirical regularity with which rates of return for small stocks have historically been higher in January than in the other months of the year. Small company stocks often outperform larger stocks by amounts in January far greater than in any other month.

Table 7-13 shows the returns of capitalization deciles 2 through 10 in excess of the return on decile 1; the excess returns are segregated into months. For each decile and for each month, the exhibit shows both the average excess return and the number of times the excess return was positive. These two statistics measure the seasonality of the excess return in different ways—the average excess return illustrates the size of the seasonality effect, while the number of positive excess returns shows its reliability.

Table 7-13

Returns in Excess of First Decile, Size-Decile Portfolios of the NYSE/AMEX/NASDAQ
1926–2005

Decile	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total (Jan–Dec)
2	0.81%	0.52%	-0.03%	-0.33%	0.09%	-0.08%	-0.05%	0.25%	0.10%	-0.25%	0.11%	0.36%	1.56%
	59	50	37	29	41	39	37	42	45	36	44	44	
3	1.15%	0.32%	0.01%	-0.12%	-0.17%	-0.11%	0.00%	0.38%	-0.02%	-0.38%	0.57%	0.32%	2.01%
	59	51	41	30	35	36	40	47	43	34	46	46	
4	1.30%	0.59%	-0.07%	-0.30%	0.08%	-0.06%	-0.02%	0.32%	0.12%	-0.76%	0.41%	0.48%	2.19%
	56	52	38	34	39	39	37	48	40	28	46	46	
5	2.19%	0.57%	-0.13%	-0.29%	-0.18%	0.03%	-0.04%	0.35%	0.16%	-0.80%	0.38%	0.31%	2.67%
	58	48	37	35	36	37	39	45	40	31	46	42	
6	2.56%	0.56%	-0.20%	-0.18%	0.27%	-0.13%	-0.08%	0.54%	0.21%	-1.24%	0.30%	0.22%	3.01%
	60	51	40	33	38	37	41	45	44	31	42	42	
7	3.16%	0.64%	-0.20%	-0.19%	0.14%	-0.27%	-0.05%	0.23%	0.29%	-1.04%	0.22%	0.02%	3.02%
	61	52	41	36	34	33	35	40	44	29	42	38	
8	4.32%	0.73%	-0.44%	-0.46%	0.45%	-0.40%	0.11%	0.07%	0.10%	-1.04%	0.31%	-0.30%	3.77%
	60	47	36	33	32	36	37	37	41	32	37	35	
9	5.79%	0.96%	-0.25%	-0.31%	0.28%	-0.35%	0.04%	0.13%	-0.03%	-1.26%	0.19%	-1.05%	4.40%
	63	44	40	32	33	33	36	40	38	30	34	33	
10	9.13%	1.01%	-0.80%	0.03%	0.51%	-0.64%	0.56%	-0.10%	0.68%	-1.41%	-0.34%	-1.69%	7.80%
	72	41	34	36	35	32	37	30	42	28	30	28	

First row: average excess return in percent.
Second row: number of times excess return was positive (in 80 years).
Source: Center for Research in Security Prices, University of Chicago.

Virtually all of the small stock effect occurs in January, as the excess outcomes for small company stocks are mostly negative in the other months of the year. Excess returns in January relate to size in a precisely rank-ordered fashion, and the January effect seems to pervade all size groups. Yet, simply demonstrating that the size premium is largely produced by the January effect does nothing to refute the existence of such a premium.

Possible Explanations for the January Effect

There is no generally accepted explanation of the January effect. One potential explanation is that it results from year-end window dressing by portfolio managers. Window dressing is the process of dumping money-losing stocks just before year-end so that such stocks are not included in the portfolio managers' annual reports.

Another explanation of the January effect is that it results from tax-loss selling at year-end, whereby money-losing stocks are sold at the end of the year for tax purposes. They are then repurchased in the market in January. Investors who have earned a capital loss on a security may be motivated to sell their shares shortly before the end of December in order to realize the capital loss for income tax purposes. This creates a preponderance of sellers in need of willing buyers at year-end. Amid such selling pressure, transactions will generally occur at the bid price, or the price a buyer is willing to pay for a particular stock, which is generally lower than the ask price. Therefore, a preponderance of sell orders will register more transactions at lower bid prices, which may create some temporary downward pressure on the prices of these stocks. They will only appear to recover in January, when trading returns to a more balanced mix of buy and sell orders, though there may be some actual recovery of prices as money generated by tax-loss selling returns to the market, driving up demand.

How does this cause "small" stocks to have higher apparent returns? Stocks that are "losers" will tend to have depressed stock prices. Also, stocks whose prices are quoted at the "bid" price will tend to have lower apparent market values than stocks quoted at the "ask" price. These two effects may lead to a bias when we use the market value of equity as our measure of "size." If losing stocks have both depressed prices and a tendency to sell at the "bid" at year-end, then they will likely be pushed down in the rankings according to market value. At the same time, winners will be pushed up. Thus, portfolios composed of "small" market value companies will tend to have more "losers" whose returns in January are distorted by tax-loss selling.

This argument vanishes if one uses a non-value criterion (such as net sales, total assets, or number of employees) to measure "size." As long as the "size" measure is not based on market value, there will be no tendency for firms with depressed stock prices to be ranked lower than other firms or for "small" stock portfolios to include a preponderance of "bid" prices at year-end. One study that corroborates the effect of different size measures is the PricewaterhouseCoopers study.[5] The PricewaterhouseCoopers study focused on different measures of size and calculated size premia using these different measures. The measures of size considered by the study are market value of equity, book value of equity, five-year average net income, market value of invested capital, total assets, five-year average EBITDA, sales, and number of employees. This study is updated annually and now sold as the Duff & Phelps, L.LC. Risk Premium Report.[6]

5 Grabowski, Roger, and David W. King. "New Evidence on Size Effects and Rates of Return," *Business Valuation Review*, September 1996, p. 103.
6 For more information on the "Duff & Phelps, L.L.C. Risk Premium Report" see Ibbotson's Cost of Capital Center at http://www.ibbotson.com.

The Size Phenomena Across Industries

One question regularly raised concerning the size premium is whether it is relevant for specific industries. In the past there has been no concrete evidence to counter the contention that a size effect exists for the economy as a whole but may not be relevant to a specific industry. The problem of supporting a size premia for a specific industry has been made difficult by a lack of data for companies in individual industries.

We have attempted to answer this question by performing an industry-specific size effect study. The study uses the Center for Research in Security Prices (CRSP) database and the following methodology:

1. Industries are defined at the two-digit SIC (Standard Industrial Classification) code level. Companies are sorted into industries using the CRSP SIC code classification system. In order to be included in the study, an industry must have a minimum of ten companies for all periods. Any industry containing less than 30 years of data was not included in the study.
2. On a calendar year-end basis, companies are ranked by market capitalization within each industry from largest to smallest. Each industry is split into a "large" and a "small" portfolio with an equal number of companies.
3. A capitalization-weighted return series is calculated for each "large" and "small" portfolio. The excess return for each industry is represented by the "small" portfolio arithmetic return less the "large" portfolio arithmetic return.

The results of the study can be found in Table 7-14. Note that a large majority of industries exhibit returns where small company stocks outperform large company stocks over extended periods.

The excess returns presented in this table should not be construed as size premia. Due to limited data, we have defined size in rather general terms. In addition, the population of companies in most industries is very small. Table 7-14 only provides evidence that smaller companies have generally outperformed larger companies across industries. The size premium study presented earlier in this chapter provides more reliable statistics as they relate to the size premium. In addition, measures of industry risk for use in the buildup model are presented in Table 3-5.

Table 7-14

Size Effect within Industries
Summary Statistics and Excess Returns

(Through Year-end 2005)

			Large Company Group		
SIC Code	Description	Years	Geometric Mean	Arithmetic Mean	Standard Deviation
10	Metal Mining	80	7.87%	11.47%	29.09%
13	Oil and Gas Extraction	43	11.41%	14.34%	26.13%
15	Building Construction-General Contractors & Op. Builders	34	12.93%	19.66%	39.85%
16	Hvy. Construction Other than Bldg. Construction-Contractors	35	7.28%	10.93%	30.54%
20	Food and Kindred Spirits	80	10.88%	12.52%	18.98%
22	Textile Mill Products	80	7.00%	11.87%	32.64%
23	Apparel & other Finished Products Made from Fabrics & Similar	46	8.01%	12.64%	32.81%
24	Lumber and Wood Products, Except Furniture	43	9.62%	12.26%	25.37%
25	Furniture and Fixtures	36	10.11%	12.46%	22.37%
26	Paper & Allied Products	76	10.29%	13.68%	28.09%
27	Printing, Publishing and Allied Products	47	10.71%	12.81%	21.05%
28	Chemicals and Allied Products	80	11.78%	13.91%	22.45%
29	Petroleum Refining & Related Industries	80	11.40%	13.50%	21.34%
30	Rubber & Miscellaneous Plastics Products	59	10.83%	13.54%	25.34%
31	Leather & Leather Products	43	12.74%	17.08%	33.02%
32	Stone, Clay, Glass & Concrete Products	77	8.66%	12.46%	31.50%
33	Primary Metal Industries	80	8.08%	12.01%	30.39%
34	Fabricated Metal Products, Except Machinery & Trans. Equip.	80	9.56%	12.08%	23.10%
35	Industrial & Commercial Machinery & Computer Equipment	80	10.68%	14.09%	27.66%
36	Electrical Equipment & Components, Except Computer	80	9.86%	13.58%	28.54%
37	Transportation Equipment	80	10.82%	15.07%	32.08%
38	Measuring, Analyzing & Controlling Instruments	69	12.04%	14.14%	21.96%
39	Miscellaneous Manufacturing Industries	44	7.88%	11.74%	28.57%
40	Railroad Transportation	80	9.65%	12.67%	24.86%
42	Motor Freight Transportation & Warehousing	42	9.78%	13.24%	28.28%
45	Transport by Air	60	7.26%	11.67%	32.37%
48	Communications	43	8.89%	11.20%	22.08%
49	Electric, Gas & Sanitary Services	80	8.78%	10.89%	21.48%
50	Wholesale Trade-Durable Goods	60	10.12%	12.34%	22.64%
51	Wholesale Trade-Nondurable Goods	38	9.94%	12.89%	24.91%
53	General Merchandise Stores	80	9.88%	13.09%	26.56%
54	Food Stores	49	11.29%	13.79%	23.37%
56	Apparel & Accessory Stores	59	14.08%	18.18%	32.15%
57	Home Furniture, Furnishings, and Equipment Stores	33	12.37%	23.69%	60.37%
58	Eating and Drinking Places	37	10.85%	15.36%	33.13%
59	Miscellaneous Retail	43	12.66%	15.93%	26.94%
60	Depository Institutions	37	11.64%	13.78%	21.37%
61	Nondepository Credit Institutions	56	12.83%	15.66%	26.45%
62	Security and Commod. Brokers, Dealers, Exchanges	33	17.78%	24.55%	43.10%
63	Insurance Carriers	37	10.63%	12.51%	20.39%
64	Insurance Agents, Brokers, and Service	33	14.79%	16.25%	18.21%
65	Real Estate	43	7.34%	11.82%	30.63%
67	Holding & Other Investment Offices	76	10.00%	13.17%	25.21%
70	Hotels, Rooming Houses, Camps, & Other Lodging	36	10.03%	15.69%	35.13%
72	Personal Services	36	8.73%	13.40%	30.78%
73	Business Services	43	10.20%	15.01%	32.56%
78	Motion Pictures	55	12.11%	16.67%	33.13%
79	Amusement and Recreation Services	33	12.44%	16.16%	27.50%
80	Health Services	34	13.17%	18.92%	35.76%

Source: Center for Research in Security Prices, University of Chicago.

Table 7-14 (continued)

Size Effect within Industries
Summary Statistics and Excess Returns

(Through Year-end 2005)

SIC Code	Description	Small Company Group: Geometric Mean	Arithmetic Mean	Standard Deviation	Excess Return
10	Metal Mining	8.31%	16.30%	46.05%	4.83%
13	Oil and Gas Extraction	12.81%	21.07%	46.60%	6.73%
15	Building Construction-General Contractors & Op. Builders	6.64%	15.87%	43.37%	–3.79%
16	Hvy. Construction Other than Bldg. Construction–Contractors	18.58%	23.57%	37.33%	12.65%
20	Food and Kindred Spirits	12.36%	15.95%	30.16%	3.44%
22	Textile Mill Products	9.77%	15.35%	34.60%	3.49%
23	Apparel & other Finished Products Made from Fabrics & Similar	5.72%	11.52%	37.95%	–1.12%
24	Lumber and Wood Products, Except Furniture	11.02%	21.19%	53.51%	8.93%
25	Furniture and Fixtures	9.12%	13.29%	29.62%	0.83%
26	Paper & Allied Products	14.21%	19.79%	42.06%	6.12%
27	Printing, Publishing and Allied Products	16.30%	19.15%	24.91%	6.34%
28	Chemicals and Allied Products	13.38%	18.87%	39.59%	4.95%
29	Petroleum Refining & Related Industries	13.21%	17.68%	31.92%	4.18%
30	Rubber & Miscellaneous Plastics Products	12.60%	17.05%	32.93%	3.52%
31	Leather & Leather Products	11.75%	16.79%	34.22%	–0.29%
32	Stone, Clay, Glass & Concrete Products	9.71%	14.54%	33.16%	2.08%
33	Primary Metal Industries	13.01%	18.76%	38.48%	6.75%
34	Fabricated Metal Products, Except Machinery & Trans. Equip.	11.77%	17.41%	37.42%	5.33%
35	Industrial & Commercial Machinery & Computer Equipment	12.20%	17.59%	35.60%	3.50%
36	Electrical Equipment & Components, Except Computer	12.01%	20.02%	45.90%	6.44%
37	Transportation Equipment	12.04%	18.32%	38.31%	3.25%
38	Measuring, Analyzing & Controlling Instruments	13.25%	18.19%	35.01%	4.05%
39	Miscellaneous Manufacturing Industries	8.07%	12.55%	31.90%	0.82%
40	Railroad Transportation	8.46%	14.82%	36.36%	2.15%
42	Motor Freight Transportation & Warehousing	7.21%	13.19%	38.93%	–0.04%
45	Transport by Air	8.71%	17.13%	48.27%	5.46%
48	Communications	17.30%	25.50%	46.18%	14.30%
49	Electric, Gas & Sanitary Services	10.34%	13.96%	29.63%	3.08%
50	Wholesale Trade–Durable Goods	11.01%	16.26%	36.38%	3.92%
51	Wholesale Trade–Nondurable Goods	8.64%	12.33%	28.69%	–0.56%
53	General Merchandise Stores	9.37%	16.84%	43.14%	3.75%
54	Food Stores	10.00%	13.82%	29.54%	0.03%
56	Apparel & Accessory Stores	11.87%	18.02%	38.93%	–0.16%
57	Home Furniture, Furnishings, and Equipment Stores	15.82%	26.33%	51.19%	2.64%
58	Eating and Drinking Places	2.03%	7.97%	36.84%	–7.39%
59	Miscellaneous Retail	12.11%	17.66%	36.52%	1.74%
60	Depository Institutions	15.33%	17.99%	25.10%	4.21%
61	Nondepository Credit Institutions	13.52%	17.44%	29.94%	1.78%
62	Security and Commod. Brokers, Dealers, Exchanges	14.58%	21.59%	42.10%	–2.96%
63	Insurance Carriers	13.39%	16.25%	24.02%	3.74%
64	Insurance Agents, Brokers, and Service	11.82%	19.26%	43.80%	3.01%
65	Real Estate	6.72%	11.65%	34.85%	–0.16%
67	Holding & Other Investment Offices	11.19%	15.46%	31.25%	2.28%
70	Hotels, Rooming Houses, Camps, & Other Lodging	6.42%	12.53%	37.23%	–3.16%
72	Personal Services	18.06%	22.49%	32.80%	9.09%
73	Business Services	13.95%	23.68%	59.91%	8.67%
78	Motion Pictures	6.18%	14.05%	45.60%	–2.62%
79	Amusement and Recreation Services	11.18%	15.10%	31.68%	–1.07%
80	Health Services	15.59%	22.05%	40.75%	3.13%

Source: Center for Research in Security Prices, University of Chicago.

Other Criticisms of the Size Premium

Bid/Ask Spread

All stocks have a bid/ask spread that represents the differential between the highest price a prospective buyer is prepared to pay (bid) and the lowest price a seller is willing to accept (ask). Market makers in a particular security make their money off of this spread. The spread is a form of transaction cost and is a function of the liquidity of a particular security; the greater the liquidity, the lower the bid/ask spread. In general, larger companies have more trading activity and therefore have greater liquidity and a lower bid/ask spread.

Some argue that the existence of such a spread adds a bias to all stock returns but particularly so to portfolios comprised of less liquid (generally smaller) companies that have higher bid/ask spreads. The bias arises because the movement from a bid price to an ask price creates a measured rate of return that is higher in absolute value than a movement from one ask price to another ask price. Since trades occur randomly at either the bid or the ask price, some bias may slip into the measured returns. This bias can be especially pronounced if one is measuring rates of return on a daily basis. Most studies (e.g., Ibbotson Associates and PricewaterhouseCoopers) calculate returns at the portfolio level on a monthly basis and then compound the portfolio returns for each of the 12 months of the year to obtain an annual rate of return.

The "bid/ask bias" is a valid concern that deserves some consideration. Most studies of the small stock effect use the Center for Research in Security Prices (CRSP) database to measure rates of return. CRSP generally uses the closing price, which will be either a "bid" or an "ask," to measure the rates of return. If there are no trades on a given day, CRSP will use the average of the "bid" and "ask" prices. Note that the most illiquid stocks (those with the highest bid/ask spreads) will be the least likely to trade on a given day. For these stocks, CRSP uses the bid/ask average, which automatically rectifies the "bias" to some extent.

The "bid/ask bias" has only a trivial impact on the observed size/return relationship. Average bid/ask spreads are less than four percent of the underlying stock price for all but the very smallest portfolios of stocks.[7] Spreads of under 4 percent could give rise to biases in measured returns that are at most 50 basis points (assuming that annual returns are being compounded from monthly portfolio results, as in the Ibbotson and PricewaterhouseCoopers studies), yet the size/return relationship is manifest even for mid-sized public companies.

Geometric versus Arithmetic Averages

It has been suggested that using geometric averages to formulate discount rates will correct for the alleged "bid/ask bias." This argument is completely spurious. The difference between the geometric and arithmetic averages has nothing whatsoever to do with the bid/ask bounce. Both measures are built up from the same underlying monthly return measurements. Geometric averages are always less than arithmetic averages as a matter of mathematical law, not as a result of the bid/ask spread. Though using geometric averages produces a lower discount rate, the lower rate cannot be attributed to a correction of the bid/ask spread.

7 Amihud, Yakov, and Haim Mendelson. "Asset Pricing and the Bid-Ask Spread," *Journal of Financial Economics*, Vol. 17, 1986, pp. 223–249.

Infrequent Trading and Small Stock Betas

It has been argued that betas for smaller, less frequently traded stocks are mismeasured; in particular, they tend to be too low. If small stock betas were sufficiently high to measure their true systematic risk, then the small stock premium might disappear. This possibility has been offered as an argument against the use of a small stock premium in calculating discount rates.

With a little bit of thought, one should come to a very different conclusion. If small stocks have high returns because they have high betas, and if methods of measuring betas for smaller companies produce betas that are too low, then in the context of the CAPM some sort of adjustment is necessary in order to produce a discount rate of the right magnitude. A small stock premium is one such adjustment.

The Ibbotson Associates size premia study presented earlier in this chapter demonstrates this concept. Beta is calculated for each decile for the entire history back to 1926. These betas are then plugged into the capital asset pricing model to produce decile costs of equity under CAPM, which are then compared to the actual returns that the deciles achieved over this period of history. For all but the largest decile, CAPM underestimates the cost of equity. The amount of this underestimation is termed the size premium.

As was noted earlier in this chapter, it is possible to estimate beta with a different regression equation to take into account the infrequent trading of small-capitalization stocks. One can accomplish this either by using the sum beta technique or by measuring beta with annual data. As seen in Tables 7-10 and 7-11, these techniques increase the cost of equity as predicted by CAPM, but fail to completely eradicate the size premium.

Transaction Costs

It has been argued that, because of high bid/ask spreads and other transaction costs, an investor in publicly traded small stocks is not able to realize returns as high as those we observe in the historical record. According to one theory, small stocks earn high returns in order to compensate investors for high transaction costs. However, in valuing a business, one typically applies to cash flows a discount rate that does not reflect the buyer's or the seller's transaction costs. It would be inconsistent to also use a discount rate that reflects a rate of return on a "net of transaction cost" basis.

Delisted Return Bias

Tyler Shumway published some evidence that the CRSP database omits delisting returns for a large number of companies.[8] This creates a potential bias because stocks generally experience negative returns upon delisting. Since delisting is concentrated in firms with small market values, this has been offered as a partial explanation of the observed size effect.

Shumway's data revealed that the possible bias is trivial for all but the very smallest companies, yet the historical size effect is still evident in mid-cap companies. Therefore, this bias would explain little of the observed historical relationship.

PricewaterhouseCoopers revised its methodology to take into account the Shumway evidence. Shumway reported that the average delisting rate of return for companies for which he could find

8 Shumway, Tyler. "The Delisting Bias in CRSP Data," *Journal of Finance*, Vol. 52, 1997, pp. 327–340.

data was approximately minus 30 percent. The PricewaterhouseCoopers calculations thus assumed a rate of return upon delisting of minus 30 percent for any company for which CRSP lacks delisting return data. This adjustment did not greatly affect the results of the 25 size portfolios in the *PricewaterhouseCoopers Risk Premia Study.* Even for the very smallest (25th) portfolio, the adjustment lowered the observed average return by only 22 basis points (less than one percent). For the rest of the portfolios, the adjustment was even smaller or non-existent. The 2005 update to the original PricewaterhouseCoopers Study is published as the *Duff & Phelps, LLC Risk Premium Report.* This report is available on www.Ibbotson.com.

CRSP questions, in its *CRSP Delisting Returns Study*, "whether or not using one replacement value for all missing delisting returns associated with poor performance delists is the most appropriate solution." CRSP further implies that using one single replacement value may create more bias in the data than would otherwise have existed because of the "significant variation in the average delisting returns for individual delist codes..." The "codes" represent groupings of firms that were delisted from an exchange for the same reason.

In the table below borrowed from the study, geometric annual returns of the 10 deciles are calculated over the 1926—2000 period in three ways: (1) Without Replacements – calculated without any substitution of the missing returns, as outlined on page 129 of this chapter, (2) Treating partial-month returns as delisting returns; partial-month returns are calculated by using the last daily trade price or bid-ask spread for the month in which the security delisted, if no post-delist value can be found, and (3) Using one of the three single-replacement values, based on the assumption "that all issues with missing delisting returns lost an additional 30, 55, or 100 percent of their pre-delist value after leaving the exchange."

Table 7-15

Size-Decile Portfolios of the NYSE/AMEX/NASDAQ, Geometric Annual Returns With or Without Single-replacement Values
1926–2000

	Without Replacements	Partial	-30%	-55%	-100%
1 – Largest	10.31%	10.31%	10.31%	10.31%	10.31%
2	11.28	11.27	11.27	11.27	11.27
3	11.58	11.58	11.58	11.58	11.57
4	11.53	11.53	11.53	11.53	11.53
5	11.81	11.81	11.81	11.81	11.81
6	11.82	11.84	11.83	11.83	11.82
7	11.57	11.57	11.57	11.56	11.55
8	11.65	11.66	11.65	11.64	11.63
9	11.75	11.75	11.74	11.74	11.72
10 – Smallest	13.11	13.11	13.05	13.00	12.92

The highest difference between the returns calculated using a single-replacement value and no replacement value is 19 basis points in the case of the smallest decile portfolio (Decile 10: 13.11%–12.92%); hence, single-replacement values have little impact on the overall decile portfolios. Consequently, the potential upward bias in the size premia—constructed by applying Ibbotson Associates' methodology to CRSP's NYSE/AMEX/NASDAQ Size-Decile Portfolios—is not evident, since the bias of the missing delisting returns (discussed by Shumway) does not manifest when decile portfolio returns are calculated with and without single-replacement value. For more information on delisting returns, visit CRSP's web site at http://www.crsp.uchicago.edu/.

Small Stock Returns Are Unpredictable

Since investors cannot predict when small stock returns will be higher than large stock returns, it has been argued that they do not expect higher rates of return for small stocks. As was illustrated earlier in this chapter, even over periods of many years, investors in small stocks do not always earn returns that are higher than those of investors in large stocks. By simple definition, one cannot expect risky companies to always outperform less risky companies; otherwise they would not be risky. Over the long-term, however, investors do expect small stocks to outperform large stocks.

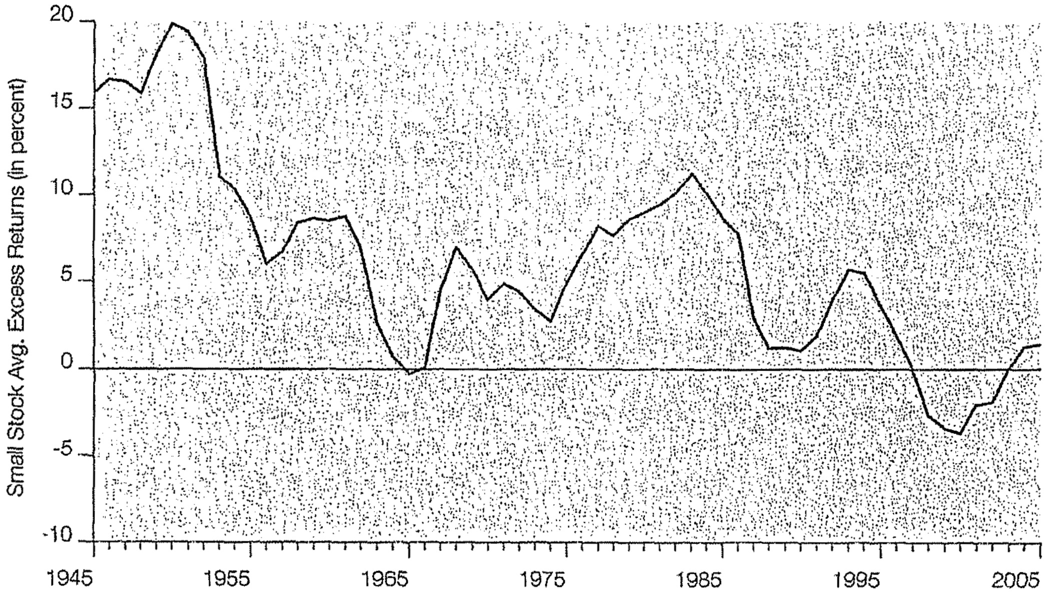
The unpredictability of small stock returns has given rise to another argument against the existence of a size premium: the argument that markets have changed so that there is no longer such a thing as a size premium. As evidence, one might observe the last 20 years of market data to see that the performance of large-capitalization stocks was basically equal to that of small-capitalization stocks. In fact, large-capitalization stocks have outperformed small-capitalization stocks in five of the last ten years.

While the 20-year returns of small-capitalization stocks currently seem low in comparison to large-capitalization stocks, the same relationship has been true in the past. Graph 7-10 shows the average excess returns of small stocks versus large stocks over historical rolling 20-year time periods. (Small stocks are represented by the CRSP NYSE/AMEX/NASDAQ deciles 9 and 10. The S&P 500 represents large stocks. The excess return is calculated by subtracting the large stock returns from the small ones.) The graph clearly shows that over the most recent 20-year rolling periods, small-capitalization stocks have not outperformed large-capitalization stocks.

As was noted earlier in this chapter, one thing that we do know about the size premium is that it is cyclical in nature. Most market returns (including those of large- and small-capitalization stocks) have no historical pattern; however, this is not true of the size premium. It is not unusual for the size premium to follow several years of consistently positive values with several years of consistently negative values. Given the cyclical nature of the size premium, it is therefore not surprising that in recent years large-capitalization stocks have dominated small-capitalization stocks. We should actually expect periods of small stock underperformance as well as overperformance in the future.

Graph 7-10

Small Stock Average Excess Returns over 20-year Rolling Periods
1926-2005



Source: Center for Research in Security Prices, University of Chicago (decile data).

Conclusion

Most criticisms of the use of size premia do not address the underlying reason for the existence of size premia. Small-capitalization stocks are still considered riskier investments than large company stocks. Investors require an additional reward, in the form of additional return, to take on the added risk of an investment in small-capitalization stock. It is unlikely that in the future investors will require no compensation for taking on this additional risk.

The size premium will undoubtedly continue to be questioned in some quarters. The goal of this section was to review the most common arguments against its existence. Most criticisms presented to date, however, have not provided sufficient evidence to disprove the existence of a size premium.

Table 7-16

Size-Decile Portfolios of the NYSE/AMEX/NASDAQ
Year-by-Year Returns

from 1926 to 1970

	Decile 1	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Decile 10
1926	0.1438	0.0545	0.0355	0.0085	0.0033	0.0335	-0.0250	-0.0932	-0.0997	-0.0605
1927	0.3400	0.2957	0.3116	0.4134	0.3467	0.2312	0.3025	0.2553	0.3190	0.3126
1928	0.3889	0.3777	0.3982	0.3736	0.4965	0.2809	0.3530	0.3212	0.3740	0.6974
1929	-0.1056	-0.0793	-0.2569	-0.3177	-0.2448	-0.4044	-0.3769	-0.4082	-0.4993	-0.5359
1930	-0.2422	-0.3747	-0.3465	-0.3418	-0.3627	-0.3781	-0.3661	-0.4951	-0.4570	-0.4567
1931	-0.4215	-0.5011	-0.4600	-0.4569	-0.4865	-0.5102	-0.4787	-0.4907	-0.4908	-0.5010
1932	-0.1226	-0.0024	-0.0252	-0.1261	-0.1018	0.0398	-0.1734	0.0147	0.0000	0.3946
1933	0.4619	0.7631	1.0107	1.1255	0.9787	1.0886	1.1649	1.5446	1.7262	2.2383
1934	0.0213	0.0595	0.0889	0.1723	0.0806	0.2123	0.1693	0.2736	0.2290	0.3238
1935	0.4164	0.5598	0.3638	0.3754	0.6417	0.5448	0.6677	0.6123	0.6563	0.8333
1936	0.3010	0.3474	0.2813	0.4264	0.4823	0.5009	0.5213	0.4952	0.8323	0.8764
1937	-0.3182	-0.3703	-0.3801	-0.4412	-0.4801	-0.4791	-0.4908	-0.5284	-0.5182	-0.5546
1938	0.2505	0.3465	0.3367	0.3472	0.5081	0.4218	0.3556	0.4584	0.2996	0.0956
1939	0.0473	-0.0279	-0.0482	0.0173	0.0224	0.0554	0.0521	-0.0433	-0.0619	0.1905
1940	-0.0707	-0.0858	-0.0860	-0.0391	-0.0076	-0.0581	-0.0571	-0.0606	-0.0409	-0.3139
1941	-0.1079	-0.0714	-0.0581	-0.1003	-0.1174	-0.1018	-0.0947	-0.0868	-0.1258	-0.1712
1942	0.1310	0.2360	0.2074	0.1961	0.2098	0.2441	0.2936	0.2963	0.4337	0.7664
1943	0.2361	0.3578	0.3342	0.4018	0.4844	0.4262	0.7259	0.7164	0.8446	1.4216
1944	0.1721	0.2513	0.2394	0.3300	0.3995	0.4438	0.3792	0.4980	0.5613	0.7060
1945	0.2935	0.4846	0.5447	0.6278	0.5429	0.6048	0.6400	0.7047	0.7621	0.9507
1946	-0.0445	-0.0442	-0.0789	-0.1289	-0.0955	-0.0656	-0.1588	-0.1470	-0.0950	-0.1882
1947	0.0557	0.0081	-0.0034	0.0221	0.0260	-0.0289	-0.0211	-0.0293	-0.0360	-0.0201
1948	0.0370	0.0009	0.0226	-0.0186	-0.0166	-0.0430	-0.0246	-0.0741	-0.0698	-0.0495
1949	0.1868	0.2566	0.2652	0.1957	0.1802	0.2349	0.2195	0.1600	0.1975	0.2464
1950	0.2862	0.2856	0.2636	0.3210	0.3682	0.3398	0.3794	0.4043	0.4029	0.5571
1951	0.2149	0.2243	0.2176	0.1656	0.1465	0.1373	0.1832	0.1528	0.1109	0.0581
1952	0.1430	0.1294	0.1220	0.1209	0.1099	0.1002	0.0974	0.0849	0.0859	0.0172
1953	0.0110	0.0177	0.0023	-0.0135	-0.0309	-0.0090	-0.0251	-0.0751	-0.0463	-0.0846
1954	0.4844	0.4831	0.5868	0.5122	0.5770	0.5927	0.5736	0.5241	0.6328	0.6888
1955	0.2833	0.1897	0.1893	0.1875	0.1795	0.2373	0.1790	0.2061	0.2008	0.2648
1956	0.0789	0.1138	0.0765	0.0849	0.0845	0.0653	0.0729	0.0532	0.0603	-0.0160
1957	-0.0932	-0.0845	-0.1324	-0.1063	-0.1391	-0.1848	-0.1712	-0.1809	-0.1474	-0.1613
1958	0.4076	0.4957	0.5439	0.5923	0.5569	0.5674	0.6794	0.6570	0.7057	0.6988
1959	0.1236	0.0960	0.1340	0.1545	0.1858	0.1497	0.2089	0.1748	0.1940	0.1552
1960	0.0037	0.0551	0.0441	0.0161	-0.0131	-0.0096	-0.0571	-0.0463	-0.0372	-0.0824
1961	0.2633	0.2685	0.2911	0.3013	0.2808	0.2704	0.3007	0.3448	0.2984	0.3227
1962	-0.0880	-0.0943	-0.1192	-0.1276	-0.1652	-0.1795	-0.1647	-0.1528	-0.1661	-0.1420
1963	0.2244	0.2131	0.1649	0.1716	0.1273	0.1843	0.1745	0.1992	0.1291	0.1101
1964	0.1596	0.1450	0.1997	0.1612	0.1588	0.1721	0.1592	0.1708	0.1537	0.2101
1965	0.0893	0.1913	0.2456	0.2429	0.3218	0.3801	0.3391	0.3182	0.3195	0.4338
1966	-0.1033	-0.0529	-0.0517	-0.0606	-0.0729	-0.0495	-0.0905	-0.0872	-0.0583	-0.1021
1967	0.2193	0.2099	0.3179	0.4524	0.5238	0.5275	0.6519	0.8177	0.9018	1.1410
1968	0.0753	0.1657	0.1978	0.1829	0.2765	0.3040	0.2671	0.4028	0.3759	0.6128
1969	-0.0584	-0.1297	-0.1170	-0.1674	-0.1804	-0.1852	-0.2458	-0.2473	-0.3157	-0.3291
1970	0.0231	0.0182	0.0328	-0.0698	-0.0594	-0.0604	-0.0971	-0.1611	-0.1535	-0.1781

Source: Center for Research in Security Prices, University of Chicago.

Table 7-16 (continued)

Size-Decile Portfolios of the NYSE/AMEX/NASDAQ
Year-by-Year Returns

from 1971 to 2005

	Decile 1	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Decile 10
1971	0.1484	0.1328	0.2011	0.2472	0.1890	0.2244	0.2018	0.1735	0.1647	0.1853
1972	0.2212	0.1278	0.0938	0.0881	0.0863	0.0695	0.0632	0.0205	-0.0229	-0.0057
1973	-0.1274	-0.2266	-0.2278	-0.2680	-0.3217	-0.3177	-0.3730	-0.3532	-0.3895	-0.4200
1974	-0.2803	-0.2441	-0.2449	-0.2834	-0.2167	-0.2694	-0.2552	-0.2360	-0.2704	-0.2716
1975	0.3169	0.4573	0.5363	0.6168	0.5966	0.5675	0.6326	0.6579	0.6634	0.7579
1976	0.2073	0.3045	0.3811	0.4008	0.4363	0.4808	0.5018	0.5690	0.5101	0.5516
1977	-0.0884	-0.0367	0.0109	0.0376	0.1126	0.1408	0.1754	0.2261	0.2022	0.2310
1978	0.0637	0.0229	0.1084	0.0974	0.1207	0.1637	0.1705	0.1632	0.1605	0.2815
1979	0.1519	0.2871	0.3061	0.3516	0.3557	0.4888	0.4206	0.4638	0.4594	0.4158
1980	0.3275	0.3442	0.3186	0.3043	0.3193	0.3141	0.3623	0.3233	0.3823	0.3071
1981	-0.0833	0.0059	0.0372	0.0403	0.0484	0.0677	-0.0040	0.0055	0.0802	0.0856
1982	0.1964	0.1749	0.2081	0.2566	0.3076	0.2940	0.2919	0.2955	0.2608	0.2855
1983	0.2057	0.1686	0.2662	0.2633	0.2626	0.2589	0.2727	0.3721	0.3130	0.3690
1984	0.0840	0.0770	0.0253	-0.0458	-0.0269	0.0248	-0.0426	-0.0747	-0.0896	-0.1951
1985	0.3137	0.3770	0.2910	0.3390	0.3115	0.3097	0.3254	0.3651	0.3077	0.2582
1986	0.1801	0.1810	0.1636	0.1741	0.1504	0.0871	0.1250	0.0387	0.0572	0.0040
1987	0.0504	0.0036	0.0393	0.0167	-0.0402	-0.0509	-0.0843	-0.0804	-0.1274	-0.1488
1988	0.1486	0.1982	0.2126	0.2237	0.2138	0.2336	0.2394	0.2854	0.2283	0.2105
1989	0.3295	0.3008	0.2629	0.2308	0.2423	0.2107	0.1785	0.1788	0.1058	0.0550
1990	-0.0088	-0.0853	-0.1015	-0.0875	-0.1409	-0.1849	-0.1532	-0.1979	-0.2460	-0.3128
1991	0.3039	0.3463	0.4140	0.3883	0.4813	0.5326	0.4421	0.4707	0.5066	0.4804
1992	0.0474	0.1577	0.1387	0.1249	0.2609	0.1885	0.1917	0.1287	0.2495	0.3374
1993	0.0733	0.1316	0.1614	0.1567	0.1691	0.1733	0.1882	0.1865	0.1656	0.2561
1994	0.0174	-0.0174	-0.0423	-0.0098	-0.0166	0.0034	-0.0252	-0.0308	-0.0312	-0.0297
1995	0.3940	0.3526	0.3533	0.3275	0.3324	0.2692	0.3264	0.2935	0.3497	0.3048
1996	0.2375	0.1963	0.1714	0.1883	0.1366	0.1737	0.1965	0.1720	0.2064	0.1722
1997	0.3486	0.3012	0.2512	0.2611	0.1565	0.2865	0.3003	0.2537	0.2554	0.2201
1998	0.3515	0.1272	0.0764	0.0724	0.0054	0.0116	-0.0090	0.0102	-0.0502	-0.1155
1999	0.2450	0.1976	0.3433	0.3006	0.2595	0.3492	0.2570	0.3888	0.3436	0.2809
2000	-0.1362	-0.0030	-0.0620	-0.0997	-0.0710	-0.1028	-0.1070	-0.1297	-0.1337	-0.1295
2001	-0.1529	-0.0882	-0.0411	-0.0096	-0.0214	0.0952	0.1226	0.2119	0.3157	0.3668
2002	-0.2246	-0.1736	-0.1934	-0.1771	-0.1778	-0.2122	-0.2297	-0.1998	-0.1859	-0.0555
2003	0.2568	0.3738	0.4029	0.4402	0.4090	0.4677	0.5075	0.5780	0.6822	0.9208
2004	0.0794	0.2013	0.1796	0.1874	0.1734	0.2205	0.1887	0.2190	0.1516	0.1858
2005	0.0372	0.1199	0.1237	0.1058	0.1011	0.0323	0.1048	0.0755	0.0200	0.0580

Source: Center for Research in Security Prices, University of Chicago.

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 228
Witness: Don Murry

Data Request:

With respect Schedules DAM-24 and DAM-25, for each of the CAPM analysis, please provide the following: (a) the source documents for the risk-free rate of 4.78%, (b) all data, assumptions, and methodology in arriving at the equity risk premiums of 7.10% in Schedule DAM-24, (c) all data, assumptions, and methodology employed in arriving at the size premiums in Schedule DAM-24, (d) all data, assumptions, and methodology employed in arriving at a Market Total Return in Schedule DAM-25, (e) all data, assumptions, and methodology employed in arriving at the Long-Term Corporate Bond Return in Schedule DAM-25, (f) all data, assumptions, and methodology employed in arriving at the Aaa Corporate Bond Return in Schedule DAM-25. Please provide the data in both paper and electronic (Microsoft Excel) formats. For the electronic version, please keep all data and equations intact.

Response:

a. Please reference the provided *FEDERAL RESERVE statistical release: H15 (519)* of December 4, 2006 included as part of AG DR1-228 ATT1 attached to this response.

b. Please reference the provided *Table C-1: Key Variables in Estimating the Cost of Capital* from p. 262 of **Ibbotson Associates' SBBI Valuation Edition 2006 Yearbook**, included as part of AG DR1-228 ATT1 attached to this response.

c. Please see the response to AG-228(b).

d. The "Market Total Return" in Schedule DAM-25 is the average of Large Company Stocks: Total Returns (12.3%) Arithmetic Mean and Ibbotson Small Company Stocks: Total Returns (17.4%) Arithmetic Mean, from Table 2-1 on p. 28 of **Ibbotson Associates' SBBI Valuation Edition 2006 Yearbook** attached to this response as part of AG DR 1-228 ATT1.

e. The "Long-Term Corporate Bond Return" in Exhibit DAM-25 is from Table 2-1 on p. 28 of **Ibbotson Associates' SBBI Valuation Edition 2006 Yearbook** attached to this response as part of AG DR1-228 ATT1.

f. Please reference the provided *FEDERAL RESERVE statistical release: H15 (519)* in the response to AG-228(a).

FEDERAL RESERVE statistical release

H.15 (519) SELECTED INTEREST RATES
Yields in percent per annum

For use at 2:30 p.m. Eastern Time
December 4, 2006

Instruments	2006 Nov 27	2006 Nov 28	2006 Nov 29	2006 Nov 30	2006 Dec 1	Week Ending Dec 1	Week Ending Nov 24	2006 Nov
Federal funds (effective)[1 2 3]	5.32	5.24	5.26	5.31	5.27	5.26	5.24	5.25
Commercial Paper[3 4 5]								
Nonfinancial								
1-month	5.20	5.24	5.21	5.22	5.19	5.21	5.21	5.21
2-month	n.a.	5.24	n.a.	n.a.	5.19	5.22	5.16	5.19
3-month	n.a.	5.23	n.a.	n.a.	n.a.	5.23	5.14	5.17
Financial								
1-month	5.23	5.22	5.23	5.24	5.23	5.23	5.23	5.23
2-month	5.24	5.23	5.23	5.22	5.24	5.23	5.24	5.24
3-month	5.24	5.24	5.24	5.24	5.23	5.24	5.25	5.24
CDs (secondary market)[3 6]								
1-month	5.29	5.29	5.29	5.30	5.30	5.29	5.29	5.29
3-month	5.32	5.32	5.31	5.31	5.31	5.31	5.32	5.32
6-month	5.32	5.31	5.30	5.30	5.29	5.30	5.33	5.33
Eurodollar deposits (London)[3 7]								
1-month	5.32	5.32	5.35	5.35	5.35	5.34	5.31	5.32
3-month	5.37	5.36	5.36	5.36	5.35	5.36	5.36	5.36
6-month	5.36	5.33	5.33	5.33	5.28	5.33	5.37	5.37
Bank prime loan[2 3 8]	8.25	8.25	8.25	8.25	8.25	8.25	8.25	8.25
Discount window primary credit[2 9]	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25
U.S. government securities								
Treasury bills (secondary market)[3 4]								
4-week	5.16	5.18	5.17	5.14	5.14	5.16	5.15	5.13
3-month	4.92	4.91	4.91	4.90	4.90	4.91	4.93	4.94
6-month	4.94	4.93	4.93	4.91	4.86	4.91	4.95	4.95
Treasury constant maturities								
Nominal[10]								
1-month	5.22	5.27	5.26	5.22	5.21	5.24	5.23	5.21
3-month	5.05	5.04	5.04	5.03	5.03	5.04	5.06	5.07
6-month	5.14	5.13	5.13	5.10	5.05	5.11	5.15	5.15
1-year	5.00	4.98	4.98	4.94	4.87	4.95	5.01	5.01
2-year	4.71	4.67	4.69	4.62	4.52	4.64	4.75	4.74
3-year	4.60	4.57	4.58	4.52	4.43	4.54	4.64	4.64
5-year	4.54	4.50	4.51	4.45	4.39	4.48	4.58	4.58
7-year	4.54	4.50	4.51	4.45	4.39	4.48	4.57	4.58
10-year	4.54	4.51	4.52	4.46	4.43	4.49	4.58	4.60
20-year	4.73	4.70	4.72	4.66	4.64	4.69	4.76	4.78
30-year	4.62	4.59	4.61	4.56	4.54	4.58	4.66	4.69
Inflation indexed[11]								
5-year	2.33	2.28	2.28	2.21	2.12	2.24	2.43	2.41
7-year	2.29	2.26	2.26	2.19	2.13	2.23	2.36	2.35
10-year	2.24	2.21	2.22	2.16	2.10	2.19	2.30	2.29
20-year	2.19	2.17	2.19	2.13	2.09	2.15	2.24	2.23
Inflation-indexed long-term average[12]	2.14	2.13	2.15	2.10	2.06	2.12	2.20	2.19
Interest rate swaps[13]								
1-year	5.29	5.24	5.24	5.22	5.11	5.22	5.30	5.30
2-year	5.08	5.01	5.00	4.96	4.86	4.98	5.08	5.09
3-year	5.00	4.92	4.92	4.89	4.78	4.90	5.01	5.03
4-year	4.98	4.90	4.90	4.87	4.76	4.88	4.99	5.01
5-year	4.98	4.91	4.91	4.87	4.78	4.89	4.99	5.02
7-year	5.01	4.93	4.93	4.90	4.82	4.92	5.02	5.05
10-year	5.06	4.98	4.99	4.96	4.89	4.97	5.07	5.11
30-year	5.18	5.11	5.11	5.09	5.04	5.10	5.19	5.23
Corporate bonds								
Moody's seasoned								
Aaa[14]	5.26	5.24	5.25	5.20	5.18	5.23	5.30	5.33
Baa	6.15	6.13	6.14	6.10	6.08	6.12	6.18	6.20
State & local bonds[15]				4.04		4.04	4.14	4.14
Conventional mortgages[16]				6.14		6.14	6.18	6.24

See overleaf for footnotes.
n.a. Not available.

Table 2-1

Total Returns, Income Returns, and Capital Appreciation of the Basic Asset Classes
Summary Statistics of Annual Returns

from 1926 to 2005

Series	Geometric Mean	Arithmetic Mean	Standard Deviation	Serial Correlation
Large Company Stocks				
Total Returns	10.4%	12.3%	20.2%	0.03
Income	4.2	4.2	1.5	0.89
Capital Appreciation	5.9	7.8	19.5	0.03
Ibbotson Small Company Stocks				
Total Returns	12.6	17.4	32.9	0.06
Mid-Cap Stocks*				
Total Returns	11.4	14.2	24.7	–0.02
Income	4.1	4.1	1.7	0.89
Capital Appreciation	7.1	9.8	24.1	–0.02
Low-Cap Stocks*				
Total Returns	11.7	15.7	29.5	0.03
Income	3.7	3.7	2.0	0.89
Capital Appreciation	7.9	11.7	28.9	0.03
Micro-Cap Stocks*				
Total Returns	12.7	18.8	39.2	0.08
Income	2.6	2.6	1.8	0.91
Capital Appreciation	10.1	16.1	38.6	0.08
Long-Term Corporate Bonds				
Total Returns	5.9	6.2	8.5	0.08
Long-Term Government Bonds				
Total Returns	5.5	5.8	9.2	–0.08
Income	5.2	5.2	2.7	0.96
Capital Appreciation	0.1	0.4	8.1	–0.22
Intermediate-Term Government Bonds				
Total Returns	5.3	5.5	5.7	0.15
Income	4.7	4.8	2.9	0.96
Capital Appreciation	0.4	0.5	4.4	–0.19
Treasury Bills				
Total Returns	3.7	3.8	3.1	0.91
Inflation	3.0	3.1	4.3	0.65

Total return is equal to the sum of three component returns; income return, capital appreciation return, and reinvestment return.

*Source: Center for Research in Security Prices, University of Chicago. See Chapter 7 for details on decile construction.

Table C-1
Key Variables in Estimating the Cost of Capital

	Value
Yields (Riskless Rates)[1]	
Long-term (20-year) U.S. Treasury Coupon Bond Yield	4.6%
Equity Risk Premium[2]	
Long-horizon expected equity risk premium (historical): large company stock total returns minus long-term government bond income returns	7.1
Long-horizon expected equity risk premium (supply side): historical equity risk premium minus price-to-earnings ratio calculated using three-year average earnings	6.3

Size Premium[3]

Decile	Market Capitalization of Smallest Company (in millions)		Market Capitalization of Largest Company (in millions)	Size Premium (Return in Excess of CAPM)
Mid-Cap, 3-5	$1,729.364	-	$7,187.244	1.02%
Low-Cap, 6-8	$587.243	-	$1,728.888	1.81
Micro-Cap, 9-10	$1.079	-	$586.393	3.95
Breakdown of Deciles 1-10				
1-Largest	$16,091.015	-	$367,495.144	-0.37
2	$7,189.887	-	$16,016.450	0.67
3	$3,968.998	-	$7,187.244	0.85
4	$2,525.472	-	$3,961.425	1.10
5	$1,729.364	-	$2,519.280	1.49
6	$1,282.276	-	$1,728.888	1.73
7	$872.443	-	$1,280.966	1.67
8	$587.243	-	$872.103	2.33
9	$265.056	-	$586.393	2.76
10-Smallest	$1.079	-	$264.981	6.36
Breakdown of the 10th Decile				
10a	$169.245	-	$264.981	4.39
10b	$1.079	-	$169.195	9.83

1 As of December 31, 2005. Maturity is approximate.
2 See chapter 5 for complete methodology.
3 See chapter 7 for complete methodology.
Note: Examples on how these variables can be used are found in Chapters 3 and 4

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 229
Witness: Don Murry

Data Request:

With respect to page 38, lines 1-4, please provide (a) copies of all studies relied upon to determine that "the beta as a market measure of risk does not account for all of the risks associated with an individual common stock," and (b) copies of all studies performed comparing the investment risk of Atmos relative to the other gas companies.

Response:

This response is sponsored by Dr. Donald A. Murry. Please reference the provided articles of academic writings in Dr. Murry's possession, and collectively labeled as AG DR1-229 ATT, on the failure of beta to encompass all investment risk.

On the use of β in regulatory proceedings

William J. Breen
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Graduate School of Management
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and

Eugene M. Lerner
Professor of Finance
Graduate School of Management
Northwestern University

Public utility regulation requires that a firm's rate of return be linked to its risk, and some analysts have urged that β be used as the appropriate measure of risk. This study explores the use of β in regulatory proceedings and finds it wanting. Empirical measures of β are known to depend upon (1) the estimating equation that is used, (2) the choice of market index, and (3) the specific time period that is selected. Empirical estimates of a firm's β are shown to range from a large positive to a large negative value.

These empirical results are not surprising when it is recognized that corporate β's depend upon managerial actions. Moreover, when managerial policies change, the estimated values of β may be over- or understated. An internal check on the reliability of the estimated β is shown to be given by the sign of α.

1. Introduction

Two recent developments in financial analysis bear directly on the problem of the riskiness of an enterprise. The first is the development of a general theory of corporate risk which is based upon portfolio and capital market considerations. The second relates this measure of risk to the corporate financial policies that the firm voluntarily pursues or is constrained to follow by such external forces as regulatory decisions.

One natural application of this theory of risk has been in the problem area of rate regulation of public utilities. Notably, the *Hope* decision required regulatory commissions to relate a utility's allowable return to its risk:[1]

> The return to the equity owner should be commensurate with returns on investments and other enterprises having corresponding risks. That return, moreover, should be sufficient to assure confidence in the financial integrity of the enterprise so as to maintain its credit and attract capital.

Myers has indicated that a regulatory commission could implement the *Hope* decision by basing the utility's allowable rate of return upon its cost of capital.[2] Since this cost is a function of the riski-

[1] Federal Power Commission et al. v. Hope Natural Gas Company, 320 U.S. 591 (1944) at 603

[2] See [6].

Autumn 1972

tory

a firm's rate of return be linked ed that β be used as the appro- lores the use of β in regulatory irical measures of β are known equation that is used, (2) the specific time period that is se- β are shown to range from

ng when it is recognized gerial actions. Moreover, when ued values of β may be over- or e reliability of the estimated β

ncial analysis bear directly on erprise. The first is the develop- risk which is based upon port- ions. The second relates this nancial policies that the firm d to follow by such external

theory of risk has been in the blic utilities. Notably, the *Hope* sions to relate a utility's allow-

commensurate with returns on invest- onding risks. That return, moreover, he financial integrity of the enterprise

commission could implement lity's allowable rate of return cost is a function of the risk-

: Natural Gas Company, 320 U.S. 591

ness of the firm, and risk can be measured within the capital asset pricing model framework, the argument is complete.

The purpose of this paper is to examine both the theoretical and empirical cost of capital estimates that are based upon the capital asset pricing model. Our conclusions may be important within the context of utility rate regulation because we find that the estimates can vary depending upon the estimating equation that is used, the choice of the market index, and the specific time period that is selected. Moreover, corporate decisions influence the riskiness of the firm. Since these decisions are made in the light of an allowable rate of return, the regulator himself can influence the empirical measures of risk that are derived from the capital asset pricing model.

2. Cost of capital and the capital asset pricing model

Current financial theory holds that the relevant cost of capital for a firm should be represented by the opportunity cost to the equity holders of the firm. The capital asset pricing model gives a representation of this opportunity cost, in terms of both the expected return to the shareholder and the risk associated with this expected return.[3] In this framework the return offered by any security is be represented as a linear combination of the return offered by a market index, such as the Standard and Poor or New York Stock Exchange index, r_m; a term which represents an individual company effect, α; and a random component, u_i. Thus

$$r_i = \alpha_i + \beta_i r_m + u_i. \tag{1}$$

The variance of return (risk) may then be represented by

$$\mathrm{var}(r_i) = \beta_i^2 \,\mathrm{var}(r_m) + \mathrm{var}(u_i). \tag{2}$$

The first term, $\beta_i^2 \,\mathrm{var}(r_m)$, is called the company's systematic or undiversifiable risk; the second term, $\mathrm{var}(u_i)$, is called the specific or diversifiable risk. When security i is combined with many other securities in a portfolio, diversification substantially reduces the individual company contributions to total risk [$\mathrm{var}(u_i)$]. The nondiversifiable contributions, $\beta_i^2 \,\mathrm{var}(r_m)$, however, cannot be eliminated as long as all companies included in the portfolio have $\beta > 0$.

In equilibrium an optimal portfolio has the property that the risk premium of a company (measured as $ER_i - r_o$, i.e., the expected return to a security minus the pure rate of interest) is proportional to the risk premium in the market as a whole. The factor of proportionality is the coefficient β_i from equation (1). Thus

$$ER_i - r_o = \beta_i (ER_m - r_o). \tag{3}$$

Combining (1) and (3), and assuming that $Eu_i = 0$, we see that one of the implications of the equilibrium assumptions is that $\alpha_i = r_o(1 - \beta_i)$. The return to a security in an equilibrium portfolio can, therefore, be thought of as a linear combination of the pure rate of interest, r_o, and the expected market rate of return ER_m. The weights

[3] The capital asset pricing model, associated with the work of Markowitz [6], Sharpe [7], Tobin [8], Lintner [4], Fama [3], and others is quite well known in the literature of finance and economics. Hence, we will make use of the assumptions and conclusions of this model without further detailed references or proofs.

of these two terms are $1 - \beta_i$ and β_i. Thus β is the "risk levering factor" associated with each individual security.

The capital asset pricing model therefore gives a representation of the opportunity cost of holding any security in an optimal portfolio in terms of the risk-return combination that an investor can expect to receive.

3. β in theory and practice

■ The capital asset pricing model provides a theoretical link between corporate activities and the equilibrium market return arising from owning the firm's shares. Thus, given the pure rate of interest, the expected return and variance of the return to the market, and the corporate β, the equilibrium set of prices in the capital market may be derived. Since β is the only variable which is dependent on the specific corporation under investigation, it follows that the determination of the specific corporate β is critical to the effective use of the capital asset theory in rate regulation as well as in corporate capital budgeting and individual portfolio management.

Two salient features concerning the corporate β must be stressed. The first is that β is a theoretical construct. It is not directly measurable; rather it is similar to such other useful theoretical constructs as permanent income and demand schedules. Most of the empirical estimates of corporate β to date have been prepared by least squares regression lines through past observations of price changes, as suggested by equations (1) or (3).

From the perspective of regulation, the estimation procedure that is followed to find β should be well understood and the empirical findings should be unambiguous. A well understood procedure implies that there is agreement between technically competent people, and that the estimating equation that is used and the data base from which β is estimated are both appropriate. An unambiguous empirical finding is one that has but a single meaning. The reason for these requirements is simply that the empirical estimates of β that are reached should be reproducible by any interested party. Unfortunately, estimates of β that have been prepared to date do not meet these standards.

The second feature concerning corporate β is that very little empirical work has been done to express β as a function of other measurable corporate variables. One exception is a study by the present authors,[4] in which at several specific time intervals, corporations were ranked on the basis of five fundamental company variables: dividend payout, growth in earnings, stability of earnings growth, market size, and the number of shares traded. These rankings were then used to predict the volatility of the company's stock price in a subsequent period. A population of 1,500 securities was examined at the peak and trough of three stock market cycles. Each security was ranked according to its position with respect to each of the five corporate variables. Companies were ranked from high to low on the basis of number of shares traded and growth rate, and from low to high on the basis of stability of growth rate, market size, and the payout ratio. Companies which ranked in the highest (lowest) x percentile on y number of criteria were then labeled

[4] See Breen and Lerner [2].

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rporate β must be stressed,
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seful theoretical constructs
ules. Most of the empirical
prepared by least squares
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; simply that the empirical
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porate β is that very little em-
ss β as a function of other
exception is a study by the
pecific time intervals, corpor-
five fundamental company
earnings, stability of earnings
of shares traded. These rank-
atility of the company's stock
tion of 1,500 securities was ex-
ree stock market cycles. Each
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ies were ranked from high to
s traded and growth rate, and
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es w... ranked in the highest
of criteria were then labeled

volatile (stable) with respect to an unweighted index of all companies in the sample. It was shown, for example, that with x equal to 0.25, and y equal to 3, about 80 percent of the volatility (and stability) predictions were accurate: i.e., these companies had β values greater than (less than) 1. The implication of this work for regulatory decision-making is immediate: if a regulator can influence the firm's growth in earnings or the stability of its earning pattern or any of the other three critical variables, it will affect the firm's measured β value.

4. Estimating difficulties

■ **Two equations for estimating β.** The theory outlined in the last section suggests that β may be estimated directly from observed price changes[5] using either equation (1) or equation (3).

Equation (1), however, may be viewed as a more general expression. The reason for this is that equation (3) strictly holds only when the market is in equilibrium. If the market is in equilibrium, and the assumptions of the capital market model are realized, both equations will yield the same estimate of β. β, of course, is a sufficient statistic to capture a firm's return and risk characteristics only when the company is in equilibrium (i.e., if equation (3) holds). If equilibrium does not exist in the equity market, a portion of the firm's total risk (called specific risk) cannot be diversified away by holding a large number of securities in a portfolio. Thus, unless equilibrium holds, β will not capture all the risk that is associated with a portfolio.[6]

The choice of proper relation [equation (1) or equation (3)] for deriving the estimate of β depends upon the assumption that the regulatory commission makes with respect to market equilibrium. From this point of view, equation (1), being more general, seems to be preferred. Estimates of company β's prepared by using both equations will be presented in Section 5, where it will be shown that there is a significant difference between the estimates arising from the two equations.

■ **The time period over which to estimate β.** If the value of β remains stationary over time, then the estimation of β through the use of time-series statistical methods would seem to be in order. Considerations of statistical accuracy would then argue for using as many observations as possible. However, it is doubtful that β values remain stable over long time periods. Strategic and operational management decisions, made in response to changing external or environmental factors, affect a firm's risk characteristics and hence its β value.

When a change does occur in fundamental operating conditions, an efficient equity market will respond with a price change which provides a new equilibrium consistent with the new β value. If such a change occurs during the period of time that is believed to be a

[5] The rate of return is defined as $(\Delta P + D)/P$, where P represents the price of the security and D the dividends received over the period under study. In the empirical work that follows, we ignore the dividends that are received from holding either a specific security or the market average as a whole.

[6] Numerous authors have recently commented about the problems associated with and the accuracy of the estimation of β.

homogeneous unit, the measured β will reflect neither the old nor the new true β values but some weighted average of the two.

Sample estimates of company β's for various time periods will be presented in Section 5. It will be shown there that these estimates change dramatically as the length of time under study varies, and, further, that the β estimates over a long time period are simply the weighted averages of a series of short-term β estimates.

☐ **The market index used to estimate β and the interpretation of the coefficient.** Market indexes are constructed differently and are not equally volatile. The New York Stock Exchange (NYSE) index, for example is a weighted average of all companies traded on the exchange; the Standard and Poor (S&P) Composite index is a more restricted universe; while an index made up of companies whose financial records are reported on the COMPUSTAT tape is a wider universe. It will be shown that empirical estimates of β can change significantly if different market indexes are used. By significant we mean that within the bounds of statistical accuracy, the estimated β changes from stable (less than one) to volatile (greater than one).

A still further complication with the estimating procedure arises because the size of β depends not only upon the choice of the index that is used, but on the overall direction that the index itself is following. For example, suppose that several changes occur within the corporation over a measurement period and that these have the effect of raising the company's risk premium relative to that of the market, i.e., raising β. The market adjustment process by which a security's risk premium rises is that the price of the stock falls relative to the market. The reason for this is that at the new and relatively lower price, the expected return to a holder of the security will be higher.

Consider two cases. First, assume that during the period in which the risk premium is rising, the general market movement of all security prices is upward. The estimated value of β, derived from the observed price changes, will be less than 1, say 0.5. This estimate, however, will substantially understate the true value of β.

Second, assume that during the period in which the risk premium is rising, the general market index of all security prices is declining. The estimated β value will now be greater than 1, say 1.5. This estimate, however, may overstate the true value of β. Similar remarks are appropriate if a company's equilibrium risk premium declines and the return to the index either rises or falls.

An implication of these remarks is that a test for a shift in β should be made before an individual company's estimate is seriously used. One such test may be performed by observing the calculated α values from equation (1). If the market is in equilibrium, and no change has taken place in the fundamental character of the firm, then both equation (1) and equation (3) hold, and $\alpha = R_o(1 - \beta)$.

The measured α should be positive for companies which are less risky than the market, ($\beta < 1$). However, if the measured β is less than one, and the measured α is negative, a downward shift in the price of the company's stock must have occurred during the measurement period which was unrelated to the general market price movement. If the market is efficient, these price shifts arise as a result of a rise in the underlying β value for the company; the

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measured β probably understates the true β for such a period. Conversely, if the measured β is greater than one, and the measured α is positive, price increases occurred that were not related to the general market movement of all prices. If the market is efficient, a downward shift in the underlying β occurred: the measured β then overstates the true β. Table 1 serves as a helpful summary of these remarks.

TABLE 1

RELIABILITY OF THE ESTIMATED β

		β	
		>1	<1
α	<0	β ESTIMATE PLAUSIBLE	β ESTIMATE UNDERSTATED
	>0	β ESTIMATE OVERSTATED	β ESTIMATE PLAUSIBLE

The potential for erroneous judgment in basing decisions on the estimated β is much more severe in terms of individual company analysis, such as rate regulation, than in portfolio selection. From equation (2), we can see that the total portfolio risk (variance) will depend on the β's from several securities. As long as the estimates of β are not systematically biased in one direction, it would seem that for a large enough portfolio, individual errors in the β estimates would tend to offset each other. This, of course, is not true when a decision is made on the basis of an individual β estimate.[7]

5. An analysis of empirical results

In order to study empirically the theoretical comments made in the previous sections, several different estimates of β were computed for three large companies: International Business Machines Corp., American Telephone and Telegraph Co., and General Motors Corp. In Table 2 we report the estimates of β for (1) varying time periods, (2) different index values (representing the "return to market"), and (3) different estimating equations, i.e., both equations (1) and (3). Using monthly price data beginning October 1964 and ending October 1971, we estimated β for continuous six-month periods, twelve-month periods, and so forth, up to one 84-month period. Both the NYSE index (which is a share-weighted index) and an unweighted price index of all COMPUSTAT industrial and large utility companies were used. The β estimates are calculated using ordinary least squares for equations (1) and (3). The one-month price change relative to the beginning price was used as our measure of rate of return. The interest rate on 30-day treasury bills was used as a proxy for the pure rate of interest when equation (3) was used.

The data in Table 2 show that the length of time used in calculating the estimate of β, the period of time over which the calculation is performed, the index used, and the estimating equation all have substantial effects on the estimate of β. The β estimates for IBM, for example, range from substantially greater than one to a negative value. While this range is greater than that found for GM or AT&T, almost any interpretation of the "riskiness" (and hence its cost of capital) of the companies we studied may be supported by the proper choice of estimation parameters.

It is instructive to examine the estimated α coefficients to test the possibility of shifting β's using the NYSE index as the indicator of the return to the market.

The six-month β estimates for IBM indicate that in early periods β was greater than one, while during later periods it fell to less than

[7] The full effects of errors in estimation on portfolio composition are much more complicated than it would seem from simply examining equations (2) and (3). For a discussion of this problem, and some empirical evidence on the exact nature of estimation errors on portfolio composition, see Breen [1].

TABLE 2

EMPIRICAL ESTIMATES OF β

(a) IBM

NUMBER OF MONTHLY INTERVALS	NYSE: STRAIGHT LINEAR REGRESSION (EQUATION (1)) TIME	ALPHA	BETA	NYSE: EQUILIBRIUM RESTRICTED REGRESSION (EQUATION (3)) TIME	BETA	COMPUSTAT: STRAIGHT LINEAR REGRESSION (EQUATION (1)) TIME	ALPHA	BETA	COMPUSTAT: EQUILIBRIUM RESTRICTED REGRESSION (EQUATION (3)) TIME	BETA
6	6	0.0079	2.2001	6	2.3628	6	0.0016	0.8957	6	0.9113
	12	0.0251	1.1911	12	1.4104	12	0.0178	0.6735	12	0.8093
	18	0.0394	0.9093	18	1.1575	18	0.0261	0.4407	18	0.7127
	24	0.0398	1.0746	24	0.9479	24	0.0221	0.5826	24	0.6152
	30	0.0847	0.7515	30	1.0545	30	0.0825	0.2901	30	0.7142
	36	0.1241	0.5575	36	0.9717	36	0.1505	−0.1536	36	0.7029
	42	0.1453	0.4886	42	1.0063	42	0.1904	−0.2995	42	0.7086
	48	0.1293	0.3798	48	0.9846	48	0.2007	−0.4761	48	0.6927
	54	0.1384	0.4603	54	1.0165	54	0.1955	−0.3240	54	0.7008
	60	0.1589	0.4745	60	0.8722	60	0.1851	−0.0959	60	0.5989
	66	0.1418	0.8779	66	0.8847	66	0.1226	0.4191	66	0.6303
	72	0.1295	0.7908	72	0.9041	72	0.1207	0.4069	72	0.5956
	78	0.1508	0.4842	78	0.8784	78	0.1622	0.1521	78	0.5891
	84	0.1209	0.6196	84	0.8801	84	0.1186	0.3589	84	0.6107
12	12	0.0116	1.3350	12	1.4104	12	0.0073	0.7616	12	0.8093
	24	0.0197	1.0293	24	0.9479	24	0.0109	0.6039	24	0.6152
	36	0.0589	0.8092	36	0.9717	36	0.0514	0.4276	36	0.7029
	48	0.0566	0.7431	48	0.9846	48	0.0490	0.4206	48	0.6927
	60	0.0754	0.7073	60	0.8722	60	0.0706	0.3471	60	0.5989
	72	0.0640	0.8601	72	0.9041	72	0.0571	0.5120	72	0.5956
	84	0.0568	0.7668	84	0.8801	84	0.0527	0.5033	84	0.6107
18	18	0.0122	1.1373	18	1.1575	18	0.0041	0.6840	18	0.7127
	36	0.0386	0.8876	36	0.9717	36	0.0310	0.5473	36	0.7029
	54	0.0398	0.8866	54	1.0165	54	0.0324	0.5466	54	0.7008
	72	0.0425	0.8829	72	0.9041	72	0.0374	0.5445	72	0.5956
24	24	0.0098	1.0070	24	0.9479	24	0.0054	0.6143	24	0.6152
	48	0.0267	0.8258	48	0.9845	48	0.0195	0.5949	48	0.6927
	72	0.0318	0.8942	72	0.9041	72	0.0278	0.5604	72	0.5956
30	30	0.0156	1.0436	30	1.0545	30	0.0115	0.6739	30	0.7142
	60	0.0292	0.8358	60	0.8722	60	0.0247	0.5247	60	0.5989
36	36	0.0190	0.9635	36	0.9717	36	0.0142	0.6462	36	0.7029
	72	0.0212	0.9055	72	0.9041	72	0.0184	0.5760	72	0.5956
42	42	0.0184	0.9904	42	1.0063	42	0.0140	0.6568	42	0.7086
	84	0.0155	0.8615	84	0.8801	84	0.0139	0.5881	84	0.6107
48	48	0.0130	0.9613		0.9845	48	0.0088	0.6578	48	0.6927
54	54	0.0127	1.0027	54	1.0165	54	0.0092	0.6700	54	0.7008
60	60	0.0145	0.8769	60	0.8722	60	0.0119	0.5745	60	0.5989
66	66	0.0129	0.9141	66	0.8847	66	0.0101	0.6259	66	0.6303
72	72	0.0106	0.9167	72	0.9041	72	0.0091	0.5913	72	0.5956
78	78	0.0099	0.8742	78	0.8784	78	0.0088	0.5766	78	0.5891
84	84	0.0077	0.8795	84	0.8801	84	0.0069	0.6036	84	0.6107

one. The positive estimated α's during the early periods are consistent with this shift, for a positive α and β greater than one indicates that an upward price movement occurred that was not related to the overall price index. This type of price movement will occur if β falls; i.e., when the measured β's overstate the true β.

An examination of the estimated α and β for AT&T yields a

…PUSTAT		
	EQUILIBRIUM RESTRICTED REGRESSION (EQUATION (3))	
…	TIME	BETA
…57	6	0.9113
…15	12	0.8093
…37	18	0.7127
…26	24	0.6152
…31	30	0.7142
…36	36	0.7029
…35	42	0.7086
…61	48	0.6927
…40	54	0.7008
…59	60	0.5989
…91	66	0.6303
…69	72	0.5956
…21	78	0.5891
…89	84	0.6107
…18	12	0.8093
…39	24	0.6152
…76	36	0.7029
…06	48	0.6927
…71	60	0.5989
…20	72	0.5956
…33	84	0.6107
…340	18	0.7127
…473	[illegible]	0.7029
…466		0.7008
…445	[illegible]	0.5956
…143	24	0.6152
…949	48	0.6927
…604	72	0.5956
…739	30	0.7142
…247	60	0.5989
…462	36	0.7029
…760	72	0.5956
…5568	42	0.7086
…5881	84	0.6107
…6578	48	0.6927
…6700	54	0.7008
…5745	60	0.5989
…6259	66	0.6303
…5913	72	0.5956
…5766	78	0.5891
…6036	84	0.6107

…ne early periods are consis-
…} greater than one indicates
…l tha… …s not related to the
…mov… …nt will occur if β
…ıte the true β.
…and β for AT&T yields a

TABLE 2 CONTINUED

(b) GM

NUMBER OF MONTHLY INTERVALS	NYSE					COMPUSTAT				
	STRAIGHT LINEAR REGRESSION (EQUATION (1))			EQUILIBRIUM RESTRICTED REGRESSION (EQUATION (3))		STRAIGHT LINEAR REGRESSION (EQUATION (1))			EQUILIBRIUM RESTRICTED REGRESSION (EQUATION (3))	
	TIME	ALPHA	BETA	TIME	BETA	TIME	ALPHA	BETA	TIME	BETA
6	6	0.0030	1.6254	6	1.6972	6	−0.0051	0.7981	6	0.7284
	12	0.0002	1.6021	12	1.6157	12	−0.0114	0.9563	12	0.8633
	18	−0.0368	1.8187	18	1.5903	18	−0.1278	2.0086	18	0.6199
	24	−0.0369	1.1265	24	1.2423	24	−0.0588	0.8285	24	0.7426
	30	−0.0503	1.6020	30	1.4264	30	−0.1023	1.3429	30	0.8089
	36	−0.0623	1.6940	36	1.4890	36	−0.1694	1.8186	36	0.8461
	42	−0.0762	1.6423	42	1.3739	42	−0.2063	1.9139	42	0.8136
	48	−0.0861	1.7559	48	1.3587	48	−0.2952	2.5044	48	0.7742
	54	−0.0879	1.5321	54	1.1817	54	−0.2461	2.0021	54	0.7029
	60	−0.0778	1.2678	60	1.0743	60	−0.1580	1.2610	60	0.6621
	66	−0.0487	1.0366	66	1.0334	66	−0.0893	0.8181	66	0.6644
	72	−0.0612	1.0362	72	0.9837	72	−0.0899	0.8124	72	0.6723
	78	−0.0630	1.1063	78	0.9459	78	−0.1056	0.9506	78	0.6641
	84	−0.0748	1.1034	84	0.9448	84	−0.1033	0.9060	84	0.6878
12	12	0.0001	1.6034	12	1.6157	12	−0.0047	0.8997	12	0.8633
	24	−0.0183	1.1685	24	1.2423	24	−0.0290	0.7719	24	0.7426
	36	−0.0296	1.5676	36	1.4890	36	−0.0579	1.1643	36	0.8461
	48	−0.0377	1.5140	48	1.3587	48	−0.0721	1.1850	48	0.7742
	60	−0.0369	1.1539	60	1.0743	60	−0.0603	0.8829	60	0.6621
	72	−0.0302	1.0035	72	0.9837	72	−0.0425	0.7342	72	0.6723
	84	−0.0351	1.0122	84	0.9448	84	−0.0459	0.7802	84	0.6878
18	18	−0.0114	1.5057	18	1.5903	18	−0.0199	0.8179	18	0.6199
	36	−0.0194	1.5282	36	1.4890	36	−0.0349	1.0295	36	0.8461
	54	−0.0253	1.2622	54	1.1817	54	−0.0407	0.9064	54	0.7029
	72	−0.0201	0.9928	72	0.9837	72	−0.0279	0.7099	72	0.6723
24	24	−0.0091	1.1892	24	1.2423	24	−0.0144	0.7442	24	0.7426
	48	−0.0177	1.4144	48	1.3587	48	−0.0287	0.9286	48	0.7742
	72	−0.0150	0.9874	72	0.9837	72	−0.0207	0.6981	72	0.6723
30	30	−0.0093	1.4264	30	1.4264	30	−0.0142	0.8672	30	0.8089
	60	−0.0143	1.0911	60	1.0743	60	−0.0211	0.7313	60	0.6621
36	36	−0.0095	1.4901	36	1.4890	36	−0.0159	0.9182	36	0.8461
	72	−0.0100	0.9821	72	0.9837	72	−0.0137	0.6665	72	0.6723
42	42	−0.0096	1.3790	42	1.3739	42	−0.0152	0.8777	42	0.8136
	84	−0.0096	0.9536	84	0.9448	84	−0.0121	0.7063	84	0.6878
48	48	−0.0086	1.3688	48	1.3587	48	−0.0130	0.8359	48	0.7742
54	54	−0.0081	1.1879	54	1.1817	54	−0.0116	0.7511	54	0.7029
60	60	−0.0071	1.0709	60	1.0743	60	−0.0101	0.6888	60	0.6621
66	66	−0.0044	1.0242	66	1.0334	66	−0.0074	0.6675	66	0.6644
72	72	−0.0050	0.9768	72	0.9837	72	−0.0068	0.6751	72	0.6723
78	78	−0.0041	0.9478	78	0.9459	78	−0.0057	0.6744	78	0.6641
84	84	−0.0048	0.9425	84	0.9448	84	−0.0060	0.6928	84	0.6878

different picture. The estimated β coefficients for AT&T are consistently less than one. The estimated α's, contrary to the implication of equation (4), are typically negative. Within the framework of the equilibrium capital market model, this development, which reflects a sharp decline in the prices of the stock relative to the market, could occur if the risk premium for AT&T was rising, i.e., β was

TABLE 2 CONTINUED

(c) A T & T

NUMBER OF MONTHLY INTERVALS	NYSE					COMPUSTAT				
	STRAIGHT LINEAR REGRESSION (EQUATION (1))			EQUILIBRIUM RESTRICTED REGRESSION (EQUATION (3))		STRAIGHT LINEAR REGRESSION (EQUATION (1))			EQUILIBRIUM RESTRICTED REGRESSION (EQUATION (3))	
	TIME	ALPHA	BETA	TIME	BETA	TIME	ALPHA	BETA	TIME	BETA
6	6	−0.0043	0.5970	6	0.5197	6	−0.0058	0.2357	6	0.1358
	12	−0.0107	0.4168	12	0.3132	12	−0.0147	0.2737	12	0.1385
	18	−0.0392	0.7474	18	0.4953	18	−0.0926	1.1059	18	0.0781
	24	−0.0240	0.6325	24	0.7118	24	−0.0326	0.2283	24	0.1804
	30	−0.0375	0.7754	30	0.6362	30	−0.0520	0.4870	30	0.2039
	36	−0.0650	0.8043	36	0.5811	36	−0.1159	0.8631	36	0.1853
	42	−0.0711	0.7174	42	0.4583	42	−0.1331	0.8895	42	0.1680
	48	−0.0654	0.7606	46	0.4474	48	−0.1521	1.0508	48	0.1455
	54	−0.0585	0.7769	54	0.5314	54	−0.1190	0.8321	54	0.1926
	60	−0.0638	0.7000	60	0.5381	60	−0.0999	0.6130	60	0.2288
	66	−0.0528	0.5850	66	0.5854	66	−0.0738	0.4276	66	0.3009
	72	−0.0782	0.6741	72	0.6090	72	−0.0945	0.4900	72	0.3433
	78	−0.0891	0.8125	78	0.5849	78	−0.1193	0.6886	76	0.3637
	84	−0.1063	0.8201	84	0.5923	84	−0.1240	0.6355	84	0.3719
12	12	−0.0049	0.3552	12	0.3132	12	−0.0060	0.2010	12	0.1385
	24	−0.0119	0.6599	24	0.7118	24	−0.0161	0.1969	24	0.1804
	36	−0.0309	0.6723	36	0.5811	36	−0.0396	0.4157	36	0.1853
	48	−0.0288	0.5770	48	0.4474	48	−0.0371	0.3711	48	0.1455
	60	−0.0303	0.6065	60	0.5381	60	−0.0381	0.3740	60	0.2288
	72	−0.0387	0.6823	72	0.6090	72	−0.0447	0.4077	72	0.3433
	84	−0.0499	0.6906	84	0.5923	84	−0.0551	0.4845	84	0.3719
18	18	−0.0121	0.5205	18	0.4953	18	−0.0145	0.2429	18	0.0781
	36	−0.0202	0.6312	36	0.5811	36	−0.0239	0.3235	36	0.1853
	54	−0.0171	0.5941	54	0.5314	54	−0.0197	0.3021	54	0.1926
	72	−0.0257	0.6186	72	0.6090	72	−0.0293	0.3822	72	0.3433
24	24	−0.0059	0.6733	24	0.7118	24	−0.0080	0.1815	24	0.1804
	48	−0.0136	0.5012	48	0.4474	48	−0.0148	0.2390	48	0.1455
	72	−0.0192	0.6116	72	0.6090	72	−0.0218	0.3698	72	0.3433
30	30	−0.0069	0.6460	30	0.6362	30	−0.0072	0.2450	30	0.2039
	60	−0.0117	0.5550	60	0.5381	60	−0.0133	0.2782	60	0.2288
36	36	−0.0100	0.5915	36	0.5811	36	−0.0109	0.2474	36	0.1853
	72	−0.0128	0.6050	72	0.6090	72	−0.0144	0.3576	72	0.3433
42	42	−0.0090	0.4720	42	0.4583	42	−0.0098	0.2212	42	0.1680
	84	−0.0137	0.6073	84	0.5923	84	−0.0146	0.3958	84	0.3719
48	48	−0.0065	0.4666	48	0.4474	48	−0.0067	0.1913	48	0.1455
54	54	−0.0055	0.5438	54	0.5314	54	−0.0056	0.2270	54	0.1926
60	60	−0.0058	0.5384	60	0.5381	60	−0.0064	0.2513	60	0.2288
66	66	−0.0048	0.5716	66	0.5854	66	−0.0061	0.3032	66	0.3009
72	72	−0.0064	0.5982	72	0.6090	72	−0.0071	0.3433	72	0.3456
78	78	−0.0059	0.5879	78	0.5849	78	−0.0065	0.3763	78	0.3637
84	84	−0.0068	0.5914	84	0.5923	84	−0.0072	0.3796	84	0.3719

increasing. The measured value of β, therefore, consistently understates the true value of β for AT&T throughout the entire period.

The six-month β estimates for GM are all greater than one and and the α estimates are almost always negative. These results are consistent with the view that the β estimates are approximately accurate.

COMPUSTAT		
	EQUILIBRIUM RESTRICTED REGRESSION (EQUATION (3))	
ETA	TIME	BETA
1.2367	6	0.1358
1.2737	12	0.1385
.1059	18	0.0781
1.2283	24	0.1804
1.4870	30	0.2039
).8631	36	0.1863
).8895	42	0.1680
1.0508	48	0.1455
0.8321	54	0.1926
0.6130	60	0.2288
0.4276	66	0.3009
0.4900	72	0.3433
0.6886	78	0.3637
0.6355	84	0.3719
0.2010	12	0.1385
0.1969	24	0.1804
0.4157	36	0.1853
0.3711	48	0.1455
0.3740	60	0.2288
0.4077	72	0.3433
0.4846	84	0.3719
0.2429	18	0.0781
0.3236	36	0.1853
0.3[illegible]	54	0.1926
0.3[illegible]	72	0.3433
0.1815	24	0.1804
0.2390	48	0.1455
0.3698	72	0.3433
0.2450	30	0.2039
0.2782	60	0.2288
0.2474	36	0.1853
0.3576	72	0.3433
0.2212	42	0.1680
0.3958	84	0.3719
0.1913	48	0.1455
0.2270	54	0.1926
0.2513	60	0.2288
0.3032	66	0.3309
0.3433	72	0.3456
0.3763	78	0.3637
0.3796	84	0.3719

herefore. consistently under-
hroughout the entire period.
are all greater than one and
s ne[illegible] e. These results are
estimates are approximately

6. Implications for rate setting

It is proper to link allowable rates of return to the firm's cost of capital and the firm's cost of capital to risk. Both the theory and the empirical work presented above, however, indicate that a regulatory body can be misled if it attempts to use estimated β coefficients from time series regression analysis in an uncritical way for rate regulation.

If the capital asset pricing model is to be used as the underlying framework for valuation, the relation between the corporate activities, both new and old, and the relative risk of the corporation must be examined in much more detail than has been done to date. It is reasonable to believe that such examinations will reveal that regulatory decisions themselves directly effect the value of β, for they influence the corporation's growth rate, stability, size, and payout. If this conjecture is borne out, the regulatory body must be prepared to assess not only the impact of its decisions on the allowable return, but also its effect on the riskiness of the company.

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On the Use of the CAPM in Public Utility Rate Cases*

Eugene F. Brigham and Roy L. Crum

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■ Since its first appearance in 1964, the Capital Asset Pricing Model (CAPM) has received increasing attention in finance. Most of the work on the CAPM to date has been "academic" in the sense that it has involved either tests or theoretical extensions of the basic market model. However, the model has also been used with apparently good results for portfolio decisions, and it has recently been applied in a number of public utility rate cases. We have not surveyed this latter usage, but from our own experience we know of its use during the past year alone in Georgia, Illinois, Iowa, Kansas, Mississippi, New Jersey, Oregon, and South Carolina, as well as before federal commissions including the FPC and FCC.

There are a number of problems with the model, including the following: 1) the model is based on a set of unrealistic assumptions, 2) there is disagreement over the most appropriate interest rate to use as the risk-free rate, 3) the market risk premium cannot be measured with precision, and 4) not only is an individual stock's historical beta unstable, but also no one knows how to estimate a stock's *future* beta coefficient, which is the one that is relevant in the CAPM. These problems are all discussed in the financial literature [1, 2, 4, 5], but one point that has not been emphasized is that an *increase* in a company's systematic risk can actually *lower* its calculated beta coefficient. Thus, whereas a low or falling calculated beta would gen-

We would like to thank a number of people for commenting on an earlier draft of this paper. Although not all of them were in agreement with the views expressed in the paper, helpful suggestions were made by Robert Angell, William Beedles, Willard Carleton, David Downes, Larry Farmer, Myron Gordon, Sam Hadaway, Eugene Lerner, Merton Miller, Stewart Myers, Richard Pettway, Gerald Pogue, David Quirin, Robert Radcliffe, William Sharpe, and Robert Vandell. Any errors that remain are, of course, the responsibility of the authors.

erally be interpreted as signaling that a firm's risk is decreasing, the opposite might in fact be true. This paper demonstrates this point, then suggests that the electric and telephone utilities are in exactly such a position today. Our specific conclusion is that the CAPM as it is typically employed may be misleading when used in utility rate cases today. Our general conclusion is that the basic model must be used with a *great deal* of caution, if it is used at all, in any situation where a firm's fundamental risks are undergoing change.

An Example of Misleading Betas

The major problem with all cost of capital estimation techniques is the fact that the models require as inputs information about investors' expectations of *future returns*, yet reliable data are available only on past returns. Consider the basic CAPM equation for estimating a firm's cost of equity,

$$k_X = R_F + \beta_X(k_M - R_F), \qquad (1)$$

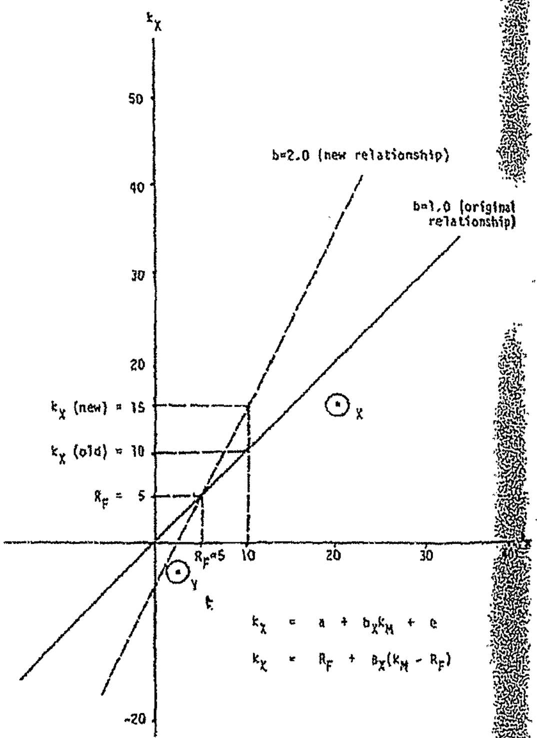
where k_X is Firm X's cost of equity, R_F is the rate of return on risk-free securities, β_X is the stock's "true" beta coefficient as estimated by investors, and k_M is the expected rate of return on the market (or on an "average" stock). To use the model to estimate k_X, we need values for R_F, β_X, and k_M. There are problems involved in estimating each of these variables, and, as noted above, most of these problems are well known and widely discussed in the literature. *However, the problem we focus upon here is not well known and could potentially cause seriously biased and grossly misleading estimates of the cost of capital.*

The problem, essentially, is that the beta coefficient estimated with historical data, b_X, is likely to be a biased estimator of the true beta whenever a company undergoes a basic change in its systematic risk position and its expected earnings do not immediately rise to offset this increase in risk. Unless there is an immediate offsetting increase in the *expected* rate of return on the company's *assets*, the increase in risk will cause a drop in the price of the stock. This stock price decline will lower the most recent holding period return used to calculate b_X, and this, in turn, can result in a biased estimate of the true beta, β_X.

Figure 1 expresses this situation in graph form. Here we assume for simplicity that Stock X has no unsystematic risk, and its original characteristic line has both a calculated and a "true" slope of 1.0. Now its systematic risk as perceived by investors increases from $\beta_X = 1.0$ to $\beta_X = 2.0$. The expected earning power of its assets does not increase, so there will be a drop in the stock price relative to the price that would have occurred without the beta change.

Suppose the change in β_X occurred during a rising stock market, a market during which the realized return on the market, k_M, was 20 percent, well above the mean market return, $\bar{k}_M = 10$ percent. Had β_X not changed, then the price of Stock X would have increased with the market to produce a realized return on Stock X equal to the required return, $k_X = 20$ percent. But β_X increased, so P_X must necessarily fall (or rise less than it otherwise would have risen), and the realized return, $\bar{k}$, will be less than the 20 percent required return. For example, $\bar{k}_X$ might equal 15 percent as represented by Point X in Figure 1. Since k_M is greater than R_F at the same time that $\bar{k}_X$ is less than k_X, adding data point X reduces the slope of the calculated characteristic line, and the calculated beta, b_X, would decline below 1.0, the old $\beta_X = b_X$. Thus an *increase* in β_X leads to a *reduction* in b_X, and if b_X were

Figure 1. Hypothetical Characteristic Lines for a Stock before and after a Fundamental Change in Risk.



used to estimate the firm's risk and its cost of capital, the results would be biased and misleading.

Had the change in β_X occurred in a down market, where k_M was less than $\bar{k}_M$, the calculated beta would again be biased, but in the opposite direction. For example, suppose the change occurred when the realized market return was $k_M = 2$ percent. P_X would decline because of the market drop, and also because of the increase in β_X. By the assumptions of the CAPM, in equilibrium all characteristic lines must cross at R_F, hence a change in β_X would cause Stock X's characteristic line to pivot about the point $k_X = k_M = R_F$. Therefore, when data Point Y is included in the calculation of b_X, the characteristic line must become steeper. Depending on the number of observations used to calculate b_X, and the placement of Point Y, it is conceivable (although unlikely) that b_X could even exceed β_X. To conclude this discussion, we note that if $k_M = \bar{k}_M$, the impact on the calculated characteristic line would be absorbed entirely in the intercept term, and the calculated b_X would not change.

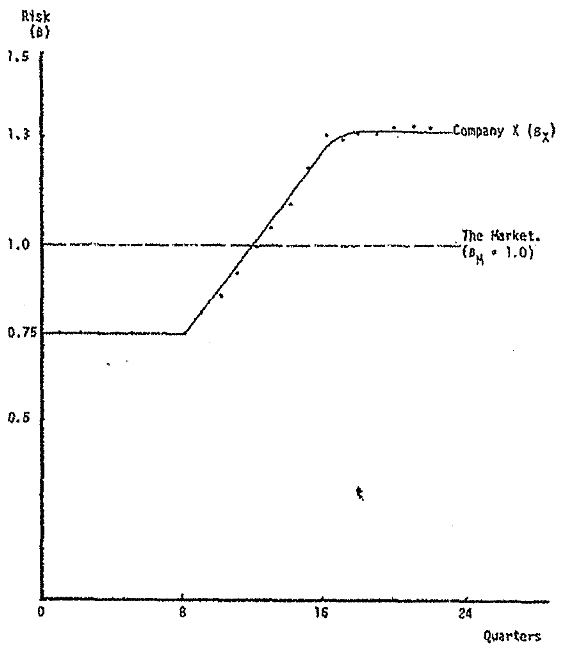
The type of situation described thus far could be described as a *shock situation* — some event occurred that increased investors' perception of β_X, which led to a one-time price decline and a one-time very low rate of return. In this case, b_X would be a poor estimate of β_X at best, and probably a *very highly misleading one* if the shock occurred in an up market. It would be fairly easy to detect a change such as this — the residual error term would increase, as would the standard error of b_X. Thus, one could view a significant increase in σ_{b_X} as a warning that b_X itself might well be a poor proxy for β_X.

A similar change in risk could occur over a longer period — there could be a *gradual increase* in a firm's true systematic risk as opposed to a shock change. The gradual change situation is probably more dangerous because it is more difficult to detect. To see what is involved here, we set up an example of a hypothetical Company X which is originally regarded by investors as being less risky than the average stock. (The details of the example may be obtained from the authors.) The company is assigned a risk index $\beta_X = 0.75$, and its historical beta as calculated over the past eight quarters is equal to its true beta; that is, $b_X = 0.75 = \beta_X$.

Now suppose the company begins to undergo a change in its fundamental risk position. This change could, as in the case of the utilities, be the result of a gradually increasing awareness of the fact that utilities experience especially difficult problems during periods of rapid inflation; it could result from a gradual increase in the company's debt ratio; or it could be caused by any number of other factors. The point is that as Company X's position deteriorates, its systematic risk increases, and, as a result, the β used by investors to determine the stock's required rate of return increases. At the same time, investors do not expect the firm to be able to earn a higher rate of return on assets to compensate for this increase in risk. (We should note that throughout this paper we follow the fundamental CAPM assumption that only systematic risk is relevant in determining risk premiums. If this assumption is incorrect, then the CAPM simply cannot be used to estimate the cost of capital anyway. So, for purposes of discussion we adopt the CAPM assumptions, then show that, even granting these assumptions, serious problems may be encountered in attempts to make the model operational on the basis of historical data, as witnesses have attempted to do in utility rate cases.)

These trends in Company X's β are shown in Figure 2. Prior to Period 9, $\beta_X = 0.75$. However, during Period 9 the company's position begins to deteriorate, and its risk as measured by β begins to increase. At the end of Period 16, the company's risk stabilizes, but by then its true beta is just over 1.3. Thus Company X has, over a two-year period, changed in the

Figure 2. Changes in Company X's Systematic Risk.



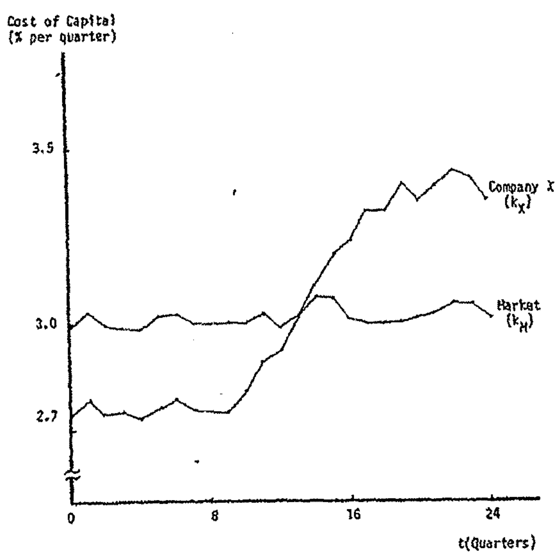
minds of investors from a low-risk to a high-risk stock.

Now consider Figure 3, which shows the cost of capital for Company X and for the market. Although both experience random changes in the cost of capital from quarter to quarter, just as interest rates and stock yields vary over time, the dominant features of the graph are these: 1) the cost of equity for the average company is approximately constant at the rate $k_M = 3$ percent per quarter; 2) Company X's cost of capital is approximately constant and equal to $k_X = 2.75$ percent per quarter during periods $t = 0$ to 8; 3) at $t = 9$, when β_X begins to rise, k_X also begins to rise; 4) this increase continues until Period 16, at which time k_X stops rising and begins to fluctuate around the value 3.5 percent per month.

Next, consider the effects of Company X's rising cost of capital on the price of its stock. We assume 1) that the increased risk does not affect the size of the future dividend stream, only its riskiness, and 2) that the stock price is determined as the present value of the expected future dividend stream:

$$P_0 = \sum_{t=0}^{\infty} \frac{D_0(1 + g_X)^t}{(1 + k_X)^t} = \frac{D_1}{k_X - g_X}. \qquad (2)$$

Figure 3. Changes in the Cost of Capital over Time.



Before the change in Company X's risk position, its earnings, dividends, and stock price grew at the rate of 1.25 percent per quarter. The stock price would have continued to grow at this rate had the company's risk not increased. However, from $t = 9$ through $t = 16$, the period during which β_X and k_X were increasing, the rising k_X causes P_X to decline. This situation is shown in Figure 4, which plots the price of the average stock along with that of Company X.

We next calculate the total returns on Company X and the market, using the equation

$$\text{Return}_t = \frac{D_t}{P_{t-1}} + \frac{P_t - P_{t-1}}{P_{t-1}}.$$

The returns of Company X are then regressed against those of the market in the standard manner to generate beta coefficients, b_X, for Company X in various periods. We use a moving series of eight quarters to calculate the betas; these calculated betas are plotted in Figure 5, along with the true betas as shown previously in Figure 2. Figure 5 demonstrates our initial contention — other things held constant, an increase in risk as measured by the true beta causes a decline in the stock price, which in turn can lead to low

Figure 4. Stock Price Trends: Company X and the Market.

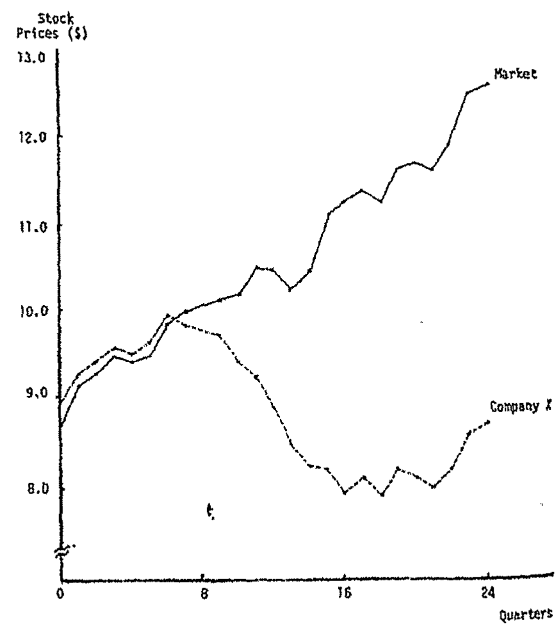
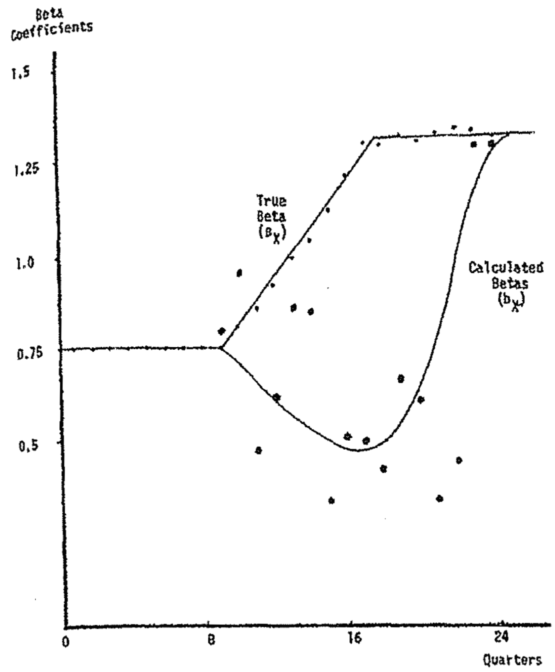


Figure 5. True versus Calculated Betas for Company X.



rates of return, which can result in low calculated beta coefficients. In this situation, the calculated betas tend to be downward biased during the period of increasing risk, $t = 9$ and $t = 16$. Once the company's risk stabilizes, the calculated beta begins to increase, and it approximates the true beta N periods after the risk stabilizes, where N is the number of periods used to calculate the beta coefficient.

We can now summarize the example and use it to show how the CAPM would lead to a serious misspecification of Company X's cost of equity capital:

1. We know that Company X's risk and cost of capital were rising over the eight quarters.
2. We know that Company X's true beta coefficient was originally 0.75, and that its cost of capital was originally

$$\begin{aligned} k_X &= R_F + b_X(k_M - R_F) \\ &= 8 + 0.75(12 - 8) \\ &= 11 \text{ percent per year.} \end{aligned}$$

3. We know that the calculated beta from Periods 9 through 24 is below the true beta; at Period 16, when the true beta is about 1.3, the calculated beta is only 0.5. Used in a mechanical way, the CAPM approach would result in a cost of capital at Period 16 of 10 percent:

$$\begin{aligned} k_X &= R_F + b_X(k_M - R_F) \\ &= 8 + 0.5(12 - 8) \\ &= 10 \text{ percent} = \text{calculated cost of capital.} \end{aligned}$$

4. However, the results in (3) are contrary to known conditions. We know that Company X's annual cost of capital has in fact risen from 11 percent, which was less than k_M, to 13.3 percent, which is above k_M:

$$\begin{aligned} k_X &= R_F + \beta_X(k_M - R_F) \\ &= 8 + 1.33(12 - 8) \\ &= 13.3 \text{ percent} = \text{true cost of capital.} \end{aligned}$$

Thus, in this situation the use of the CAPM produces seriously misleading results.

Is the Problem More Than Hypothetical?

These hypothetical examples demonstrate that a *potential* problem exists if betas based on historical data are used to estimate security risk. However, are they strictly hypothetical situations, or do similar problems actually arise in the real world? While we cannot *prove* that the problem exists because we do not know how to determine β_X, there is strong evidence that the situation described does, at times, exist.

First, during the period 1973–1975, the real estate investment trusts (REIT's) experienced disastrous declines. These companies were borrowing heavily on a short-term basis, and when short-term interest rates rose dramatically during 1974, the interest costs of REIT's exceeded their incomes. The problem was compounded by high vacancy rates and slow turnovers for many REIT-financed projects. Before these developments occurred, the REIT's were regarded as being average risk stocks, while their average cost of capital was probably about equal to that of the average firm. Then, as the true situation began to unfold, analysts' reappraisals of the stocks caused investment advisory services such as Value Line and S&P to change their REIT ratings from low or average risk to higher risk. These reappraisals were undoubtedly accompanied by increases in the required rate of return, which certainly contributed to the decline in the S&P index of REIT stocks from 11.48 in January of 1973 to 1.19 in December of 1974.

During this period the betas of the individual REIT's were declining steadily, just like our hypo-

Table 1. Selected Real Estate Investment Trust Data

	April 5, 1974		July 5, 1974
American Century Mortgage Investment			
Value Line Safety Index	3		5
Price/Share	$ 7.30		$4.50
(% Decrease)		—38%	
Beta	1.09		0.85
C. I. Mortgage Group			
Value Line Safety Index	3		4
Price/Share	$11.00		$5.60
(% Decrease)		—49%	
Beta	0.84		0.65

Source: Value Line

thetical Company X. For example, American Century Mortgage Investment's stock price fell from $7.30 in April 1974 to $4.50 in July 1974, or by 38 percent (see Table 1). Value Line changed its "safety index" for the stock from 3 (average risk) to 5 (highest risk) during that time, but Value Line's beta for the stock dropped from 1.09 to 0.85. The decline in the calculated beta *could* indicate that the company's systematic risk actually declined, but this seems unlikely. Actually, the reduction in beta was probably caused by an *increase* in risk from the viewpoint of investors, as hypothesized in this paper. It simply boggles the mind to think that a portfolio manager would really think that he was *reducing* his portfolio's risk if he added a REIT stock after their troubles became apparent, even though their calculated betas had fallen.

If our contention is correct, then the REIT's betas should have followed a path like that shown in Figure 5, first declining and later rising. Indeed, on November 12, 1976, Value Line reported a beta of 1.15, up from 0.85, for American Century, and one of 1.05, up from 0.65, for C. I. Mortgage Group.

The phenomenon of falling betas in the face of rising risks is also seen in Table 2, which traces the betas of the three largest U. S. business failures — Penn Central, W. T. Grant, and the Franklin National Bank — as they headed into bankruptcy. Like the REIT's, it would appear that the rising risk perceptions helped cause a decline in stock prices, which in turn produced low betas. Thus, these data also suppor the contention that historical betas can be grossly mis leading indicators of risks and of investors' percep tions of these risks.

A similar situation, but one where misleading beta could cause a great deal more harm, appears to hav occurred in the electric and telephone industries in re cent years. Fuel shortages, environmental problem: and uncertainties about future demand have raised th investment risks of the electrics, while actual an potential increases in competition and a rising del ratio have increased the risks inherent in telephor stocks. Both groups have suffered from regulatory la inflation, and earnings quality declines. Althou other industries are exposed to somewhat simil

Table 2. Beta as an Indicator of Risk

	1/74	7/74	1/75	7/75	1/76	7/76
W. T. Grant						
Beta	1.37	1.30	1.30	1.30		
Safety Rank	3	3	4	5	B	
Franklin NY Corp.						
Beta	0.82	0.75				
Safety Rank	3	4	B			
Penn Central						
Beta	1.24	1.20			[t]0.76	0.75
Safety Rank	5	5	B	B	5	5

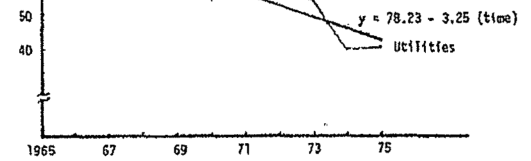
B = Bankrupt
Source: Value Line

problems, it does appear that the electric and telephone stocks' risks have increased relative to the average stock. This change has been noted in the financial press, in analysts' comments, and in the "quality ratings" of the companies' stocks and bonds. The appendix lists some of the fundamental factors that have been cited as having increased the utilities' risks *vis-à-vis* those of the average industrial company, while Figure 6 gives a plot of the price performance of utility and industrial stocks in the period 1965–1975. Note particularly the similarity between Figure 6 and Figure 4, the one for our hypothetical Company X.

In spite of the utilities' increasing risks, their beta coefficients remained essentially unchanged from 1964 through 1975. The average electric company as represented by Moody's 24 utilities had a beta of 0.74 for the period October 1964 to June 1970; the average beta of these same companies was 0.75 during the period January 1971 to December 1975. AT&T's beta actually declined from 0.62 to 0.59 between the two dates.

These essentially constant betas could be interpreted in either of two ways: 1) that the utilities' systematic risk has remained stable over the past 12 years or 2) that the industry's true risks have risen, but that the same arithmetic phenomenon which biased downward the beta of our hypothetical Company X, and probably produced the low betas of Penn Central, W. T. Grant, Franklin National Bank, and the REIT's,

Figure 6. Utility and Industrial Stock Prices, 1965–1975.



Source: Standard and Poor's Corporation, *Statistics*, 1976 Edition, pp. 121–122. The data plotted are annual averages.

has also affected the utilities' betas. The second explanation seems more plausible than the first.*

Conclusions

The Capital Asset Pricing Model (CAPM) has received increasing attention in recent years. It has an appearance of simple elegance which gives it great appeal, especially in legal procedures such as utility rate cases, where commissions seek precise, quantitative "answers." However, this paper suggests that in the current environment the CAPM probably produces downward-biased betas, and hence cost of capital estimates that are too low. Calculated beta coefficients will tend to decline whenever a company's fundamental risk position is increasing at a time when the general market is rising if investors do not expect earnings to rise sufficiently to offset the increase in risk. Thus, using betas as a measure of risk can yield conclusions that are exactly opposite to the actual facts. This point was demonstrated with hypothetical examples, but there is evidence that the situation described in the examples may, in fact, exist. Thus, the firms involved in the three largest U. S. bankruptcies — Penn Central, W. T. Grant, and Franklin National Bank — all had declining betas and poor earnings prospects as they approached bankruptcy, as did the REIT's during a period in which their stock prices dropped sharply because of investors' increasing awareness of the industry's inherent risks. Similarly, the electric and telephone companies' betas remained constant or even declined from 1964 to 1975, at precisely the time when the industries' fundamental risks were increasing and investors were downgrading the companies' stocks and bonds from "widow and orphan stocks" to stocks that possess a significant degree of risk.

The implications of all this for utility rate cases is quite clear: historic betas do not necessarily reflect the risks inherent in utility stocks, so a great deal of caution is necessary if the CAPM is to be used to estimate a utility's cost of equity capital. The CAPM is logically appealing, and it is the subject of a great deal of current research, including research designed to use a company's fundamental position to help estimate its future beta [5]. Quite possibly, this research will be successful in increasing the model's validity and usefulness in the utility context. Yet, at present, the

*It should be noted that the conclusions reached here are completely consistent with those reached by W. J. Breen and E. M. Lerner [1].

CAPM should be used in utility rate cases, if at all, only with a great deal of caution.

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Appendix. Factors That Raised Utilities' Fundamental Risks *Vis-à-vis* the Market in the Period 1965–1975.

I. Factors That Have Affected Both Electric and Telephone Companies

A. Related to Inflation

1. Regulatory lag: costs rise, but rates are increased only after a lag.
2. Depreciation is inadequate, so economic profits are overstated. This problem is especially pronounced for utilities because they are so capital intensive.
3. Interest rates rise as a result of increased inflation. This has an adverse effect on utilities' profits because utilities use a great deal of financial leverage, and also because of regulatory lag in getting higher rates to cover higher money costs.
4. Inflation increases investment requirements and the need for new capital. This factor is especially pronounced for utilities because of their capital intensity.

B. Deterioration of "Quality of Earnings"

1. Allowance for Funds Used During Construction (AFDC) is a much higher percentage of earnings today than it was in 1965.
2. Flow-through effects are increasingly important to companies operating in flow-through states.
3. Increased financial leverage has helped to increase EPS, but, at the same time, this increased leverage has increased the risk inherent in reported earnings.

II. Factors That Have A Primary Impact on the Electrics

A. Environmental Factors

1. Huge and changing pollution control expenditure requirements have had an effect on current profits, and they have also increased uncertainty about future profits.
2. Pollution control standards are uncertain, as are the costs of meeting these standards and even the ability to meet them at any cost.
3. The situation with regard to nuclear plants is unclear. This factor has seriously increased the risks of certain companies.
4. There are problems involved in getting sites for generating plants, including time and money cost of getting all necessary approvals.

B. Fuel Cost Availability

1. What fuels will be available, and what will be their costs? Examples of the kinds of problems that have increased uncertainties and raised risks include the following: Westinghouse's situation with regard to nuclear fuel; the oil price jump; the natural gas shortages; will coal be available, and can it be burned?
2. Fuel adjustment clauses mitigate some of these problems but certainly do not eliminate them.

C. Demand Forecasting Uncertainties

1. Utilities can no longer make accurate long run demand forecasts with a ruler. No one knows the lagged effects of sharply higher electric prices on demand (lagged price elasticity), how successful conservation efforts will be, and so on.
2. The utilities must start construction years ahead of need, but find it terribly difficult to develop accurate forecasts in the current en

vironment. They could end up with excess capacity, or with shortages and poor service. Efforts toward load-leveling will compound this forecasting problem, because if these efforts are successful, they will mean larger base load plants, which have longer construction times.

III. Factors That Have a Primary Impact on the Telephone Companies

A. Increased competition as a result of recent FCC decisions.
B. Changes and potential changes in procedures for costing and pricing services. The effects of these changes on demand are unknown, but the uncertainty about them increases the risks of equity investors.
C. The threat that AT&T might be broken up. What would this do to the U. S. telephone system? Would massive rate increases be required on local residential services? Would political pressures delay increases? Would rate increases meet consumer resistance and result in lower demand? We know that Gillette loses money on razor production, but produces razors in order to sell blades. If it were forced to use a strict incremental cost pricing system, Gillette's revenues would decline. The same thing might hold true in the telephone industry, where the existence of telephones in most residences increases the value of business telephones.
D. Telephone companies' equity ratios have declined even more than those of the electrics during the past ten years.

FINANCIAL MANAGEMENT ASSOCIATION
1977 Annual Meeting

Dates:	October 13–15, 1977
Place:	Washington Plaza Hotel Seattle, Washington
Program Participation:	Professor George E. Pinches School of Business University of Kansas Lawrence, Kansas 66045 (913) 864-3536
Meeting Arrangements:	Professor Charles A. D'Ambrosio Graduate School of Business Administration University of Washington Seattle, Washington 98105 (206) 543-4773 or 523-4748
Placement Information:	Professor Donald J. Puglisi College of Business & Economics University of Delaware Newark, De. 19711 (302) 738-2556

1978, spring 9(1)

On the use of β in regulatory proceedings: an empirical examination

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Since the development of the capital asset pricing model and the articles of Myers (1972) and Breen-Lerner (1972), the use of the CAPM to measure the required rate of return of equity investors and thereby to determine the allowed rate of return for a utility has become more common. Although the CAPM does not require structural stability of its parameters measured from historical observations, reasonable stability is presumed. Otherwise the model is not operationally useful. The purposes of this paper are to explore the structural stability of the estimating process and to assess whether the CAPM is operational in actual regulatory proceedings.

1. Introduction

Since the development of the capital asset pricing model (Sharpe, 1963 and 1964; Lintner, 1965; Fama, 1968) and especially since the articles by Myers (1972a and 1972b) and Breen and Lerner (1972), the use of the CAPM to measure the risk perceptions of equity investors and thereby to determine the allowed rate of return for a utility has become more common.[1] Advocates of the CAPM generally have developed estimates of the required rate of return based upon historical observations of the return on comparable utilities versus the return on the market portfolio, thus measuring the shareholder's required price of risk in a "beta" term. Using the CAPM to determine the required cost of equity capital of comparable companies will provide estimates of the required rate of return that may be used to determine the allowed rate of return of a utility following the dictum of the *Hope* case.[2]

This research was supported in part by a grant from the Public Research Center, University of Florida.

[1] A brief and incomplete list of the applications of the CAPM in regulatory hearings is as follows: Stewart C. Myers used the CAPM in the Comsat rate case (FCC Docket 16070) and the A. T. & T. rate case before the FCC in 1971. Recently, there have been more uses of the CAPM in rate cases such as: Basil L. Copeland, Jr., before the Arkansas Public Service Commission, Docket No. U-2647, concerning Arkansas Western Gas Company, and James L. Bicksler before the South Carolina Public Service Commission, Docket No. 76-352-C, concerning Southern Bell Telephone Company. Professor Bicksler has filed testimony using the CAPM before the Public Service Commissions in the states of Mississippi, Georgia, Illinois, New Jersey, Oregon, and Iowa.

[2] "The return to the equity owner should be commensurate with the returns on investments and other enterprises having corresponding risks. That return, moreover, should be sufficient to assure confidence in the financial integrity of the enterprise so as to maintain its credit and attract capital." *Federal Power Commission et al. v. Hope Natural Gas Company*, 320 U.S. 591 (1949) at 603.

Although the CAPM does not require structural stability of its parameters over time, it is hoped that they are reasonably stable, for otherwise the model is not operationally useful. Since the majority of applications of the CAPM in utility hearings have used historical data to measure the required rate of return, this structural stability in the parameters of the model is generally assumed. It is the purpose of this paper, in light of the many and varied shocks in the electric power industry since 1970, to explore the structural stability of the estimating process and to assess whether the CAPM is an operational model for determining the allowed rate of return in regulatory proceedings.

2. Methodology

Myers (1972b) correctly points out that any use of historical price data as employed in most applications of the CAPM to determine the required rate of return on equity capital must fit a model such as:

$$\tilde{r}_{it} = \hat{\alpha}_i + \hat{\beta}_i \tilde{r}_{mt} + \tilde{u}_{it}, \tag{1}$$

where $\tilde{r}_{it}$ is the return on stock i in time t and where the tilde indicates a random variable, $\tilde{r}_{mt}$ is a market return factor common to all assets, $\hat{\alpha}_i$ and $\hat{\beta}_i$ are the parameters to be measured, and $\tilde{u}_{it}$ is the error term associated with the linear model. The real question is whether the parameters of the *ex post* model are good estimates of the true α_i and β_i which are unobservable and represent *ex ante* expectations of market participants. It is the objective of this paper to measure the stability of the estimates of these parameters over time in such a way as to be able to comment on the validity of using the *ex post* estimating process in equation (1) to determine the required price of risk and thereby the required rate of return on equity capital of electric utilities.

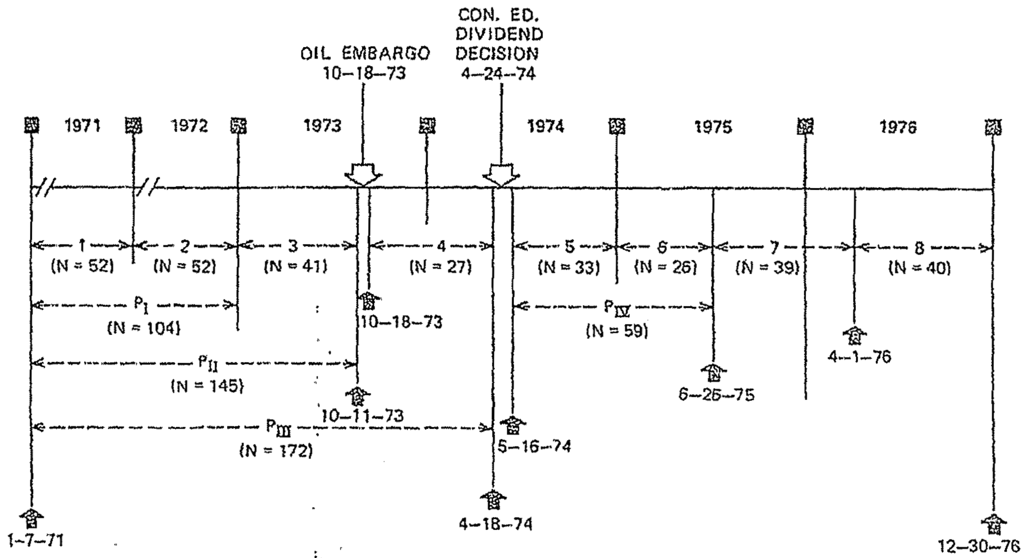
To obtain better estimates of these parameters and to measure their structural change over time in the electric utility industry, 36 electric utilities were chosen to represent the industry.[3] The weekly holding period returns excluding cash dividends were determined for each utility based upon its Thursday's closing prices adjusted for stock splits and stock dividends.[4] These returns for each utility for each week were then added to determine an average holding period return for a week on a portfolio containing equal amounts

[3] In almost all rate cases, the required rate of return on equity capital for the company in the hearing is estimated by measuring "the return to the equity owner in other enterprises having corresponding risks" as suggested by the *Hope* case. Since we are not concerned with a specific electric utility with specific risks, we have generalized the measurement process to a large group of electric power companies. The thirty-six utilities chosen here are large and publicly traded and represent the population of electric utilities on the I.S.L. data tapes, except for one company, Consolidated Edison. Consolidated Edison was omitted from the sample because of its dramatic price movements after omitting its second quarter 1974 dividend.

[4] The one-week holding period return on stock i was defined as equal to $(P_t - P_{t-1})/P_{t-1}$, where t is the Thursday closing price of the utility's common stock. It has been argued that the holding period return should contain dividends as well as price changes, especially for high dividend paying stocks such as public utilities. A test was performed on the 36 public utilities in this sample over the six years of the study period to determine the degree of correlation between the measure used, $(P_t - P_{t-1})/P_{t-1}$, versus a dividend and price return measure, $(P_t + D_t - P_{t-1})/P_{t-1}$. The dividends were added to the price returns in the week that the stock went ex dividend. Over the study period, these two measures were extremely highly correlated, $R^2 = 0.9827$. Thus, because of the high degree of correlation between the two measures and because of the difficulty of adding dividend return to the market index returns, the holding period returns used in this study are based only on market prices.

FIGURE 1

EVENT CHART; PUBLIC UTILITIES



of investment in each security.[5] Thursday's closing prices of the S & P 500 composite index were used to determine the holding period returns of the market index or common factor.

To test the stability and validity of the parameter estimates obtained in a manner used in past rate hearings, a test period of six years was chosen of weekly holding period returns from January 1, 1971, through December 31, 1976. This six-year period was initially divided into eight separate time periods. Since major changes or shock events such as the energy embargo and the Consolidated Edison dividend decision could have had a dramatic effect upon the stability of these parameters, the time periods were chosen such that the beginning of a period was just after one of the shocks and ended just before the next major shock. A diagram of these periods and the dates of these shocks can be seen in Figure 1. The eight sample time periods were:

Period 1, year 1971, 52 observations of portfolio holding period returns.
Period 2, year 1972, 52 observations of portfolio holding period returns.
Period 3, year 1973 through October 11, 1973. The date of the first news about the energy embargo was October 18, 1973; therefore this test period ended the Thursday preceding this date. The period contains 41 observations.
Period 4, from October 18, 1973, until April 18, 1974. The announcement that Consolidated Edison was omitting its second quarter 1974 dividend,

[5] Note that the holding period returns each week were determined first for each utility, and then were averaged to determine the holding period return of the portfolio of thirty-six utilities for week *t*. Thus, an equally weighted portfolio was created. The author is not arguing that the portfolio formed is "efficient," but only that the firms are comparable so that the *Hope* case dictum can be followed. Additionally, it is not argued that the weekly holding period employed here is the "optimal" holding period for these securities. Again we are only attempting to replicate existing practices in rate hearings for this test.

reversing its policy of paying a dividend in each quarter of the previous 89 years, was made April 24, 1974. This period contains 27 observations.

Period 5, from May 16, 1974, until the end of 1974. Three weeks were omitted from this study around the Consolidated Edison announcement to remove any distortion that could have occurred due to this shock. The period contains 33 observations.

Period 6, the first two quarters of 1975, 26 observations.

Period 7, the last two quarters of 1975 and the first quarter of 1976, 39 observations.

Period 8, the last three quarters of 1976, 40 observations.

Each test period was used to develop estimates of $\hat{\alpha}_t$, $\hat{\beta}_t$, and σ_{u_t}, and these were compared with the observed parameter values in the next time period. If no significant difference between these structural parameters was found, then the time periods were pooled and new estimates were formed and then compared to the observed value in the next period. If there were significant differences in any parameter, that time period could not be pooled. This technique enabled us to observe the validity of estimated structural relationships developed from *ex post* data containing a large number of observations and long-run estimates of these parameters.[6] Thus, the following hypotheses were established for testing (see Figure 1):

$$\alpha_1 = \alpha_2;\ \alpha_{PI} = \alpha_3;\ \alpha_{PII} = \alpha_4;\ \alpha_{PIII} = \alpha_5;\ \alpha_5 = \alpha_6;\ \alpha_{PIV} = \alpha_7;\ \alpha_7 = \alpha_8;\ \alpha_{PIII} = \alpha_{PIV};\ \alpha_{PIII} = \alpha_7;\ \alpha_{PIII} = \alpha_8.$$

$$\beta_1 = \beta_2;\ \beta_{PI} = \beta_3;\ \beta_{PII} = \beta_4;\ \beta_{PIII} = \beta_5;\ \beta_5 = \beta_6;\ \beta_{PIV} = \beta_7;\ \beta_7 = \beta_8;\ \beta_{PIII} = \beta_{PIV};\ \beta_{PIII} = \beta_7;\ \beta_{PIII} = \beta_8.$$

$$\sigma_{u1} = \sigma_{u2};\ \sigma_{uPI} = \sigma_{u3};\ \sigma_{uPII} = \sigma_{u4};\ \sigma_{uPIII} = \sigma_{u5};\ \sigma_{u5} = \sigma_{u6};\ \sigma_{uPIV} = \sigma_{u7};\ \sigma_{u7} = \sigma_{u8};\ \sigma_{uPIII} = \sigma_{uPIV};\ \sigma_{uPIII} = \sigma_{u7};\ \sigma_{uPIII} = \sigma_{u8}.$$ [7]

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[6] Occasionally a Chow test (1960) is performed to test whether $\beta_1 = \beta_2 = \beta$. This test is not applicable in this case, because the test requires that the error terms of the two samples have the same normal distribution. This is not the case here and is, in fact, what we were testing for and found. Second, the vector β in the Chow test also contains intercept values, whereas we wanted to separate out the intercept value from the slope value, $\hat{\beta}$. The actual tests were a means test and a variance test. See notes 7 and 9.

[7] Note that the hypotheses are stated in terms of true values of α and β, not just sample estimates, because if we assume that the populations sampled are normal, the population variances are homogeneous, and the parameters are independent, then the following sets of relationships hold:

$$\text{true beta} = \text{estimated beta} + \text{error}$$

$$\beta_t = \hat{\beta}_t + l_t$$

$$\beta_{t+1} = \hat{\beta}_{t+1} + l_{t+1}.$$

We want to test whether $\beta_t - \beta_{t+1} = 0$. In terms of the expected values $\beta_t = E(\hat{\beta}_t)$ and $\beta_{t+1} = E(\hat{\beta}_{t+1})$ as $E(l_t) = 0$ and $E(l_{t+1}) = 0$. In terms of the variance of the difference $\text{Var}(\hat{\beta}_t - \hat{\beta}_{t+1}) = \sigma^2_{\hat{\beta}_t} + \sigma^2_{\hat{\beta}_{t+1}}$ as the covariance is equal to zero. Thus, the estimated σ difference is

$$\sqrt{\left[\frac{(N_1 - 2)S_1^2 + (N_2 - 2)S_2^2}{N_1 + N_2 - 4}\right]\left[\frac{N_1 + N_2}{N_1 N_2}\right]}.$$

Therefore, a t-statistic of this difference test is

TABLE 1

AUTOCORRELATION TEST FOR UTILITY SAMPLE

PERIOD	DURBIN–WATSON	d_L (0.05)	d_U (0.05)	
1. (n = 52)	1.1231	1.46	1.63	SIGNIFICANT POSITIVE AUTOCORRELATION
2. (n = 52)	1.1912	1.46	1.63	SIGNIFICANT POSITIVE AUTOCORRELATION
3. (n = 41)	1.4333	1.39	1.60	INCONCLUSIVE
4. (n = 27)	1.0005	1.24	1.56	SIGNIFICANT POSITIVE AUTOCORRELATION
5. (n = 33)	1.4951	1.32	1.58	INCONCLUSIVE
6. (n = 26)	0.8671	1.22	1.55	SIGNIFICANT POSITIVE AUTOCORRELATION
7. (n = 39)	1.5102	1.38	1.60	INCONCLUSIVE
8. (n = 40)	1.4392	1.38	1.60	INCONCLUSIVE

3. Empirical tests

After obtaining all of the regression results of the market model (1) applied to the average weekly holding period returns on the utility portfolio over each of the eight time periods, the Durbin-Watson statistics, found in Table 1, were calculated. Significant positive autocorrelation was found at the 0.05 level in four of the eight periods. Although the other four periods exhibited inconclusive positive autocorrelation, the Cochrane-Orcutt iterative technique was employed to develop a model which would not have any significant positive autocorrelation in any of the eight periods. Thus, a first-order autocorrelation model of (1) was employed in each period.[8]

$$t = \frac{\hat{\beta}_t - \hat{\beta}_{t+1}}{\sqrt{\left[\frac{(N_1 - 2)S_1^2 + (N_2 - 2)S_2^2}{N_1 + N_2 - 4}\right]\left[\frac{N_1 + N_2}{N_1 N_2}\right]}}.$$

The same logic can be used on the intercept values, α_t and α_{t+1}. See William L. Hays and Robert L. Winkler, *Statistics: Probability, Inference and Decisions* (New York: Holt, Rinehart and Winston, Inc., 1970), p. 426.

[8] Although the random walk hypothesis assumes that there is no autocorrelation present in the market model, significant autocorrelation was found in the model applied to the portfolio return data of 36 public utilities in this study. One should realize that the portfolio used in this study is not randomly selected, but is concentrated in only one industry. Therefore, any "industry effect" or consistent industry change which is not captured by a change in the general index employed, the S & P 500, may be found in the error term of the model in such a way that it becomes nonrandom. Such "industrial effects" were found to be significant in several periods of this study; therefore, to eliminate this source of bias in the distributions of the expected values of the parameters of the model, the Cochrane-Orcutt (1949) iterative technique was employed on the original data. All subsequent analysis is performed after using this technique to eliminate any autocorrelation in the data.

An anonymous reviewer suggested that the positive autocorrelation in the data may be due

TABLE 2

CORRELATION AND REGRESSION INFORMATION OF UTILITY SAMPLE

	$\hat{\alpha}$	t–VALUE	$\hat{\beta}$	t–VALUE	DURBIN–WATSON STATISTIC	STANDARD ERROR OF REGRESSION	R^2	F–VALUE (D.F.)
1. 1971; 1–52, n = 52	–0.00144118	–0.434475	0.494058	4.66267	1.746	0.0097087	0.3316	24.308 (49)
2. 1972, 53–104, n = 52	–0.00089305	–0.327169	0.349811	3.08419	1.943	0.0117701	0.2757	18.651 (49)
P_I. POOLED I, 1971, 1972, 1–104, n = 104	–0.00126628	–0.614418	0.434420	5.68698	1.923	0.0126421	0.3152	46.485 (101)
3. 1973 (PART); 105–145, n = 41	–0.00284659	–1.13793	0.392529	5.60752	1.902	0.0114886	0.4408	29.953 (38)
P_{II}. POOLED II, 1971, 1972, 1973 (PART), 1–145, n = 145	–0.00164036	–1.01566	0.412839	8.04930	1.930	0.0122457	0.3537	77.705 (142)
4. 1973 (PART), 1974 (PART), 146–172, n = 27	–0.0044574	–0.765478	0.368078	4.36724	1.925	0.0144881	0.5453	28.777 (24)
P_{III}. POOLED III, 1971, 1972, 1973, 1974 (PART), 1–172, n = 172	–0.00220043	–1.35404	0.405338	9.50453	1.948	0.0126633	0.4121	118.442 (169)
5. 1974 (PART), 176–208, n = 33	–0.00065803	–0.117696	0.671932	7.52182	1.938	0.0240772	0.6220	49.362 (30)
6. 1975 (PART), 209–234, n = 26	+0.00131642	0.168520	0.610715	3.72217	2.227	0.0210514	0.4350	17.709 (23)
P_{IV}. POOLED IV, 1974 (PART), 1975 (PART), 176–234, n = 59	+0.00241799	0.503282	0.699834	8.8569	1.891	0.0246528	0.5692	73.985 (56)
7. 1975 (PART), 1976 (PART), 235–273, n = 39	–0.000183507	–0.0942245	0.691107	9.72209	1.917	0.0099171	0.7305	97.576 (37)
8. 1976 (PART), 274–313, n = 40	+0.00294946	1.53667	0.41373	4.7656	1.859	0.0086468	0.4148	26.230 (37)

Table 2 contains the initial analysis of the coefficients of the adjusted market model. The Durbin-Watson statistics indicate that there is insignificant autocorrelation present in the first-order autocorrelation market model in any of the eight periods. The coefficient of determination over the periods ranged from 0.28 to 0.78 and all of the associated F-values of the regression were significant at the 0.05 level. The $\hat{\alpha}$ values were all insignificantly different from zero. The $\hat{\beta}$ values ranged from 0.35 to 0.78 and were all significantly different from zero at the 0.05 level.

To test the hypotheses about the structural changes over time, the $\hat{\alpha}$'s, $\hat{\beta}$'s and σ_{u_t}'s for each period were compared with the corresponding values of the next time period. Thus, we are testing the validity of using *ex post* measures of the market model parameters to estimate subsequent observed structural

to a "Fisher effect," because of nonsynchronized trading. He suggested adding leading and lagging values of the return on the market index to the model. These variables were added, but in the eight basic periods of the study, six periods had significant positive autocorrelation at the 0.05 level. Additionally in each of the eight periods, only the contemporaneous beta was significant, whereas the leading and lagged betas were not significant. Thus, since the normal adjustment for nonsynchronized trades did not reduce the significant positive autocorrelation, and because the additional variables had insignificant betas, it was felt that the Cochrane-Orcutt method was the better alternative to employ in this case.

TABLE 3

t-AND F-VALUES FOR STRUCTURAL TESTS

PERIODS OF TEST	t-VALUE OF $\hat{\alpha}$ (D.F.)		t-VALUE OF $\hat{\beta}$ (D.F.)		F-VALUE OF STANDARD ERROR OF REGRESSION	(D.F.)
1 vs. 2	−0.127589	(98)	+0.929334	(98)	1.63367	(50/50)
P_I vs. 3	+0.431567	(139)	+0.321122	(139)	1.21089	(103/90)
P_{II} vs. 4	+0.624059	(166)	+0.354694	(166)	1.39977	(144/26)
P_{III} vs. 5	−0.346438	(199)	−2.5181*	(199)	3.67286*	(32/171)
5 vs. 6	−0.211065	(53)	+0.347084	(53)	1.27952	(32/25)
P_{IV} vs. 7	+0.422285	(92)	+0.077788	(92)	6.17964*	(58/38)
7 vs. 8	−1.14578	(73)	+2.46512**	(73)	1.354065	(39/39)
P_{III} vs. P_{IV}	−1.17212	(225)	−3.40732*	(225)	3.85057*	(58/171)
P_{IV} vs. 8	−0.0873482	(93)	+2.38768**	(93)	8.128711*	(59/39)
P_{III} vs. 7	−0.564002	(205)	−2.95835*	(205)	1.60486**	(172/39)
P_{III} vs. 8	−1.45785	(206)	−0.0852221	(206)	2.1110*	(172/39)

*SIGNIFICANT AT THE 0.01 LEVEL, TWO-TAILED TEST.
**SIGNIFICANT AT THE 0.05 LEVEL, TWO-TAILED TEST.

relationships. The resulting t- and F-values of these structural tests are found in Table 3.[9]

By observing the values in Table 3, it can be seen that there was a long period of stability in the parameters which lasted until the Consolidated Edison's dividend decision. This period of structural stability where there was insignificant difference between the estimated parameters and the observed parameters lasted from January 7, 1971, through April 19, 1974. In fact, these data show that the oil embargo of 1973 had no significant structural effect on the model parameters.

Yet after the Consolidated Edison dividend decision there was significant structural change.[10] The estimates derived from pooled III (periods 1–4) were not adequate to predict the observed structural values after the Consolidated Edison dividend shock. The observed beta for period 5 was 65.8 percent higher

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[9] The actual t-values were calculated by using the formula described in note 7. The F-values were calculated by using

$$F = \frac{S_i^2/\sigma_i^2}{S_{i+1}^2/\sigma_{i+1}^2}.$$

See Hays and Winkler (1970), p. 432.

[10] It has been suggested by an anonymous reviewer that one could have predicted an increase in the beta after the Consolidated Edison dividend decision, because when the equity prices declined, there would have been a shift upward in the market value of the debt-equity ratio of the utilities. Thus, the "sophisticated consumer of betas" could reasonably predict an increase in beta due to the increase in financial leverage.

than the estimated value from pooled III. The error term also increased significantly; in fact, it almost doubled. Thus, there was a significant interruption of the structural stability of the market model parameters after the Consolidated Edison shock in such a way as to suggest that the use of *ex post* estimates were not valid predictors of the observed parameters during periods 5 and 6.

The data in Table 3 indicate that almost one year after the dividend decision, the beta of period 7 was insignificantly different from pooled IV (periods 5 and 6), but that there was a significant reduction in the error term, almost a 60 percent decline. The tests comparing period 7 to period 8 showed a significant decline in the beta, with the observed beta in period 8 being 67 percent lower.

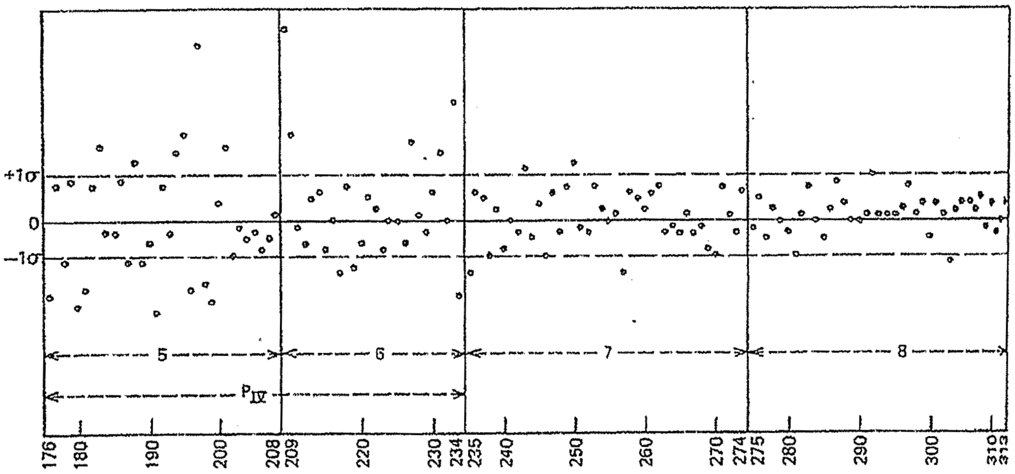
4. Dynamics of the adjustment process

To further study the time dynamics of the relationship of the estimated parameters to those observed parameters after the Consolidated Edison dividend decision, the parameter estimates from pooled III were fitted to the observed market returns from periods 5, 6, 7, and 8. Figure 2 contains the plot of residuals, the actual observed value each period less the predicted value for that period developed from pooled III. The mean residual value over all the fitted periods was 0.0023617 and the standard deviation of the distribution of 138 residual values was 0.0198193. In Figure 2, the residual of each period is plotted against zero with bands of one standard deviation from the mean residual value noted on the plot.

After the Consolidated Edison dividend decision on April 24, 1974, the prices of utility stocks declined dramatically. The residuals shown in Figure 2 illustrate well the dynamics of the adjustment process during periods 5, 6, 7, and 8. The observed weekly holding period returns in period 5 are difficult

FIGURE 2

PLOT OF RESIDUALS
ACTUAL VERSUS PREDICTED VALUES DEVELOPED FROM POOLED III



to estimate with the structural parameters of the market model developed from pooled III. In fact, 16 out of 32 residuals (50 percent) are more than one standard deviation away from the mean during period 5. In period 6, 8 out of 26 residuals (30.77 percent) are more than one standard deviation away from the mean residual value. In period 7, the process becomes more stable and more easy to estimate with the structural parameters from pooled III, as only 4 out of 40 residuals (10 percent) are more than one standard deviation from the mean. In period 8, the process becomes quite stable with only 1 out of 40 residuals (2.5 percent) being more than one standard deviation from the mean value.

Thus, the adjustment process to new risk/return assessments is one that continued to be dramatic during period 5 and to a lesser degree in period 6. It should be remembered that period 6 was found to have no statistically significant structural difference from period 5 and therefore they were merged to form pooled IV. Yet, the movement of the residuals is much less dramatic in period 7 and becomes fairly stable in period 8. Thus, the *ex post* market model estimates were significantly in error during periods 5 and 6. The most dramatic estimating errors occurred during the last six months of 1974. Therefore, the technique of using *ex post* estimates of structural parameters of the market model was significantly invalid for more than one year. But the error was transitory. In the second half of 1975 and in 1976 the observed parameters returned to their former levels such that the use of *ex post* estimates of alpha and beta of the market model developed from 1971, 1972, 1973, and the first half of 1974 were not significantly different from the observed values in late 1976.

5. Summary and conclusions

This study has examined the stability of β and associated estimates used in the CAPM applied to public utilities and has found:

(1) There were periods when the estimated structural parameters were stable enough to provide good estimates of the subsequent observed values.
(2) There were some periods of significant disturbance when the parameters were not good estimates of the observed values. This period of instability lasted for in excess of one year.
(3) The period of instability, although somewhat long, was transitory as the values of the observed $\hat{\beta}$'s returned to their former levels such that they were insignificantly different from those of previous estimates.

The problem of utilizing *ex post* parameter estimates in regulatory proceedings are that one does not know whether they will be good estimates when compared to subsequently observed parameters and that there is no *ex post* test that can assure regulators that past relationships will be valid in the future. But this study did find that there were some fairly long periods of stability when *ex post* estimates were not significantly different from observed values. Additionally, the period of instability found, although somewhat long, was transitory. Thus, it may be possible, by observing the structural parameters carefully, to derive estimates of the future long-run observed structural values. Under these conditions, the use of $\hat{\beta}$'s might be of some value in the regulatory process as one of the many factors to consider in determining the required rate of return.

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More on the Estimation of β for Public Utilities: Biases Resulting from Structural Shifts in True Beta

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■ In a recent issue of *Financial Management* (Summer 1977) Eugene F. Brigham and Roy L. Crum (hereafter B-C) attempt to demonstrate "that an increase in a company's systematic risk can actually lower its calculated beta coefficient" [p. 7]. Using hypothetical examples, B-C conclude that "using betas as a measure of risk can yield conclusions that are exactly opposite to the actual facts" [p. 13]. They then rationalize the decline in the observed betas of REITs, W. T. Grant, Penn Central, Franklin National Bank, and electric utilities in terms of the same downward bias of estimated beta described in their hypothetical example.

This paper demonstrates that the size and closure rate of the discrepancy that occurs between a firm's true beta and its regression estimated beta, following a structural shift in the firm's systematic risk, are a function of the correlation between changes in holding period returns due to changes in true beta and changes in holding period returns due to all other causes. We also show that B-C fail to identify this correlation effect and that the "arithmetic phenomenon" that B-C allege "is not well known and could potentially cause seriously biased and grossly misleading estimates of the cost of capital" [p. 8] depends on an assumption of theirs and not on unique CAPM estimation limitations. An alternative interpretation of the observed decline in the beta of firms approaching financial embarrassment is also offered.

B-C's Arithmetic Phenomenon

B-C use a simulation example to demonstrate that calculated beta (b) *can* fall when true beta (β) is actually increasing. They use a Company X to provide numerical examples of "misleading betas." Briefly, they imagine that this company has a true beta (β) of .75 during the initial 8 periods of a 24-quarter period of analysis. Company X's systematic risk and true beta increase throughout periods 9-16 before stabilizing at the end of period 16 at just over 1.3. B-C then generate a "return on the market" series for the 24-quarter period, employing conventional valuation logic to obtain moving 8-quarter regression estimated betas (b) in order to examine the discrepancy between β and b quarter by quarter. The simulated data reveal the estimated betas are not only significantly less than the true quarterly betas, but that they are also less than the .75 pre-risk change β level in 10 of the next 16 quarters (quarters 9–24).

Stated simply, B-C's "arithmetic phenomenon" relates to the size and closure rate of the discrepancy that occurs between a firm's "true beta" and its "regression estimated beta" following a structural shift in the firm's systematic risk. Clearly an estimation problem arises whenever a structural shift in β occurs, since the estimate, b, is calculated using pre- and post-structural shift observations. For example, if no offsetting increase in the expected return on assets accompanies an increase in perceived systematic risk, the resulting downward pressure on the price of the stock causes realized holding period returns (HPR) during the adjustment periods to be below the equilibrium returns suggested by the prevailing security market line. As such, the most recent HPRs used to estimate b embody episodic risk adjustment influences that can cause b to be a biased estimate of the true beta, β. This paper addresses two questions in this regard: Is there a likely direction to the bias of the estimator after a structural shift occurs (as B-C maintain), and what determines the closure rate between estimated and true systematic risk?

Estimation bias is to be expected when there is a structural shift in the underlying process. But B-C allege that CAPM regression estimates have unique limitations. Assumed β and simulated b data for Company X are used to support their view that a change in a firm's systematic risk could cause "the use of the CAPM to produce seriously misleading results" [p. 11]. We show that the algorithm used by B-C to construct their simulated data produced a perfect (or almost perfect) negative correlation between the drop in security returns due solely to an increase in β and fluctuating security returns due to all other causes. It is then demonstrated algebraically that the b values calculated during a transition period from one level of β to another depend on the correlation between returns due to changes in β and returns due to all other causes. Thus, B-C's simulation results are due to their implicit assumption of negative correlation. Other assumptions could of course result in a bias opposite to that described by B-C.

B-C's actual simulation procedure is described in general terms in their article; the precise derivation is available by request from B-C or the present authors, so the methodology will not be repeated here. However, the values for quarters 9 through 16 of several of B-C's key simulation variables are presented in the appendix.

In essence, B-C derive their simulated data following generally accepted corporate financial theories. However, the B-C algorithm has one critical assumption: the only independent stochastic variable in periods 9 through 16 of the B-C simulation is the cost of capital of the market, K_m. The random fluctuations of all other variables are entirely due to changes in this variable. This interdependency causes a high degree of correlation among most of the time series B-C simulate. One correlation is of particular significance to B-C's findings: the correlation between single period returns due to the changes in true beta and single period returns due to all other causes. B-C did not separate total return into these components. Component return analysis for periods 9 through 16 requires the creation of four additional simulated time series. These four data series, calculated using B-C data, are presented in the appendix. Two of these series, the return due to changes in true beta, R_β, and the return due to all other causes, R_o, for periods 9 through 16, have an extremely high (perhaps perfect, $\hat{\rho} = -.992$) negative correlation.

Correlation between R_o and R_β has a significant impact upon the size and closure rate of the discrepancy that occurs between β and b when there is a structural shift in a firm's systematic risk. This can be shown algebraically. The total return of a security, R_T, in period t can be expressed as the sum of the return due solely to changes in true beta, R_β, and the return due to all other causes, R_o,

$$R_T = R_o + R_\beta. \tag{1}$$

The variance of R_T,

$$\mathrm{Var}(R_T) = \mathrm{Var}(R_o) + \mathrm{Var}(R_\beta) + 2\rho_{R_o,R_\beta}\sqrt{\mathrm{Var}(R_o)\,\mathrm{Var}(R_\beta)}, \tag{2}$$

is significantly affected by the correlation between R_o and R_β. Estimated beta, b, can be expressed as

$$b = \frac{\mathrm{Cov}(R_T,R_M)}{\mathrm{Var}(R_M)} = \frac{E(R_TR_M) - ER_TER_M}{\mathrm{Var}(R_M)} \tag{3}$$

where R_T is the total return of a security, R_M is the return of the market, and b is the estimated beta for a firm. The importance of correlation in the component returns of R_T becomes apparent when b is expressed in terms of R_o and R_β by substituting Equation (1) into Equation (3).

$$b = \frac{E[(R_\beta + R_o)R_M] - E(R_\beta + R_o)ER_M}{Var(R_M)}$$

$$= \frac{E(R_\beta R_M + R_o R_M) - ER_\beta ER_M - ER_o ER_M}{Var(R_M)}$$

$$= \frac{E(R_\beta R_M) + E(R_o R_M) - ER_\beta ER_M - ER_o ER_M}{Var(R_M)} \quad (4)$$

If R_β is not correlated with R_M, then the expected value of a product is equal to the product of the expected values and

$$b = \frac{E(R_o R_M) - ER_o ER_M}{Var(R_M)} = b_o \quad (5)$$

where b_o is the value of beta measured for a time interval assuming no change in true beta, β.

Equation (5) suggests that, when R_β is uncorrelated with the R_M, estimated beta, b, for any one time interval is not affected by changes in security price due to changes in true beta. If, on the other hand, R_β is perfectly correlated with R_o, R_β can be expressed as a linear function of R_o

$$R_\beta = \alpha_o + \alpha_1 R_o. \quad (6)$$

Substituting Equation (6) into Equation (4) yields

$$b_t$$

$$= \frac{E[(\alpha_o + \alpha_1 R_o + R_o)R_M] - E(\alpha_o + \alpha_1 R_o + R_o)ER_M}{Var(R_M)}$$

$$= \frac{\alpha_o + E[(1 + \alpha_1)R_o R_M] - \alpha_o - E[(1 + \alpha_1)R_o]ER_M}{Var(R_M)}$$

$$= \frac{(1 + \alpha_1)[E(R_o R_M) - ER_o ER_M]}{Var(R_M)}$$

$$= (1 + \alpha_1)(b_o) \quad (7)$$

Equation (7) demonstrates that, if R_β is perfectly correlated with R_o, the estimated beta, b_t, is equal to b_o times a constant, $(1 + \alpha_1)$.

B-C's support for their view that the CAPM generates misleading betas revolves around a hypothetical Company X which experiences an increase in perceived systematic risk, β, while the regression estimated betas during the transition period tend to decline below the original β level. Equation (7) reveals this relationship is to be expected (under B-C's assumptions) and should not be construed as support for the allegation that "using betas as a measure of risk can yield conclusions that are exactly opposite to the actual facts" [p. 13]. In the B-C study the correlation between R_o and R_β is negative. Therefore, α_1 in Equations (6) and (7) is negative and the term $(1 + \alpha_1)$ is less than one. As such, estimated betas, b_t, during the transition periods are reduced (as B-C indicate) due to an increase in true beta.

Equation (7) also indicates that if B-C had simulated their data so as to produce perfect positive correlation between R_o and R_β, α_1 would have been positive, thus producing an *exaggerated increase* in b_t during the transition period.

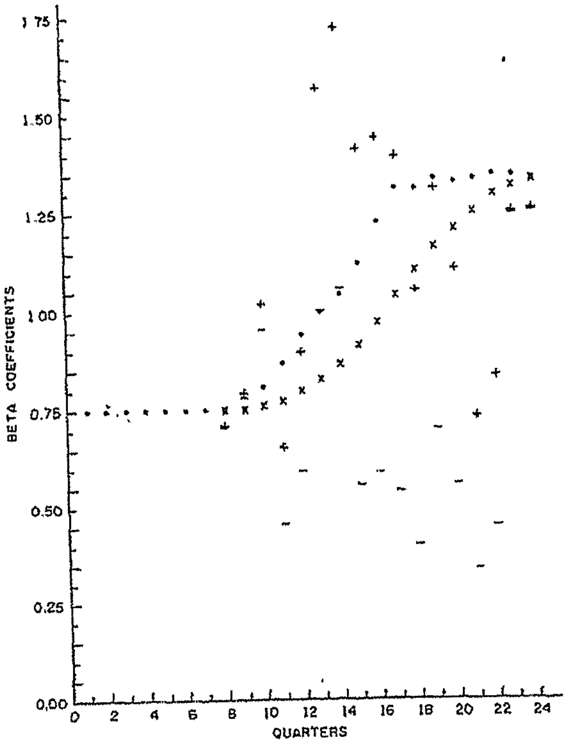
The exhibit summarizes graphically the impact of correlation between R_o and R_β upon the size and closure rate of the discrepancy that arises between a firm's "true beta" (β) and its "regression estimated beta" (b) when a structural shift in systematic risk occurs (using data from B-C's hypothetical Company X). The exhibit is the same as B-C's Figure 5 except for the addition of the 8-quarter moving average of true β series and the estimated beta with perfect positive correlation between R_β and R_o series.*

The data in the exhibit demonstrate the range of the estimation problem that arises whenever a structural shift in true beta, β, occurs. Even if β were observable, an 8-quarter estimation period would nonetheless cause a sizeable discrepancy to emerge between estimated beta, b, and true beta, β, starting in quarter 9 and continuing until quarter 24. This 8-quarter moving average of β could be thought of as comparable to the no correlation between R_β and R_o cases.

When the correlation between R_β and R_o is negative, as in B-C's hypothetical Company X, 8-quarter estimated betas, b_t's, tend to decline below the original pre-structural shift in β level of .75. This may be intuitively surprising; it appears to support B-C's view that "using betas as a risk measure can yield conclusions that are exactly opposite to the actual facts" [p. 13]. However, Equation (7) reveals that this observed decline in estimated betas is to be expected and results from the B-C R_β to R_o correlation assumption.

*The method used for calculating simulated returns when R_β and R_o are positively correlated involves the simple expedient of reversing the sign of the coefficient of R_o in Equation (6). The intercept was derived in such a way that the $R_{\beta+}$ time series has the same mean and variance as B-C's implicitly derived value of R_β. A more detailed derivation is available from the authors.

Exhibit. True Versus Calculated Betas for B-C's Company X



• TRUE BETA
PERFECTLY NEGATIVELY CORRELATED
PERFECTLY POSITIVELY CORRELATED
8Q MOV. AVG. OF TRUE BETA

The exhibit also presents data on the size and closure rate of the discrepancy between 8-quarter estimated betas and true betas when the correlation between R_β and R_o is positive. Clearly, the size and rate of closure in the discrepancy between true beta and 8-quarter estimated beta is influenced importantly by the correlation between R_β and R_o.

B-C's Empirical Support

B-C attempt to buttress their "contention that historical betas can be grossly misleading indicators of risks" [p. 12] by examining the measured betas of several firms approaching financial embarrassment. The phenomenon of falling betas is apparent in the beta data presented in the three largest U.S. business failures — Penn Central, W. T. Grant, and the Franklin National Bank — as they approached bankruptcy. B-C interpret the phenomenon of falling betas for these firms in much the same way as for their hypothetical Company X: namely, rising risk perceptions cause a decline in stock prices, which in turn produces low betas.

Without stopping to explore the likely correlation between R_o and R_β for each of these firms, it is sufficient to observe that the correlation issue discussed above does *not* permit such unconstrained generalizations. Stated differently, is not B-C's interpretation of falling betas for these three business failures tantamount to a hypothesis of negative correlation between R_o and R_β for each firm? (B-C and the present authors do not present any evidence as to what this correlation might be for a real company. B-C's observation that a very *peculiar bias* might occur under *some* conditions is interesting and important. This paper demonstrates that other types of correlation between R_o and R_β would produce different biases.)

B-C choose to view these three business failures as providing support for their explanation of "the phenomenon of falling betas in the face of rising risks" [p. 12]. Clearly the total risk perceived by investors increased, as W. T. Grant, for example, approached bankruptcy. But beta is a measure of systematic risk, not total security risk. It could be plausibly argued that the phenomenon of falling betas of W. T. Grant was simply a reflection that the expected return distributions of investors were becoming less systematically associated with the expected return distributions for the market, and more closely associated with expected judicial ploys and rulings. In other words r^2 and β might both decrease. As such, a serious question regarding B-C's empirical support data revolves around whether the increase in risk they envision accompanying impending financial embarrassment is total security risk or systematic risk. B-C's failure to explore this issue raises serious questions about the empirical support for their "misleading beta" contention.

B-C extend their "misleading beta" logic to electrical and telephone utilities. Observing that the essentially constant betas of utilities during the 1964–1975 period would be consistent with either a stable systematic risk hypothesis or with increasing systematic risk but stable calculated betas due to "a B-C arithmetic phenomenon" at work, B-C opt for the latter. This choice appears questionable because 1) this paper has demonstrated that B-C's "arithmetic phenomenon" does *not* necessarily work to offset changes in true beta, and 2) why should the reader accept a complex explanation of stable calculated utility betas (*i.e.*, increasing true beta is offset by an "arithmetic phenomenon") when a simple explanation (*i.e.*, utility betas are actually stable) explains reality equally well?

Concluding Observations

B-C correctly warn users of CAPM cost of equity capital estimates that a perceived risk level change during the measurement interval can bias the estimate. But B-C appear to go further and argue the CAPM has a unique estimation shortcoming when they state: "Our general conclusion is that the basic model must be used with a great deal of caution, if it is used at all, in any situation where a firm's fundamental risks are undergoing change" [p. 8]. Indeed, B-C make a number of stronger statements regarding how calculated beta coefficients can yield conclusions opposite to the actual facts.

Any statistical measure of association displays shortcomings in a situation where a structural shift occurs in the underlying relationship being measured. Thus a discrepancy between true beta, β, and measured beta, b, is to be expected in B-C's hypothetical example. However, the size and rate of closure of this discrepancy from which B-C deduced their "misleading beta" logic was shown to revolve around a specific correlation assumption implicit in B-C's simulation procedure. Certainly the possibility that such a peculiar result might occur is an interesting observation. However, this paper has pointed out that other correlation assumptions would produce other results, and that the correlation assumption used by B-C is the *one* assumption that produces the most bizarre results.

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Eugene F. Brigham and Roy L. Crum, "On the Use of the CAPM in Public Utility Rate Cases," *Financial Management* (Summer 1977), pp. 7–15.

Appendix. Component Return Analysis

The following methodology was used to break B-C's simulated total return for periods 9 through 16 into a component due to changes in beta, R_β, and a component due to all other factors, R_o.

The procedure is conceptually simple. For each period 9 through 13, we calculated the price that would have obtained if actual beta had remained constant from the beginning of each single period to the end of each single period. This price change was turned into a return, R_o and subtracted from total return to produce R_β for the period.

The first step was to calculate the cost of capital in period t+1, $K_{x(t+1)u}$ that would have existed if true beta had not changed between period t and t+1.

$$K_{x(t+1)u} = R_F + \beta_{xt}\,(K_{m(t+1)} - R_F) \quad \text{(A-1)}$$

where R_F, β_{xt}, and $K_{m(t+1)}$ are B-C's values of the risk free rate, true beta at period t, and the cost of capital of the market in period t+1, respectively. These values and the derived values of $K_{x(t+1)u}$ are listed in the table.

Next the cost of capital was used to calculate the price of the security at the end of period t, P_{tu}, that would have existed if beta had not changed during the period.

$$P_{tu} = 100\,\frac{D_{x(t+1)}}{K_{x(t+1)u} - g} \quad \text{(A-2)}$$

where $D_{x(t+1)}$ and g are B-C's values of Company X's dividend in period t+1, and Company X's growth rate, respectively, and where the factor of 100 compensates for the fact that $K_{x(t+1)u}$ and g are both expressed as a percentage. Values for these variables are listed in the table.

This price was turned into a return and subtracted from the capital gain for period t, CG, which includes the effect of a change in beta.

$$R_{t\beta} = CG_t - (100)\,\frac{(P_{tu} - P_{t-1})}{P_{t-1}}$$

where $R_{t\beta}$ is the return in period t due solely to a change in actual beta. Values for $R_{t\beta}$ are listed in the third row in the table.

Finally $R_{t\beta}$ was subtracted from the total return in period t, TR_t, to give the component of total return in period t due to all factors other than changes in beta, R_{to}. Values of R_{to} are listed in the table.

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Simulated Variable Values For B-C's Company X

Variable/Quarter	9	10	11	12	13	14	15	16	17
K_{xtu}		2.750	2.820	2.853	2.952	3.109	3.109	3.126	3.234
P_{tu}	10.127	9.795	9.714	9.259	8.761	8.694	8.723	8.346	
$R_{t\beta}$	(3.767)	(3.544)	(4.381)	(3.323)	(2.583)	(4.386)	(5.678)	(4.196)	
$R_{t\alpha}$	2.767	2.024	4.341	1.243	(.3466)	3.796	6.778	3.146	
R_{tT}	(1.302)	(2.362)	.946	(3.479)	(5.748)	.168	4.427	(.760)	
k_{Mt}	3.000	3.000	3.015	2.986	3.015	3.077	3.064	3.005	3.005
B_x	0.75	0.808	0.865	0.938	0.995	1.042	1.120	1.228	1.313
D_{xt}	0.1500	0.1519	0.1538	0.1557	0.1576	0.1596	0.1616	0.1636	0.1656
g_x	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
P_t	9.75	9.45	9.30	8.95	8.53	8.32	8.25	8.00	8.09
C.G.	(2.50)	(3.08)	(1.59)	(3.76)	(4.69)	(2.46)	(0.84)	(3.03)	1.24
T.R.	(1.00)	(1.52)	(0.04)	(2.08)	(2.93)	(0.59)	1.10	(1.05)	3.31

THE JOURNAL OF FINANCE • VOL. XXXV, NO. 2 • MAY 1980

On the CAPM Approach to the Estimation of A Public Utility's Cost of Equity Capital

ROBERT LITZENBERGER, KRISHNA RAMASWAMY and HOWARD SOSIN*

I. Introduction

IN RECENT YEARS the Capital Asset Pricing Model (CAPM) has been used in several public utility rate cases to measure the cost of equity capital. In actual application, the cost of equity capital is frequently estimated as the annualized 90 day Treasury Bill rate plus a risk premium. The risk premium is obtained as the product of the average annual excess rate of return on a value weighted index of NYSE stocks (where the average is taken over a long period of time) and an estimate of the utility's NYSE beta.

Underlying this procedure is the assumption that risk premiums are *strictly* proportional to NYSE betas. However, this assumption is inconsistent with the academic empirical literature on CAPM. This literature supports a (non-proportional) linear relationship between risk premiums and NYSE betas with a positive intercept. Other empirical studies suggest that, in addition to betas, risk premiums are influenced by dividend yields and systematic skewness. Evidence presented in this literature is consistent with the predictions of CAPM models that account for margin restrictions on the borrowing of investors, divergent borrowing and lending rates, the existence of risky assets (such as bonds, residential real estate, unincorporated businesses, and human capital) that are not included in the value weighted NYSE stock index, taxes and skewness preference.

The version of the CAPM that should be employed in estimating a public utility's cost of equity capital cannot be conclusively demonstrated by theoretical arguments. A positive theory of the valuation of risking assets should not be judged upon the realism of its assumptions but rather on the accuracy of its predictions. The relationship between risk premiums and betas that is used to estimate the cost of equity capital should therefore be estimated econometrically rather than specified *à priori.*

Section 2 compares the predictions of alternative versions of the CAPM. The assertion that risk premiums are proportional to NYSE betas is shown to result in a downward (upward) biased prediction of the cost of equity capital for a public utility having a NYSE beta that is less (greater) than unity, a dividend yield higher (lower) than the yield on the value weighted NYSE stock index, and/or a systematic skewness that exceeds (is less than) its beta.

Section 3 discusses problems that arise in implementing CAPM approaches and presents possible solutions. Section 4 describes econometric procedures for

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estimating the relationship between risk premiums and NYSE betas. Section 5 presents estimates of CAPM parameters, and, Section 6, using two utilities as examples, illustrates how these estimates can be used to measure the cost of equity capital.

II. Alternative versions of the CAPM: Theory and Evidence

The versions of the CAPM discussed below all assume that investors are risk averse and have homogeneous beliefs. They also assume that a riskless asset exists, that all assets are marketable, and that there are no transactions costs or indivisibilities. The mean-variance versions assume that expected utility is completely defined over the first two moments of the rate of return on investors portfolios. The three moment CAPM assumes that investors have utility functions displaying non-increasing absolute risk aversion and that expected utility is defined over the first three moments of the rate of return on investors portfolios. The before-tax versions ignore taxes while the after-tax versions account for the differential taxation of dividends and capital gains. The constrained borrowing versions allow unlimited short selling of risky securities while the unconstrained borrowing versions allow unlimited short selling of the riskless security (i.e., unlimited borrowing).

The Traditional Version of the CAPM

The traditional version of the CAPM developed by Sharpe [1964] and Lintner [1965] predicts the following relationship between risk premiums and betas,

$$E(\tilde{r}_i) = E(\tilde{r}_m)\beta_i, \tag{1}$$

where:

$E(\tilde{r}_i)$ = the risk premium, or expected excess rate of return above the riskless rate of interest, on the i-th security,

$E(\tilde{r}_m)$ = the risk premium on the market portfolio of all assets, and

β_i = $\mathrm{Cov}(\tilde{r}_i, \tilde{r}_m)/\mathrm{Var}(\tilde{r}_m)$, the beta of the i-th security measured against the true market portfolio of all assets.

Before-Tax Constrained Borrowing Versions of the CAPM

Constrained borrowing versions of the CAPM have been developed by Lintner [1969], Vasiçek [1971], Black [1972], Brennan [1972], and Fama [1976]. They predict the following relationship between risk premiums and betas,

$$E(\tilde{r}_i) = E(\tilde{r}_m)\beta_i + E(\tilde{r}_z)(1 - \beta_i), \tag{2}$$

$$\text{or} \quad E(\tilde{r}_i) = E(\tilde{r}_z) + \beta_i(E(\tilde{r}_m) - E(\tilde{r}_z)) \tag{2A}$$

where:

$E(\tilde{r}_z)$ = the risk premium on the minimum variance zero beta portfolio.

With diverse investor preferences and no borrowing (Vasicek [1972] and Black

[1972]), divergent borrowing and lending rates (Brennan [1972]), or margin restrictions (Fama [1976]), the risk premium on the zero beta portfolio is positive (i.e., $E(\tilde{r}_z) > 0$). The first term on the RHS of relation (2) is the risk premium on security i that is predicted by the traditional CAPM. The second term is the bias inherent in that prediction when investor borrowing is constrained. Because $E(\tilde{r}_z) > 0$, the traditional CAPM's prediction of the risk premium would be biased downward (upward) for a public utility having a beta less (greater) than unity.

After-Tax Versions of the CAPM

After-tax versions of the CAPM have been developed by Brennan [1973] under the assumption of unlimited borrowing and lending and by Litzenberger and Ramaswamy [1979] under constrained borrowing. They predict the following relationship between risk premiums, betas and dividend yields,

$$E(\tilde{r}_i) = E(\tilde{r}_m)\beta_i + E(\tilde{r}'_z)(1 - \beta_i) + E(\tilde{r}_h)(d_i - \beta_i d_m), \tag{3}$$

where:

$E(\tilde{r}'_z)$ = the risk premium on a portfolio having a zero beta and zero dividend yield,
$E(\tilde{r}_h)$ = the expected rate of return on a hedge portfolio having a zero beta and a dividend yield of unity,
d_i = the dividend yield on stock i, and
d_m = the dividend yield on the market portfolio.

The first term on the RHS of relation (3) is once again the prediction of the traditional CAPM. The sum of the second and third terms indicates the bias inherent in this prediction. With constrained borrowing, the sign of $E(\tilde{r}'_z)$ cannot be determined theoretically; however, econometric estimates indicate that $E(\tilde{r}'_z) > 0$. This result implies that the second term on the RHS of relation (3) is positive (negative) for public utilities having betas less (greater) than unity. With the taxation of corporate dividends and the preferential taxation of capital gains, $E(\tilde{r}_h) > 0$. Therefore, the third term on the RHS of relation (3) would be positive (negative) for a public utility having a beta less (greater) than unity and a dividend yield that is higher (lower) than the dividend yield on the market portfolio. Thus, the sum of the second and third terms is positive (negative) for public utilities having betas less (greater) than unity and higher (lower) than average dividend yields, indicating that the prediction of the traditional version of the CAPM would be downward (upward) biased.

The Three Moment Version of the CAPM

The three moment CAPM, developed by Rubinstein [1973] and Kraus and Litzenberger [1976], predicts the following relationship between risk premiums, betas, and gammas (systematic skewness),

$$E(\tilde{r}_i) = E(\tilde{r}_m)\beta_i + E(\tilde{r}_w)(\gamma_i - \beta_i), \tag{4}$$

where:

$$\gamma_i = \frac{E[(\tilde{r}_i - E(r_i))(\tilde{r}_m - E(r_m))^2]}{E[(\tilde{r}_m - E(\tilde{r}_m))^3]}, \text{ the systematic skewness of security } i$$

$E(\tilde{r}_w)$ = the expected risk premium on a security having a zero beta and a gamma of unity.

With non-increasing absolute risk aversion, $E(\tilde{r}_w) > 0$. The second term on the RHS of relation (4) is the bias inherent in the traditional version of the CAPM. For a public utility whose future profitability is constrained by the regulatory process, gamma may be less than beta and, the risk premium predicted by the traditional version of the CAPM may be downward biased.

Missing Asset Version of the CAPM

Many classes of assets such as human capital, residential real estate, unincorporated business, and bonds are not included in the value weighted index of NYSE stocks. This "missing assets" problem has been analyzed by Mayers [1972], Sharpe [1977] and Roll [1977]. If the traditional version of the CAPM were valid (i.e., if risk premiums were proportional to true betas) it can be shown that,[1]

$$E(\tilde{r}_i) = E(\tilde{r}_s)\beta_{i,s} + E(\tilde{r}_{zs})(1 - \beta_{i,s}) + u_i \tag{5}$$

where:

$$u_i = E(\tilde{r}_m)\beta_{e_i,zs} - E(\tilde{r}_{zs})\{\beta_{i,zs} - (1 - \beta_{i,s})\}$$

and:

$\beta_{i,s}$ = the beta of security i w.r.t. the NYSE index,

$E(\tilde{r}_{zs})$ = the risk premium on the minimum variance zero NYSE beta portfolio,

[1] To obtain relation (5) note that without loss of generality the return on any security i may be expressed as,

$$\tilde{r}_i - E(\tilde{r}_i) = \beta_{i,s}[\tilde{r}_s - E(r_s)] + \beta_{i,zs}[\tilde{r}_{zs} - E(\tilde{r}_{zs})] + \tilde{e}_i$$

where:

$$E(e_i) = \mathrm{Cov}(e_i, r_s) = \mathrm{Cov}(e_i, r_{zs}) = 0$$

Multiplying both sides by $\tilde{r}_m$, taking expectations and dividing by the variance of $\tilde{r}_m$ yields.

$$\beta_i = \beta_{i,s}\beta_s + \beta_{i,zs}\beta_{zs} + \beta_{e_i},$$

where z is used here to refer to the zero beta portfolio related to NYSE index.

Substituting the RHS of the above relation for β_i in relation (1) yields

$$E(\tilde{r}_i) = [E(\tilde{r}_m)\beta_s]\beta_{i,s} + [E(r_m)\beta_{zs}]\beta_{i,zs} + E(r_m)\beta_{e_i}$$

Using the traditional CAPM to evaluate the terms in [·]'s yields

$$E(\tilde{r}_i) = E(\tilde{r}_s)\beta_{i,s} + E(r_s)\beta_{i,zs} + E(\tilde{r}_m)\beta_{e_i}$$

which, when rearranged, is relation (5) in text.

$\beta_{e_i,zs}$ = the beta of the residual of security i measured using a two factor model where the factors are the value weighted NYSE index and the minimum variance zero NYSE beta portfolio.

The first term on the RHS of relation (5) is the predicted return on security i obtained by naively assuming that the NYSE portfolio is the true market portfolio. If the NYSE portfolio were on the efficient frontier then the third term, u_i, would be zero for all i and the second term would be the bias inherent in this naive application of the traditional model. Thus, even if the NYSE portfolio were efficient and risk premiums were proportional to true market betas, risk premiums would not in general be proportional to NYSE betas. For example, if the NYSE portfolio was efficient, but riskier than the true market portfolio, there would be an *ex-ante* linear relationship between risk premiums and NYSE betas with a positive intercept (i.e., $E(\tilde{r}_i) = E(\tilde{r}_{zs}) + \beta_{i,s}(E(\tilde{r}_s) - E(\tilde{r}_{zs}))$).

However, there is no reason to believe that the NYSE portfolio is on the efficient frontier. Here the error term on the RHS of relation (5) would no longer be identically zero for all securities. However, the value weighted average of the error term on the RHS of relation (5) is zero.[2] Thus, for a randomly selected NYSE stock (i) where its probability of selection is proportional to its weight in the NYSE index, the expectation of u_i would be zero. Thus, when the NYSE portfolio is not efficient, *ex-ante* risk premiums would be linear functions of NYSE betas plus an error term. If the minimum variance zero-NYSE beta portfolio had a positive beta with respect to the true market, then its risk premium would be positive (i.e., $E(\tilde{r}_{zs} > 0)$). This would imply the existence of a (non-proportional) linear relationship between risk premiums and NYSE betas (with a positive intercept) plus an error term.

Other Versions of the CAPM

Other versions of the CAPM have been developed. Merton [1971], Cox, Ingersoll and Ross [1978], Breeden and Litzenberger [1978] and Breeden [1980] have derived intertemporal CAPM's that account for shifts in the investment opportunity set. The Merton and the Cox, Ingersoll and Ross studies present multi-beta equilibrium models. The Breeden and Litzenberger, and the Breeden studies, respectively, indicate that the relevant measure of risk is covariance with the marginal utility of consumption and a beta measured relative to aggregate consumption.

While the CAPM theories previously discussed were developed in terms of a single good model, they have been implemented using nominal rates of return. Gonzalez-Gaverra [1973] developed a model that accounts for unanticipated inflation. It suggests that *nominal* risk premiums are linearly related to *real* betas rather than nominal betas.

[2] This follows because for the value weighted index of NYSE stocks $\beta_{e_s,zs} = \beta_{sz} = (1 - \beta_{ss}) = 0$ by construction.

Implications of Empirical Evidence

Empirical studies by Black, Jensen and Scholes [1972], Fama and MacBeth [1973] and Friend and Blume [1973] find that the relationship between average excess rates of return and NYSE betas is linear, with a positive intercept, rather than proportional. There are at least three possible explanations for these results:

1. Constraints on investor borrowing;
2. Misspecification caused by the exclusion of classes of assets such as bonds, residential real estate, unincorporated business, and human capital from the index; and/or,
3. Misspecification caused by exclusion of other independent variables such as systematic skewness and/or dividend yield from the model.

Each of these explanations yields predictions that are inconsistent with the proportional relationship between risk premiums and NYSE betas that has been asserted in several recent rate cases that use CAPM. To the extent that the NYSE index is a good surrogate for the true market index, the first explanation suggests that a linear relationship between NYSE betas and risk premiums should be estimated and used to calculate the cost of equity capital. The second explanation suggests that a broadly based index should be used to calculate betas. Unfortunately, rate of return data do not exist for some classes of assets and are difficult to obtain for other classes of assets. This suggests that an exact linear relationship between risk premiums and NYSE betas does not exist. However, the NYSE betas of common stocks may be highly correlated with the true unknown betas (measured relative to the true market index). This suggests that the empirical relationship between risk premiums and NYSE betas should be estimated empirically rather than asserted *a priori*.

The third explanation suggests that the effect of other independent variables on risk premiums should be estimated and used in calculating the cost of equity capital. Empirical studies by Rosenberg and Marathé [1979], Litzenberger and Ramaswamy, and Blume [1979] find that, in addition to beta, dividend yield has a significant positive association with average excess rates of return. This result is consistent with the after-tax version of the CAPM and suggests that the relationship between risk premiums, NYSE betas, and dividend yields should be estimated and used to calculate the cost of equity capital. However, Litzenberger and Ramaswamy also present preliminary evidence indicating that the relationship between risk premiums, NYSE betas and yields is non-linear. This result is inconsistent with the Brennan, and Litzenberger and Ramaswamy versions of after-tax CAPM and therefore the use of a linear relationship between risk premiums, betas and dividend yield to calculate the cost of equity capital should be viewed as an approximation to a more complex non-linear relationship.

An empirical study by Kraus and Litzenberger [1976] found that, in addition to beta, systematic skewness (gamma) has a significant negative association with average excess rates of return. However, estimates of gamma are not stable over time and therefore it is not possible to obtain accurate *ex-ante* estimates of the systematic skewness of individual securities. Betas and gammas have a strong positive association, and, therefore, the use of a linear relationship between risk premiums and betas may again be viewed as approximation to a more complex relationship.

III. Implementing the CAPM Approach

This section discusses econometric problems that are associated with implementing the CAPM approach and presents possible solutions.

Measuring Expectations

The alternative versions of the CAPM discussed above are positive theories of the relationship between *ex-ante* risk premiums and betas.

Ex-ante risk premiums are not, however, directly observable. To handle this problem it is assumed that investors have rational expectations, that the excess rate of return (realized rate of return less the riskless rate of interest) on any portfolio or security in a given month is an unbiased estimate of its risk premium, and that the excess rates of return on each portfolio are independently and identically distributed over time.

Computing Beta

Estimates of the unadjusted betas for each security are obtained from an OLS regression of its excess rate of return on the value weighted NYSE index over a 60 month period. An advantage of using monthly data is that it mitigates the effect of the nonsimultaneity of closing prices. Recently Scholes and Williams [1978] have suggested the use of lagged rates of return as an instrumental variable for the errors in variables problem. Unfortunately, the CRSP daily data file is not available over a sufficiently long time period to be useful in estimating the parameters of the relationship between risk premiums and NYSE betas. Beaver, Kettler and Scholes [1970] and Rosenberg and McKibben [1973] have shown that accounting measures of risk are useful in predicting future betas. However, the Compustat data file, which would be necessary to estimate betas using either of their procedures, does not cover the 1926 to 1947 period.

It has been observed by Blume [1971] that historical betas which are adjusted towards unity are better predictors of future betas (in a mean square forecast error sense) than are unadjusted betas. One explanation of this phenomenon is that the true underlying betas follow a mean reverting process where the mean is unity. Another is that the true underlying beta is constant, the historical beta is a sample estimate of the true underlying beta, and the prior of the beta is unity. These explanations are not mutually exclusive and Blume [1975] has presented preliminary empirical evidence that the true underlying betas display reversion towards the population mean of unity.

Regardless of the cause of the phenomenon, the existence of reversion towards unity suggests that "adjusted" betas, computed as convex combinations of the historical beta and unity, are better predictors than are unadjusted betas. A possible approach is to assume that the same weight ω, $(0 < \omega < 1)$ is applicable to all securities such that,

$$\beta_i(\text{predicted}) = \omega\beta_{i(\text{historical})} + (1-\omega)1.$$

This is the procedure used by Blume [1971] and by Merrill Lynch and is called a global adjustment approach. This approach implies a linear relationship between future betas and historical betas and suggests that unadjusted betas may be used to predict risk premiums. For example, consider the following relationship between excess rates of returns and globally adjusted betas,

$$\tilde{r}_i = a + b[\omega\beta_{i(\text{historical})} + (1-\omega)1] + \tilde{e}_i.$$

This relationship reduces to the following relationship between excess rates of return and historical betas,

$$\tilde{r}_i = a' + b'\beta_{i(\text{historical})} + \tilde{e}_i$$

where

$$a' = a + b(1-\omega), \text{ and}$$

$$b' = b\omega.$$

Note that for predictive purposes, a' and b' may be estimated directly; knowledge of ω is not required. If the ω used were constant over time, then the cost of equity capital estimates obtained using CAPM parameters measured using this global procedure would be identical to those obtained using unadjusted betas. This global adjustment procedure has the advantage of not depending on the exact cause or combination of causes for the empirical tendency of beta estimates to revert towards unity.

Another approach to adjusting betas is to use an individual Bayesian-adjustment procedure. This approach recognizes that the variances of sample betas (obtained from an OLS time series regression of stock returns on the NYSE index) are not identical. This approach is, however, based on the assumption that the true underlying beta is stationary which is inconsistent with Blume's preliminary empirical evidence. Under this approach, the probability of selecting a given stock is assumed to be proportional to its weight in the value weighted portfolio. Therefore, the diffuse prior estimate of its beta is unity. The variance of this prior is computed as

$$\text{Var}(\beta_{i,\text{prior}}) = \sum_{i=1}^{N_i}[[V_i/\sum_{i=1}^{N_i} V_i](\beta_{i,\text{sample}} - 1.0)^2] \tag{6}$$

where V_i is the value of firm i. Thus, the variance of the prior is the cross-sectional variation in sample betas around the value weighted mean of unity. It differs from the Vasicek [1971] adjustment, which computes the prior variance as,

$$\text{Var}(\beta_{i,\text{prior}}) = \sum_{i=1}^{N}(\beta_{i,\text{sample}} - 1.0)^2/N$$

thus giving equal weight to each security. With either the global adjustment or the individual adjustment, the posterior estimate of beta has variance given by

$$\mathrm{Var}(\beta_{i,\mathrm{prior}}) = \omega_i \mathrm{Var}(\beta_{i,\mathrm{sample}}) + (1-\omega_i)^2 \mathrm{Var}(\beta_{i,\mathrm{prior}}) \tag{7}$$

This information is useful in estimating the model coefficients.

Knowing the variance of the measurement error allows implementation of the classical approach to errors in variables and therefore yields a consistent estimator of $\hat{a}_2 = [E(\tilde{R}_{zo}) - R_f]$ (see the next section).

Computing the Risk-Free Rate

In choosing the appropriate proxy for the riskless rate of interest, explicit cognizance should be taken of the fact that the fair rate of return determined in a rate case is applicable throughout a future period. Therefore, the risk-free rate that is chosen should correspond to a risk free return that would be expected to prevail during the period that the pending rate order is expected to be in force.

One simple procedure is to compute the risk free rate as a simple average of monthly forward Treasury Bill rates for the period the pending rate order is expected to be in effect. The Treasury-Bill futures market or McCulloch's [1971] procedure of computing forward rates from the yield curve can be used to obtain the needed forward rates.

Data

The raw data for this study consisted of monthly rates of returns for all NYSE securities and monthly measures of the risk-free rate of interest.

Monthly data on security returns are obtained from the Center for Research in Security Prices (CRSP) at the University of Chicago. The same service also provides the return on a value weighted index of all the NYSE stocks.

Monthly returns on high grade commercial paper from 1926 to 1951 were used as a proxy for the return on a riskless asset. From 1952 to 1978, the return on a Treasury Bill with 30 days to maturity was used for this purpose.

IV. Estimating the Relationship between Risk Premiums and NYSE Betas

The structural econometric model that is estimated in a given cross section is,[3]

$$\tilde{r}_{it} = a + b\beta_{ist} + \tilde{e}_{it}.$$

Any linear estimator of this relationship is obviously a linear combination of the dependent variable. Since the dependent variable is a rate of return, any linear estimator is a rate of return on a portfolio. The unbiasedness condition for an estimator is a set of constraints on this portfolio that assures that the expected rate of return on the portfolio is the coefficient that we are estimating. Once a set

[3] Procedures specific to the implementation of the three moment CAPM, the multiperiod CAPM, and the unanticipated inflation CAPM are not discussed because of unresolved issues relating to the estimation or *ex-ante* systematic skewness, *ex-ante* consumption betas and real betas. The after-tax version of the CAPM and its refinements are considered in Litzenberger and Ramaswamy (1979, 1980).

of portfolio weights $\{h_{it}, i = 1, 2, \cdots, N_t\}$ is chosen, the resulting portfolio rate of return is,

$$\sum_{i=1}^{N_t} h_{it} r_{it} = a \sum_{i=1}^{N_t} h_{it} + b\left[\sum_{i=1}^{N_t} h_{it}\beta_{ist}\right] + \sum_{i=1}^{N_t} h_{it} e_{it}. \qquad (8)$$

The unbiasedness condition for an estimator of $(a + b)$ requires the following portfolio constraints,

$$\sum_{i=1}^{N_t} h_{it} = 1, \quad \text{and} \quad \sum_{i=1}^{N_t} h_{it}\beta_{ist} = 1.$$

That is, for any normal portfolio (i.e. portfolio weights summing to unity) having a beta of unity, equation (8) reduces to,

$$\sum_{i=1}^{N_t} h_{it} r_{it} = a + b + \sum_{i=1}^{N_t} h_{it} e_{it}.$$

Since the $E(\tilde{e}_{it}) = 0, \forall i$, it follows that such a portfolio is an unbiased estimator. The best linear unbiased estimator of $a + b$ would be the rate of return on the minimum variance normal portfolio having a beta of unity.

Without loss of generality the variance of any portfolio having a NYSE beta of unity may be expressed as

$$\mathrm{Var}\left[\sum_{i=1}^{N_t} h_{it}\tilde{r}_{it}\right] = \mathrm{Var}(\tilde{r}_{st}) + \mathrm{Var}\left[\sum_{i=1}^{N_t} h_{it}\tilde{e}_{it}\right],$$

where:

$\tilde{r}_{st}$ = the excess rate of return on the value weighted NYSE portfolio

Note that $\mathrm{Var}(\sum_{i=1} h_{it}\tilde{e}_{it}) = 0$ if and only if the h_{it} for each security corresponds to its weight in the NYSE value weighted index. Thus, the *best* unbiased estimator of $a_t + b_t$ is the excess rate of return on the value weighted NYSE portfolio itself, r_{st}. Assuming that observations of r_{st} are i.i.d., the BLUE estimation of $a + b$ is the average over time of the excess rate of return on the NYSE portfolio.

The unbiasedness conditions for a linear estimator of 'a' are,

$$\sum_{i=1}^{N_t} h_{it} = 1 \quad \text{and} \quad \sum_{i}^{N_t} h_{it}\beta_{ist} = 0.$$

Thus, the rate of return on any normal portfolio that has a zero (true) NYSE beta is an unbiased estimator of 'a'. In any cross-sectional month the best linear unbiased estimator of 'a' would be the rate of return on the minimum variance zero NYSE beta portfolio, $\tilde{z}_{st}$.

Without loss of generality the variance of any portfolio having a zero NYSE beta may be expressed as

$$\mathrm{Var}\left(\sum_{i}^{N_t} h_{it}\tilde{r}_{it}\right) = \mathrm{Var}\left(\sum_{i}^{N_t} h_{it} e_{it}\right)$$

Assume momentarily that the true NYSE betas are known. Using the single index model, which assumes that $\mathrm{Cov}(e_{it}, e_{jt}) = 0 \; \forall \; i, j \neq i$, the variance of a normal portfolio having a zero NYSE beta is,

$$\mathrm{Var}\left(\sum_{i=1}^{N_t} h_{it} r_{it}\right) = \sum_{i=1}^{N_t} h_{it}^2 S_{it}^2$$

where:

S_{it}^2 = the residual risk for security i.

The BLUE estimator of 'a' for a given cross-section month 'a_t' is, therefore, the minimum variance rate of return zero NYSE beta portfolio. The rate of return on this portfolio in month t may be obtained by solving the above described portfolio problem for the h_{it}'s and then calculating $\sum_{i=1}^{N_t} h_{it} r_{it}$. The resulting r_{zst} is

$$r_{zst} = \left[m_{pp} - \frac{m_{p\beta}^2}{m_{\beta\beta}} \right]^{-1} \cdot \left[m_{pr} - \frac{m_{p\beta} m_{\beta r}}{m_{\beta\beta}} \right] \tag{10}$$

where:

$$m_{pp} = \frac{1}{N_t} \sum_{i=1}^{N_t} \frac{1}{S_{it}^2} \qquad m_{p\beta} = \frac{1}{N_t} \sum_{i=1}^{N_t} \frac{\beta_{it}}{S_{it}^2} \qquad m_{pr} = \frac{1}{N_t} \sum_{i=1}^{N_t} \frac{r_{it}}{S_{it}^2}$$

$$m_{\beta\beta} = \frac{1}{N_t} \sum_{i=1}^{N_t} \frac{\beta_{it}^2}{S_{it}^2} \qquad m_{\beta r} = \frac{1}{N_t} \sum_{i=1}^{N_t} \frac{r_{it}\beta_{it}}{S_{it}^2}$$

In the absence of measurement errors in betas, if r_{zst}'s were i.i.d. then a simple average of this would yield the BLUE estimator of 'a', the risk premium on the minimum variance NYSE portfolio.

Errors in the Measurement of Betas

The true NYSE betas are unobservable. If the previously described procedures were used with estimated betas, the cross sectional variance in the estimated betas $m_{\hat\beta\hat\beta}$ would be an upward biased and inconsistent estimator of the cross sectional variance in the true betas. This would give h_{it}'s that results in portfolio that has positive true NYSE beta for large samples and hence an upward biased estimator of 'a' the risk premium on a portfolio having a zero NYSE beta. To obtain a consistent estimator of 'a', a classical errors in variables approach is undertaken. In this approach, the 'normal' equations for estimation are adjusted as follows: The cross sectional variation in the true NYSE betas, that are unobserved, is replaced by the cross sectional variation in observed NYSE betas less the (sum) of the variances of the measurement errors of the NYSE betas, which has been computed above as $\mathrm{Var}(\hat\beta_{it})$. When solved, the resulting estimator is,

$$r_{zt} = \left[m_{pp} - \frac{m_{p\hat\beta}^2}{m_{\hat\beta\hat\beta} - Q} \right]^{-1} \cdot \left[m_{pr} - \frac{m_{p\hat\beta} m_{\hat\beta r}}{m_{\hat\beta\hat\beta} - Q} \right] \tag{11}$$

where

$$Q = \frac{1}{N_t} \sum_{i=1}^{N_t} \frac{\mathrm{Var}(\hat\beta_{it})}{S_{it}^2}.$$

Comparing relation (10) with relation (11) indicates that they are identical except for the Q term which is the adjustment due to the variability in the estimator of beta. Under the assumption that the error term is normally distributed and that the true variances of the measurement errors are known, $m_{\hat\beta\hat\beta} - Q$ is the maximum likelihood estimator of $m_{\beta\beta}$, the cross sectional variation in the unobservable true NYSE betas. It also follows that $m_{p\hat{\beta}}$ and $m_{\hat{\beta}r}$ are maximum likelihood estimators of $m_{p\beta}$ and $m_{\beta r}$. Since the above described estimator of 'a' is a function of a maximum likelihood estimator, it is also a maximum likelihood estimator (see Kendall and Stuart [1973]).

V. Estimates of CAPM Parameters

The consistent estimators (as described in the previous section) of the parameters of the relationship between *ex-ante* premiums and NYSE betas are given in Table 1. Results for individually Bayesian adjusted and raw betas are presented.

Since the raw betas are *not* adjusted towards unity, the a_t's calculated each month would be expected to have a positive beta. Regressing the a_t's that were calculated using raw NYSE betas on the r_{st}'s gives a slope coefficient of 0.109 and an R^2 of 0.039. This suggests that the true NYSE beta on this portfolio is positive.

The standard deviation of the r_{zt}'s is less than the standard deviation of the $(r_{st} - r_{zt})$'s as the mathematics of the efficient frontier would suggest. Since individually Bayesian adjusted betas are adjusted towards unity, the r_{zt}'s calculated using the Bayesian adjusted betas would be expected to have a zero NYSE beta. However, regressing the r_{zt}'s that were calculated using Bayesian adjusted NYSE betas (the r_{zt}'s) on the r_{st}'s gives a slope of -0.144 and an R^2 of 0.0327. This suggests that the NYSE beta of this portfolio is negative. Unfortunately, an econometric rationale for a negative beta is not readily apparent. Again, the standard deviation of the r_{zt}'s is lower than the standard deviation of the $(r_{st} - r_{zt})$'s as would be expected from the mathematics of the efficient frontier. The $\bar{r}_z$ calculated using Bayesian adjusted betas is lower than the $\bar{r}_z$ calculated using raw betas as would be expected given the correlation of these portfolios with the NYSE index. Note that the consistent estimators of 'a' and a' reported in TABLE 1 are lower than the corresponding inconsistent estimators obtained using gen-

Table 1

CAPM Parameters

Bayesian Betas

$$r_{it} = r_{zst} + [r_{st} - r_{zst}]\beta_{is(\text{ADJ})} + \epsilon_{it}$$

$$\hat{a} = \bar{r}_{zs} = 0.136 \qquad \hat{b} = \bar{r}_s - \bar{r}_{zs} = 0.519$$

$$\sigma(r_{zst}) = 4.73 \qquad \sigma(r_{st} - r_{zst}) = 8.14$$

Raw Betas

$$r_{it} = [r_{zst} + (r_{st} - r_{zst})(1 - \omega)] + [(r_{st} - r_{zst})\omega]\beta_{is(\text{raw})} + \epsilon_{it}$$

$$\hat{a}' = 0.326, \qquad \hat{b}'_t = 0.330$$

$$\sigma(a_t) = 3.23 \qquad \sigma(b_t) = 6.14$$

where

$$a'_t = [r_{zst} + (r_{st} - r_{zst})(1 - \omega)], \qquad b'_t = [(r_{st} - r_{zst})\omega]$$

eralized least squares as would be expected from the econometric theory. GLS parameters are reported in TABLE 2.

VI. Examples and Conclusions

To illustrate the biases that arise by naively assuming a proportional relationship between NYSE betas and risk premiums, the parameters from Table 1 along with estimates of the risk free rate of interest and betas were used to estimate the cost of equity capital for two utilities: one with a beta substantially less than unity, Pacific Gas and Electric (PGE), and one with a beta close to unity, Consolidated Edison (Con Ed).

The relevant unadjusted and Bayesians betas are presented in Table 3 along with cost of equity capital estimates made by naively assuming a proportional relationship, and by using the estimated linear relationship in all of the calculations.

A risk free rate of interest of 9.29% per annum was used. This was obtained by averaging forward interest rates implied by Treasury Bill futures settlement prices on the International Monetary Market for October 1, 1979 (the assumed date of the rate case). Assuming a nine month lag between the rate case and its implementation, Treasury Bill futures contracts for delivery in June 1980 and thereafter were used in the average. For the main model the same estimates of the risk premium on the NYSE index was used (i.e., $a + b$). The monthly cost of equity capital estimates were compounded to obtain annual estimates.

The differences in the cost of equity capital estimates, which illustrate the so called "zero beta effect", are substantial for PG&E since its NYSE beta estimates are less than unity. The zero beta effect is negligible for Con Ed since its beta is close to unity.

Table 2

Bayesian Betas		
	$\hat{a} = 0.321$	$\hat{b} = 0.335$
	$\sigma(\hat{a}_t) = 3.26$	$\sigma(\hat{b}_t) = 6.23$
Raw Betas		
	$\hat{a} = 0.420$	$\hat{b} = 0.236$
	$\sigma(\tilde{a}_t) = 3.04$	$\sigma(\tilde{b}_t) = 5.19$

Table 3

Maximum Likelihood Estimates of the Cost of Equal Capital

	Unadjusted/Global adjusted betas			Individually Adjusted Bayesian betas		
Company	Raw beta	Proportional	Linear	Beta	Proportional	Linear
PGE	0.48	13.49	15.78	0.53	13.87	14.74
Con Ed	1.06	16.68	18.42	1.05	18.61	18.50

These two companies, as well as utilities in general, have residual standard deviations that are smaller than those of most industrial firms. Hence the individual Bayesian adjustment procedure did not adjust the betas of the sample companies as much towards unity as a global procedure would have. The effect of the individual Bayesian adjustment procedure on the estimated parameters presented in Table 2 can be loosely viewed as reflecting the average adjustment towards unity. Therefore, for a utility such as PG&E having a NYSE beta less than unity and having a lower than average residual risk and the cost of capital estimates obtained using a linear relationship between risk premiums and betas estimated with individually adjusted Bayesian betas would be lower than that obtained using a linear relationship estimated with unadjusted or globally adjusted betas. The difference between the estimates obtained using the individually Bayesian adjusted estimates and the raw betas is negligible for Con Ed since its beta is close to unity. The difference between the estimates for PG&E are substantial and indicate the importance of future research on the revision of betas towards unity.

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DISCUSSION

RICHARD S. BOWER*: As a regulator I find the three papers stimulating and helpful. Each is reassuring because it supports some aspect of regulatory practice, rewarding because it suggests an opportunity to improve practice and less than totally satisfying because it does not provide all the answers.

Bruce Greenwald's paper on admissable rate bases may be too rich to digest at a single sitting. Greenwald starts conventionally by stating that the Hope decision criteria for fairness to investors and capital attraction are met by any rate base valuation formula which permits market value to equal rate base and which causes rate base to increase dollar for dollar with new investment. He then argues, less conventionally, that to be admissable a formula must allow regulators to establish cash revenue requirements and rate base appreciation through time and

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across states of nature which maximize rate payer welfare by distributing risk properly, avoiding input inefficiencies and minimizing deadweight losses. His arguments are reassuring. They indicate that embedded cost rate bases are admissable. They support efforts to allocate revenue requirements among periods using CWIP, AFUDC and various types of deferrals. And they justify such specific policies as rejection of financing devices aimed at filling holes in incomplete markets, pushing revenue requirements into later, more elastic periods when price must be set below marginal cost, and using forecast test years to avoid a downward rate base bias that would distort investment and operating choices.

His arguments are also rewarding. Current regulation forces investors to bear the risk of management error and, during the period of regulatory lag between cases, to bear state of nature risks such as a cool summer or an unanticipated increase in labor costs. Greenwald's analysis suggests that the state of nature risks to be borne by investors should not be limited to those left to them by lag. They should include the risk of changes in plant value; risk such as the loss in value of an oil plant or gain in value of a coal plant that accompanies a drastic OPEC oil price increase. This risk, currently passed to rate payers, would fall on investors if rate base was written down or up to reflect the state of nature at the time of a rate case decision. Investors, as Greenwald implies, could act on it in ways that rate payers cannot. Better capital budgeting decisions would result. This is a rewarding idea. I think it is the *right* idea but it is less than totally satisfying because the method of implementation has not yet been described.

In his paper, Roger Clarke finds that shareholders in utilities given fuel adjustment clause coverage during the years 1970–74 experienced a reduction in systematic risk. He also finds that shareholders received no excess return. The result is reassuring. A policy intended to reduce shareholder risk apparently accomplished its purpose. In addition, the regulators involved recognized the risk change and adjusted allowed return as well. Finally, the rate payers who assumed the risk of fuel cost changes, received some compensation in the form of the lower revenue requirements that were associated with lower allowed return. There is also some rewarding insight in the findings for the question of whether or for which companies the fuel adjustment clause should be continued. Although Clarke found that the clause reduced systematic risk, as represented by beta, .06 in the 5 years 1970–74, he also found that its affect on beta was only .005 and not significantly different from zero for the 10 years 1965–74. This suggests that shareholder risk may have gone up for utilities that received clause coverage in the 1965–69 period. This finding, although surprising, could be explained by stable fuel prices during these years and by the clause's transfer from shareholders to ratepayers of the advantage of greater use of fuel efficient generating plants in the low output months of a recession. To me this means that companies for which fuel input prices can be forecast reasonably well and output fluctuations can not, may be good candidates for clause discontinuation. In spite of the reassurance and the reward Clarke's work is not completely satisfying. The reason for this is simply that it does not show when a shift of risk between shareholders and ratepayers is worthwhile. Is there some situation in which both groups may gain from the shift? Is the fuel adjustment clause being applied to such a situation? Or is any shift of risk away from the investors who can act on it a threat to efficient resource decisions as Greenwald seems to argue?

Litzenberger, Ramaswamy and Sosin provide a paper that should be useful to all rate case participants. They review theory and evidence on the capital asset pricing model, support its use in determining allowed return, and argue that it can provide downward biased estimates. The downward bias comes from failure to provide upward correction to betas below one and from assuming that a stock with a beta of zero has a required return equal to the treasury bill rate. It is reassuring for a regulator to hear that risk can be measured by beta and that there is a return/risk relationship that can give some substance to the idea of "comparables" in a regulatory proceeding. It is rewarding to find a guide to further study, a basis for deciding that utility dividend decreases may not be all bad and a method for estimating both beta and the capital market line that could put an upper bond on allowed return. But it is less than totally satisfying to consider that the relationship between capital asset pricing model and discounted cash flow estimates of allowed return is still osbscure and that the allowed return being sought has not really been defined as either a long or short term rate.

Difficult as it is to imagine, regulation is responsive to advances in understanding of economics and finance. It should be, because papers such as the three given in this session provide practical guidance for regulatory action.

DISCUSSION

WILLIAM MARSHALL*: Roger Clarke's empirical study focuses directly on the aspect of these diverse papers that I find most interesting: the endogeneity of the risk bore by a firm's investors and the role of market institutions in determining the allocation of risk. Clarke notes that the use of a fuel adjustment clause has equity implications if the risks bore by investors are altered. There are implications for efficiency as well, on both the input and output sides. Ceterus paribus, prices that accurately reflect costs in a timely fashion, will promote efficiency in the use of a utility's product. But the shift in risk that accompanies the change in a pricing rule may induce a change in behavior beyond that attributable solely to the change in expected prices. The less risk tolerant is the consumer, the more his behavior will be altered, simply by the knowledge that he bears the risk of uncertain energy costs. Likewise, utilities may vary the technology they employ in the production process, depending on the portion of the uncertainty about factor prices that they bear. It seems plausible, and is potentially a testable proposition, that utilities located in jurisdictions that do not employ fuel adjustment clauses will utilize technologies that rely on input factors with less volatile supplies, and that integration vertically to gain control over inputs will be more extensive among these firms. Warranties, incentive contracts, and tenure systems are free market responses to the often conflicting goals of providing incentives for efficient resource use and obtaining efficiency in risk bearing. The complexity

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and variety of those arrangements argues that regulators are likely to find no simple solutions to the analogous problems they face.

Clarke provides convincing evidence of the reduction in systematic risk he thought had occurred when fuel adjustment clauses were adopted, but his expectations were based on the observation of negative correlations between oil and coal prices and market returns. I'm uncomfortable with attempts to generalize beyond the sample and period of his analysis. Theory doesn't tell us the signs of correlations between input prices and firms' profits, when both are determined endogenously. The relationship between changes in factor prices and deviations of actual from expected profits will differ depending on whether the exogenous shock to the system was 1) a shift in the factor supply curve, 2) a shift in the demand for the firm's product, or 3) an unanticipated change in the rate of inflation. During the period of Clarke's analysis, uncertainty about the supply of energy resources was apparently the dominant source of risk, on average. That may not always be the case.

Bruce Greenwald also considers a choice over alternative regulatory schemes, in particular, the choice of rate base valuation rule and the appropriate allowed rate of return. Greenwald provides an elaborate and incisive model of the regulated market. Few important aspects of the problem escape his attention. He considers issues of equity and efficiency, the impact of uncertainty, the role of the regulatory process in allocating risk and various pricing rules, all in the process of an analysis of the rate base problem. Not the least of his contributions is an analytical framework that might be applied equally as appropriately to other issues.

I disagree with Greenwald on one minor point that seems worthy of mention. I'm inclined to believe that, except where necessary to motivate desirable behavior, regulators should avoid putting the consumer in the role of riskbearer. If risk remains with the ownership position, consumers who consider the compensation to be sufficient can become riskbearers by choice by purchasing claims on the firm's income stream. But the markets make few provisions for a consumer to hedge the risks that might be imposed upon him through various regulatory conventions. It seems to me that the separation of the roles of consumer and riskbearer provides options not otherwise available and eliminates none. I'm not persuaded by the large numbers-small risk argument. The greatest potential for dilution of specific risks over large numbers of investors would seem to exist where marketable securities are available for investment directly or through intermediaries.

I'm influenced by the observation that cooperative ownership as an alternative to regulation is an option chosen in some cases. Where it is not, I can only assume that the market in its wisdom prefers to maintain the separate riskbearing role of private ownership. As Greenwald points out, only empirical evidence (that may not be attainable even under ideal conditions) can resolve the issue. Unfortunately, decisions must be made and I would argue that a strong prima facie case exists in favor of the use of securities markets rather than regulatory edict to allocate risk.

Of the three, the paper of Litzenberger, Ramaswamy, and Sosin is perhaps of the greatest immediate importance. The CAPM has and continues to gain acceptance as a basis for rate of return regulation. The methodology they propose for the measurement of risk premiums is based on a comprehensive and thorough critique of the relevant issues.

I'm convinced by the authors' accumulation of arguments that a linear rather than proportional risk-return relationship ought to be estimated and used to determine fair rates of returns. I'm also convinced that the proposed estimator of the parameter of the market equilibrium condition determining securities returns has several desirable properties. However, I suspect that their proofs depend more than the authors appreciate on the validity of the underlying theoretical market model, the CAPM, rather than just on the validity of the hypothesized empirical relationship. On the other hand, I suspect that the estimator they propose will be more robust than the conventional estimator with respect to violations of the underlying distributional assumptions. Eventually, of course, the superiority of their estimator should be established empirically.

Time-Series Processes of Utility Betas: Implications for Forecasting Systematic Risk

Michael J. Gombola and Douglas R. Kahl

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■ Brigham and Crum [5] describe difficulties with the Capital Asset Pricing Model (CAPM) in estimating utility cost of capital. This controversial article elicited six comments [7, 15, 17, 21, 22, 24], a reply [6], and one extension [11]. Examining the dividend omission by Consolidated Edison (Con Ed), Brigham and Crum note that this information release could confound estimation of Con Ed's beta. Although the Ordinary Least Squares (OLS) beta estimate decreased concurrent with the dividend omission, Brigham and Crum contend that Con Ed's risk had not decreased.

An OLS estimate of beta requires an estimation period during which the relationship between stock return and market return is stable. Without this stability, the forecaster needs alternatives for forecasting a time-varying relationship, such as the general Bayesian adjustment process [25] or its specific variations employed by Merrill Lynch [18]. The appropriateness of a given procedure depends on the particular time-series properties of the beta being forecast.

Information on the time-series properties of utility betas, including the variability of beta and the tendency of utility betas to auto-regress toward an underlying mean, is presented here. The degree of difficulty in forecasting beta depends on both of these properties. Since the basis of Bayesian adjustment lies in beta's *tendency* to return to an underlying mean, if betas follow a random walk process then Bayesian adjustment will be fruitless.

Collins, Ledolter, and Rayburn [10] explain that random variation in beta leads to severe forecasting difficulties, unlike variability due to auto-regression in beta. To the extent that beta instability is auto-correlated, an unstable beta can be forecasted accurately. Estimating that about 25% of beta variability in their sample is due to auto-correlated beta changes, Collins, Ledolter, and Rayburn suggest that recognition of auto-correlation can improve forecasting accuracy by 15%.

Auto-correlated beta changes allow use of beta adjustment models to improve beta forecasts. A general Bayesian adjustment model would adjust the short-term (transient) beta estimate towards a long-term underlying mean. An example of such an application is the Merrill Lynch [18] adjustment process:

$$B_t = 0.65(B_{t-1}) + 0.35(1.0)\,. \qquad (1)$$

Here, the transient beta estimate obtained by OLS is presumed to return to an underlying mean of 1.0 slowly, since more weight is placed on the transient beta than on the underlying mean.

Studying the time-series properties of utility betas—including their tendency to return to an underlying mean, the speed of this return, and the underlying mean itself—should prove helpful in formulating Bayesian adjustments of beta forecasts. Carleton [7] suggests that Bayesian-adjusted beta forecasts have been applied, often inappropriately, to beta forecasts in regulatory proceedings. This study strives to determine whether such Bayesian adjustment processes are appropriate at all.

I. Beta Coefficient Instability and the Rate-Setting Process

Cooley [12] points out the widespread, albeit controversial, use of the Capital Asset Pricing Model in estimating required return for utility equity. Exchanges published by two journals dealing with the CAPM for rate setting ([7, 15, 17, 21, 22, 24] and [4, 19, 20]) center not on the validity of the theory but on the reliability and usefulness of beta estimates.

Concern over empirical estimates of systematic risk is based on a substantial body of empirical literature pointing to beta instability. From the early descriptive work of Blume [2] through later tests by Fabozzi and Francis [13] and Collins, Ledolter, and Rayburn [10], the evidence supports instability in security betas. Studying specifically the behavior of utility betas, Bey [1], Chen [8], and Pettway [23] all demonstrate instability.

Although the size of beta instability has been extensively investigated, comparatively little attention has been focused on the form of that instability, particularly for utilities. Beta instability does not necessarily preclude application of the CAPM unless combined with a random walk process for beta.

The simplest case, a constant coefficient process for beta, may be expressed as:

$$B_{it} = B_{i,t-1} = B_i^m \text{ for all } t\,. \qquad (2)$$

In Equation (2), the beta at any point in time remains equal to the previous beta and also to a constant underlying mean beta, B_i^m. This constant coefficient process is assumed in OLS estimation of a beta and serves as the null hypothesis in tests of beta variability [3, 13].

When the transient beta for a particular company (B_{it}) is distributed around an underlying mean beta for that company B_i^m, the resulting time-series process may be described as:

$$B_{it} = B_i^m + u_{it}\,. \qquad (3)$$

Equation (3) describes the random coefficient model tested by Fabozzi and Francis [13] and assumed in a beta forecasting model by Chen and Keown [9]. Since the deviations of beta from its underlying mean (u_{it}) are limited to a single period and are serially uncorrelated, the transient beta (B_{it}) tends to return quickly to the underlying mean.

If the transient beta takes more than one period to return to its underlying mean, then an auto-regressive process describes the time-series behavior of beta:

$$B_{it} = a_i B_{i,t-1} + (1 - a_i)B_i^m + u_{it}\,. \qquad (4)$$

This process is very similar to the random coefficient process, except for the strength of the tendency for mean-reversion. A value of 0.9 for $1 - a_i$ would cause the process to be classified as auto-regressive, whereas a value of 1.0 would label it random coefficient. Otherwise, there is little difference.

The auto-regressive model described in Equation (4) is the same one studied by Bos and Newbold [3] and Collins, Ledolter, and Rayburn [10]. The process considers a tendency to return to an underlying mean beta, where the tendency is measured by $1 - a_i$. The Merrill Lynch adjustment process [18] describes a special case in which the underlying mean beta (B_i^m) is 1.0 and the adjustment factor to the mean, also called the regression rate ($1 - a_i$), is 0.35. Vasicek's adjustment model [25] is a less restrictive case in which the underlying mean beta is unity and no restriction is made on the adjustment rate toward the underlying mean.

If all beta variation is random, then there will be no tendency for beta to return to an underlying mean, resulting in a random walk process:

$$B_{it} = B_{i,t-1} + u_{it}. \tag{5}$$

This model has been suggested as a time-varying model for beta in a stability test described by Garbade and Rentzler [14]. Since there are no bounds on the value that beta can assume, the process is difficult to forecast, especially in the long run. If beta follows a random walk process then the best long-term forecast is the short-term beta, and a Bayesian adjustment process will not improve the forecast. Notably, Brigham and Crum's [6] original criticism of the CAPM was based on unadjusted OLS estimates of Con Ed's beta, which implicitly assumes that an unstable beta follows a random walk.

II. The Beta Coefficient as an Auto-Regressive Variable

Any of the four beta-generating processes can be represented as a special case of a general auto-regressive process. The general model has a measurement equation,

$$R_{it} = B_{it} R_{mt} + e_{it}, \tag{6}$$

and state equation,

$$B_{it} = a_i B_{i,t-1} + (1 - a_i) B_i^m + u_{it}, \tag{6'}$$

where R_{it} is the excess return on the ith security during time t, R_{mt} is the return on the market index during time t, B_i^m is the underlying mean beta for the ith stock, and B_{it} is the transient beta for the ith stock at time t.

Equation (6') specifies a first-order auto-regressive process for beta. If the value for $1 - a_i$ is 0.0, then (6') reverts to the random walk process described in Equation (5). If the value for $1 - a_i$ is 1.0, then (6') reverts to the random coefficient process described in Equation (3). If the residual variance is 0.0, then $1 - a_i$ becomes 0.0 and the underlying mean and error terms in Equation (6') drop out, leaving the constant beta process in Equation (2).

III. Estimating Parameters of the Model

The parameters of the model in Equations (6) and (6') were estimated using monthly stock return data from the Compustat PDE file for 109 utility companies, 61 electric and 48 electric and gas. The 15-year sample period is from January 1967–December 1981. The period contains both the dividend omission by Consolidated Edison [5] and the Three Mile Island incident.

The model in Equations (6) can be expressed in matrix format as:

$$R_{it} = \underline{h}_t \underline{B}_{mt} + \underline{e}_{it}, \tag{7}$$

$$\underline{B}_{it} = \underline{A}_i \underline{B}_{i,t-1} + \underline{U}_{it}, \tag{7'}$$

where

$\underline{h}_t = (R_{mt}, 0)$;
$\underline{B}'_{it} = (B_{it}, B_i^m)$;
$\underline{U}'_{it} = (u_{it}, 0)$ and is distributed as $N(0, W_i S_i^2)$,

$$\underline{W} = \begin{bmatrix} w_i & 0 \\ 0 & 0 \end{bmatrix}, \tag{8}$$

$$\underline{A} = \begin{bmatrix} a_i & 1 - a_i \\ 0 & 1 \end{bmatrix}. \tag{9}$$

The recursive Kalman filtering approach described by Kahl and Ledolter [16] is used to estimate simultaneously the three parameters of the market model in Equations (6). These parameters are: the underlying mean beta (B_i^m), the regression rate toward the underlying mean $(1 - a_i)$, and the variance of beta over time.

Simultaneous estimation of three parameters requires considerable data and computer resources which might explain why studies using broad samples and large numbers of stocks formulate the problem somewhat differently. Bos and Newbold estimated a Kalman filtering model with a two-pass process. Decreasing the number of parameters from three to two reduces the computation time to only a fraction of that required for a full model. Collins, Ledolter, and Rayburn [10] suggest that the procedure followed by Bos and Newbold [3] creates a downward bias in the estimate of beta's regression rate. They were able to eliminate the estimate of the underlying mean beta in the model and focus on beta regression tendencies.

The model used in this study produces independent variance estimates like the model used by Collins, Ledolter, and Rayburn. In addition, this model estimates the underlying mean beta. Maximum likelihood estimates of elements in the transition matrix (a_i), the variance ratio (w_i), and the variance of the measurement equa-

Exhibit 1. Maximum Likelihood Estimates of Model Parameters

Regression	Standard Deviation of Beta										
Rate	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
0.0			2[a]	3[a]	4[a]	6[a]	12[a]	5[a]	3[a]		
0.1				1	2	5	1				
0.2					1	7	2	5	2		
0.3				1	1	2	5	1	3		
0.4				1	2	1	3	1			
0.5											
0.6						1					
0.7						1					
0.8											
0.9		1	1								
1.0	6[b]	17[c]									

[a]These firms display characteristics of firms whose betas follow a random coefficient process.
[b]These firms display characteristics of firms whose betas are constant.
[c]These firms display characteristics of firms whose betas follow a random walk process.

tion (S_i^2), were all concurrently estimated using a grid search procedure.

IV. Results

The particular time-series process followed by a beta can be indicated by two parameters: the standard deviation of this beta over time, u_{it} in Equation (6'); and its adjustment rate to the mean, $(1 - a_i)$ in Equation (6'). Consequently, the cross-tabulation of these two parameters in Exhibit 1 is also a tabulation of the process followed by the beta. The most common process shown in Exhibit 1 is the auto-regressive process. Nearly half of the companies in the sample, 51 out of 109, show a nonzero standard deviation of beta together with a value for the regression rate between zero and unity.

The next most common process is the random coefficient process, indicated by a nonzero value for the standard deviation of beta together with an estimate of 1.0 for $1 - a_i$. These estimates are shown by 35 of the sample companies. The firms with auto-regressive betas and those with very similar random coefficient betas jointly comprise 86 of the 109 sample firms.

A nonzero estimate of the standard deviation of beta combined with a regression rate of zero indicates a beta following a random walk process. Parameter estimates consistent with a random walk process are shown for only 17 companies.

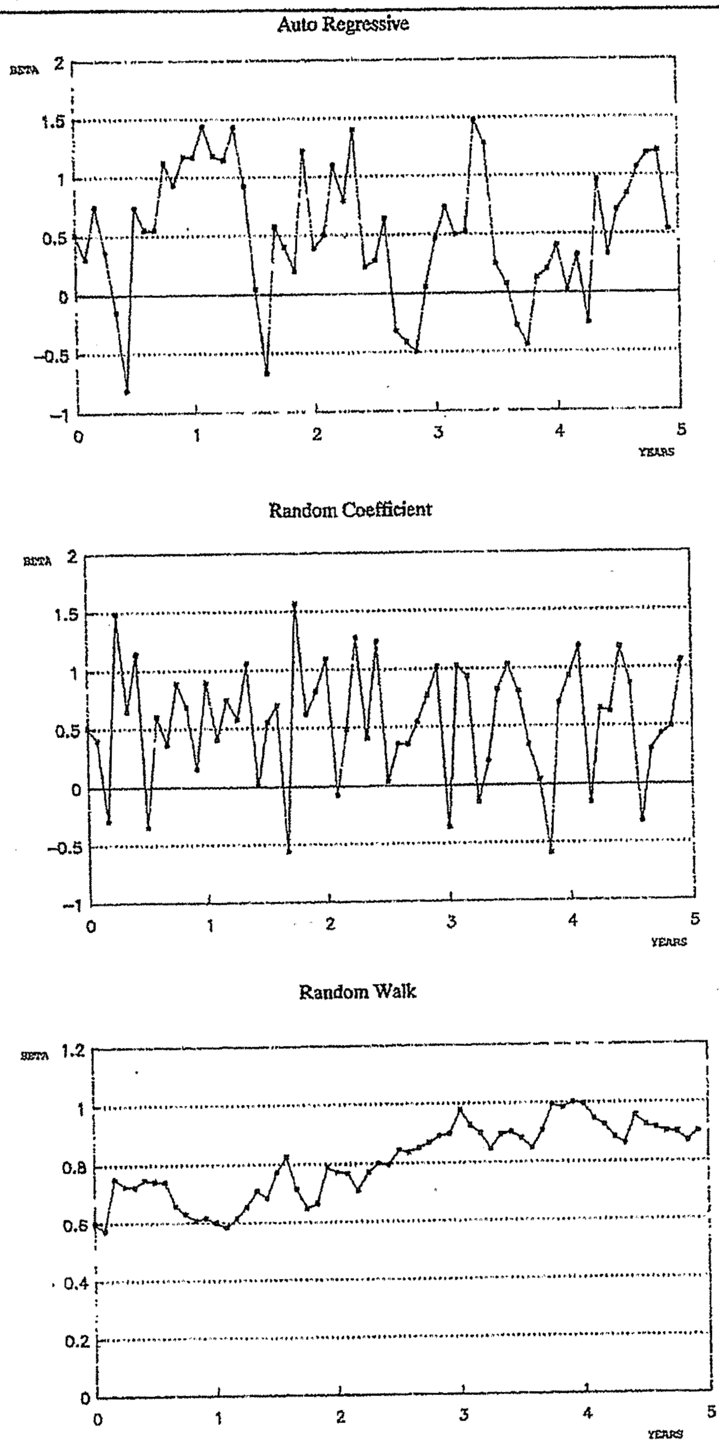
The least common process indicated by companies in the sample is the constant coefficient process, shown by only 6 companies. A constant beta coefficient is indicated by a zero estimate for the standard deviation of beta.

Since the estimation period covers 15 years (180 months), many companies could not maintain a constant beta coefficient. The long estimation period allows management, regulators, and the markets to react to any exogenous changes affecting systematic risk so as to bring risk back to reasonable levels. Such reaction is consistent with a beta that follows an auto-regressive process. Consequently, the preponderance of companies with auto-regressive betas in Exhibit 1 conforms to expected long-term behavior of management and markets.

Internal consistency of parameter estimates in Exhibit 1 is just as important as reasonableness. All companies having a zero estimate for the standard deviation of beta also show a value of 0.0 for the adjustment rate estimate. Any other estimate would be ambiguous for classifying the process. A positive association between the estimate of the standard deviation of beta and the estimate of $1 - a_i$ further points to the lack of ambiguity and helps in interpreting the process for all of the sample companies.

The positive association between beta variability and the regression rate is also consistent with boundaries upon beta values. Companies with high beta variability tend to have betas that return quickly to an underlying mean. Companies with low or zero return rates have low beta variability. High variability to-

Exhibit 2. Three Time-Series Processes for Beta



gether with a low or zero return rate would lead to extreme beta instability and preclude application of the CAPM. The results show no evidence of this type of beta instability.

A. Behavior of Transient Betas

To illustrate the implications of different processes and parameters, plots of betas following an auto-regressive process, a random coefficient process, and a random walk process are presented in Exhibit 2. Each of these processes behaves according to average coefficient values of companies with that process in Exhibit 1. For the auto-regressive process, the coefficients are an underlying mean of 0.51, a standard deviation of transient beta of 0.50, and a return rate toward the underlying mean of 0.52. For the random coefficient process, the underlying mean is 0.52 and its standard deviation is 0.53. For the random walk process the standard deviation of beta is 0.05.

The auto-regressive beta depicted in Exhibit 2 shows considerable variability and ranges between a minimum value of -0.8 and a maximum value of 1.50. Although the variability in the short run is rather large, the beta at no time takes longer than 9 months to return to its underlying mean, usually returning in three or four months. However, upon returning to its underlying mean it often strays on the opposite side, requiring several additional months to return.

Over the 60-month period shown for the auto-regressive process in Exhibit 2, only 36 of the transient beta values fall between a low of 0.0 and a high of 1.0. These bounds might be considered reasonable for a utility. Nine of the 60 beta observations lie below 0.0. The presence of such outliers might frustrate, but not obviate, application of OLS techniques for beta estimation. Although Exhibit 2 indicates that extreme beta values, such as those discussed by Brigham and Crum [5], might be common in the short run, the forecaster should not be deterred by the presence of short-run instability. In the long run, beta will return to its mean.

The similarity between the auto-regressive process and the random coefficient process, also shown in Exhibit 2, is obvious. Even if rather extreme values are encountered, the random coefficient beta reverts back to the mean within the next two observations. The upper and lower bounds on beta as well as the proportion of betas less than zero are very similar for the two processes.

Exhibit 2 also contains a plot of the time-series behavior of a beta following a random walk process. Although the beta behavior for the random walk process seems more stable than the auto-regressive or random coefficient process, such apparent short-run stability is misleading. Over the 60 months depicted in Exhibit 2, the beta wanders from a value of 0.6 to a value of about 0.9. Over the next 60 months, the beta could potentially rise by another 0.3, fall back to 0.6, or be anywhere in between. In the longer run, the beta becomes even more difficult to forecast, due to the lack of any tendency to revert to an underlying mean.

B. Focusing on the Consolidated Edison Dividend Omission

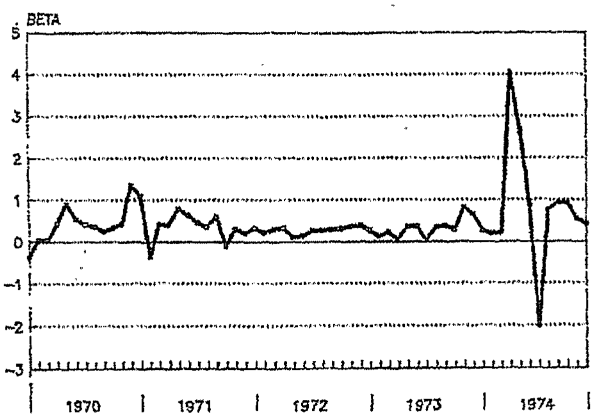
A plot during the period from January 1970–December 1984 of the behavior of the transient beta for Consolidated Edison is presented in Exhibit 3. The transient beta behaves much like the typical beta for any utility with an auto-regressive beta, except for the period immediately following the dividend omission. During this period, the transient beta becomes very erratic for about 9 months. Once it settles down, it continues to behave like any other utility with a typical auto-regressive beta. The plot of the transient beta for Con Ed over the last 60 months, if placed on the same scale as Exhibit 2, would be visually indistinguishable from the auto-regressive process depicted in that exhibit.

The plot of Con Ed's transient beta shown in Exhibit 3 depicts the transitory effect of economic disturbances on beta estimates. Even in this dramatic case of a dividend omission, the relationship between the stock and the market returned to normal within less than one year. This strong tendency to return to the mean beta gives empirical support to forecaster-supplied prior values in Bayesian adjustment models that place more weight on the underlying mean beta and less weight on the transient beta than the Merrill Lynch model would imply.

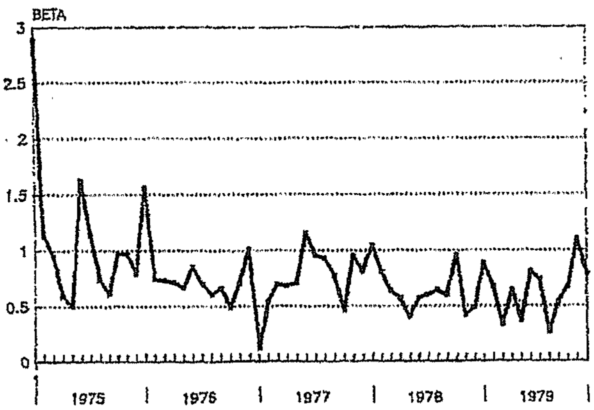
Some additional information on the behavior of Con Ed's beta is presented in Exhibit 4. During the overall period, which extends from January 1970–June 1984, its OLS beta estimate was 0.61 and the estimate of its underlying mean beta was 0.58. Since this overall period contains the dividend omission, a null hypothesis of a constant coefficient process for beta can be easily rejected. The regression rate of 0.70 toward the underlying mean indicates a strong mean-reversion tendency.

Exhibit 3. Transient Beta for Consolidated Edison, 1970–1984

1970–1974



1975–1979



1980–1984

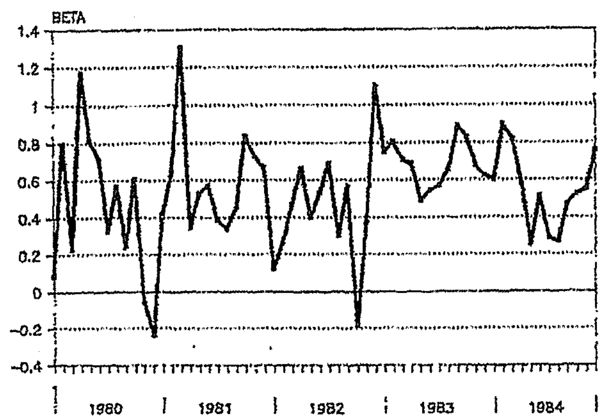


Exhibit 4. Parameter Estimates for Consolidated Edison Beta

Parameter	Overall Period 1970–1984	Before Dividend Omission 1970–1973	After Dividend Omission 1978–1981
Ordinary Least Squares Beta	0.61	0.39	0.62
Standard Error of OLS Beta	0.08	0.04	0.05
$K-F$ Underlying Mean Beta	0.58	0.34	0.47
$K-F$ Regression Rate to Mean	0.70	1.00	1.00
$K-F$ Standard Deviation of Beta	0.74	0.62	0.78
$K-F$ Residual Error in Market Model	0.05	0.03	0.04
$K-F$ Beta Stability Test	58.80*	20.30*	7.00*

*Significant at the 0.05 level.

Exhibit 4 also contains Kalman filtering and OLS estimates of beta for both a four-year period prior to the divided omission and a four-year period after the dividend omission. Forty-eight monthly observations is not sufficient to estimate reliably the underlying mean beta, since by nature this parameter reveals itself only over the long run. Likewise, the estimate of $1 - a_i$ may also be unreliable when estimated by only a few observations over a short time period. However, the subperiods do depict the variability that is characteristic of short-term estimates, whether those estimates are obtained by OLS or by Kalman filtering.

Although these short-term estimates should be approached with caution, some effects of the dividend omission on Con Ed's risk might be inferred. First, estimates for the long-term period or either of the short-term periods do not appear contaminated by the dividend omission but appear quite reasonable for a utility. Second, no indication of a decline in the beta estimate due to inclusion of the dividend omission period is evident. The indication is to the contrary. The estimate of the underlying mean beta for the overall period is higher than either the four-year period prior to the omission or the four years following the omission.

V. Implications for Beta Forecasting and Rate Setting

A partial resolution to the beta measurement problem is outlined by Peseau and Zepp [22], who show that the effect of the dividend omission was transitory and could be diagnosed from examination of OLS statistics. Although the dividend omission produces beta estimation problems for Consolidated Edison, subsequent estimates using data after the omission become much more reasonable.

The primary difference between the Brigham and Crum [5] forecast using an OLS beta and the Peseau and Zepp comment lies in the assumption of the time-series process followed by beta. The OLS estimate for five years of return data is only a good beta forecast if beta follows a constant coefficient process. This assumption is untenable for an estimation period containing a major information release.

When beta is time-varying, a short-term unadjusted OLS estimate may not be the best estimate of beta. Instead, the forecaster, taking advantage of auto-regressive properties of beta, should adjust that short-term estimate toward an underlying mean beta. When beta is unstable but reverts to an underlying mean, beta instability would not preclude application of the CAPM, but might preclude use of an OLS beta.

Reliance on a short-term beta forecast, whether from an OLS estimate or the transient beta estimate in the Kalman filtering model, is appropriate only if the firm's beta follows a random walk process. This research shows little evidence suggesting the typical utility beta follows a random walk and no evidence that, specifically, Con Ed's beta follows a random walk.

Due to the preponderance of auto-regressive or random coefficient betas, the results of this study strongly support the use of Bayesian-type adjustment processes such as the one employed by Merrill Lynch. The results also suggest that the behavior of utility betas may differ from the behavior of large diversified samples of stocks. For example, since Blume [2] finds an underlying mean beta of 1.0 for a large sample of stocks, many Bayesian models will adjust the OLS beta estimate toward 1.0. The results of this study, however, indicate that 1.0 is too high an underlying mean for most utilities. Instead, they should be adjusted toward a value that is less than one. For Consolidated Edison, an underlying mean of 0.7 would be more appropriate.

VI. Conclusions

Understanding beta behavior requires more information than whether or not betas are stable. Development of statistical procedures admitting a continuously time-varying beta now allows forecasters to understand how beta may behave over the short run and how that short-run behavior can differ from long-run behavior. Measuring continuously time-varying betas also frees the forecaster from the limitations imposed by assuming a constant coefficient beta. Instead, like most economic variables, beta can be modeled as a coefficient that is always changing. From the time series process followed by betas, the forecaster also gains an understanding of the difficult problem of forecasting beta. The beta for the majority of utility companies in this sample follows either an auto-regressive process or a constant coefficient process. Very few appear to follow a random walk process, which would produce betas that are not only unstable but very difficult to forecast. On the other hand, with an auto-regressive process, a patient forecaster using relatively simple diagnostic procedures should be able to obtain a reasonable long-run estimate of systematic risk. A reasonable forecast of beta then admits application of the CAPM for utilities even if beta is time varying.

The strong evidence of auto-regressive tendencies in utility betas lends support to the application of adjustment procedures such as the Bayesian adjustment procedure presented by Vasicek [25]. This procedure depends upon beta following an auto-regressive process. In addition, the Kalman filtering methodology also provides objective prior estimates of the underlying mean beta and the adjustment rate toward that underlying mean.

Typical adjustment models use a prior estimate of about 0.35 for the adjustment rate toward the underlying mean and a prior estimate of 1.0 as the underlying mean. The results of this study indicate that an underlying mean of 1.0 is too high for most utilities and an adjustment rate of 0.35 is too low.

Although considerable variability in adjustment rates and underlying mean betas can be observed in the sample, it may not be necessary for a forecaster to apply the Kalman filtering approach in order to obtain these estimates. A reasonable estimate of the underlying mean may be obtained by OLS if applied to a very long time period. The prior estimate of the adjustment rate toward the mean can be obtained by considering the positive relationship between the adjustment rate and beta variability. Estimates of the prior adjustments in the Bayesian adjustment models could be applied without relying blindly on large-sample estimates that may not be applicable to utilities.

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Beta and Return

"Announcements of the 'death' of beta seem premature."

Fischer Black

Eugene Fama says (according to Eric Berg of *The New York Times*, February 18, 1992) "beta as the sole variable explaining returns on stocks is dead." He also says (according to Michael Peltz of *Institutional Investor*, June 1992) that the relation between average return and beta is *completely* flat.

In these interviews, I think that Fama is misstating the results in Fama and French [1992]. Indeed, I think Fama and French, in the text of that article, misinterpret their own data (and the findings of others).

Black, Jensen, and Scholes [BJS, 1972] and Miller and Scholes [1972] find that in the period from 1931 through 1965 low-beta stocks in the United States did better than the capital asset pricing model (CAPM) predicts, while high-beta stocks did worse. Several authors find that this pattern continued in subsequent years, at least through 1989. Fama and French extend it through 1990.

All these authors find that the estimated slope of the line relating average return and risk is lower than the slope of the line that the CAPM says relates expected return and risk. If we choose our starting and ending points carefully, we can find a period of more than two decades where the line is essentially flat.

How can we interpret this? Why is the line so flat? Why have low-beta stocks done so well relative to their expected returns under the CAPM?

Black [1972] shows that borrowing restrictions

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(like margin requirements) might cause low-beta stocks to do relatively well. Indeed, Fama and French refer often to the Sharpe-Lintner-Black (SLB) model that includes these borrowing restrictions. This model predicts only that the slope of the line relating expected return and beta is positive.

Fama and French claim to find evidence against this model. They say (for example, on p. 459) that their results "seem to contradict" the evidence that the slope of the line relating expected return and beta is positive.

This is a misstatement, in my view. Even in the period they choose to highlight, they cannot rule out the hypothesis that the slope of the line is positive. Their results for beta and average return are perfectly consistent with the SLB model.

Moreover, if the line is really flat, that implies dramatic investment opportunities for those who use beta. A person who normally holds both stocks and bonds or stocks and cash can shift to a portfolio of similar total risk but higher expected return by emphasizing low-beta stocks.

Beta is a valuable investment tool if the line is as steep as the CAPM predicts. It is even more valuable if the line is flat. No matter how steep the line is, beta is alive and well.

DATA MINING

When a researcher tries many ways to do a study, including various combinations of explanatory factors, various periods, and various models, we often say he is "data mining." If he reports only the more successful runs, we have a hard time interpreting any statistical analysis he does. We worry that he selected, from the many models tried, only the ones that seem to support his conclusions. With enough data mining, all the results that seem significant could be just accidental. (Lo and MacKinlay [1990] refer to this as "data snooping." Less formally, we call it "hindsight.")

Data mining is not limited to single research studies. In a single study, a researcher can reduce its effects by reporting all the runs he does, though he still may be tempted to emphasize the results he likes. Data mining is most severe when many people are studying related problems.

Even when each person chooses his problem independently of the others, only a small fraction of research efforts result in published papers. By its nature, research involves many false starts and blind alleys. The results that lead to published papers are likely to be the most unusual or striking ones. But this means that any statistical tests of significance will be gravely biased.

The problem is worse when people build on one another's work. Each decides on a model closely related to the models that others use, learns from the others' blind alleys, and may even work with mostly the same data. Thus in the real world of research, conventional tests of significance seem almost worthless.

In particular, most of the so-called anomalies that have plagued the literature on investments seem likely to be the result of data mining. We have literally *thousands* of researchers looking for profit opportunities in securities. They are all looking at roughly the same data. Once in a while, just by chance, a strategy will seem to have worked consistently in the past. The researcher who finds it writes it up, and we have a new anomaly. But it generally vanishes as soon as it's discovered.

Merton [1987, pp. 103-108] has an excellent discussion of these problems. He says (p. 108) "although common to all areas of economic hypothesis testing, these methodological problems appear to be especially acute in the testing of market rationality."

The "size effect" may be in this category. Banz [1981] finds that firms with little stock outstanding (at market value) had, up to that time, done well relative to other stocks with similar betas. Since his study was published, though, small firms have had mediocre and inconsistent performance.

Fama and French [1992] continue studying the small-firm effect, and report similar results on a largely overlapping data sample. In the period since the Banz study (1981-1990), they find no size effect at all, whether or not they control for beta. Yet they claim in their paper that size is one of the variables that "captures" the cross-sectional variation in average stock returns.

Fama and French also give no reasons for a relation between size and expected return. They might argue that small firms are consistently underpriced because they are "neglected" in a world of large institutional investors. But they do not give us that reason or any other reason. Lack of theory is a tipoff: watch out for data mining!

Fama and French also find that the ratio of book value to the market value of the firm's equity helps capture the cross-sectional variation in average stock returns. They favor the idea that this ratio captures some sort of rationally priced risk, rather than market overreaction to the relative prospects of firms. But they say nothing about what this risk might be, or why it is priced, or in what direction.

They mention the possibility that this result is due to "chance," which is another way to describe data mining, but they don't consider that plausible, because the result appears in both halves of their period, and because the ratio predicts a firm's accounting performance.

I consider both those arguments weak. Given that an "effect" appears in a full period, we expect to find it in both halves of the period. We are not surprised when we do.

We know that when markets are somewhat efficient, stock prices react before accounting numbers to events affecting a firm's performance. Thus we are not surprised when firms with high ratios of book-to-market equity show poor subsequent accounting performance. I don't think this is evidence of a priced risk factor at all.

Thus I think it is quite possible that even the book-to-market effect results from data mining, and will vanish in the future. But I also think it may result in part from irrational pricing. The ratio of book-to-market equity may pick up a divergence between value and price across any of a number of dimensions. Thus the past success of this ratio may be due more to market inefficiencies than "priced factors" of the kind that Fama and French favor.

If the subsequent convergence of price and value is gradual, people seeking profit opportunities may not fully eliminate the effect. To capture the gains, they have to spend money on active management, and they must bear the risks of a less-than-fully diversified portfolio.

BETA THEORY

I think most of the Fama and French results are attributable to data mining, especially when they reexamine "effects" that people have discussed for years. Even they note that the ratio of book-to-market equity has long been cited as a measure of the return prospects of stocks.

I especially attribute their results to data mining when they attribute them to unexplained "priced factors," or give no reasons at all for the effects they find.

Strangely, the factor that seems most likely to be priced they don't discuss at all: the beta factor. We can construct the beta factor by creating a diversified portfolio that is long in low-beta stocks and short in smaller amounts of high-beta stocks, so that its beta is roughly zero. The returns to all such portfolios tend to be highly correlated, so we don't have to worry about the details of the "right" way to create the beta factor.

The empirical evidence that the beta factor had extra returns is stronger than the corresponding evidence for the small-stock factor or the book-to-market equity factor. The first evidence was published in 1972, and the factor has performed better since publication than it did prior to publication.

Moreover, we have some theory for the beta factor. Black [1972] showed that borrowing restrictions might cause low-beta stocks to have higher expected returns than the CAPM predicts (or the beta factor to have a higher expected return than interest at the short-term rate). Borrowing restrictions could include margin rules, bankruptcy laws that limit lender access to a borrower's future income, and tax rules that limit deductions for interest expense.

These restrictions have probably tightened in the United States in recent decades. Margin rules have remained in effect, bankruptcy laws seem to have shifted against lenders, and deductions for interest expense have been tightened. Many countries outside the United States seem to have similar restrictions. If they help explain the past return on the beta factor, they will continue to influence its future return.

Moreover, many investors who can borrow, and who can deduct the interest they pay, are nonetheless reluctant to borrow. Those who want lots of market risk will bid up the prices of high-beta stocks. This makes low-beta stocks attractive and high-beta stocks unattractive to investors who have low-risk portfolios or who are willing to borrow.

We can see some evidence for this in the market's reaction to a firm that changes its leverage. An exchange offer of debt for equity generally causes the firm's stock price to increase, while an offer of equity for debt causes it to decrease. This may be because of the tax advantages of debt; or because more debt transfers value from existing bondholders to stockholders; or because buying equity signals manager optimism.

I believe, though, that an important reason is reluctance to borrow: in effect, a firm that adds leverage is providing indirect borrowing for investors who are unwilling to borrow directly. These investors bid up its stock price.

BJS [1972] discuss another possible reason for beta factor pricing: mismeasurement of the market portfolio. If we use a market portfolio that differs randomly from the true market portfolio, stocks that seem to have low betas will on average have higher betas when we use the correct market portfolio to estimate them. Our betas are estimated with error (even in the final portfolio), and we select stocks that seem to have low betas. Such stocks will usually have positive alphas using the incorrect market portfolio. The portfolio method does not eliminate this bias.

Perhaps the most interesting way in which the market portfolio may be mismeasured involves our neglect of foreign stocks. World capital markets are becoming more integrated all the time. In a fully integrated capital market, what counts is a stock's beta with the world market portfolio, not its beta with the issuer country market portfolio. This may cause low-beta stocks to seem consistently underpriced. If investors can buy foreign stocks without penalty, they should do so; if they cannot, stocks with low betas on their domestic market may partly substitute for foreign stocks. If this is the reason the line is flat, they may also want to emphasize stocks that have high betas with the world market portfolio.

Can't we do some tests on stock returns to sort out which of these theoretical factors is most important? I doubt that we have enough data to do that.

We have lots of securities, but returns are highly correlated across securities, so these observations are far from independent. We have lots of days, but to estimate factor pricing what counts is the number of years for which we have data, not the number of distinct observations. If the factor prices are changing, even many years is not enough. By the time we have a reasonable estimate of how a factor was priced on average, it will be priced in a different way.

Moreover, if we try to use stock returns to distinguish among these explanations, we run a heavy risk of data mining. Tests designed to distinguish may accidentally favor one explanation over another in a given period. I don't know how to begin designing tests that escape the data mining trap.

VARYING THE ANALYSIS

While the BJS study covers lots of ground, I am especially fond of the "portfolio method" we used. Nothing I have seen since 1972 leads me to believe that we can gain much by varying this method of analysis.

The portfolio method is simple and intuitive. We try to simulate a portfolio strategy that an investor can actually use. The strategy can use any data for constructing the portfolio each year that are available to investors at the start of that year. Thus we can incorporate into our selection method any "cross-sectional" effects that we think are important.

However, the more complex our portfolio selection method is, the more we risk bringing in a data mining bias. I must confess that when we were doing the original BJS study, we tried things that do not appear in the published article. Moreover, we were reacting to prior work suggesting a relatively flat slope for the line relating average return to beta. Thus our article had elements of data mining too.

To minimize the data mining problem, BJS used a very simple portfolio strategy. We chose securities using historical estimates of beta, and we used many securities to diversify out the factors not related to beta.

But this method does have flaws. For example, beta is highly correlated with both total risk and residual risk across stocks. So what we call the "beta factor" might better be called the "total risk factor" or the "residual risk factor." I can't think of any reliable way to distinguish among these.

When doing the BJS study, we considered estimating the entire covariance matrix for our population of stocks, and using that to improve the efficiency of our test. We realized that this would require us to deal with uncertainty in our estimated covariances. We decided that the potential for improved efficiency was small, while the potential for error in our econometric methods was large. So we did not pursue that route.

Others have used different methods to update our study. My view is that in the presence of data mining and estimate error and changing risk premiums, none of these methods adds enough accuracy to warrant its complexity. I view most of these methods as our method expressed in different language.

For example, Fama and MacBeth [1973] start with cross-sectional regressions of return on beta, and look at the time series of regression intercepts. The time series is very similar to the BJS time series of returns on the beta factor. Stambaugh [1982] extends the analysis through 1976, and considers broader possible definitions of the market portfolio, but finds similar results. Lakonishok and Shapiro [1986] update the analysis to 1981, and include firm size to help explain average portfolio return. They conclude that the risk measures were unrelated to average return in the period 1962-1981.

OVERALL PORTFOLIO RISK LOWERED.

Gibbons, Ross, and Shanken [GRS, 1989] contrast their "multivariate" tests with the series of univariate tests that they say BJS use. In fact, though, the key test in BJS is the portfolio method used to construct the beta factor. This method implicitly uses all the covariances that GRS estimate explicitly. The single BJS portfolio takes account of the covariances in a way that leaves relatively little scope for data mining. Thus I feel our portfolio method has about as much power as the GRS method, and may have less bias.

Malkiel [1990, pp. 238-248] studies the relation between beta and return for mutual funds in the 1980-1989 period. Stocks generally did well in this period, so we'd expect high-beta funds to outperform low-beta funds. But beta and fund performance seem utterly unrelated.

We can even interpret Haugen and Baker [1991] as showing for the 1972-1989 period that return and beta were not related as the CAPM leads us to expect. They say the market portfolio is not efficient, but the way it's inefficient is that low-risk stocks seem to have abnormally high expected returns.

Kandel and Stambaugh [1989] give a general mean-variance framework for likelihood ratio tests of asset pricing models, taking account of estimate error in both means and covariances, but assuming that the covariances are constant. In the real world, I doubt that their method adds precision to the single portfolio BJS test of the pricing of the beta factor.

Shanken [1992] has a comprehensive discussion of methods for estimating "beta-pricing models." He discusses such problems as estimate error in beta when using methods like Fama and MacBeth's [1973]. For some reason, he does not discuss the BJS and Black-Scholes [1974] portfolio method. Black and Scholes estimate beta for the final portfolio as they estimate alpha. Thus I believe they avoid the bias due to estimate error in beta.

EXHIBIT 1
Number of Stocks in the Sample

Year	Number of Stocks	Year	Number of Stocks	Year	Number of Stocks
1931	592	1951	954	1971	1182
1932	678	1952	979	1972	1238
1933	699	1953	1003	1973	1286
1934	693	1954	1011	1974	1363
1935	688	1955	1018	1975	1429
1936	685	1956	1009	1976	1479
1937	673	1957	1004	1977	1484
1938	699	1958	1010	1978	1470
1939	722	1959	1008	1979	1466
1940	752	1960	1033	1980	1452
1941	754	1961	1026	1981	1435
1942	767	1962	1034	1982	1405
1943	782	1963	1066	1983	1394
1944	784	1964	1089	1984	1400
1945	783	1965	1104	1985	1380
1946	798	1966	1128	1986	1361
1947	820	1967	1152	1987	1329
1948	847	1968	1152	1988	1325
1949	900	1969	1122	1989	1340
1950	934	1970	1126	1990	1415
				1991	1505

UPDATING THE BLACK-JENSEN-SCHOLES STUDY

I want to illustrate the portfolio method by updating the BJS [1972] study. I follow the BJS procedure closely, except that at the very end I adopt the Black-Scholes method of estimating portfolio beta, alpha, and residual risk at the same time.

I use monthly data from the Center for Research in Security Prices at the University of Chicago for the period 1926-1991. The portfolio method is especially useful when analyzing data over such a long period, since the stocks in the portfolio are constantly changing. Even when the stocks don't change, the portfolio method adapts in part to changes in their covariances.

I do not try to estimate changes in residual risk through time. In principle, this might let me improve the efficiency of the BJS "significance tests." But the significance tests are more seriously compromised by data mining than by heteroscedasticity, in my view. So I stick to the use of an average residual volatility for the whole period to keep the method simple.

I use New York Stock Exchange listed stocks, as BJS did. Exhibit 1 shows the number of stocks in

EXHIBIT 2
Monthly Regressions: 1931 to 1965

	Black-Jensen-Scholes Study Portfolio Number										
Item	1	2	3	4	5	6	7	8	9	10	M
1. β	1.56	1.38	1.25	1.16	1.06	0.92	0.85	0.75	0.63	0.50	1.00
2. α	-0.01	-0.02	-0.01	0.00	-0.01	0.00	0.01	0.01	0.02	0.02	
3. $t(\alpha)$	-0.43	-1.99	-0.76	-0.25	-0.89	0.79	0.71	1.18	2.31	1.87	
4. $\rho(\tilde{R}, \tilde{R}_m)$	0.96	0.99	0.99	0.99	0.99	1.98	0.99	0.98	0.96	0.90	
5. $\rho(\tilde{e}_t, \tilde{e}_{t-1})$	0.05	-0.06	0.04	-0.01	-0.07	-0.12	0.13	0.10	0.04	0.10	
6. $\sigma(\tilde{e})$	0.14	0.07	0.06	0.05	0.04	0.05	0.05	0.05	0.06	0.08	
7. μ	0.26	0.21	0.21	0.20	0.17	0.16	0.15	0.14	0.13	0.11	0.17
8. σ	0.50	0.43	0.39	0.36	0.33	0.29	0.25	0.24	0.20	0.17	0.31

	Current Study Portfolio Number										
Item	1	2	3	4	5	6	7	8	9	10	M
1. β	1.53	1.36	1.24	1.17	1.06	0.92	0.84	0.76	0.63	0.48	1.00
2. α	-0.02	-0.02	-0.01	0.00	-0.01	0.00	0.01	0.01	0.02	0.03	
3. $t(\alpha)$	-0.78	-2.12	-1.30	-0.54	-1.38	0.55	0.72	1.64	1.74	2.21	
4. $\rho(\tilde{R}, \tilde{R}_m)$	0.97	0.99	0.99	0.99	0.99	0.99	0.98	0.98	0.96	0.90	
5. $\rho(\tilde{e}_t, \tilde{e}_{t-1})$	0.05	-0.06	0.00	-0.13	-0.11	-0.07	0.10	0.06	0.11	0.15	
6. $\sigma(\tilde{e})$	0.12	0.06	0.06	0.05	0.04	0.05	0.05	0.05	0.06	0.07	
7. μ	0.26	0.22	0.21	0.21	0.18	0.17	0.16	0.15	0.13	0.12	0.18
8. σ	0.49	0.43	0.39	0.37	0.33	0.29	0.27	0.24	0.20	0.17	0.31

my sample for each year in six decades plus a year. Because CRSP has corrected the data since the BJS study, the numbers differ slightly from the corresponding numbers in BJS.

Exhibit 2, panel 2, and Exhibit 5, line 2, replicate the BJS results for the BJS period. The results are similar, but not identical. Most studies that followed BJS emphasize the ten portfolios in Exhibit 2. But the essence of the portfolio method lies in constructing a single portfolio (in this case, the beta factor) as in Exhibit 5.

In Exhibit 2, the first two lines show the slope and intercept of a regression of portfolio excess return on an equally weighted market excess return. We chose the equally weighted market portfolio rather than the value-weighted portfolio for convenience only. Line 3 shows a standard statistical measure of the "significance" of the intercept (compared with zero). But the data mining we did (along with the hundreds of other people looking at the same data) invalidates the significance test. I interpret the numbers in line 3 as roughly measuring the consistency of the positive intercept for low beta portfolios.

Line 4 shows the correlation between portfolio and market excess returns, while line 5 shows the estimated serial correlation of the residuals. Line 6 gives the estimated standard deviation of the residual. Lines 7 and 8 give the sample mean and standard deviation of portfolio excess return. Since means, correlations, and standard deviations are all changing, these are estimates of their averages through the period. Everything is expressed in annual terms, though BJS gave their

EXHIBIT 3
Monthly Regressions: 1931 through 1991

Item					Portfolio Number						
	1	2	3	4	5	6	7	8	9	10	M
1. β	1.52	1.34	1.22	1.14	1.05	0.93	0.85	0.76	0.64	0.49	1.00
2. α	-0.03	-0.02	-0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	
3. $t(\alpha)$	-2.34	-2.25	-1.54	-0.62	-1.41	1.03	1.50	1.50	2.00	2.91	
4. $\rho(\tilde{R}, \tilde{R}_m)$	0.97	0.99	0.99	0.99	0.99	0.99	0.98	0.98	0.95	0.88	
5. $\rho(\tilde{e}_t, \tilde{e}_{t-1})$	0.02	-0.04	0.00	-0.08	-0.06	-0.03	0.05	0.05	0.10	0.13	
6. $\sigma(\tilde{e})$	0.11	0.06	0.05	0.04	0.04	0.04	0.05	0.05	0.06	0.07	
7. μ	0.17	0.17	0.16	0.14	0.14	0.13	0.11	0.11	0.10	0.09	0.14
8. σ	0.43	0.37	0.33	0.29	0.29	0.25	0.23	0.23	0.18	0.18	0.27

figures in monthly terms.

Exhibit 3 gives similar results for the entire period from 1926 through 1991. If anything, the pattern looks stronger than it did for the 1926-1965 period. (But keep in mind that if it looked weaker, I might not have written this article.) Low-beta stocks did better than the CAPM predicts, and high-beta stocks did worse.

In fact, as Exhibit 4 shows, the results since 1965 have been very strong. Over the entire twenty-six-year period, the market rose by normal amounts or more, but low-beta portfolios did about as well as high-beta portfolios. This is what Fama and French [1992] mean when they say the slope of the line relating average return to beta is flat (though they usually control for firm size).

Exhibit 5 shows the results for the beta factor calculated the way BJS did it. We took the excess returns from the ten portfolios in Exhibits 2-4, and weighted them by $1 - \beta_i$, where β_i is the i^{th} portfolio's beta. Thus we used positive weights on low-beta portfolios, and negative weights on high-beta portfolios. In effect, the beta factor is a portfolio that is long in low-beta stocks and short in high-beta stocks, with the largest long positions in the lowest-beta stocks, and the largest short positions in the highest-beta stocks.

Because low-beta stocks all tend to do well or badly at the same time, and because high-beta stocks

EXHIBIT 4
Monthly Regressions: 1966 through 1991

Item					Portfolio Number						
	1	2	3	4	5	6	7	8	9	10	M
1. β	1.50	1.30	1.17	1.09	1.03	0.95	0.87	0.78	0.67	0.51	1.00
2. α	0.00	-0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.03	
3. $t(\alpha)$	-3.24	-0.93	-1.02	-0.24	-0.57	1.31	0.63	0.81	0.94	1.79	
4. $\rho(\tilde{R}, \tilde{R}_m)$	0.96	0.98	0.99	0.99	0.99	0.99	0.98	0.97	0.93	0.82	
5. $\rho(\tilde{e}_t, \tilde{e}_{t-1})$	-0.02	-0.02	0.00	0.04	0.06	0.02	-0.03	-0.02	0.09	0.12	
6. $\sigma(\tilde{e})$	0.08	0.05	0.04	0.03	0.03	0.03	0.03	0.04	0.05	0.08	
7. μ	0.06	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.06	0.08
8. σ	0.31	0.26	0.24	0.22	0.21	0.19	0.18	0.16	0.14	0.12	0.20

EXHIBIT 5
The Beta Factor

	Period	μ_z	σ_z	$t(\mu)$
BJS	1/31-12/65	0.04	0.15	1.62
1.	1/31-12/65	0.05	0.15	1.93
2.	1/31-12/91	0.05	0.14	2.94
3.	1/66-12/91	0.06	0.13	2.44
	Period	μ_z	σ_z	$t(\mu)$
1.	1/31-12/39	-0.07	0.22	-1.00
2.	1/40-12/49	0.06	0.15	1.17
3.	1/50-12/59	0.10	0.07	4.56
4.	1/60-12/69	0.06	0.11	1.67
5.	1/70-12/79	0.02	0.14	0.32
6.	1/80-12/91	0.14	0.12	3.90

all tend to do badly when low-beta stocks are doing well, this portfolio is not perfectly diversified. It has substantial variance. That's why we call it the "beta factor."

This portfolio captures the relative behavior of stocks with different betas. Since stocks that differ in beta also tend to differ in other ways, it combines the effects of all the characteristics correlated with beta. For example, high-beta stocks tend to be stocks with high return standard deviation, and issuers of high-beta stock tend to be high-leverage firms.

BJS did not, and I do not, try to isolate these characteristics. One reason is that it complicates the analysis. Another is that it invites data mining.

Exhibit 5 summarizes the results in Exhibits 2-4, and divides them into approximate decades. We see that the beta factor had a negative excess return only in the first decade. Low-beta stocks did better after the BJS study period than during it. They did best of all in the most recent decade.

BJS, however, did not use a strict portfolio method. They chose stocks for the ten portfolios using only information that would have been available at the time (about five prior years of monthly data to estimate beta). But the weights on the ten portfolios use information that was not available.

Black and Scholes [1974] refine the portfolio method to eliminate this possible source of bias. The principle is simple. We select stocks *and* weight them using only information that would have been available at the time. This eliminates any bias, and generally makes it easier to understand and interpret the results. Since we revise the portfolio over time, it lets us adapt to changes in the stock list and in the covariances.

The "multivariate" testing methods that such researchers as Kandel and Stambaugh [1989] and Shanken [1992] have explored do not have these features. In effect, they require use of information on covariances that would not have been available to an investor constructing a portfolio. And I find formal statistical tests harder to interpret than a "portfolio test."

Exhibit 6 shows the beta factor using a strict portfolio test. We weight the ten portfolios using five-year historical betas rather than the realized betas. This takes out any bias due to use of unavailable information in creating portfolio weights. Then we regress the portfolio excess return on the market excess return, and figure the residual. This takes out any effects of market moves because the portfolio beta is not exactly zero. The story in Exhibit 6 is about the same as the story in Exhibit 5.

Is this article, like so many others, just an exercise in data mining? Will low-beta stocks continue to do well in the future, or will recognition of the pricing of the beta factor cause so many investors to change their strategies that the effect is eliminated (or reversed)? Are the effects of borrowing restrictions, reluctance to borrow, and a mismeasured market portfolio strong enough to keep it alive? If the flat line relating past return to beta steepens in the future, how much will it steepen?

EXHIBIT 6
The Beta Factor Using Only Prior Information

	Period	μ_e	σ_e	$t(\mu)$
BJS	1/31-12/65	0.04	0.15	1.62
1.	1/31-12/65	0.03	0.11	1.68
2.	1/31-12/91	0.04	0.10	2.69
3.	1/66-12/91	0.04	0.09	2.32
	Period	μ_e	σ_e	$t(\mu)$
1.	1/31-12/39	-0.05	0.17	-0.94
2.	1/40-12/49	0.03	0.10	1.06
3.	1/50-12/59	0.08	0.06	4.25
4.	1/60-12/69	0.03	0.07	1.32
5.	1/70-12/79	0.01	0.10	0.18
6.	1/80-12/91	0.09	0.08	3.90

Send me your predictions! I'll record them, and in future decades we can see how many were right. My prediction is that the line will steepen, but that low-beta stocks will continue to do better than the CAPM says they should.

CORPORATE FINANCE

Suppose you believe that the line relating expected return to beta will continue to be flat, or flatter than the CAPM suggests. What does that imply for a firm's investment and financing policy?

On the surface, you might think that the line for corporate investments will be flat or flatter too. You might think a corporation should use a discount rate when it evaluates proposed investments that does not depend very much on the betas of its cash flows. In effect, it should shift its asset mix toward high-risk assets, because its investors face borrowing restrictions or because they prefer high-risk investments.

But this conclusion would be wrong, because corporations can borrow so easily. They face fewer borrowing restrictions than individuals. The beta of a corporation's stock depends on both its asset beta and its leverage.

If the line is flat for investors, a corporation will increase its stock price whenever it increases its leverage. Exchanging debt or preferred for stock increases leverage, even when the debt is below investment-grade. Now that the market for high-yield bonds is so active, there is almost no limit to the amount of leverage a corporation can have. Some securities even let a firm increase its leverage without significantly increasing the probability of bankruptcy.

If today's corporations do not face borrowing restrictions, and if a corporation makes its investment decisions to maximize its stock price, the market for corporate assets should be governed by the ordinary CAPM. A firm should use discount rates for its investments that depend on their betas in the usual way.

On the other hand, I think many corporations act as if they do face borrowing restrictions. They worry about an increase in leverage that may cause a downgrade from the rating agencies, and they carry over the investor psychology that makes individuals reluctant to borrow.

This may mean that corporate assets are priced like common stocks. Low-beta assets may be underpriced, while high-beta assets are overpriced. The line relating expected return to beta for corporate assets may be flatter than the CAPM predicts.

If so, then any corporation that is free to borrow and that wants to maximize its stock price should again use the ordinary CAPM to value its investments, and should use lots of leverage. Low-beta investments will look attractive because they have positive alphas. Thus the corporation will emphasize low-risk assets and high-risk liabilities.

Just like an investor who is free to borrow, a rational corporation will emphasize low-beta assets and use lots of leverage. Even if the line is flat for both investors and corporations, beta is an essential tool for making investment decisions. Indeed, beta is more useful if the line is flat than if it is as steep as the CAPM predicts.

No matter what the slope of the line, a rational corporation will evaluate an investment using the betas of that investment's cash flows. It will not use the betas of its other assets or the betas of its liabilities.

Announcements of the "death" of beta seem premature. The evidence that prompts such statements implies more uses for beta than ever. Rational investors who can borrow freely, whether individuals or firms, should continue to use the CAPM and beta to value investments and to choose portfolio strategy.

ENDNOTE

The author is grateful to Russell Abrams and Jonathan Kelly for help with the calculations; and to Clifford Asness, John Bu, Wayne Ferson, Josef Lakonishok, Richard Roll, Barr Rosenberg, Jay Shanken, and Myron Scholes for comments on prior drafts.

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Reports of Beta's Death Have Been Greatly Exaggerated

Beta remains a quite serviceable measure of downside risk.

Kevin Grundy and Burton G. Malkiel

For decades the capital asset pricing model (CAPM) has been held as an article of faith among financial economists. The model, usually attributed to 1990 Nobel Laureate William Sharpe [1964], was also developed by Fischer Black [1972], John Lintner [1965], Jan Mossin [1966], and Jack Treynor [1965].

The CAPM attempts to quantify the relationship between risk and return. Both economists and financial practitioners have long believed that riskier assets must yield a higher expected rate of return to induce investors to hold them. The innovation of the CAPM is to specify the particular risk measure that would be priced in the market.

DEFINING RISK

Risk is generally defined as the chance that investment outcomes will come out differently from expected. Most investors think of risk as measuring the chance that returns will be lower than expected and, specifically, that the investment will produce a loss. This suggests a natural measure for risk, namely, the dispersion (or variance) of return outcomes around their average or expected values.

To be sure, positive surprises (i.e., returns higher than anticipated) can hardly be considered to be unfavorable. Nevertheless, if return outcomes are reasonably symmetric, a dispersion measure will capture the magnitude or likelihood of downward or unfavor-

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able surprises and, thus, should be a serviceable measure of risk.

THE CAPITAL ASSET PRICING MODEL

Before the CAPM, risk was typically estimated by measuring the variability of the past returns for each individual security. Securities with a low variance of past returns were considered quite safe, while those whose past returns display large dispersion were deemed risky. The critical insight of the CAPM is to argue that only a portion of that past instability would be priced in the market as risk.

Two types of factors tend to produce variability in returns. The first, called idiosyncratic risk, represents events that are specific to the individual company. Factors such as a new drug discovery, an oil find, a damaging product liability lawsuit, or the incapacity of a highly respected chief executive officer all can affect the returns from individual securities.

The second factor, called systematic risk, represents the variability imparted to common stock returns by general movements in the broad market. During periods of market distress, such as October 1987, the broad market declined sharply, and individual stocks followed suit. But not all stocks are equally sensitive to market swings. When the market drops by 10%, a relatively stable stock, such as AT&T, might drop by only 5%. A less stable stock, on the other hand, such as Digital Equipment, might decline by 20%.

Beta is a measure of an individual stock's general sensitivity to market swings. The market as a whole (represented by a broad stock market index such as the Standard & Poor's 500 stock index) is accorded a beta of 1. Stocks with betas of 1/2 tend to swing half as much as the market, while stocks with a beta of 2 tend to be twice as volatile. Beta is then a measure of relative volatility. It measures the systematic tendency of individual stocks to follow market movements.

Thus, the dispersion in returns for any individual stock is influenced by two risk factors: idiosyncratic, or specific risk, and systematic, or market risk. The insight of the CAPM is that only one of these risk factors is relevant for the pricing of individual issues. The CAPM argues that idiosyncratic risk would not be priced in an efficient market and would not command a risk premium (i.e., an extra expected return to compensate for the extra risk).

The reason is that idiosyncratic risk can essentially be eliminated by holding a diversified portfolio. The positive and negative events affecting individual companies are likely to cancel each other out. The new drug that makes one company's stock rise is likely to have a negative effect on the stock of another company that once had the most effective drug. If specific risk can, thus, largely be cancelled out by diversification, it stands to reason that the market will not pay a premium for it.

Systematic risk, on the other hand, cannot be reduced by diversification. Indeed, even if an investor is perfectly diversified by holding all the individual stocks in the market, her portfolio would still be risky in the sense that it is subject to the ups and downs of the market as a whole. Thus, only systematic, or non-diversifiable risk (measured by beta) will deserve some risk compensation in the market. And the higher the risk of a stock or a portfolio (as measured by the portfolio's average beta value), the higher the return should be. Exhibit 1 depicts the relationship between risk and return.

Here the risk-free rate (R_F) is taken to be the short-term Treasury bill rate (a security whose nominal rate of return over some short holding period is perfectly certain). The return for the market (R_M) is taken to be the return from a broad stock market index.

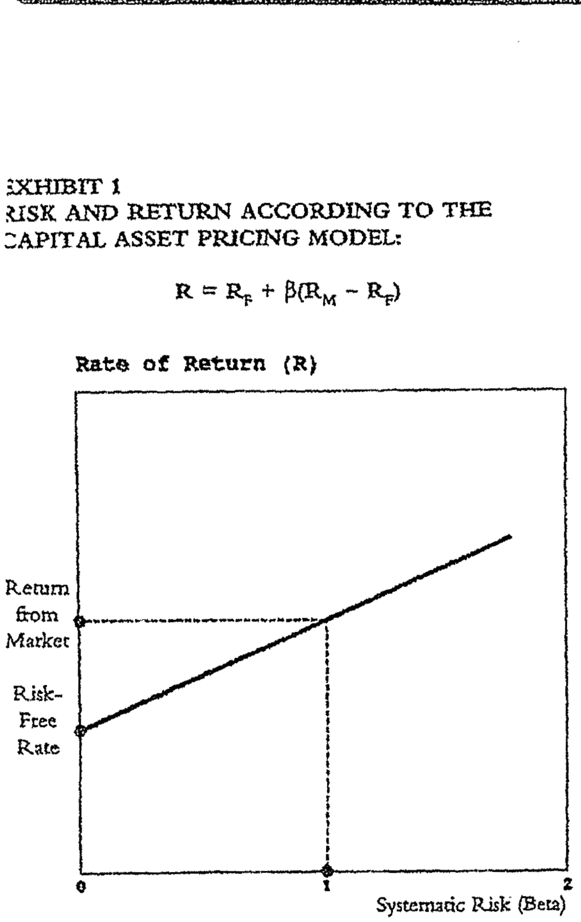
TESTS OF THE CAPM

At first, tests of the capital asset pricing model seemed encouraging. Data from the 1960s and 1970s for individual stocks and for mutual funds appeared to indicate that security returns are, in fact, directly related to beta as the theory asserts. Stocks and mutual funds with higher betas did seem to produce somewhat higher rates of return. It turns out, however, that even during the period when the theory appeared to work, the actual risk/return relationship was somewhat flatter than that predicted by the CAPM. Low-risk stocks appeared to earn higher rates of return and high-risk stocks lower rates of return than the theory predicted.

Other troubling aspects of the model came to light. Roll [1977] points out that it is impossible to observe the market's return, because the market includes *all* stocks, a variety of other financial instruments, and even non-marketable assets, such as an individual investment in education. The S&P 500 index (or any other index used to represent the market) is an imperfect market proxy at best. Roll shows that by changing the market index against which betas are measured, on

EXHIBIT 1
RISK AND RETURN ACCORDING TO THE CAPITAL ASSET PRICING MODEL:

$$R = R_F + \beta(R_M - R_F)$$



The equation can also be written as an expression for the risk premium, that is, the rate of return on the portfolio or stock over and above the risk-free rate of interest: $R - R_F = \beta(R_M - R_F)$.

can obtain quite different measures of the risk level of individual stocks or portfolios. As a consequence, one would make very different predictions about expected returns.

The most damaging blow to the CAPM, however, came with publication of a study by Eugene Fama and Kenneth French [1992], which seemed to shatter any support for beta in the academic and professional community. Their empirical evidence is clear; beta and long-run average return are simply not correlated, as is shown in Exhibit 2. Beta appears to be of no use to investors.

With release of the Fama and French study, investment professionals almost universally condemned beta. Articles with titles such as "Bye-Bye to Beta" (Dreman [1992]) and "Is Beta Dead Again?" (Grinold [1993]) are representative. A comment typical of the investment community was put forth by a prominent manager: "I have always thought this academic wisdom [the CAPM and beta] was way off base, and now there's new evidence to prove I was right."[1]

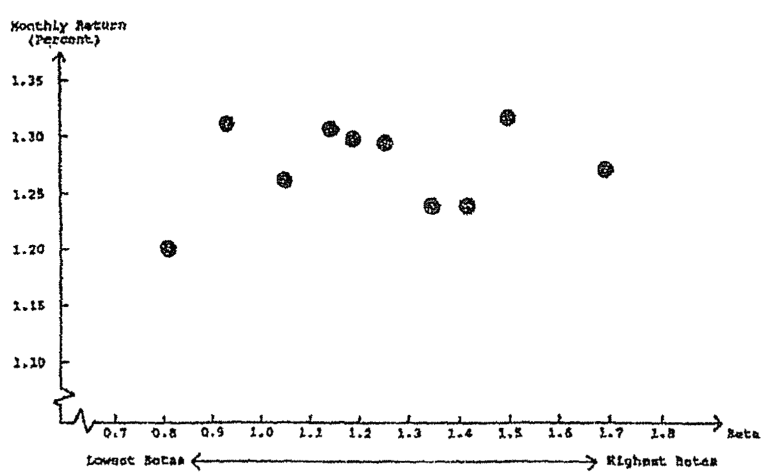
SHOULD WE CONSIGN BETA TO THE SCRAP HEAP?

Are we, therefore, ready to consign beta to the scrap heap of discarded economic ideas? We think not. Reports of beta's death are (as they say) greatly exaggerated. Here we review an important insight Fischer Black offers about the usefulness of beta as a tool for portfolio managers. Then we present an empirical study covering a twenty-five-year period showing that beta is indeed a quite serviceable and dependable indicator of risk.

In an article in this Journal, Fischer Black [1993] proposes that even if Fama and French are correct in their conclusions, and high-beta stocks generate returns that are the same as low-beta stocks, the CAPM might still be useful. Indeed, Black argues that beta might be more useful than ever for portfolio managers.

If one is not rewarded for bearing the increased risk of a high-beta portfolio, this would suggest that

EXHIBIT 2
AVERAGE MONTHLY RETURN VERSUS BETA — 1963-1990



Source: Fama and French [1992].

investors should shift to low-beta portfolios. In addition, low-beta stocks might serve the function of an alternative asset to bonds or cash in an investor's portfolio, possessing similar risk but earning higher average returns. If investors are rational and risk-averse, preferring higher return and lower risk, ceteris paribus, then this new relationship, or lack thereof, suggests unique opportunities to invest in low-beta stocks without suffering the punishment of lower returns.

Moreover, investors willing to accept a market level of risk could buy low-beta portfolios on margin (borrowing at or near the risk-free rate) and leverage up the portfolio's risk to the beta of the market. By employing leverage, the investor would achieve a higher-than-market return with a risk level not exceeding that of the market as a whole.

Black's conclusions have significant implications for investors and corporations:

> Just like an investor who is free to borrow, a rational corporation will emphasize low-beta assets and use lots of leverage. Even if the line is flat for both investors and corporations, beta is an essential tool for making investment decisions. Indeed, beta is more useful if the line is flat than if it is as steep as the CAPM predicts [1993, p. 17].

BETA AS A SERVICEABLE MEASURE OF RISK

We shall also show that beta is, in fact, a quite serviceable measure of risk. Recalling our earlier discussion, most investors think that a useful risk measure will indicate the chance of disappointment in investment returns — especially the possibility of losing money in a declining market. The question we pose is whether the beta measure of systematic risk does fulfill that function.

Investors who are risk-averse will find a risk measure important in the investment process, regardless of the long-run risk and return relationship. Specifically, the risk they wish to minimize is that on the downside. What is needed is a risk measure that sufficiently reflects exposure to significant drops in the market as a whole.

Does beta accurately measure an investment's risk exposure when the market declines? Traditional CAPM theory asserts that high-beta stocks tend to experience greater losses than low-beta stocks in a declining market. The empirical study described here will show that, for the twenty-five-year period from 1968 to 1992, beta has served as an accurate ex ante indicator of downside risk exposure in significantly declining markets.

AN EMPIRICAL STUDY OF RISK IN DECLINING MARKETS

The results of the empirical study analyzed below support the claim that beta is indeed useful in measuring the downside exposure of a portfolio in declining market conditions. Whether the market proxy used is the S&P 500 or an equal-weighted market index, our results are the same: High-beta stocks suffer significantly greater losses than low-beta stocks in declining markets, with the market return falling approximately in the middle. In addition, the length of time used to measure beta, within the range of twenty-four months to sixty months, seems to matter little to the ultimate conclusion.

The first step in the study involves determination of appropriate declining market periods for examination. In an effort to replicate the Fama and French techniques, we focus the study on the years 1968 to 1992. This similar time frame will enable us to say that, although Fama and French find no overall beta and return relationship over the period, there *is* a clear relationship if we focus simply on declining markets during this period.

Unlike previous CAPM analyses, which limit their focus to defined periods of time (months or years usually), we allow for flexibility in the duration of declining markets. Declining market periods (bear markets) are determined by a graphical observation of weekly market returns for the S&P 500.

We select two value-weighted indexes of market activity, the S&P 500 and a value-weighted market index, and define a declining market as one where both indexes fall at least 10% from peak to trough. This definition focuses the study on periods when there are losses in the broader market as well as in the larger issues heavily weighted in the S&P 500.

The definition gives us thirteen periods between 1968 and 1992 that qualify as declining or bear markets. Exhibit 3 summarizes these market periods. Note that in all periods except one an equal-weighted market

HIBIT 3
:entage Returns on Indexes for Declining Market Periods Studied

Declining Market Period	Dates	Number of Days in Period	S&P 500	Value-Weighted Market	Equal-Weighted Market
1	05/14/69-07/29/69	52	−15.06	−16.45	−23.47
2	11/10/69-01/30/70	57	−13.47	−13.19	−15.78
3	04/01/70-05/26/70	40	−22.69	−24.62	−32.63
4	12/08/72-10/03/74	458	−47.49	−46.20	−45.31
5	06/30/75-09/16/75	55	−13.42	−13.00	−9.58
6	09/12/78-11/14/78	46	−13.54	−14.42	−21.57
7	02/13/80-03/27/80	31	−16.69	−17.98	−23.22
8	04/01/81-09/25/81	124	−17.08	−15.55	−14.29
9	12/04/81-03/08/82	64	−14.21	−13.77	−11.22
10	05/07/82-08/12/82	68	−13.70	−12.23	−11.41
11	01/06/84-06/15/84	113	−11.72	−10.16	−10.04
12	10/05/87-12/04/87	44	−31.75	−31.05	−32.54
13	07/16/90-10/11/90	63	−19.56	−18.53	−21.47

ıdex also declined by 10% or more.

To test whether beta is a serviceable measure of ısk in declining markets, we use every stock listed on ıe New York Stock Exchange and the American tock Exchange during these declining market periods s available on the monthly Center for Research in ìecurity Prices (CRSP) security price tapes. For each tock, we calculate four different measures of beta to letermine if a specific measurement technique affects he ultimate outcome.

We use the traditional CAPM equation, $r_i - r_f = (r_m - r_f)\beta$, where r_i, r_f, and r_m stand for the return from the i[th] stock, the risk-free return, and the market return, respectively. We regress the monthly excess return of each security above the risk-free rate on the monthly excess return of a market proxy above the risk-free rate to determine beta. The monthly three-month rate on United States Treasury bills is used as a proxy for the risk-free rate.

Four measures of beta are calculated using different market proxies and lengths of time for the regressions. Two of the betas are calculated using the S&P 500 as a market proxy and two using an equal-weighted market index as the market proxy. Within those two groups, betas are calculated using a sixty-month window preceding the declining market and a shorter twenty-four-month window.

From these initial calculations, each individual stock is assigned a beta. As previous studies have shown, however, portfolio betas are more reliable than individual security betas, which are prone to significant measurement error. We therefore rank the securities according to their preceding betas and form portfolio deciles, the lowest-beta stocks falling in the first decile, and the highest-beta stocks falling in the tenth decile. Portfolio betas are then calculated as the mean betas of their composite securities, with an equal weighting assigned to each security in the portfolio. Thus, only information available to investors is used to form the portfolios.

DECLINING MARKET RETURNS AND BETA

Using the CRSP tapes, we calculate period returns for securities listed during the declining-market periods. The returns include dividends and are compounded daily. Stocks not listed for the entire declining-market period were dropped.[2] These period returns are then matched with their corresponding securities in the portfolio deciles. Portfolio returns are determined by calculating the mean return of all securities in a given decile, with an equal weight assigned to each security in the portfolio.

Aggregate results are determined by grouping all first deciles from each of the thirteen periods together and then recalculating a mean decile beta and mean decile return. The process is repeated for subsequent deciles. In the end, there are four pairs of portfolio betas and returns corresponding to the four calculation groups for each decile. Exhibit 4 summarizes

EXHIBIT 4
Summary of Aggregate Results for Thirteen Declining Market Periods (1968-1992)

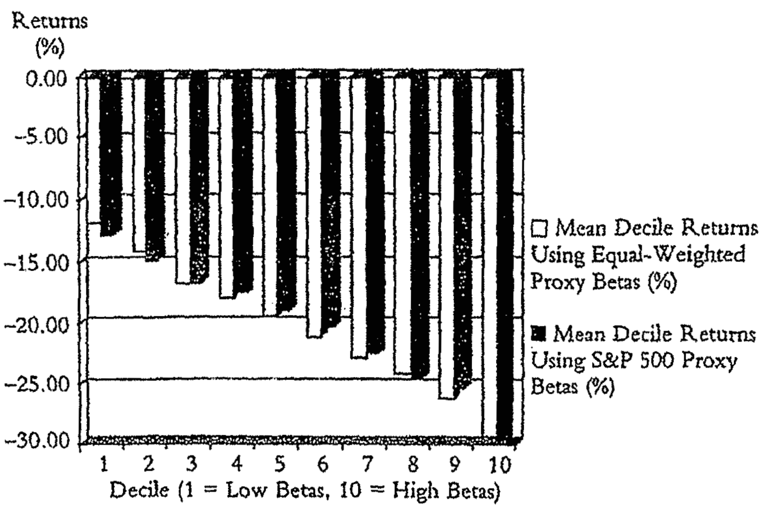
24-Month-Preceding Betas	Deciles									
Mean Decile Betas with Equal-Weighted Market Proxy	0.18	0.46	0.63	0.76	0.89	1.02	1.15	1.31	1.53	2.02
Mean Decile Betas with S&P 500 Market Proxy	0.14	0.48	0.67	0.83	0.98	1.12	1.29	1.47	1.73	2.27
Mean Decile Returns Using Equal-Weighted Proxy Betas (%)	−11.70	−14.06	−16.83	−17.98	−19.52	−21.11	−22.70	−24.03	−26.12	−29.65
Mean Decile Returns Using S&P 500 Proxy Betas (%)	−12.82	−14.91	−16.78	−17.75	−19.06	−20.33	−22.54	−24.51	−25.34	−29.58
60-Month-Preceding Betas										
Mean Decile Betas with Equal-Weighted Market Proxy	0.33	0.53	0.67	0.79	0.89	0.99	1.09	1.22	1.40	1.79
Mean Decile Betas with S&P 500 Market Proxy	0.38	0.64	0.80	0.94	1.05	1.16	1.28	1.42	1.61	2.01
Mean Decile Returns Using Equal-Weighted Proxy Betas (%)	−8.68	−13.63	−16.49	−18.06	−19.57	−20.91	−22.68	−23.28	−26.37	−29.77
Mean Decile Returns Using S&P 500 Proxy Betas (%)	−9.25	−13.25	−16.06	−18.49	−20.28	−20.41	−22.23	−23.91	−25.58	−29.80

these aggregate results.

The data show a clear relationship between beta and downside risk in declining markets. The high-beta portfolios consistently perform most poorly during periods when the S&P 500 and value-weighted indexes drop at least 10%. The result holds regardless of the market proxy or the length of time used to calculate the betas.

Exhibits 5 and 6 plot the results. The usefulness of beta as a measure of downside risk appears compelling. The relationship between beta and return in declining markets is strictly negative and monotonic.[3] As one increases the portfolio beta from the lowest deciles, the portfolios perform progressively worse in declining markets, regardless of the market proxy used.[4]

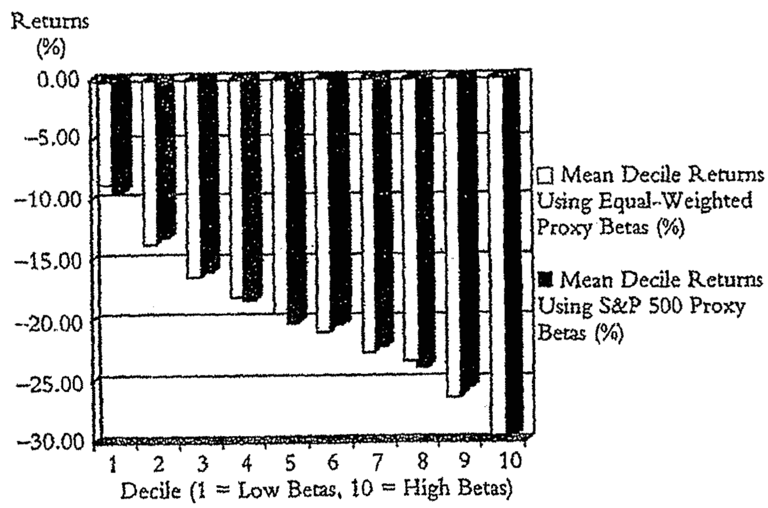
EXHIBIT 5
MEAN DECILE RETURNS DURING DECLINING-MARKET PERIODS (1968-1992): DECILES FORMED USING 24-MONTH-PRECEDING BETAS



INDIVIDUAL PERIOD RESULTS

As striking as the aggregate results are, it is also important to break down the analysis

EXHIBIT 6
MEAN DECILE RETURNS DURING DECLINING-MARKET PERIODS (1968-1992): DECILES FORMED USING 60-MONTH-PRECEDING BETAS



by period. If investors plan to use beta as their risk measure in choosing a portfolio, they will be concerned with not only the aggregate performance of beta in forecasting downside exposure but also its consistency in each market period. Analyzing data for each of the thirteen market periods studied, we find that the relationship holds in every period. While the relationship is not always strictly monotonic, the general tendency for high-beta portfolios to suffer more in bear markets is always upheld.

Another interesting result of this study is the predictive strength shown by beta in the periods after 1980. Many economists hypothesized after the Fama and French study that the long-run beta and return relationship had ceased to exist after 1980. Whether or not this conclusion is accurate, our data suggest that the short-run relationship between return and beta in declining markets following 1980 did not significantly weaken.[5]

CONCLUDING COMMENT

The focus of this study has been the practical use of beta as a serviceable measure of risk. The rational risk-averse investor needs to identify a risk measure that will highlight the downside potential of the portfolio. The empirical study presented here indicates that beta, however measured, remains a useful tool in forecasting short-term risk in declining markets.

ENDNOTES

[1]Cited in Dreman [1992, p. 148].

[2]This procedure obviously imparts some survivorship bias to our results. We believe, however, that it strengthens our results because high-risk stocks are likely to generate even lower returns than we have estimated during periods of declining markets.

[3]Non-parametric tests of the data reveal a high and statistically significant degree of correlation between ex ante beta and ex post return in declining markets. Both Spearman's rank correlation coefficients and Kendall's tau correlation coefficients for ex ante beta and declining market return are highly significant.

[4]Chan and Lakonishok [1993] perform a somewhat similar study. In an examination of the ten largest down-market months since 1932, they find that higher-beta stocks consistently declined more than low-beta stocks in each of the periods covered. Our study shows that such results hold consistently in each individual declining market during a recent twenty-five-year period.

Chan and Lakonishok also find that high-beta stocks rose significantly more than low-beta stocks in bull markets. What Fama and French have found, however, is that these effects have been roughly offsetting, producing a generally flat long-term relationship.

[5]Another way to look at our results is to conclude that we have simply tested for the stationarity of our beta portfolios. If betas for portfolios are reasonably constant over time, then, by definition, high-beta stocks will tend to fall farther in future bear markets.

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Risk and Return Revisited

The volatility of individual stocks and the predictability of returns — some surprising patterns.

Burton G. Malkiel and Yexiao Xu

One time-honored rule in the field of finance is that risk and return are related. Often called the "no free lunch" principle, it asserts that over the long run it is not possible to achieve exceptional returns without accepting substantial risk. Any standard equilibrium model of asset pricing justifies this relationship. Data from Ibbotson Associates confirm that since 1926, U.S. common stocks have provided a total return of 10.7% per year, about seven percentage points greater than the return from riskless Treasury bills.

RISK AND RETURN ACCORDING TO THE CAPITAL ASSET PRICING MODEL

For decades, the standard way to model the risk/return relationship and to measure risk has been to use the capital asset pricing model (CAPM), the product of William Sharpe [1964] and others. The CAPM insight is that volatility arising from specific events (called specific, or idiosyncratic, risk) can be eliminated in a diversified portfolio, and that investors will not be paid for bearing these risks with extra returns.

But volatility resulting from general movements in stock prices and the tendency of all stocks to fluctuate to some extent in sympathy cannot be diversified away. According to the CAPM, the risk variable that will be (linearly) related to return is beta, the measure of relative volatility, or systematic risk. The higher the beta of an individual stock or portfolio, the higher the

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returns an investor should expect.

Unfortunately, theory and practice do not always accord. In a remarkable article, Eugene Fama and Kenneth French [1992] find that over a twenty-seven-year period, from 1963 through 1990, returns and the beta measure of risk appeared to be completely unrelated.

Fama and French divide all stocks in their sample into ten subsamples according to their market capitalization (a measure of size). Within each subsample, they construct ten portfolios according to their beta levels, for a total of a hundred portfolios each year. They could then test whether size or beta is more effective in explaining the cross-section of returns, and whether beta could explain the pattern of stock returns within size deciles.

We have constructed the same hundred portfolios using a somewhat larger sample through 1994. For illustrative purposes, we group our sample of stocks into ten portfolios according to beta. In other words, decile 1 is the 10% of the total sample with the lowest betas. Decile 2 is the stocks with the second-lowest betas, and so on.

We graph the relationship between beta levels and the average returns from the decile portfolios in Exhibit 1. Confirming Fama and French, we find that the relationship between returns and beta does not accord with the CAPM. Rather, the relationship is essentially flat: High-beta portfolios have no greater returns than moderate-beta portfolios.[1]

Fama and French do find, however, that the size of a company appears to be a far better proxy for risk than beta.[2] Again dividing stocks into ten portfolios according to size, rather than beta, we confirm the Fama and French finding of a very strong relationship, as is shown in Exhibit 2. Here the decile portfolios of the smallest companies are shown on the left-hand side of the graph, while the portfolios of larger companies are shown on the right. We note a clear tendency for the portfolios of smaller companies to produce rates of return that are greater than the returns from portfolios of larger companies.

Fama and French's conclusion appears to be upheld — size may be a better proxy for risk than beta.

MARKET VOLATILITY OVER TIME

Ever since the stock market crash of October 19, 1987 (the largest one-day percentage decline in the popular Dow Jones Industrial Average since the stock market average was first published in the nineteenth century), there has been intense interest in the question of market volatility. Some say that heightened stock market volatility may imply that stock prices are straying too far from their "proper" fundamental values (e.g., Shiller [1991]). An increase in stock market volatility could signal increased riskiness of equities and therefore a higher required rate of return (see, for

EXHIBIT 1
RELATIONSHIP OF RETURN AND BETA: 1963-1994

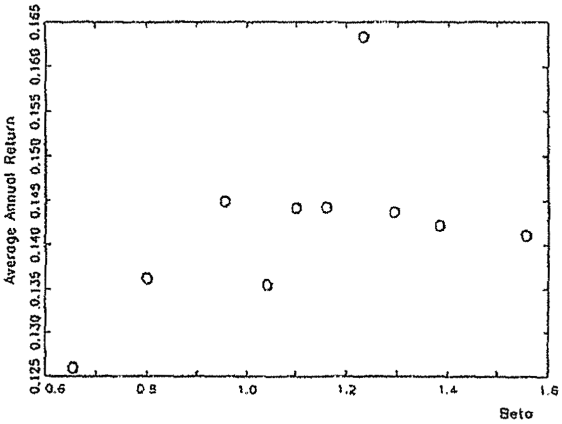
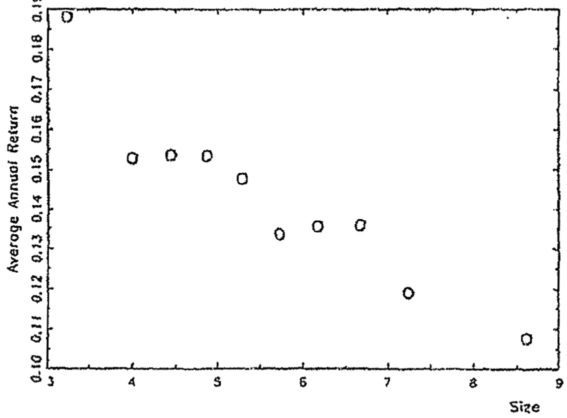


EXHIBIT 2
RELATIONSHIP OF RETURN AND SIZE: 1963-1994



example, French, Schwert, and Stambaugh [1987] and Pindyck [1984]).

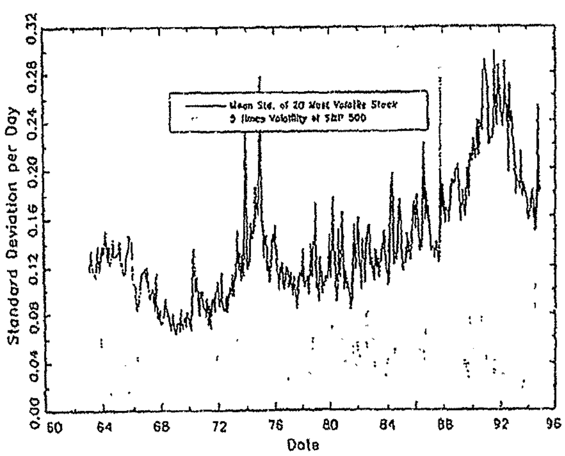
Possible reasons for increased volatility include improvements in the speed and availability of financial information, the increased importance of institutional investors whose decisions are often likely to be coordinated, and the growth of derivatives markets. All these factors could lead to enhanced responsiveness of stock prices to new information or a change in investor sentiment.

In fact, however, volatility for the market as a whole has been remarkably stable over time. Schwert [1991] and Malkiel and Xu [1995] confirm that stock market volatility during the 1980s and early 1990s was actually lower than in earlier decades. Volatility during 1994 and 1995 was lower than it was for most of the 1970s and 1980s.

According to Malkiel and Xu [1995], the picture is different for individual stocks, however, which have increased in volatility in recent years. We have confirmed this finding by examining the volatility of the most volatile stocks each day, as well as the volatility of the individual stocks in the Standard & Poor's 500 Stock Index. Exhibit 3 taken from Malkiel and Xu [1995] shows the volatility over time of the twenty most volatile stocks each month compared with five times the volatility of the S&P 500 index.[3]

As would be expected, the most volatile stocks exhibit far more volatility than the market index. What appears to be more surprising, however, is that unlike the S&P index, the most volatile stocks have become more volatile over time. A variety of statistical tests described in Malkiel and Xu [1995] substantiate the finding that the volatility of individual stocks has been rising over time.

EXHIBIT 3
MONTHLY VOLATILITY FOR THE TWENTY MOST VOLATILE STOCKS: 1963-1994



We have also calculated the idiosyncratic risk for the individual stocks in the S&P 500 index. First, we calculate the volatility (variance of returns) for each stock in the index and (value-) weight the volatility numbers to obtain a measure of aggregate volatility. Second, we calculate the volatility of the index itself, which is, of course, lower than the aggregate numbers because much of the volatility of the individual securities washes out when stocks are held in a diversified S&P portfolio.

We take the difference between the two measures to represent the idiosyncratic volatility of the stocks in the index. This idiosyncratic, or specific, risk of the stocks in the S&P 500 has also exhibited a clear and statistically significant time trend from 1952 to the present.[4]

We conclude that while there has been no increase in the volatility of the market as a whole, there is very clear evidence of increased volatility for individual stocks. Movements up or down of 50 points in the popular Dow Jones Industrial Average are often written up in press reports as signs of extraordinary volatility. In fact, in percentage terms, such movements are well under 1% of the value of the index and represent no more volatility than a 6- or 7-point movement in the index during the periods of the 1960s and 1970s when the level of the Dow was below 1000.

On the other hand, when the press reports that particular companies fail to meet the "Street" earnings estimates and lose 25% of their value in a single day with increased frequency, such reports do indeed represent increased volatility for individual components of the market averages.

IDIOSYNCRATIC VOLATILITY AND RISK

We turn now to the question of whether individual, or idiosyncratic, volatility is reflected in share prices. We have shown that idiosyncratic volatility has increased over time, while the volatility of the whole market has been remarkably stable. Idiosyncratic volatility is precisely the kind of volatility that is uncorrelated across stocks and thus is washed out for the market as a whole. Therefore, we should be able to observe that the correlation among the returns for individual stocks decreases over time. This would allow the volatility of the market portfolio to remain the same, even if there is an increase in each individual stock's volatility.

Computationally, it is extraordinarily difficult to calculate the pairwise correlations between each pair of stocks in the market universe. For example, even if we limit our analysis to 5,000 stocks over all monthly periods from the 1960s, billions of correlations would need to be estimated. As a check, however, we can calculate the correlations among industry portfolios over time.

We construct thirteen industry portfolios according to SIC codes for individual stocks, and confirm that there was a decline in the mean of the correlation coefficients from 1970 through the mid-1990s. We also analyze the twenty-fifth percentile, the median, and the seventy-fifth percentile of the correlation distribution; all exhibit a decreasing trend over the '70s, '80s, and '90s.

This analysis suggests that the risk reduction benefits of holding a diversified portfolio have been increasing over time. Whether this tendency will persist will depend upon whether idiosyncratic volatility stabilizes or continues to increase.

Recalling our earlier discussion of the capital asset pricing model, an increase in the volatility of individual stocks should not command an added risk premium in the market as long as it reflects an increase in idiosyncratic risk. We know that market volatility has not increased over time, and that idiosyncratic risk can be eliminated in a well-diversified portfolio. Thus, a perception that some stocks are particularly susceptible to idiosyncratic shocks should have no consequence for asset pricing, according to the CAPM.

Two arguments lead us to believe that idiosyncratic volatility may not be irrelevant for asset pricing and may, in fact, be a serviceable risk proxy. First, we find that idiosyncratic volatility for individual stocks is strongly related to the size of the company. When we regress estimates of the (percentage of) idiosyncratic volatility (V_i) on the (log) size of each company (CAP_i), we obtain a very strong correlation:

$$(V_i) = 8.05 - \underset{(0.06)}{0.82}(CAP_i) \qquad R^2 = 0.67$$

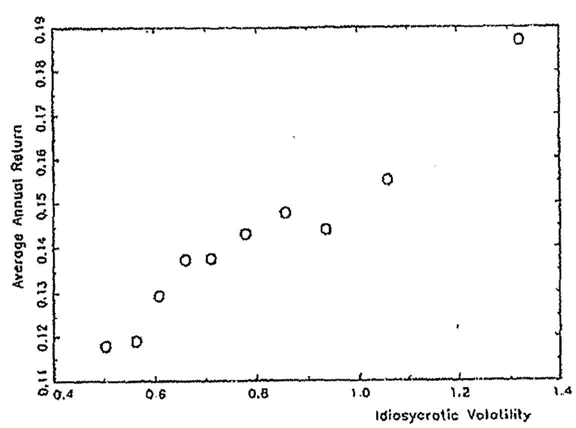
Here size is measured by market capitalization, and idiosyncratic volatility is measured as the standard deviation of the residuals from estimating each security's beta from the CAPM.[5] The number in parentheses is the standard error of the regression coefficient. The equation makes it clear that the larger the size of the company, the smaller the stock's idiosyncratic volatility. Thus, we conjecture that the strong size effect in the Fama and French work could perhaps just as reasonably be interpreted as reflecting idiosyncratic volatility.

The second argument supporting our conjecture that idiosyncratic volatility may serve as a useful risk proxy concerns the behavior of portfolio managers. It is all well and good to argue that only portfolio results matter to an institutional investor. But portfolio managers are often called upon to explain to an investment committee why they held one or more stocks that lost considerable value during some reporting period. Such portfolio managers may well demand an extra risk premium on individual issues that are perceived to carry extraordinary specific risk. Alternatively, such idiosyncratic volatility estimates may serve as a useful proxy for a wide range of systematic risk factors that are associated with the factor sensitivities of the arbitrage pricing model of Ross [1987].

We proceed in the manner of Fama and French and form ten portfolios of companies according to their idiosyncratic volatility (V_i) levels in Exhibit 4. Decile 1 is the 10% of the sample companies with the lowest V_i levels. Decile 10 is the companies with the highest V_i levels. The vertical axis shows the average portfolio returns over the thirty-one years from 1963 through 1994.

Portfolios are rebalanced each year. No account

EXHIBIT 4
RELATIONSHIP OF RETURN AND IDIOSYNCRATIC VOLATILITY: 1963-1994



is taken of potential transaction costs, so these results should not be interpreted as representing actual returns that could be achieved.

Exhibit 4 presents a clear tendency for higher levels of V_i to be associated with higher returns. Comparing Exhibits 4 and 2, you can see that the relationship between returns and V_i appears to be even a little stronger than that between returns and size.[6]

An estimate of the average idiosyncratic volatility of the stocks in a diversified portfolio may well provide a useful risk proxy and may have considerable power to predict the long-run returns the portfolio is likely to produce.

CONCLUDING COMMENTS

The efficient market theory argues that only systematic risk should be priced in the market and be deserving of a risk premium. Here we present some surprising evidence. It appears that idiosyncratic volatility is related to the returns from individual stocks from our cross-sectional regressions. Since idiosyncratic volatility is related to the size of the individual firm, we may have found an alternative explanation for the Fama and French [1992] conclusion that size and return are strongly correlated.

While idiosyncratic volatility and size measures seem to bear a strong relationship to returns, we do recognize that these variances may simply be proxies for the variety of systematic risk elements that influence security prices. It is clear, however, that a simple overall systematic risk measure, such as a beta, is not likely to be an effective predictor of future returns.

ENDNOTES

[1]The relationship is even worse if we use the same sample period as Fama and French. We can also confirm a flat relationship

within each size decile. We use a slightly different sample of stocks from Fama and French's, including all NYSE/AMEX stocks on the CRSP tape but excluding Nasdaq stocks. The exclusion of Nasdaq stocks does not alter the basic Fama-French conclusion.

[2]They also find that the ratio of book-to-market value is another useful variable in explaining the cross-section of returns.

[3]If we graph the most volatile 5% of the total universe of stocks, the same conclusion holds.

[4]It can be shown that this measure of idiosyncratic volatility is consistent with a variety of models including the CAPM.

[5]This estimate of idiosyncratic volatility is different in principle from the measure we use in the previous section. Nevertheless, the measures are consistent with each other. The first measure is useful only when dealing with a portfolio rather than with individual stocks.

[6]In fact, the R^2 is about 10% higher than that of the return-market capitalization relationship.

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A Yield Effect in Common Stock Returns

Yield is the one "common factor" that led to abnormal investment performance during the past decade.

James L. Grant

This study looks at the monthly investment performance of U.S. equity portfolios during the 1980-1992 period. Three findings, ranging in order of the knowable to not-so-knowable, characterize the return/risk relationship for common stocks during this period.

- At 16.14%, the annualized monthly average return on the stock market as measured by the S&P 500 index is substantially higher than the long-term (arithmetic) mean return of 12.4% reported by Ibbotson Associates for the 1926-1992 period.
- Portfolio returns on common stocks during the 1980-1992 period are also negatively related to the traditional measures of risk, including beta and return standard deviation. Correlation values in the average return/risk relationship are strongly negative, ranging from −0.75 to −0.828, respectively.
- Moreover, it seems that high-dividend-yielding stocks of both small and large firms were the best-performing equity investments for the thirteen-year period ending in December 1992.

This one-factor yield finding for superior risk-adjusted performance is interesting in light of the long-term stock market findings of Fama and French [1992], who find that the stocks of small firms with low price-to-book value ratios were the best-performing U.S. equity investment over the long run. This study indi-

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EXHIBIT 1
Investment Fundamentals for U.S. Equity Portfolios*

Module	Dividend Yield (%)	Price/ Earnings	Annualized Five-Year EPS Growth (%)	Price/ Book Value	Beta
EG	0.55	18.63	34.00	2.09	1.40
SHY	4.26	13.47	12.91	1.54	0.90
MQG	2.83	16.10	14.33	2.12	1.08
S-CAP	0.64	18.27	23.19	2.21	1.23
LHY	5.77	10.81	9.89	1.40	0.84
SHG	1.88	17.10	19.02	2.09	1.21
S-CYC	2.34	15.16	26.23	1.39	1.23
LQG	2.97	14.36	14.13	2.27	1.08

*Source: State Street Global Advisors — calculated as of December 31, 1986. Modules identified in text.

cates that a change has occurred in the investment performance landscape over the past thirteen years.[1]

INVESTMENT FUNDAMENTALS FOR U.S. EQUITY PORTFOLIOS

There are many ways to partition the U.S. equity market to satisfy investor interests. Multiple equity return series (MULDEX) have been constructed by State Street Bank and Trust Company from over 5,000 securities using the BARRA E2 model. The resulting benchmark portfolios are listed here, while their investment fundamentals are shown in Exhibit 1:[2]

Emerging Growth (EG)
Small-Company High-Yield (SHY)
Medium-Company Quality-Growth (MQG)
Small-Cap (S-CAP)
Large-Company High-Yield (LHY)
Small-Company High-Growth (SHG)
Small-Cyclical (S-CYC)
Large-Company Quality-Growth (LQG)

Exhibit 1 is interesting in many respects. For instance, it reveals that the high-dividend yield stocks of both small and large firms (SHY and LHY) have common investment characteristics. Fama and French [1992] focus on the long-term return importance of small firms with low stock price-to-book value ratios. A look at this table indicates that large high-yield (LHY) stocks also have low price relative characteristics like the small high-yield (SHY) stocks.

At 13.47 and 1.54, the small high-yield (SHY) stocks have comparably low price-to-earnings and price-to-book value ratios, respectively. These stocks have a relatively low (five-year) earnings growth rate (12.91%), and an average beta value less than unity. Large high-yield stocks (LHY), with a price-to-earnings ratio of 10.81 and price-to-book value ratio of 1.4, also have relatively low price relative fundamentals. Taken together, these observations seem to indicate that dividend yield is one "common factor" to these small- and large-firm portfolios.

Exhibit 1 also enables some other interesting comparisons concerning the growth stocks of different size firms. Both medium-quality growth (MQG) and large-quality growth (LQG) firms have comparable price-to-earnings (at 16.10 and 14.36) and price-to-book (at 2.12 and 2.27) ratios. The growth stocks have similar (five-year) earnings growth rates (at 14%), and beta values just above unity. Moreover, the small-company stock portfolios, such as emerging growth (EG) and small-company high-growth (SHG), have relatively high price relatives, with beta values in excess of 1.2.

A HISTORICAL PERSPECTIVE ON RETURN AND RISK 1980-1992

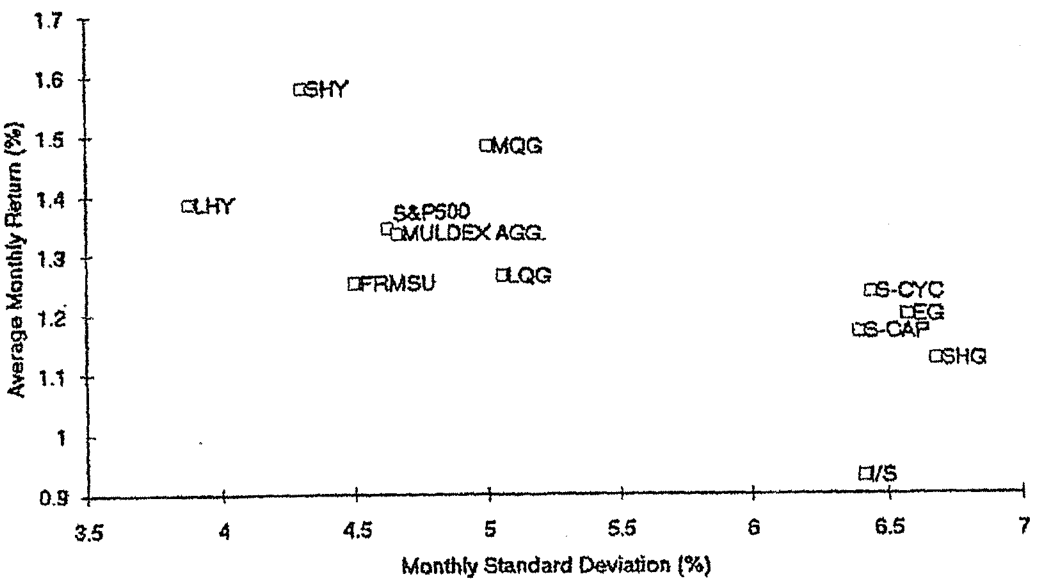
Exhibit 2 reports the average monthly returns, standard deviations, and coefficients of variation for the MULDEX return series for the period from January

EXHIBIT 2
Monthly Performance of U.S. Equity Portfolios
January 1980–December 1992

Portfolio	Average Monthly Return (%)	Standard Deviation of Return (%)	Coefficient of Variation
S&P 500	1.345	4.622	3.44
FRMSU	1.253	4.497	3.59
MULDEX AGG.	1.336	4.656	3.49
EG	1.199	6.570	5.48
SHY	1.580	4.298	2.72*
MQG	1.482	4.997	3.37
S-CAP	1.170	6.390	5.46
LHY	1.386	3.876	2.80*
SHG	1.124	6.674	5.94
S-CYC	1.237	6.435	5.20
LQG	1.265	5.053	3.99

*Lowest of CV (risk/reward) values shown.

EXHIBIT 3
MONTHLY PERFORMANCE OF U.S. EQUITY CLASSES
JANUARY 1980-DECEMBER 1992 (RELATIVE TO I/S HISTORICAL)*



*Ibbotson/Sinquefield average monthly return on the S&P 500 of 0.93% (11.2% yearly), with a historical monthly return standard deviation of 6.41% (22.2% per year) during the 1926-1978 period.

1980 through December 1992. Market return performance as measured by the S&P 500, the MULDEX aggregate, and the BARRA FRMSU universe is also shown in this table. Average returns and standard deviations on the various equity portfolios are graphed in Exhibit 3.[3]

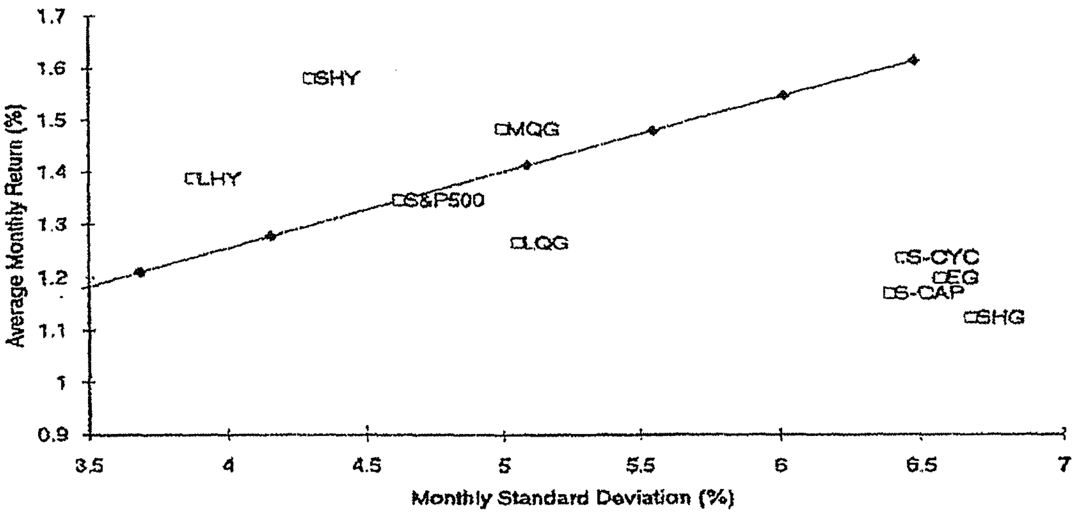
These two exhibits indicate that the 1980s was an exciting time for investing in the stock market. All eight equity MULDEX portfolios have positive average monthly returns, ranging from a low of 1.124% for the small-company high-growth (SHG) portfolio to a high of 1.58% per month for the small-company high-yield portfolio (SHY).

In addition, the stock market experience during this decade readily outperforms the long-term average return performance on the S&P 500 as calculated by Ibbotson and Sinquefield [1979] for the fifty-three-year period spanning 1926 to 1978. With an average monthly return of about 1.34% during the 1980-1992 period, both the S&P 500 and the MULDEX aggregate portfolios outperform the historical return average (fifty-three-year) of 0.93% per month (or 11.2% yearly) for the S&P.[4]

Another look at Exhibits 2 and 3 indicates that the highest average monthly returns during the past decade come from the low-risk (standard deviation) stocks of both small and large high-yield firms, while the lowest (positive) average returns are earned on the high-volatility portfolios consisting of small-company growth stocks. Both the large-company high-yield (LHY) and small-company high-yield (SHY) portfolios outperform the S&P 500 average monthly return of 1.345% for the 1980-1992 period (as well as the broader return averages on the MULDEX aggregate and BARRA's FRMSU).

In fact, with coefficients of variation (Exhibit 2) at 2.72 and 2.80, respectively, these high-yield portfolios (SHY and LHY) earn abnormally high rewards in the presence of relatively low return standard deviations. The coefficient of variation estimates for the yield portfolios are considerably lower than the 3.5 figure for the various market return indexes.

EXHIBIT 4
MONTHLY PERFORMANCE OF U.S. EQUITY CLASSES
JANUARY 1980-DECEMBER 1992 (RELATIVE TO TWO-ASSET EFFICIENT FRONTIER)*



*The two-asset efficient frontier consists of efficient combinations of U.S. Treasury bills (ninety-day) and the S&P 500 using average monthly returns and standard deviations calculated over the 1980-1992 period. The average portfolio return and risk points for the (ex post) curve are shown in the Appendix.

Exhibits 2 and 3 also show that the lowest positive average returns during the 1980-1992 period were earned on the high-risk portfolios consisting of small-company growth stocks. The emerging growth (EG), small-cap (S-CAP), small-company high-growth (SHG), and the small cyclicals (S-CYC) portfolios all experience low positive average monthly returns in view of return standard deviations in excess of 6% per month (or 20.79% annually).

This high risk-low average return anomaly is also reinforced in Exhibit 2 by the small-company growth portfolios having coefficients of variation ranging from 5.20 for the small cyclicals (S-CYC) to 5.94 for the small-company high-growth (SHG) portfolio. Moreover, these volatility/reward estimates are substantially higher than the corresponding values (about 3.5) for the various market return series.

The return/risk anomaly for common stocks during the past thirteen years can also be examined in the context of a two-asset efficient frontier. Exhibit 4 shows the location of the eight MULDEX equity portfolios relative to (ex post) efficient combinations of U.S. Treasury bills (ninety-day) and the S&P 500 for the 1980-1992 monthly reporting period.

The low-volatility high-yield stocks of both small and large firms (SHY and LHY) plot to the left of the market index and above the efficient frontier. In contrast, the high-risk growth stocks of small firms (EG and SHG, for example) plot to the right of the S&P 500, and below points on the frontier that represent highly leveraged (return/risk) combinations of the U.S. market portfolio with Treasury bills.

Although the return volatility on the medium-company quality-growth (MQG) portfolio exceeds that for the market portfolio, its added reward more than compensates investors for the higher risk. Hence, this portfolio lies to the right of the S&P 500, and above the two-asset efficient frontier.[5]

Finally, Exhibit 5 sheds some more light on the relationship between average rewards on common stocks and investment risk during the past decade. Exhibit 5 shows a strong negative association between average monthly returns on the MULDEX benchmark portfolios and traditional measures of risk, including beta and return standard deviation. Correlation values between average monthly returns and the two risk measures are –0.75 and –0.828, respectively.

It is also interesting to note the high positive correlation in Exhibit 5 between total portfolio risk (return standard deviation) and market risk (beta) for the eight U.S. equity return series. The strongly positive correlation of 0.941 is consistent with the view that market risk (beta) captures a large portion of total portfolio return volatility.

INVESTMENT IMPLICATIONS OF THE RESEARCH FINDINGS

The empirical evidence on common stock returns during the 1980-1992 period raises a number of challenging questions for investors making decisions for the future.

Since average returns on the market portfolio as measured by the S&P 500 have exceeded 15% only in the 1920s and 1950s (using decade reporting periods from Ibbotson Associates), one wonders whether the 16.14% annualized performance (Exhibit 2) on this market proxy can continue into the next decade. One possibility is that general market performance for the rest of the 1990s will revert to the long-term (arithmetic) average return of 12.4% as reported by Ibbotson Associates for the sixty-seven-year period ending in 1992.

It is also important to ask whether high-yield stocks of both small and large firms will continue to show promising risk-adjusted rewards for the future. Part of the answer to this question lies in understanding why these low-risk stocks outperformed the various market return series including the S&P 500, the MULDEX aggregate, and BARRA's FRMSU over the past thirteen years. A number of considerations seem relevant in answering this question.

With long-term interest rates falling by 6% or more during the 1980-1992 period, it is reasonable to expect that windfall gains in the bond market would convey price gains to those stocks with fixed-income characteristics — namely, the equity investments of both small and large high-yield firms. If Jensen's [1989] argument is largely correct, then firms that pay out their "free cash flow" (dividends) would also provide abnormal rewards to investors. Indeed, these current payouts would be a positive growth signal to shareholders in an era of corporate restructuring through mergers and acquisitions.

In addition, since the Tax Reform Act of 1986 increased the tax rate on capital gains to the rate of personal taxation (on dividends), it is also possible that some of the unusual performance of yield stocks is related to a positive shift in the attractiveness of income stocks over growth stocks — which, by definition, are more capital gain-intensive. A flight to both income-producing and low-risk equities (LHY and SHY) is also likely to have occurred in the aftermath of the stock market crash of October 1987.

Moreover, demographic shifts in the aging profile of investors may help to partially explain the relative benefits of income-producing stocks of both small and large firms during the recent decade. A joint assessment of the economic importance of all of these considerations would be helpful in predicting the return performance of the high-yield (SHY and LHY) stocks for the 1990s and beyond.

EXHIBIT 5

Correlations of Average Returns and Risk Measures on U.S. Equity Portfolios January 1980-December 1992*

	Average Return	Standard Deviation
Standard Deviation	–0.828	
Beta	–0.750	0.941

*For the eight U.S. equity portfolios constituting MULDEX.

APPENDIX

Data for Two-Asset Efficient Frontier*

T-Bill	S&P 500	Average Return	Standard Deviation
100%	0%	0.67090%	0.24580%
90	10	0.73831	0.48820
80	20	0.80572	0.92201
70	30	0.87313	1.37685
60	40	0.94054	1.83717
50	50	1.00795	2.29968
40	60	1.07536	2.76328
30	70	1.14277	3.22749
20	80	1.21018	3.69210
10	90	1.27759	4.15696
0	100	1.34500	4.62200
–10	110	1.41241	5.08717
–20	120	1.47982	5.55244
–30	130	1.54723	6.01778
–40	140	1.61464	6.48319

*Data for the two-asset efficient frontier is based on a return correlation of –0.11849 between U.S. Treasury bills (ninety-day) and the S&P 500 using monthly returns for the January 1980 to December 1992 period.

Finally, if one fundamentally believes that stock returns should be positively related to investment risk (as measured by beta or standard deviation of return) then reward predictions on equity portfolios are quite clear. In particular, the average returns earned on the high-yield stocks of various size firms (SHY and LHY in Exhibit 4) should decline over time, while the average returns of small-company growth stocks (EG and SHG, for example) should rise to restore the positive trade-off between investment returns and risk.

On the other hand, if the traditional measurement of risk is misspecified, then portfolio selection will be somewhat of a quandary until investors obtain a better understanding of the true return-generating process of capital market equilibrium. And here may be a future role for multiple-factor models.

ENDNOTES

The author acknowledges helpful discussions on return and risk linkages with Paul Price, Vice President, State Street Bank and Trust Company.

Monthly return information on multiple equity (MULDEX) indexes for the 1980-1992 period is provided by State Street Global Advisors. Research assistance from Susan Rodd at the Simmons Graduate School of Management and Kevin Cahalane, Senior Analyst at State Street Bank, is also acknowledged and appreciated.

[1]In a major long-term study using common stock returns during the 1941-1990 period, Fama and French [1992] conclude that the traditionally celebrated CAPM relationship between average returns and beta risk is "weak," and "perhaps nonexistent."

They also find that "two easily measured variables" including size (market equity) and price-to-book value provide a "simple and powerful characterization of the cross-section of average stock returns for the 1963-1990 period."

[2]The investment fundamentals shown in Exhibit 1 were calculated by State Street Global Advisors. The MULDEX modules are largely used to provide benchmarks for the performance evaluation of money managers.

A practical discussion on how to use the multifactor BARRA E2 model is provided by Fogler [1990].

[3]FRMSU is the BARRA universe of about 1,300 "high-cap" stocks. The FRMS notation refers to the Fundamental Risk Measurement Service, which is the statistical arm of BARRA.

[4]The historical (Ibbotson-Sinquefield) return volatility on the S&P 500 of 6.4% per month in Exhibit 3 is considerably higher than the 4.6% risk estimate for this market index during the January 1980 to December 1992 period. Grant [1990] shows, however, that common stock return volatility was abnormally high during the October crash of 1987.

[5]Growth per se, however, is not the one "common factor" that led to abnormal investment performance during the 1980-1992 period.

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"Stocks, Bonds, Bills, and Inflation — 1992 Yearbook." Chicago: Ibbotson Associates, 1992.

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 230
Witness: Don Murry

Data Request:

With respect to page 41, lines 1-14, please provide (a) copies of all studies that support the use of After Tax Interest Coverage as a test for the allowed return on common equity, (b) all data, work papers, and calculations used in the theoretical Interest Coverage calculations for Atmos, and (c) all data, work papers, and calculations used in the actual Interest Coverage calculations for the comparable companies. Please provide the data in both paper and electronic (Microsoft Excel) formats. For the electronic version, please keep all data and equations intact.

Response:

a. The times interest earned statistic is a very common measure of financial health of a company, and Dr. Murry has noted in his experience that many analysts have used it in regulatory analysis. He does not have copies of all studies that support the use of this statistic in this way.

b. Dr. Murry performed no "theoretical" Interest Coverage calculations.

c. Please reference the document attached hereto and labeled AG DR1-230 ATT, as well as the response to AG 1-231.

AGL RESOURCES NYSE-ATG

RECENT PRICE	35.97	P/E RATIO	14.2 (Trailing: 13.3 / Median: 14.0)	RELATIVE P/E RATIO	0.84	DIV'D YLD	4.2%	VALUE LINE	460

TIMELINESS 4 Lowered 8/11/06
SAFETY 2 New 7/27/90
TECHNICAL 3 Lowered 9/1/06
BETA .95 (1.00 = Market)

2009-11 PROJECTIONS

	Price	Gain	Ann'l Total Return
High	50	(+40%)	12%
Low	40	(+10%)	7%

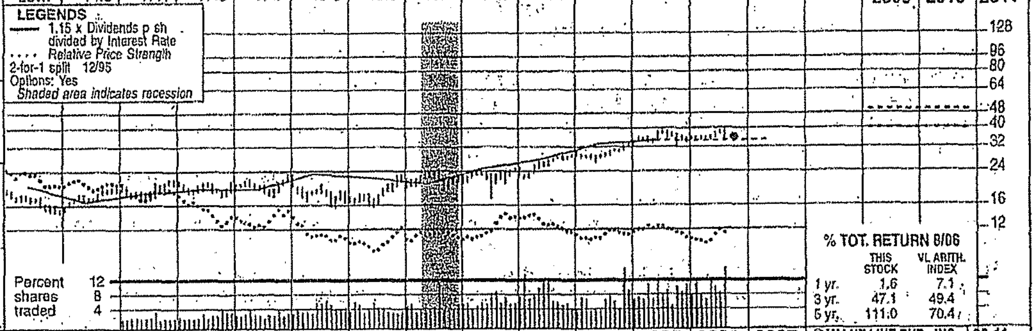
Insider Decisions

	O	N	D	J	F	M	A	M	J
to Buy	0	0	0	0	0	0	0	0	0
Options	1	2	1	0	1	1	0	0	0
to Sell	1	1	1	0	0	1	0	0	0

Institutional Decisions

	4Q2005	1Q2006	2Q2006
to Buy	109	110	95
to Sell	88	83	102
Hld's(000)	49186	45106	49525

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
High:	20.0	22.0	21.6	23.4	23.4	23.2	24.5	25.0	29.3	33.7	39.3	40.0
Low:	14.9	17.1	17.8	17.7	15.6	15.5	19.0	17.3	21.9	26.5	32.0	34.4



Target Price Range

2009	2010	2011

% TOT. RETURN 8/06

	THIS STOCK	VL ARITH. INDEX
1 yr.	1.6	7.1
3 yr.	47.1	49.4
5 yr.	111.0	70.4

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	© VALUE LINE PUB., INC.	09-11
22.58	20.26	20.43	22.73	23.59	19.32	21.91	22.75	23.36	18.71	11.25	19.04	15.32	15.25	23.89	34.98	35.55	36.10	Revenues per sh A	38.45
2.04	2.07	2.31	2.25	2.24	2.33	2.49	2.42	2.65	2.29	2.86	3.31	3.39	3.47	3.29	4.20	4.40	4.50	"Cash Flow" per sh	4.85
1.01	1.04	1.13	1.08	1.17	1.33	1.37	1.37	1.41	.91	1.29	1.50	1.82	2.08	2.28	2.48	2.65	2.70	Earnings per sh A B	2.95
.98	1.02	1.03	1.04	1.04	1.04	1.06	1.08	1.08	1.08	1.08	1.08	1.08	1.11	1.15	1.30	1.50	1.58	Div'ds Decl'd per sh C■	1.75
2.73	2.85	2.74	2.49	2.37	2.17	2.37	2.59	2.05	2.51	2.92	2.83	3.30	2.46	3.44	3.44	2.80	3.10	Cap'l Spending per sh	2.25
8.97	9.42	9.70	9.90	10.19	10.12	10.56	10.99	11.42	11.59	11.50	12.19	12.52	14.66	18.06	19.29	20.40	21.50	Book Value per sh D	24.80
44.32	47.57	48.69	49.72	50.86	55.02	55.70	56.60	57.30	57.10	54.00	55.10	56.70	64.50	76.70	77.70	77.90	78.00	Common Shs Outst'g E	78.30
14.2	15.9	15.5	17.9	15.1	12.6	13.8	14.7	13.9	21.4	13.6	14.6	12.5	12.5	13.1	14.3	Bold figures are		Avg Ann'l P/E Ratio	15.0
1.05	.98	.94	1.06	.99	.84	.86	.85	.72	1.22	.88	.75	.68	.71	.69	.76	Value Line		Relative P/E Ratio	1.00
6.8%	6.4%	5.9%	5.4%	5.9%	6.2%	5.6%	5.4%	5.5%	5.5%	6.2%	4.9%	4.7%	4.3%	3.9%	3.7%	estimates		Avg Ann'l Div'd Yield	4.0%

CAPITAL STRUCTURE as of 6/30/06
Total Debt 2087.0 mill. Due in 5 Yrs $530.0 mill.
LT Debt $1632.0 mill. LT Interest $100.0 mill.

(Total interest coverage: 4.4x)
Leases, Uncapitalized Annual rentals $27.0 mill.

Pension Assets-12/05 $371.0 mill.
Oblig. $464.0 mill.

Pfd Stock None
Common Stock 77,878,889 shs.
as of 7/31/06

MARKET CAP: $2.8 billion (Mid Cap)

1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	© VALUE LINE PUB., INC.	09-11
1220.2	1287.6	1338.6	1068.6	607.4	1049.3	868.9	983.7	1832.0	2718.0	2770	2815	Revenues ($mill) A	3010
75.6	76.6	80.6	52.1	71.1	82.3	103.0	132.4	153.0	193.0	205	210	Net Profit ($mill)	230
38.6%	37.9%	32.5%	33.1%	34.3%	40.7%	36.0%	35.9%	37.0%	37.7%	38.0%	38.0%	Income Tax Rate	38.0%
6.2%	5.9%	6.0%	4.9%	11.7%	7.8%	11.9%	13.5%	8.4%	7.1%	7.5%	7.5%	Net Profit Margin	7.7%
46.2%	48.7%	47.5%	45.3%	45.9%	61.3%	58.3%	50.3%	54.0%	51.9%	51.0%	50.0%	Long-Term Debt Ratio	48.5%
48.9%	45.9%	47.1%	49.2%	48.3%	38.7%	41.7%	49.7%	46.0%	48.1%	49.0%	50.0%	Common Equity Ratio	51.5%
1201.3	1356.4	1308.4	1345.8	1286.2	1736.3	1704.3	1901.4	3009.0	3114.0	3225	3310	Total Capital ($mill)	3775
1415.4	1496.6	1534.0	1598.9	1637.5	2058.9	2194.2	2352.4	3178.0	3271.0	3350	3450	Net Plant ($mill)	3750
8.0%	7.3%	7.6%	5.7%	7.4%	6.5%	8.1%	8.9%	6.9%	7.9%	8.0%	8.0%	Return on Total Cap'l	7.5%
11.7%	11.0%	11.1%	7.1%	10.2%	12.3%	14.5%	14.0%	11.0%	12.9%	13.0%	12.5%	Return on Shr. Equity	12.0%
12.1%	11.3%	12.3%	7.9%	11.5%	12.3%	14.5%	14.0%	11.0%	12.9%	13.0%	12.5%	Return on Com Equity	12.0%
3.8%	3.2%	4.4%	NMF	3.2%	4.2%	7.0%	6.6%	5.6%	6.2%	5.5%	5.5%	Retained to Com Eq	5.0%
71%	74%	64%	101%	72%	65%	52%	53%	49%	52%	57%	58%	All Div'ds to Net Prof	59%

CURRENT POSITION ($MILL.)	2004	2005	6/30/06
Cash Assets	49.0	30.0	37.0
Other	1408.0	2002.0	1471.0
Current Assets	1457.0	2032.0	1508.0
Accts Payable	207.0	264.0	566.0
Debt Due	334.0	522.0	455.0
Other	936.0	1153.0	329.0
Current Liab.	1477.0	1939.0	1350.0
Fix. Chg. Cov.	510%	442%	470%

ANNUAL RATES of change (per sh)	Past 10 Yrs.	Past 5 Yrs.	Est'd '03-'05 to '09-'11
Revenues	1.0%	7.0%	7.5%
"Cash Flow"	5.0%	7.0%	5.0%
Earnings	6.5%	13.5%	4.5%
Dividends	1.5%	2.0%	6.5%
Book Value	5.5%	8.5%	6.0%

Calendar	QUARTERLY REVENUES ($ mill.) A Mar.31	Jun.30	Sep.30	Dec.31	Full Year
2003	352.5	186.6	166.3	278.3	983.7
2004	651.0	294.0	262.0	625.0	1832.0
2005	908.0	430.0	387.0	993.0	2718.0
2006	1047.0	436.0	405	882	2770
2007	970	480	465	900	2815

Calendar	EARNINGS PER SHARE A B Mar.31	Jun.30	Sep.30	Dec.31	Full Year
2003	.98	.29	.27	.54	2.08
2004	1.00	.33	.31	.64	2.28
2005	1.14	.30	.19	.85	2.48
2006	1.41	.25	.27	.72	2.65
2007	1.30	.37	.29	.74	2.70

Calendar	QUARTERLY DIVIDENDS PAID C■ Mar.31	Jun.30	Sep.30	Dec.31	Full Year
2002	.27	.27	.27	.27	1.08
2003	.27	.28	.28	.28	1.11
2004	.28	.29	.29	.29	1.15
2005	.31	.31	.31	.37	1.30
2006	.37	.37	.37		

BUSINESS: AGL Resources, Inc. is a public utility holding company. Its distribution subsidiaries are Atlanta Gas Light, Chattanooga Gas, and Virginia Natural Gas. The utilities have more than 2.2 million customers in Georgia (primarily Atlanta), Virginia, and in southern Tennessee. Also engaged in nonregulated natural gas marketing and other, allied services. Also wholesales and retails propane. Nonregulated subsidiaries: Georgia Natural Gas Services markets natural gas at retail. Acq. Virginia Natural Gas, 10/00. Sold Utilipro, 3/01. Off./dir. own less than 1.0% of common; Goldman Sachs, 5.5%; JPMorgan, 5.9% (3/06 Proxy). Pres. & CEO: John W. Somerhalder II. Inc.: GA. Addr.: 10 Peachtree Place N.E., Atlanta, GA 30309. Tel.: 404-584-4000. Internet: www.aglresources.com.

AGL Resources' utility business performed well despite warmer-than-normal temperatures and conservation by customers. Earnings before interest and taxes increased $7 million versus the year-ago period, driven by a $6 million decrease in operating expenses. This can be attributed to last year's workforce and facilities restructuring programs. Also, operation and maintenance expenses per customer throughout AGL's distribution segment decreased 9% over the first six months of 2006. However, these results were offset by a lackluster performance at SouthStar, which markets natural gas and related services to retail customers on an unregulated basis, where results were also impacted by lower customer usage and higher bad debt expense.

Virginia Natural Gas (VNG) has accepted a modified performance-based rate plan. As part of the deal, VNG will freeze its base rates for five years; construct a pipeline to connect its northern and southern systems, which is expected to cost about $48 million to $60 million; and will be allowed to file for a permanent weather normalization plan. Also, Chattanooga Gas filed for a $5.8 million rate increase with the Tennessee Regulatory Authority to cover rising costs of financing its operations and lower consumption of natural gas. The proposal includes a plan to better align its interest with customers, by adjusting rates annually based on actual consumption versus an assumed level. We think Chattanooga will receive some, if not all, of the rate increase, which should provide a boost to earnings.

AGL's expansion of its Jefferson Island storage facility has hit a road block. In early August, the Louisiana Department of Natural Resources terminated the company's mineral lease due to the timing of leasehold payments and a lack of mining activity on the site for six months. Even so, the company remains committed to resolving these issues and getting the project completed, which will increase working gas capacity, along with revenues.

This neutrally ranked stock has worthwhile total return potential, thanks partly to dividend growth prospects. The good-quality shares are safe and steady, but not overly enticing.

Evan I. Blatter *September 15, 2006*

(A) Fiscal year ends December 31st. Ended September 30th prior to 2002.
(B) Diluted earnings per share. Excl. nonrecurring gains (losses): '95, d$0.83; '99, $0.39; '00, $0.13; '01, $0.13; '03, d$0.07. Next earnings report due late Oct.
(C) Dividends historically paid early March, June, Sept, and Dec. ■ Div'd reinvest. plan available.
(D) Includes intangibles. In 2005: $422 million, $5.43/share.
(E) In millions, adjusted for stock split.

Company's Financial Strength	B++
Stock's Price Stability	95
Price Growth Persistence	70
Earnings Predictability	75

NEW JERSEY RES. NYSE-NJR

RECENT PRICE 49.55 | P/E RATIO 20.6 (Trailing: 16.2; Median: 15.0) | RELATIVE P/E RATIO 1.21 | DIV'D YLD 2.9% | VALUE LINE 465

TIMELINESS 4 Raised 2/17/06

SAFETY 1 Raised 9/15/06

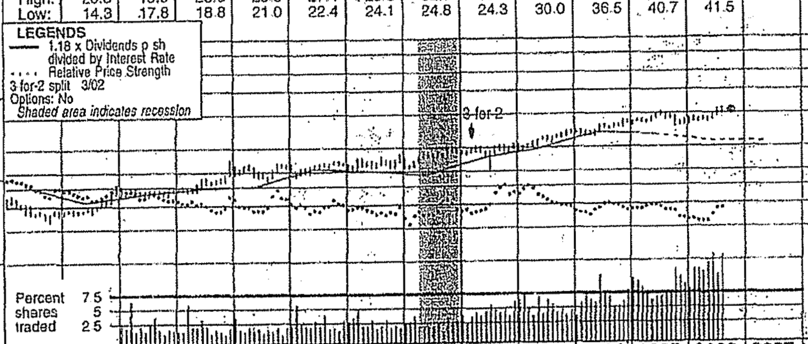
TECHNICAL 2 Raised 8/25/06

BETA .80 (1.00 = Market)

High:	20.3	19.9	28.0	26.8	27.4	29.8	32.5	33.6	39.5	44.6	49.3	51.4
Low:	14.3	17.8	18.8	21.0	22.4	24.1	24.8	24.3	30.0	36.5	40.7	41.5

Target Price Range 2009 | 2010 | 2011

LEGENDS
— 1.18 x Dividends p sh divided by Interest Rate
.... Relative Price Strength
3-for-2 split 3/02
Options: No
Shaded area indicates recession



2009-11 PROJECTIONS

	Price	Gain	Ann'l Total Return
High	60	(+20%)	8%
Low	50	(Nil)	3%

Insider Decisions

	O	N	D	J	F	M	A	M	J
to Buy	0	0	0	0	0	0	0	0	0
Options	1	4	0	0	5	0	0	2	0
to Sell	1	4	0	0	4	0	0	2	0

Institutional Decisions

	4Q2005	1Q2006	2Q2006
to Buy	64	71	73
to Sell	60	52	60
Hld's(000)	13455	14778	16255

Percent shares traded 75 / 50 / 25

% TOT. RETURN 8/06

	THIS STOCK	VL ARITH. INDEX
1 yr.	9.2	7.1
3 yr.	51.6	49.4
5 yr.	95.0	70.4

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	© VALUE LINE PUB., INC.	09-11
16.01	15.99	16.88	18.02	19.22	17.03	20.22	25.97	26.59	33.98	44.13	76.82	66.17	93.43	91.33	114.29	117.45	120.60	Revenues per sh A	129.80
1.54	1.58	1.95	2.14	2.31	2.13	2.22	2.45	2.60	2.79	2.99	3.18	3.21	3.58	3.75	3.92	4.00	4.20	"Cash Flow" per sh	4.70
.65	.55	1.09	1.15	1.26	1.29	1.37	1.48	1.55	1.66	1.79	1.95	2.09	2.38	2.55	2.65	2.80	2.90	Earnings per sh B	3.30
.96	1.00	1.01	1.01	1.01	1.01	1.03	1.07	1.09	1.12	1.15	1.17	1.20	1.24	1.30	1.36	1.45	1.50	Div'ds Decl'd per sh C■	1.70
4.37	2.91	1.99	2.31	2.10	1.77	1.78	1.72	1.60	1.81	1.85	1.66	1.53	1.71	2.17	1.92	1.80	1.95	Cap'l Spending per sh	2.10
8.85	8.57	9.44	9.81	9.64	9.70	10.10	10.38	10.88	11.35	12.43	13.20	13.06	15.38	16.87	15.90	17.45	18.80	Book Value per sh	23.15
20.28	20.95	24.43	25.23	25.95	26.69	27.13	26.82	26.72	26.61	26.39	26.66	27.67	27.23	27.74	27.55	28.10	28.20	Common Shs Outst'g D	28.50
24.0	22.3	12.4	15.1	13.0	11.7	13.6	13.5	15.3	15.2	14.7	14.2	14.7	14.0	15.3	16.8	Bold figures are		Avg Ann'l P/E Ratio	17.0
1.78	1.42	.75	.89	.85	.78	.85	.78	.80	.87	.96	.73	.80	.80	.81	.90	Value Line		Relative P/E Ratio	1.15
6.2%	8.1%	7.5%	5.8%	6.2%	6.7%	5.6%	5.3%	4.6%	4.5%	4.4%	4.2%	3.9%	3.7%	3.3%	3.1%	estimates		Avg Ann'l Div'd Yield	3.0%

1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007		09-11
548.5	696.5	710.3	904.3	1164.5	2048.4	1830.8	2544.4	2533.6	3148.3	3300	3400	Revenues ($mill) A	3700
38.7	41.5	43.3	44.9	47.9	52.3	56.8	65.4	71.6	74.4	80.0	82.0	Net Profit ($mill)	95.0
32.6%	33.3%	30.4%	36.2%	37.8%	38.0%	38.7%	39.4%	39.1%	39.1%	39.0%	39.0%	Income Tax Rate	40.0%
7.1%	6.0%	6.1%	5.0%	4.1%	2.6%	3.1%	2.6%	2.8%	2.4%	2.4%	2.4%	Net Profit Margin	2.5%
50.7%	49.3%	51.2%	48.7%	47.0%	50.1%	50.6%	38.1%	40.3%	42.0%	42.0%	41.0%	Long-Term Debt Ratio	37.0%
45.8%	47.1%	45.6%	51.2%	52.9%	49.9%	49.4%	61.9%	59.7%	58.0%	58.0%	59.0%	Common Equity Ratio	63.0%
598.2	590.6	638.2	590.4	620.1	706.2	732.4	676.8	783.8	765.3	845	890	Total Capital ($mill)	1055
655.2	659.4	680.0	705.4	730.6	743.9	756.4	852.6	880.4	905.1	935	970	Net Plant ($mill)	1120
8.1%	8.6%	8.1%	9.0%	9.0%	8.5%	8.7%	10.7%	10.1%	11.2%	10.5%	10.5%	Return on Total Cap'l	10.5%
13.1%	13.9%	13.9%	14.8%	14.6%	14.8%	15.7%	15.6%	15.3%	17.0%	16.0%	15.5%	Return on Shr. Equity	14.5%
13.5%	14.3%	14.4%	14.8%	14.6%	14.9%	15.7%	15.6%	15.3%	17.0%	16.0%	15.5%	Return on Com Equity	14.5%
3.4%	4.0%	4.4%	5.0%	5.4%	6.1%	6.9%	7.7%	7.8%	8.5%	8.0%	7.5%	Retained to Com Eq	7.0%
76%	73%	71%	67%	63%	59%	56%	51%	49%	50%	52%	52%	All Div'ds to Net Prof	52%

CAPITAL STRUCTURE as of 6/30/06
Total Debt $490.8 mill. Due in 5 Yrs $250.0 mill.
LT Debt $333.8 mill. LT Interest $22.0 mill.
Incl. $6.9 mill. capitalized leases.
(LT interest earned: 5.5x; total interest coverage: 4.8x)

Pension Assets-9/05 $82.6 mill. Oblig. $99.9 mill.

Pfd Stock None

Common Stock 28,080,314 shs. as of 8/8/06

MARKET CAP: $1.4 billion (Mid Cap)

CURRENT POSITION ($MILL.)	2004	2005	6/30/06
Cash Assets	5.0	25.0	4.7
Other	681.0	927.8	808.7
Current Assets	686.0	952.8	813.4
Accts Payable	42.9	54.7	38.0
Debt Due	287.4	177.4	157.0
Other	357.4	744.2	510.4
Current Liab.	687.7	976.3	705.4
Fix. Chg. Cov.	626%	660%	700%

ANNUAL RATES of change (per sh)	Past 10 Yrs.	Past 5 Yrs.	Est'd '03-'05 to '09-'11
Revenues	18.5%	23.5%	4.5%
"Cash Flow"	5.5%	6.0%	4.0%
Earnings	7.5%	8.5%	4.5%
Dividends	2.5%	3.0%	4.5%
Book Value	5.0%	7.0%	6.5%

Fiscal Year Ends	QUARTERLY REVENUES ($ mill.) A Dec.31	Mar.31	Jun.30	Sep.30	Full Fiscal Year
2003	668.9	1152.7	369.7	353.1	2544.4
2004	643.0	1037.7	438.5	414.4	2533.6
2005	854.0	1065.1	544.3	684.9	3148.3
2006	1164.6	1064.4	536.1	534.9	3300
2007	1085	1150	610	555	3400

Fiscal Year Ends	EARNINGS PER SHARE A B Dec.31	Mar.31	Jun.30	Sep.30	Full Fiscal Year
2003	.85	1.50	.16	d.13	2.38
2004	.87	1.82	.06	d.20	2.55
2005	.91	1.84	.07	d.17	2.65
2006	1.23	2.14	d.14	d.43	2.80
2007	1.13	1.84	.10	d.17	2.90

Cal-endar	QUARTERLY DIVIDENDS PAID C■ Mar.31	Jun.30	Sep.30	Dec.31	Full Year
2002	.30	.30	.30	.30	1.20
2003	.31	.31	.31	.31	1.24
2004	.325	.325	.325	.325	1.30
2005	.34	.34	.34	.34	1.36
2006	.36	.36	.36		

BUSINESS: New Jersey Resources Corp. is the holding company for New Jersey Natural Gas Co., a natural gas utility (about 463,000 customers at 9/30/05) in Monmouth, Ocean, and parts of other N.J. counties. Fiscal 2005 volume: 124.7 bill. cu. ft. (50% firm, 8% interruptible industrial and electric utility, 42% off-system and capacity release). New Jersey Natural Energy subsid. provides unregulated retail and wholesale natural gas and related energy services to customers in 17 states. 2005 deprec rate: 2.8%. Est'd plant age: 8 years. Has 551 utility employees, 16,300 stckhldrs. Off & dir. own about 3% of common stock (12/05 Proxy). Chairman and CEO: Laurence M. Downes. Inc.: N.J. Address: 1415 Wyckoff Road, Wall, NJ 07719. Tel.: 732-938-1000. Internet: www.njliving.com.

New Jersey Resources results over the first nine months of fiscal 2006 (year ends September 30th) have been solid. Earnings over this timeframe increased about 14.5%, to $3.23 a share, with most of the gains being driven by an improved performance at the company's energy services subsidiary. In fact, the segment posted an earnings advance of about 90% this year due to growth in its portfolio of storage and transportation contracts. Since the unit covers many markets in the eastern half of the United States and Canada, it is able to capture additional value when prices fluctuate between regions. All told, the business now represents over 20% of corporate earnings.

The third quarter was a weak one at the company's main subsidiary, New Jersey Natural Gas (NJNG). It posted earnings of $1.7 million, well below the $3.9 million in the year-earlier period. The decrease was primarily the result of conservation by customers. The utility currently has a weather normalization plan in place to protect against temperatures that are warmer than normal, though, it is unable to protect against lower usage. Therefore, in December, NJNG proposed a plan with the New Jersey Board of Public utilities to implement a conservation usage adjustment (CUA) plan to replace the normalization policy, which would provide protection against both temperature and usage changes. Management remains optimistic that the program will be approved and be in place by next winter's heating season. However, should regulatory approval not be granted, the company is exploring alternatives that includes filing for a rate increase. Meanwhile, the utility added about 7,870 new customers through the third quarter, and will likely grow at a rate above the industry average for the next few years thanks to the strong demographics of the region NJNG serves. About a third of new customers are conversions from other fuel sources.

Though untimely, this stock offers decent total return potential. This is largely due to expanding profits from its nonutility operations. Other pluses include the likelihood of a more consistent earnings stream through the CUA proposal, and steady dividend increases.

Evan I. Blatter — *September 15, 2006*

(A) Fiscal year ends Sept. 30th.
(B) Diluted earnings. Next earnings report due late Oct.
(C) Dividends historically paid in early January, April, July, and October. ■ Dividend reinvestment plan available.
(D) In millions, adjusted for split.

Company's Financial Strength	A
Stock's Price Stability	100
Price Growth Persistence	85
Earnings Predictability	100

NICOR, INC. NYSE-GAS

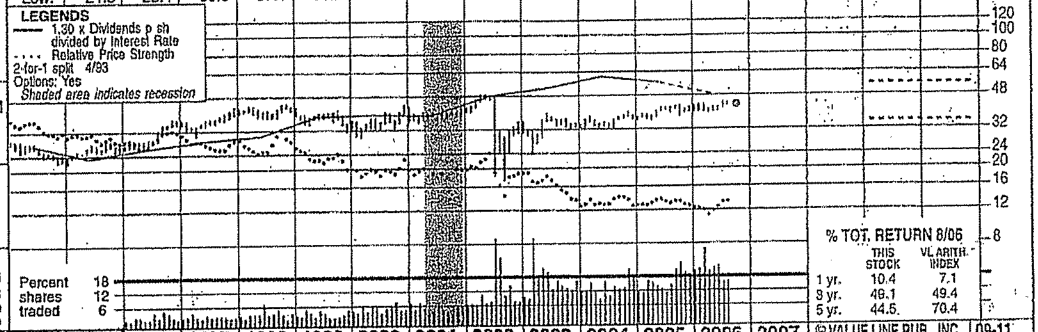
RECENT PRICE	43.05	P/E RATIO	17.2 (Trailing: 18.6; Median: 14.0)	RELATIVE P/E RATIO	1.01	DIV'D YLD	4.3%	VALUE LINE	466

MELINESS 3 Raised 7/7/06
SAFETY 3 Lowered 6/17/05
TECHNICAL 3 Raised 5/5/06
BETA 1.20 (1.00 = Market)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
High:	28.5	37.1	42.9	44.4	42.9	43.9	42.4	49.0	39.3	39.7	43.0	44.4
Low:	21.8	25.4	30.0	37.1	31.2	29.4	34.0	17.3	23.7	32.0	35.5	38.7

Target Price Range 2009 | 2010 | 2011

LEGENDS
—— 1.30 x Dividends p sh divided by Interest Rate
.... Relative Price Strength
2-for-1 split 4/93
Options: Yes
Shaded area indicates recession



2009-11 PROJECTIONS

	Price	Gain	Ann'l Total Return
High	55	(+30%)	10%
Low	35	(-20%)	Nil

Insider Decisions

	D	N	D	J	F	M	A	M	J
to Buy	1	0	0	1	0	0	1	0	0
Options	0	0	0	0	0	2	0	0	0
to Sell	0	0	0	0	0	2	0	0	0

Institutional Decisions

	4Q2005	1Q2006	2Q2006
to Buy	117	112	98
to Sell	97	94	110
Hld's(000)	30966	32581	32450

Percent shares traded 18 12 6

% TOT. RETURN 8/06

	THIS STOCK	VL ARITH. INDEX
1 yr.	10.4	7.1
3 yr.	49.1	49.4
5 yr.	44.5	70.4

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	© VALUE LINE PUB., INC.	09-11
26.52	26.46	28.90	31.02	31.23	29.42	37.39	41.33	30.84	34.45	50.52	57.30	43.11	60.46	62.12	76.00	*73.35*	*72.30*	Revenues per sh	*71.25*
3.86	3.92	4.14	3.80	4.11	4.19	4.97	5.29	5.21	5.59	6.16	6.41	6.03	5.37	6.00	6.19	*6.45*	*6.50*	"Cash Flow" per sh	*6.80*
1.93	1.86	1.92	1.97	2.07	1.96	2.42	2.55	2.31	2.57	2.94	3.01	2.88	2.11	2.22	2.27	*2.45*	*2.50*	Earnings per sh A	*2.80*
1.06	1.12	1.18	1.22	1.25	1.28	1.32	1.40	1.48	1.54	1.66	1.76	1.84	1.86	1.86	1.86	*1.86*	*1.92*	Div'ds Decl'd per sh B ■	*2.02*
3.00	3.65	3.12	2.62	3.34	3.12	2.42	2.34	2.87	3.28	3.48	4.18	4.37	4.12	4.32	4.57	*4.50*	*4.50*	Cap'l Spending per sh	*4.50*
11.67	12.28	12.76	13.05	13.26	13.67	14.74	15.43	15.97	16.80	15.56	16.39	16.55	17.13	16.99	18.36	*18.90*	*19.40*	Book Value per sh	*21.60*
57.93	57.30	55.77	53.96	51.54	50.30	49.49	48.22	47.51	46.89	45.49	44.40	44.01	44.04	44.10	44.18	*44.50*	*44.60*	Common Shs Outst'g C	*44.90*
10.7	11.5	11.6	14.1	12.5	13.1	12.5	14.2	17.6	14.6	11.9	12.8	13.1	15.8	15.9	17.3	*Bold figures are*		Avg Ann'l P/E Ratio	*16.0*
.79	.73	.70	.83	.82	.88	.78	.82	.92	.83	.77	.66	.72	.90	.84	.91	*Value Line*		Relative P/E Ratio	*1.05*
5.1%	5.2%	5.3%	4.4%	4.8%	5.0%	4.4%	3.9%	3.6%	4.1%	4.7%	4.6%	4.9%	5.6%	5.3%	4.7%	*estimates*		Avg Ann'l Div'd Yield	*4.5%*

1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007		09-11
1850.7	1992.6	1465.1	1616.2	2298.1	2544.1	1897.4	2662.7	2739.7	3357.8	*3265*	*3225*	Revenues ($mill)	*3200*
121.2	124.3	111.1	121.9	136.4	136.3	128.0	93.1	98.1	101.1	*110*	*110*	Net Profit ($mill)	*125*
35.8%	35.0%	34.4%	34.7%	34.8%	33.5%	31.0%	35.2%	31.8%	28.3%	*27.0%*	*30.0%*	Income Tax Rate	*32.0%*
6.5%	6.2%	7.6%	7.5%	5.9%	5.4%	6.7%	3.5%	3.6%	3.0%	*3.4%*	*3.4%*	Net Profit Margin	*3.9%*
41.3%	42.3%	42.1%	35.5%	32.7%	37.8%	35.1%	39.6%	39.8%	37.4%	*36.0%*	*35.0%*	Long-Term Debt Ratio	*32.0%*
58.1%	57.2%	57.4%	64.0%	66.7%	61.7%	64.5%	60.3%	60.1%	62.5%	*64.0%*	*65.0%*	Common Equity Ratio	*68.0%*
1255.1	1300.6	1322.6	1230.1	1061.2	1180.1	1128.9	1251.5	1246.0	1297.7	*1310*	*1335*	Total Capital ($mill)	*1430*
1771.9	1735.8	1731.8	1735.2	1729.6	1768.6	1796.8	2484.2	2549.8	2659.1	*2750*	*2850*	Net Plant ($mill)	*3150*
11.1%	11.1%	9.9%	10.8%	13.7%	12.3%	12.2%	8.3%	8.8%	9.4%	*10.0%*	*9.5%*	Return on Total Cap'l	*10.0%*
16.4%	16.6%	14.5%	15.4%	19.1%	18.6%	17.5%	12.3%	13.1%	12.5%	*13.0%*	*12.5%*	Return on Shr. Equity	*13.0%*
16.6%	16.7%	14.6%	15.4%	19.2%	18.7%	17.5%	12.3%	13.1%	12.5%	*13.0%*	*12.5%*	Return on Com Equity	*13.0%*
7.6%	7.6%	5.4%	6.2%	8.5%	7.9%	6.5%	1.5%	2.1%	2.3%	*3.0%*	*3.0%*	Retained to Com Eq	*3.5%*
54%	55%	63%	60%	56%	58%	63%	88%	84%	81%	*75%*	*77%*	All Div'ds to Net Prof	*73%*

CAPITAL STRUCTURE as of 6/30/06
Total Debt $520.2 mill. Due in 5 Yrs $215.0 mill.
LT Debt $470.2 mill. LT Interest $20.0 mill.
(Total interest coverage: 4.0x)

Pension Assets-12/05 $424.0 mill. Oblig. $284.4 mill.

Pfd Stock $.6 mill. Pfd Div'd $.03 mill.
1,681 shares of 4.48% mandatorily redeemable preferred stock)
Common Stock 44,536,603 shares as of 4/28/06
MARKET CAP: $1.9 billion (Mid Cap)

CURRENT POSITION ($MILL.)	2004	2005	6/30/06
Cash Assets	83.2	126.9	226.6
Other	937.7	1218.8	477.4
Current Assets	1020.9	1345.7	704.0
Accts Payable	502.9	658.2	433.9
Debt Due	490.2	636.0	50.0
Other	178.3	328.7	511.4
Current Liab.	1171.4	1622.9	995.3
Fix. Chg. Cov.	428%	367%	NMF

ANNUAL RATES of change (per sh)	Past 10 Yrs.	Past 5 Yrs.	Est'd '03-'05 to '09-'11
Revenues	8.0%	11.5%	*1.0%*
"Cash Flow"	4.0%	0.5%	*2.5%*
Earnings	1.0%	-3.5%	*4.0%*
Dividends	4.0%	3.5%	*1.5%*
Book Value	3.0%	1.5%	*3.0%*

Calendar	QUARTERLY REVENUES ($ mill.) Mar.31	Jun.30	Sep.30	Dec.31	Full Year
2003	1171.3	452.8	294.8	743.8	2662.7
2004	1115.7	429.5	299.9	894.6	2739.7
2005	1179.9	484.4	336.0	1357.5	3357.8
2006	1319.4	451.3	*320*	*1174.3*	*3265*
2007	*1250*	*500*	*350*	*1125*	*3225*

Calendar	EARNINGS PER SHARE A Mar.31	Jun.30	Sep.30	Dec.31	Full Year
2003	1.11	.21	.01	.78	2.11
2004	.96	.44	d.26	1.08	2.22
2005	.98	.35	d.06	1.02	2.27
2006	.94	.41	*d.05*	*1.15*	*2.45*
2007	*1.00*	*.40*	*d.05*	*1.15*	*2.50*

Calendar	QUARTERLY DIVIDENDS PAID B ■ Mar.31	Jun.30	Sep.30	Dec.31	Full Year
2002	.46	.46	.46	.46	1.84
2003	.46	.465	.465	.465	1.86
2004	.465	.465	.465	.465	1.86
2005	.465	.465	.465	.465	1.86
2006	.465	.465	.465		

BUSINESS: Nicor Inc. is a holding company with gas distribution as its primary business. Serves over 2.1 million customers in northern and western Illinois. 2005 gas delivered: 470.6 Bcf, incl. 219.4 Bcf from transportation. 2005 gas sales (251.2 bcf): residential, 80%; commercial, 18%; industrial, 3%. Principal supplying pipelines: Natural Gas Pipeline, Horizon Pipeline, and TGPC. Current operations include Tropical Shipping subsidiary and several energy related ventures. Divested inland barging, 7/86; contract drilling, 9/86; oil and gas E&P, 6/93. Has about 3,700 employee. Off./dir. own about 2.8% of common stock. (3/06 proxy). Chairman and CEO: Russ Strobel. Inc.: IL. Address: 1844 Ferry Road, Naperville, IL 60563. Telephone: 630-305-9500. Internet: www.nicor.com.

Nicor's core gas distribution segment has posted mixed results. In the first six months of the year, this unit posted a modest decline in operating profits from a year ago. Excluding the cost recovery of $3.8 million related to a mercury repair and inspection program, operating earnings declined by 1%, to $70.8 million, in the period. An increase in base rates, approved by the Illinois Commerce Commission last fall, helped to boost revenues, but was partially offset by unseasonably warm weather, which reduced the demand for gas deliveries. This decrease in demand lowered net profits by roughly $7.5 million compared to management's forecast. In light of the weather-related losses, the gas distribution segment will probably weigh on the bottom line in the full year. Even so, this is considered a temporary issue, and an eventual return to normal weather conditions should benefit earnings. Too, operating and maintenance expenses have been running below management's expectations, with room for further cost reductions, barring an unforeseen spike in natural gas prices.

The company's other business segments should bolster the bottom line. Nicor's Tropical Shipping unit is generating higher revenues, due to an increase in rates. But some of those gains are likely to be mitigated, in part, by incremental payroll and transportation costs. Separately, the energy ventures segment should post better results in the second half of this year, as deferred revenue, related to its utility-bill management products, are recognized.

Nicor may be able to raise its dividend following a recent legal settlement. In July, the company reached a settlement with the SEC regarding the investigation over its accounting for natural gas costs between 2000 and 2002. Under the terms of the settlement, Nicor will be subject to a $10 million fine, without admitting or denying any wrongdoing. With the legal issues in the rearview mirror, there ought to be a greater amount of cash available to shareholders. As of June 30th, there was nearly $227 million in cash on the balance sheet.

These shares may interest income-oriented accounts.

Charles W. Noh *September 15, 2006*

(A) Based on primary earnings thru. '96, then diluted. Excl. nonrecurring gains/(loss): '89, 7¢; '97, 6¢; '98, 11¢; '99, 5¢; '00, ($1.96); '01, 16¢; '03, (27¢); '04, (52¢); '05, 80¢; '06, (17¢). Excl. items from discontinued ops.: '93, 4¢; '96, 30¢. Quarterly earnings may not sum to total due to rounding. Next earnings report due early Nov. (B) Dividends historically paid early February, May, August, November. ■ Dividend reinvestment plan available. (C) In millions, adjusted for stock split.

Company's Financial Strength	A
Stock's Price Stability	55
Price Growth Persistence	35
Earnings Predictability	80

N.W. NAT'L GAS NYSE-NWN

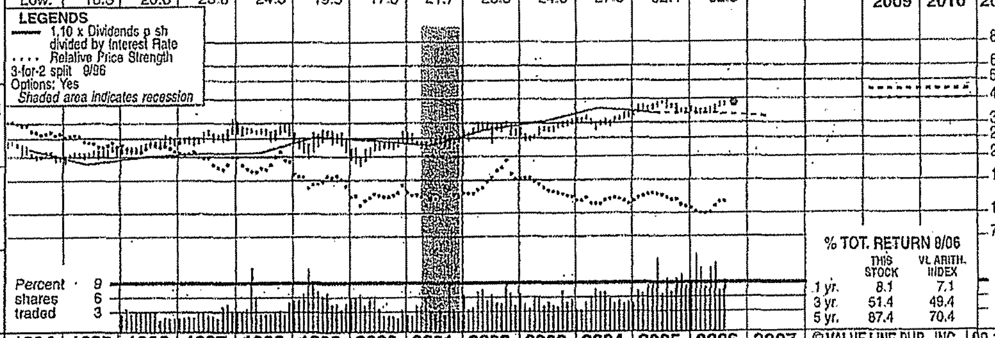
RECENT PRICE 38.19 | P/E RATIO 16.7 (Trailing: 17.6; Median: 15.0) | RELATIVE P/E RATIO 0.98 | DIV'D YLD 3.6% | VALUE LINE 467

TIMELINESS 3 Raised 8/25/06
SAFETY 1 Raised 3/18/05
TECHNICAL 2 Raised 9/15/06
BETA .75 (1.00 = Market)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
High:	22.8	25.9	31.4	30.8	27.9	27.5	26.8	30.7	31.3	34.1	39.6	38.8
Low:	18.3	20.8	23.0	24.3	19.5	17.8	21.7	23.5	24.0	27.5	32.4	32.8

Target Price Range 2009 | 2010 | 2011

LEGENDS
— 1.10 x Dividends p sh divided by Interest Rate
.... Relative Price Strength
3-for-2 split 9/96
Options: Yes
Shaded area indicates recession



2009-11 PROJECTIONS

	Price	Gain	Ann'l Total Return
High	45	(+20%)	8%
Low	40	(+5%)	5%

Insider Decisions

	O	N	D	J	F	M	A	M	J
to Buy	0	0	0	0	1	1	0	0	0
Options	0	0	1	0	0	0	0	0	0
to Sell	0	0	1	0	0	0	0	1	0

Institutional Decisions

	4Q2005	1Q2006	2Q2006
to Buy	59	62	77
to Sell	54	59	59
Hld's(000)	12922	13095	14328

% TOT. RETURN 8/06

	THIS STOCK	VL ARITH. INDEX
1 yr.	8.1	7.1
3 yr.	51.4	49.4
5 yr.	87.4	70.4

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	© VALUE LINE PUB., INC.	09-11
17.02	16.74	14.10	18.15	18.30	16.02	16.86	15.82	16.77	18.17	21.09	26.78	25.07	23.57	25.69	33.01	*39.65*	*42.25*	Revenues per sh	*51.60*
3.22	2.57	3.25	3.74	3.50	3.41	3.86	3.72	3.24	3.72	3.68	3.86	3.65	3.85	3.92	4.34	*4.60*	*4.75*	"Cash Flow" per sh	*5.10*
1.62	.67	.74	1.74	1.63	1.61	1.97	1.76	1.02	1.70	1.79	1.88	1.62	1.76	1.86	2.11	*2.22*	*2.40*	Earnings per sh A	*2.85*
1.10	1.13	1.15	1.17	1.17	1.18	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.30	1.32	*1.38*	*1.42*	Div'ds Decl'd per sh B■	*1.70*
3.85	3.58	3.73	3.61	4.23	3.02	3.70	5.07	4.02	4.78	3.46	3.23	3.11	4.90	5.52	3.48	*3.70*	*3.60*	Cap'l Spending per sh	*3.60*
12.61	12.23	12.41	13.08	13.63	14.55	15.37	16.02	16.59	17.12	17.93	18.56	18.88	19.52	20.64	21.28	*22.10*	*22.95*	Book Value per sh	*25.55*
17.41	17.68	19.46	19.77	20.13	22.24	22.56	22.86	24.85	25.09	25.23	25.23	25.59	25.94	27.55	27.68	*27.75*	*27.80*	Common Shs Outst'g C	*28.00*
10.2	28.1	27.0	12.9	13.0	12.9	11.7	14.4	26.7	14.5	12.4	12.9	17.2	15.8	16.7	17.0	*Bold figures are*	*Value Line*	Avg Ann'l P/E Ratio	*15.0*
.76	1.79	1.64	.76	.85	.86	.73	.83	1.39	.83	.81	.66	.94	.90	.88	.91	*estimates*		Relative P/E Ratio	*.95*
6.7%	5.9%	5.7%	5.2%	5.5%	5.7%	5.2%	4.8%	4.5%	5.0%	5.6%	5.1%	4.5%	4.6%	4.2%	3.7%			Avg Ann'l Div'd Yield	*4.3%*

CAPITAL STRUCTURE as of 6/30/06
Total Debt $577.3 mill. **Due in 5 Yrs** $204.2 mill.
LT Debt $492.0 mill. **LT Interest** $31.0 mill.

(Total interest coverage: 3.4x)

Pension Assets-12/05 $218.6 mill.
Oblig. $267.9 mill.
Pfd Stock None

Common Stock 27,548,346 shs.
as of 7/31/06
MARKET CAP $1.1 billion (Mid Cap)

1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007		09-11
380.3	361.8	416.7	455.8	532.1	650.3	641.4	611.3	707.6	910.5	*1025*	*1050*	Revenues ($mill)	*1450*
46.8	43.1	27.3	44.9	47.8	50.2	43.8	46.0	50.6	58.1	*62.0*	*66.5*	Net Profit ($mill)	*80.0*
36.9%	32.9%	31.0%	35.4%	35.9%	35.4%	34.9%	33.7%	34.4%	36.0%	*36.0%*	*36.0%*	Income Tax Rate	*36.0%*
12.3%	11.9%	6.6%	9.9%	9.0%	7.7%	6.8%	7.5%	7.1%	6.4%	*5.7%*	*5.7%*	Net Profit Margin	*5.5%*
41.4%	46.0%	45.0%	46.0%	45.1%	43.0%	47.6%	49.7%	46.0%	47.0%	*47.0%*	*47.0%*	Long-Term Debt Ratio	*47%*
52.8%	49.0%	50.6%	49.9%	50.9%	53.2%	51.5%	50.3%	54.0%	53.0%	*53.0%*	*53.0%*	Common Equity Ratio	*53%*
657.4	748.0	815.6	861.5	887.8	880.5	937.3	1006.6	1052.5	1108.4	*1150*	*1200*	Total Capital ($mill)	*1350*
745.3	827.5	894.7	895.9	934.0	965.0	995.6	1205.9	1318.4	1373.4	*1375*	*1400*	Net Plant ($mill)	*1500*
8.9%	7.4%	5.0%	6.8%	6.7%	6.9%	5.9%	5.7%	5.9%	6.5%	*7.0%*	*7.0%*	Return on Total Cap'l	*7.0%*
12.1%	10.7%	6.1%	9.7%	9.8%	10.0%	8.9%	9.1%	8.9%	9.9%	*10.0%*	*10.5%*	Return on Shr. Equity	*10.5%*
12.7%	11.0%	6.0%	9.9%	10.0%	10.2%	8.5%	9.0%	8.9%	9.9%	*10.0%*	*10.5%*	Return on Com Equity	*10.5%*
5.0%	3.6%	NMF	2.8%	3.1%	3.5%	1.9%	2.6%	2.7%	3.7%	*3.7%*	*3.7%*	Retained to Com Eq	*3.8%*
63%	70%	118%	74%	70%	67%	79%	72%	69%	63%	*62%*	*59%*	All Div'ds to Net Prof	*60%*

CURRENT POSITION ($MILL.)	2004	2005	6/30/06
Cash Assets	5.2	7.1	6.6
Other	231.9	316.6	191.5
Current Assets	237.1	323.7	198.1
Accts Payable	102.5	135.3	76.8
Debt Due	117.5	134.7	85.3
Other	47.3	56.6	53.0
Current Liab.	267.3	326.6	215.1
Fx. Chg. Cov.	316%	340%	NMF

ANNUAL RATES of change (per sh)	Past 10 Yrs.	Past 5 Yrs.	Est'd '03-'05 to '09-'11
Revenues	4.5%	8.0%	*11.0%*
"Cash Flow"	1.5%	2.5%	*4.5%*
Earnings	1.5%	5.0%	*7.0%*
Dividends	1.0%	1.0%	*4.0%*
Book Value	4.0%	3.5%	*3.5%*

Cal-endar	QUARTERLY REVENUES ($ mill.) Mar.31	Jun.30	Sep.30	Dec.31	Full Year
2003	206.5	117.5	69.5	217.8	611.3
2004	254.5	109.7	81.4	262.0	707.6
2005	308.7	153.7	106.7	341.4	910.5
2006	390.4	171.0	*130*	*333.6*	*1025*
2007	*375*	*185*	*140*	*350*	*1050*

Cal-endar	EARNINGS PER SHARE A Mar.31	Jun.30	Sep.30	Dec.31	Full Year
2003	1.01	.17	d.25	.83	1.76
2004	1.24	d.03	d.30	.95	1.86
2005	1.44	.04	d.31	.94	2.11
2006	1.48	.07	*d.30*	*.97*	*2.22*
2007	*1.55*	*.05*	*d.30*	*1.10*	*2.40*

Cal-endar	QUARTERLY DIVIDENDS PAID B■ Mar.31	Jun.30	Sep.30	Dec.31	Full Year
2002	.315	.315	.315	.315	1.26
2003	.315	.315	.315	.325	1.27
2004	.325	.325	.325	.325	1.30
2005	.325	.325	.325	.345	1.32
2006	.345	.345	.345		

BUSINESS: Northwest Natural Gas Co. distributes natural gas at retail to 90 communities, 624,000 customers, in Oregon (90% of custs.) and in southwest Washington state. Principal cities served: Portland and Eugene, OR; Vancouver, WA. Service area population: 2.4 mill. (77% in OR). *Company buys gas supply from Canadian and U.S. producers; has transportation rights on Northwest* Pipeline system to bring gas to market. Owns local underground storage. Rev. breakdown: residential, 53%; commercial, 27%; industrial; gas transportation, and other, 20%. Employs 1,305. Barclays owns 6.2% of shares; insiders, 1% (4/06 proxy). CEO: Mark S. Dodson. Inc.: OR. Address: 220 NW 2nd Ave., Portland, OR 97209. Tel.: 503-226-4211. Internet: www.nwnatural.com.

Northwest Natural's second-quarter earnings turned out a bit better than expected, despite weather that was 16% warmer than average and 12% warmer than last year's. The company's share of commodity cost savings added about $0.03 a share in the June period, and profits from interstate gas storage contributed an additional $0.02. Operations and maintenance expenses were up 3% but would have risen 2% without increased bad debt costs, due to higher gas prices.

We anticipate roughly normal earnings growth over the balance of the year. Northwest Natural increased its customer count by 3.3% in the 12 months ended in June, and the new accounts should boost earnings through 2006 and 2007. While the national economy is definitely slowing, Portland seems to be doing better than the nation as a whole, with little decline in new home construction. (Northwest's share of new home heating fuel is over 90%.) But the company plans to lay off 50 to 100 employees in the second half of the year, and severance costs will probably add up to around $0.04 a share in the fourth quarter.

Earnings in 2007 will likely benefit from new efficiency and cost-cutting efforts. Northwest has begun to implement a companywide plan to reduce costs by consolidating some operations, standardizing functions, and outsourcing some operations, such as new construction. The plan will take a few years to implement completely and will probably result in a workforce reduction of 200 to 250 employees, some by normal attrition.

Northwest's earnings will probably grow faster than its industry's, thanks to above-average customer growth. The area to the southeast of Portland will soon be zoned for higher density, permitting profitable installation of gas mains and significant customer growth. And the company serves less than 60% of its market at present, allowing it to pick up new customers as old oil tanks need replacing.

These neutrally ranked shares have below-average total return potential at their recent quotation. Although we like Northwest's prospects, we think investors will have an opportunity to invest at a better price.

Sigourney B. Romaine September 15, 2006

(A) Diluted earnings per share. Excludes nonrecurring gain: '98, $0.15; '00, $0.11. Next earnings report due early November.
(B) Dividends historically paid in mid-February, mid-May, mid-August, and mid-November.
■ Div'd reinvestment plan available.
(C) In millions, adjusted for stock split.

Company's Financial Strength	A
Stock's Price Stability	100
Price Growth Persistence	55
Earnings Predictability	75

PIEDMONT NAT'L. NYSE-PNY

RECENT PRICE	P/E RATIO	RELATIVE P/E RATIO	DIV'D YLD	VALUE LINE
25.29	18.9 (Trailing: 18.2, Median: 17.0)	1.11	3.9%	469

TIMELINESS 4 Raised 12/23/05
SAFETY 2 New 7/27/90
TECHNICAL 2 Raised 9/8/06
BETA .80 (1.00 = Market)

																Target Price Range		
High:	12.4	12.9	18.2	18.1	18.3	19.7	19.0	19.0	22.0	24.3	25.8	26.2				2009	2010	2011
Low:	9.1	10.3	11.0	13.9	14.3	11.8	14.6	13.7	16.6	19.2	21.3	23.2						

2009-11 PROJECTIONS

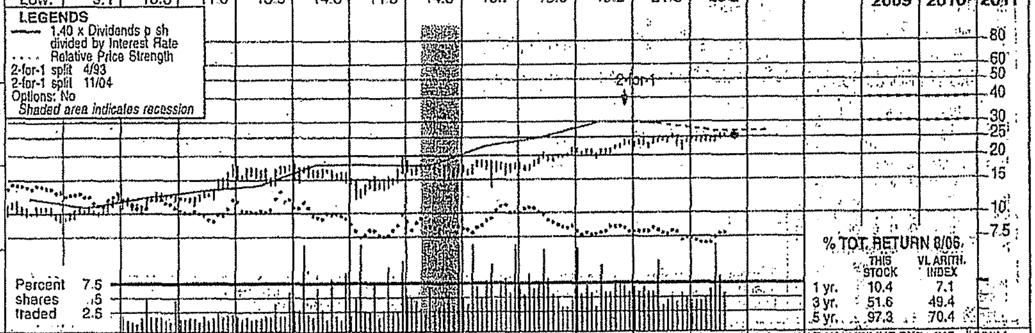
	Price	Gain	Ann'l Total Return
High	40	(+60%)	15%
Low	30	(+20%)	8%

Insider Decisions

	O	N	D	J	F	M	A	M	J
to Buy	10	24	11	10	9	9	9	9	9
Options	0	0	0	0	0	0	0	0	0
to Sell	0	0	2	0	1	1	1	0	1

Institutional Decisions

	4Q2005	1Q2006	2Q2006
to Buy	76	66	85
to Sell	77	71	61
Hld's(000)	30419	31060	32936



% TOT. RETURN 8/06

	THIS STOCK	VL ARITH. INDEX
1 yr.	10.4	7.1
3 yr.	51.6	49.4
5 yr.	97.3	70.4

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	© VALUE LINE PUB., INC.	09-11
9.42	8.32	8.91	10.57	10.82	8.76	11.59	12.84	12.45	10.97	13.01	17.06	12.57	18.14	19.95	22.96	*26.00*	*28.20*	Revenues per sh A	*33.10*
.97	.78	1.07	1.14	1.13	1.25	1.49	1.62	1.72	1.70	1.77	1.81	1.81	2.04	2.31	2.43	*2.50*	*2.65*	"Cash Flow" per sh	*3.20*
.61	.44	.70	.73	.68	.73	.84	.93	.98	.93	1.01	1.01	.95	1.11	1.27	1.32	*1.30*	*1.40*	Earnings per sh B	*1.75*
.42	.44	.46	.48	.51	.54	.57	.61	.64	.68	.72	.76	.80	.82	.85	.91	*.96*	*1.00*	Div'ds Decl'd per sh C■	*1.17*
1.62	1.37	1.41	1.58	1.95	1.72	1.64	1.52	1.48	1.58	1.65	1.29	1.21	1.16	1.85	2.50	*2.65*	*2.40*	Cap'l Spending per sh	*2.20*
4.58	4.83	5.13	5.45	5.68	6.16	6.53	6.95	7.45	7.88	8.26	8.63	8.91	9.36	11.15	11.53	*10.85*	*11.35*	Book Value per sh D	*12.75*
42.87	49.46	51.59	52.30	53.15	57.67	59.10	60.39	61.48	62.59	63.83	64.93	66.18	67.31	76.67	76.70	*75.00*	*74.50*	Common Shs Outst'g E	*72.50*
11.3	16.3	12.3	15.4	15.7	13.8	13.9	13.6	16.3	17.7	14.9	16.7	18.4	16.7	16.6	17.9	*Bold figures are*		Avg Ann'l P/E Ratio	*19.0*
.84	1.04	.75	.91	1.03	.92	.87	.78	.85	1.01	.93	.86	1.01	.95	.88	.95	*Value Line*		Relative P/E Ratio	*1.25*
6.0%	6.0%	5.3%	4.3%	4.8%	5.4%	4.9%	4.8%	4.0%	4.1%	5.0%	4.5%	4.6%	4.4%	4.1%	3.8%	*estimates*		Avg Ann'l Div'd Yield	*3.5%*

CAPITAL STRUCTURE as of 4/30/06
Total Debt $912.0 mill. Due in 5 Yrs $325.0 mill.
LT Debt $625.0 mill. LT Interest $40.0 mill.
(LT interest earned: 4.5x; total interest coverage: 4.5x)

Pension Assets-10/05 $199.2 mill. Oblig. $236.6 mill.

Pfd Stock None

Common Stock 75,277,520 shs. as of 6/2/06

MARKET CAP: $1.9 billion (Mid Cap)

1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	© VALUE LINE PUB., INC.	09-11
685.1	775.5	765.3	686.5	830.4	1107.9	832.0	1220.8	1529.7	1761.1	*1950*	*2100*	Revenues ($mill) A	*2400*
48.6	55.2	60.3	58.2	64.0	65.5	62.2	74.4	95.2	101.3	*100*	*105*	Net Profit ($mill)	*130*
38.9%	39.1%	39.2%	39.7%	34.7%	34.6%	33.1%	34.8%	35.1%	33.7%	*35.0%*	*36.0%*	Income Tax Rate	*36.0%*
7.1%	7.1%	7.9%	8.5%	7.7%	5.9%	7.5%	6.1%	6.2%	5.8%	*5.1%*	*5.1%*	Net Profit Margin	*5.3%*
50.3%	47.6%	44.7%	46.2%	46.1%	47.6%	43.9%	42.2%	43.6%	41.4%	*43.5%*	*42.5%*	Long-Term Debt Ratio	*42.0%*
49.7%	52.4%	55.3%	53.8%	53.9%	52.4%	56.1%	57.8%	56.4%	58.6%	*56.5%*	*57.5%*	Common Equity Ratio	*58.0%*
777.1	800.8	829.3	914.7	978.4	1069.4	1051.6	1090.2	1514.9	1509.2	*1440*	*1470*	Total Capital ($mill)	*1600*
862.0	941.7	990.6	1047.0	1072.0	1114.7	1158.5	1812.3	1849.8	1939.1	*2040*	*2170*	Net Plant ($mill)	*2400*
8.2%	8.9%	9.2%	8.1%	8.3%	7.9%	7.8%	8.6%	7.8%	8.2%	*8.5%*	*8.5%*	Return on Total Cap'l	*9.0%*
12.6%	13.1%	13.2%	11.8%	12.1%	11.7%	10.6%	11.8%	11.1%	11.5%	*12.0%*	*12.5%*	Return on Shr. Equity	*13.0%*
12.6%	13.1%	13.2%	11.8%	12.1%	11.7%	10.6%	11.8%	11.1%	11.5%	*12.0%*	*12.5%*	Return on Com Equity	*13.0%*
3.9%	4.6%	4.7%	3.3%	3.5%	3.0%	1.7%	3.1%	3.7%	3.6%	*3.5%*	*4.0%*	Retained to Com Eq	*4.5%*
69%	65%	65%	72%	71%	75%	83%	74%	66%	68%	*72%*	*70%*	All Div'ds to Net Prof	*67%*

CURRENT POSITION ($MILL.)

	2004	2005	4/30/06
Cash Assets	5.7	7.1	20.3
Other	329.5	497.8	431.7
Current Assets	335.2	504.9	452.0
Accts Payable	99.6	182.8	73.7
Debt Due	109.5	193.5	287.0
Other	97.1	152.3	123.0
Current Liab.	306.2	528.6	483.7
Fix. Chg. Cov.	378%	400%	390%

ANNUAL RATES of change (per sh)	Past 10 Yrs.	Past 5 Yrs.	Est'd '03-'05 to '09-'11
Revenues	7.5%	11.0%	*8.5%*
"Cash Flow"	7.0%	5.5%	*6.0%*
Earnings	5.5%	5.0%	*6.0%*
Dividends	5.5%	5.0%	*5.5%*
Book Value	6.5%	6.5%	*3.0%*

Fiscal Year Ends	QUARTERLY REVENUES ($ mill.) A Jan.31	Apr.30	Jul.31	Oct.31	Full Fiscal Year
2003	493.5	407.8	140.1	179.4	1220.8
2004	618.8	482.4	214.7	213.8	1529.7
2005	680.6	508.0	232.9	339.6	1761.1
2006	921.4	483.2	237.9	*307.5*	*1950*
2007	*875*	*565*	*315*	*345*	*2100*

Fiscal Year Ends	EARNINGS PER SHARE A B F Jan.31	Apr.30	Jul.31	Oct.31	Full Fiscal Year
2003	.87	.47	d.15	d.08	1.11
2004	1.03	.54	d.11	d.21	1.27
2005	.93	.62	d.06	d.07	1.32
2006	.94	.57	d.16	*d.05*	*1.30*
2007	*.98*	*.57*	*d.06*	*d.09*	*1.40*

Cal-endar	QUARTERLY DIVIDENDS PAID C■ Mar.31	Jun.30	Sep.30	Dec.31	Full Year
2002	.193	.20	.20	.20	.79
2003	.20	.208	.208	.208	.82
2004	.208	.215	.215	.215	.85
2005	.215	.23	.23	.23	.91
2006	.23	.24	.24		

BUSINESS: Piedmont Natural Gas Company is primarily a regulated natural gas distributor, serving over 990,000 customers in North Carolina, South Carolina, and Tennessee. 2005 revenue mix: residential (39%), commercial (24%), industrial (13%), other (24%). *Principal suppliers: Transco and Tennessee Pipeline.* Gas costs: 71.6% of revenues. '05 deprec. rate: 3.3%. Estimated plant age: 8.7 years. Non-regulated operations: sale of gas-powered heating equipment; natural gas brokering; propane sales. Has about 2,125 employees. Officers & directors own less than 1% of common stock (1/06 proxy). CEO & President: Thomas E. Skains. Inc.: NC. Addr.: 1915 Rexford Road, P.O. Box 33068 Charlotte, NC 28233. Telephone: 704-364-3120. Internet: www.piedmontng.com.

Piedmont Natural Gas posted a larger share loss than we had anticipated. The fiscal third quarter (ended July 31st) was impacted by reduced margins due to rate design changes, and costs associated with the company's corporate restructuring program. In July, Piedmont and North Carolina's Attorney General office reached a settlement on its customer utilization tracker rate mechanism, which decouples the collection of utility margin from customer volume. This plan is favorable for both customers, who will benefit by the more efficient use of natural gas, and Piedmont shareholders, who will not suffer the negative consequences of conservation by customers. As part of the agreement, the company will fund up to $1.5 million annually over the next few years toward customer conservation programs, in addition to the $500,000 it had already committed to spend. Furthermore, Piedmont's initial restructuring involved offering early retirement to management-level employees and will eventually *include* other positions as part of an effort to streamline business processes and improve corporate efficiencies. The company should realize about $5 million to $6 million in annual cost savings beginning in 2007.

The company's nonutility operations will likely represent a greater percentage of future profits. Over the first six months of 2006, these activities contributed earnings of $25.5 million, which is nearly 20% above the year-ago period. Even though regulated operations make up most of Piedmont's total income, unregulated operations, such as Cardinal Pipeline, Pine Needle, and SouthStar Energy provide an added boost to the company's bottom line. We expect Piedmont to continue to pursue strategic investments to diversify its earnings stream over the next few years.

Though untimely, this stock is suitable for conservative income-oriented investors. Piedmont offers a respectable dividend yield, at 3.9%, and has an Above Average Safety rank (2). Moreover, the company should benefit as it diversifies its supply portfolio away from the Gulf Coast region through agreements with Midwestern Gas Transmission Company and Hardy Storage Company.

Evan I. Blatter *September 15, 2006*

(A) Fiscal year ends October 31st.
(B) Diluted earnings. Excl. extraordinary item: '00, 8¢. Excl. nonrecurring charge: '97, 2¢. Next earnings report due mid-Dec.
(C) Dividends historically paid mid-January, April, July, October.
■ Div'd reinvest. plan available; 5% discount.
(D) Includes deferred charges. At 10/31/05: $4.0 million, 5¢/share.
(E) In millions, adjusted for stock splits.
(F) Quarters may not add to total due to change in shares outstanding.

Company's Financial Strength	B++
Stock's Price Stability	100
Price Growth Persistence	75
Earnings Predictability	80

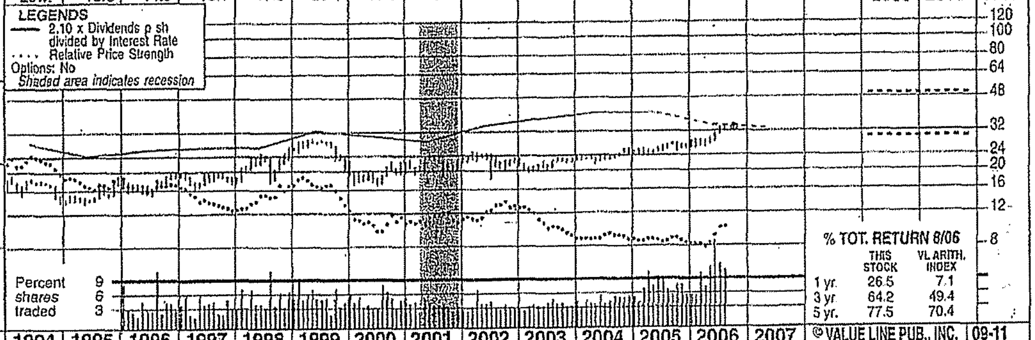
SOUTHWEST GAS NYSE-SWX

RECENT PRICE 33.28 | P/E RATIO 17.6 (Trailing: 21.2; Median: 20.0) | RELATIVE P/E RATIO 1.04 | DIV'D YLD 2.5% | VALUE LINE 473

TIMELINESS 3 Raised 5/12/06
SAFETY 3 Lowered 1/4/91
TECHNICAL 3 Lowered 9/1/06
BETA .85 (1.00 = Market)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
High:	18.4	19.9	20.3	26.9	29.5	23.0	24.7	25.3	23.6	26.2	28.1	34.2
Low:	13.6	14.9	16.1	17.3	20.4	16.9	18.6	18.1	19.3	21.5	23.5	26.0

Target Price Range 2009 | 2010 | 2011



2009-11 PROJECTIONS

	Price	Gain	Ann'l Total Return
High	50	(+50%)	12%
Low	30	(-10%)	Nil

Insider Decisions

	O	N	D	J	F	M	A	M	J
to Buy	0	1	2	0	0	0	3	0	0
Options	0	0	0	1	0	5	1	5	5
to Sell	0	0	0	1	0	5	1	6	6

Institutional Decisions

	4Q2005	1Q2006	2Q2006
to Buy	62	69	82
to Sell	53	53	46
Hld's(000)	25543	26476	29036

% TOT. RETURN 8/06

	THIS STOCK	VL ARITH. INDEX
1 yr.	26.5	7.1
3 yr.	64.2	49.4
5 yr.	77.5	70.4

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	© VALUE LINE PUB., INC.	09-11
25.90	24.99	25.93	25.68	28.16	23.03	24.09	26.73	30.17	30.24	32.61	42.98	39.68	35.96	40.14	43.59	*47.60*	*48.35*	Revenues per sh A	*50.00*
3.96	1.53	3.34	3.24	5.09	2.65	3.00	3.85	4.48	4.45	4.57	4.79	5.07	5.11	5.57	5.20	*5.90*	*6.05*	"Cash Flow" per sh	*6.50*
1.81	d.76	.81	.63	1.22	.10	.25	.77	1.65	1.27	1.21	1.15	1.16	1.13	1.66	1.25	*1.85*	*1.95*	Earnings per sh A B	*2.25*
1.40	.88	.70	.74	.80	.82	.82	.82	.82	.82	.82	.82	.82	.82	.82	.82	*.82*	*.82*	Div'ds Decl'd per sh C■	*.82*
5.06	3.76	5.02	5.43	6.64	6.79	8.19	6.19	6.40	7.41	7.04	8.17	8.50	7.03	8.23	7.49	*7.25*	*7.20*	Cap'l Spending per sh	*7.55*
17.63	15.88	15.99	15.96	16.38	14.65	14.20	14.09	15.67	16.31	16.82	17.27	17.91	18.42	19.18	19.10	*19.50*	*20.25*	Book Value per sh	*24.00*
20.04	20.60	20.60	21.00	21.28	24.47	26.73	27.39	30.41	30.99	31.71	32.49	33.29	34.23	36.79	39.33	*41.50*	*43.00*	Common Shs Outst'g D	*45.00*
8.7	--	16.6	26.5	14.0	NMF	NMF	24.1	13.2	21.1	16.0	19.0	19.9	19.2	14.3	20.6	*Bold figures are*	*Value Line*	Avg Ann'l P/E Ratio	*18.0*
.65	--	1.01	1.57	.92	NMF	NMF	1.40	.69	1.20	1.04	.97	1.09	1.09	.76	1.10	*estimates*		Relative P/E Ratio	*1.20*
8.9%	7.0%	5.2%	4.4%	4.7%	5.4%	4.7%	4.4%	3.8%	3.1%	4.2%	3.8%	3.6%	3.8%	3.6%	3.2%			Avg Ann'l Div'd Yield	*2.0%*

1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007		09-11
644.1	732.0	917.3	936.9	1034.1	1396.7	1320.9	1231.0	1477.1	1714.3	*1975*	*2080*	Revenues ($mill) A	*2250*
6.6	20.8	47.5	39.3	38.3	37.2	38.6	38.5	58.9	48.1	*75.0*	*85.0*	Net Profit ($mill)	*100*
37.1%	29.2%	43.4%	35.5%	26.2%	34.5%	32.8%	30.5%	34.8%	29.7%	*35.0%*	*35.0%*	Income Tax Rate	*35.0%*
1.0%	2.8%	5.2%	4.2%	3.7%	2.7%	2.9%	3.1%	4.0%	2.8%	*3.9%*	*4.0%*	Net Profit Margin	*4.5%*
60.2%	63.6%	60.2%	60.3%	60.2%	56.2%	62.5%	66.0%	64.2%	63.8%	*60.7%*	*59.9%*	Long-Term Debt Ratio	*56.5%*
34.4%	31.5%	35.3%	35.5%	35.8%	39.6%	34.1%	34.0%	35.8%	36.2%	*39.3%*	*40.1%*	Common Equity Ratio	*43.5%*
1104.8	1224.7	1349.3	1424.7	1489.9	1417.6	1748.3	1851.6	1968.6	2076.0	*2060*	*2170*	Total Capital ($mill)	*2480*
1278.5	1360.3	1459.4	1581.1	1686.1	1825.6	1979.5	2175.7	2336.0	2489.1	*2600*	*2750*	Net Plant ($mill)	*3200*
2.8%	3.9%	5.8%	4.8%	4.6%	5.1%	4.3%	4.2%	5.0%	4.3%	*5.5%*	*6.0%*	Return on Total Cap'l	*6.0%*
1.5%	4.7%	8.9%	7.0%	6.5%	6.0%	5.9%	6.1%	8.3%	6.4%	*9.5%*	*10.0%*	Return on Shr. Equity	*9.5%*
1.7%	5.4%	10.0%	7.8%	7.2%	6.6%	6.5%	6.1%	8.3%	6.4%	*9.5%*	*10.0%*	Return on Com Equity	*9.5%*
NMF	NMF	5.0%	2.8%	2.4%	1.9%	1.8%	1.7%	4.3%	2.2%	*5.0%*	*6.0%*	Retained to Com Eq	*6.0%*
NMF	107%	50%	64%	67%	71%	70%	72%	49%	65%	*44%*	*41%*	All Div'ds to Net Prof	*36%*

CAPITAL STRUCTURE as of 6/30/06

Total Debt $1251.9 mill. Due in 5 Yrs $344.5 mill.
LT Debt $1166.9 mill. LT Interest $85.0 mill.
(Total interest coverage: 2.0x)

Pension Assets-12/05 $359.6 mill. Oblig. $511.0 mill.

Pfd Stock None

Common Stock 40,846,327 shs. (as of 8/3/06)

MARKET CAP: $1.4 billion (Mid Cap)

CURRENT POSITION ($MILL.)	2004	2005	6/30/06
Cash Assets	13.6	29.6	8.6
Other	418.4	513.1	310.2
Current Assets	432.0	542.7	318.8
Accts Payable	165.9	259.5	82.7
Debt Due	129.8	107.2	85.0
Other	187.3	254.3	258.2
Current Liab.	483.0	621.0	425.9
Fix. Chg. Cov.	166%	167%	189%

ANNUAL RATES of change (per sh)	Past 10 Yrs.	Past 5 Yrs.	Est'd '03-'05 to '09-'11
Revenues	4.5%	5.0%	*4.0%*
"Cash Flow"	4.0%	3.5%	*3.5%*
Earnings	7.5%	-0.5%	*9.0%*
Dividends	0.5%	--	*Nil*
Book Value	2.0%	3.0%	*4.0%*

Cal-endar	QUARTERLY REVENUES ($ mill.) Mar.31	Jun.30	Sep.30	Dec.31	Full Year
2003	403.3	255.8	220.2	351.7	1231.0
2004	473.4	278.7	264.5	460.5	1477.1
2005	542.9	361.1	313.3	497.0	1714.3
2006	676.9	430.9	*350*	*517.2*	*1975*
2007	*700*	*450*	*370*	*560*	*2080*

Cal-endar	EARNINGS PER SHARE B Mar.31	Jun.30	Sep.30	Dec.31	Full Year
2003	.76	d.12	d.51	1.00	1.13
2004	1.18	d.24	d.51	1.23	1.66
2005	.88	d.07	d.43	.87	1.25
2006	1.11	.02	*d.35*	*1.07*	*1.85*
2007	*1.15*	*.05*	*d.40*	*1.15*	*1.95*

Cal-endar	QUARTERLY DIVIDENDS PAID C■ Mar.31	Jun.30	Sep.30	Dec.31	Full Year
2002	.205	.205	.205	.205	.82
2003	.205	.205	.205	.205	.82
2004	.205	.205	.205	.205	.82
2005	.205	.205	.205	.205	.82
2006	.205	.205	.205		

BUSINESS: Southwest Gas Corporation is a regulated gas distributor serving approx. 1.7 million customers in sections of Arizona, Nevada, and California. '05 margin mix: resid. and small commercial, 86%; large commercial and industrial, 5%; transportation, 9%. Annual volume: 2.2 billion therms. Principal suppliers: El Paso Natural Gas Co. and Northwest Pipeline Corp. Acquired gas utility assets from Arizona Public Service in 1984. Sold PriMerit Bank (acq. in '86) in 7/96. Has about 2,590 employees. Officers & Directors own 2.3% of common stock (3/06 Proxy). Chairman: LeRoy Hanneman. Chief Executive Officer: Jeffrey W. Shaw. Incorporated: California. Address: 5241 Spring Mountain Rd., Las Vegas, Nevada 89150. Telephone: 702-876-7011. Internet: www.swgas.com.

Shares of Southwest Gas have increased roughly 15% since our June report, as the company reported solid performance in the second quarter. Despite warmer weather, revenues in the natural gas segment increased by nearly 19%. Rate relief (primarily in Arizona) and customer growth drove these results. Strength in the construction services subsidiary benefited the company's bottom line. Excluding a nonrecurring gain of $0.07 per share from a property tax settlement, share net came in at $0.02. This is the first time in recent years the company has reported a positive tally for the second quarter.

For full-year 2006, we expect revenues will advance by 15%. We have increased our bottom-line estimate to $1.85, representing an increase of 48% over the prior year. We anticipate moderate growth from 2007 to the end of the decade. The company's increased focus on obtaining rate relief and improving rate design could be important growth drivers, as Southwest Gas depends upon such approved revenue increases to help it cope with increasing natural gas prices. Net profit margins should strengthen, as well.

Nevertheless, the company is not without risk. We anticipate significant capital expenditures in the coming years, as Southwest Gas works to expand its customer base. We expect a rising share count as the company continues to issue common stock to support these investments. Long-term debt should continue to increase, although probably at a slower rate than shareholders' equity. Also, warmer-than-usual weather, increased customer conservation, and insufficient, or lagging, rate relief could have a negative impact on corporate results. The possibility of increased operating and maintenance costs is another caveat.

With a Timeliness rank of 3 (Average), these shares are not a standout for the year ahead. Moreover, following the recent increase in stock price, appreciation potential for the pull to late decade is subpar. The dividend yield of 2.5% is lower than the group's average, too. Income-oriented investors should also note that the company has not increased the dividend in the past decade.

Michael F. Napoli *September 15, 2006*

(A) Incl. income for PriMerit Bank on the equity basis through 1994.
(B) Based on avg. shares outstand. thru. '96, then diluted. Excl. nonrec. gains (losses): '93, 8¢; '97, 16¢; '02, (10¢); '05, (11¢). Incl. asset writedown: '93, 44¢. Excl. loss from disc. ops.: '95, 75¢. Next egs. report due in early November.
(C) Dividends historically paid early March, June, September, December. ■ Div'd reinvest. plan avail.
(D) In millions.

Company's Financial Strength	B
Stock's Price Stability	95
Price Growth Persistence	55
Earnings Predictability	65

WGL HOLDINGS NYSE-WGL

RECENT PRICE 30.77 | P/E RATIO 14.4 (Trailing: 17.1; Median: 15.0) | RELATIVE P/E RATIO 0.85 | DIV'D YLD 4.5% | VALUE LINE 475

TIMELINESS 4 Raised 8/4/06

SAFETY 1 Raised 4/2/93

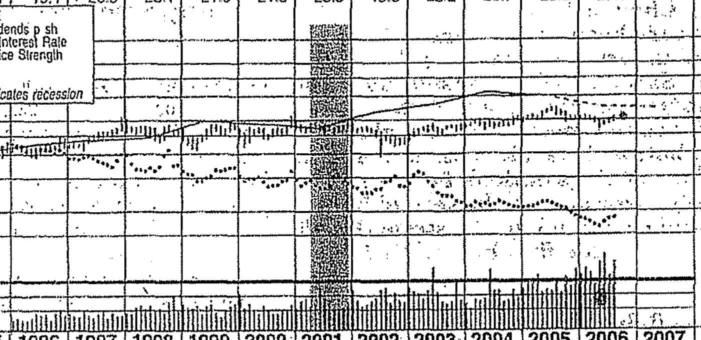
TECHNICAL 3 Raised 5/26/06

BETA .80 (1.00 = Market)

High:	22.4	25.0	31.4	30.8	29.4	31.5	30.5	29.5	28.8	31.4	34.8	31.5
Low:	16.1	19.1	20.9	23.1	21.0	21.8	25.3	19.3	23.2	26.7	28.8	27.0

Target Price Range 2009 | 2010 | 2011

LEGENDS
—— 1.30 x Dividends p sh divided by Interest Rate
.... Relative Price Strength
2-for-1 split 5/95
Options: No
Shaded area indicates recession



2009-11 PROJECTIONS

	Price	Gain	Ann'l Total Return
High	35	(+15%)	7%
Low	30	(-5%)	4%

Insider Decisions

	O	N	D	J	F	M	A	M	J
to Buy	0	0	0	0	0	0	0	0	0
Options	0	0	0	0	0	0	0	0	0
to Sell	0	0	0	0	0	0	0	0	0

Institutional Decisions

	4Q2005	1Q2006	2Q2006
to Buy	88	70	73
to Sell	67	77	78
Hld's(000)	27959	27311	29760

Percent shares traded 9 6 3

% TOT. RETURN 8/06

	THIS STOCK	VL ARITH. INDEX
1 yr.	-1.2	7.1
3 yr.	32.0	49.4
5 yr.	44.8	70.4

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	© VALUE LINE PUB., INC.	09-11
18.75	17.50	18.37	21.55	21.69	19.30	22.19	24.16	23.74	20.92	22.19	29.80	32.63	42.45	42.93	44.94	*53.80*	*55.40*	Revenues per sh A	*61.50*
2.17	2.04	2.17	2.25	2.43	2.51	2.93	3.02	2.79	2.74	3.20	3.24	2.63	4.00	3.87	3.97	*3.75*	*3.90*	"Cash Flow" per sh	*4.50*
1.26	1.14	1.27	1.31	1.42	1.45	1.85	1.85	1.54	1.47	1.79	1.88	1.14	2.30	1.98	2.11	*1.85*	*1.95*	Earnings per sh B	*2.35*
1.01	1.05	1.07	1.09	1.11	1.12	1.14	1.17	1.20	1.22	1.24	1.26	1.27	1.28	1.30	1.32	*1.35*	*1.38*	Div'ds Decl'd per sh C■	*1.48*
2.38	2.05	2.17	2.43	2.84	2.63	2.85	3.20	3.62	3.42	2.67	2.68	3.34	2.65	2.33	2.32	*3.40*	*3.30*	Cap'l Spending per sh	*4.00*
10.17	9.63	10.66	11.04	11.51	11.95	12.79	13.48	13.86	14.72	15.31	16.24	15.78	16.25	16.95	17.80	*17.85*	*18.60*	Book Value per sh D	*21.15*
39.23	39.89	40.62	41.50	42.19	42.93	43.70	43.70	43.84	46.47	46.47	48.54	48.56	48.63	48.67	48.65	*48.70*	*48.70*	Common Shs Outst'g E	*48.80*
11.7	12.8	13.6	15.6	14.0	12.7	11.5	12.7	17.2	17.3	14.6	14.7	23.1	11.1	14.2	14.7	*Bold figures are*		Avg Ann'l P/E Ratio	*14.0*
.87	.82	.82	.92	.92	.85	.72	.73	.89	.99	.95	.75	1.26	.63	.75	.78	*Value Line*		Relative P/E Ratio	*.90*
6.9%	7.2%	6.2%	5.3%	5.6%	6.1%	5.4%	5.0%	4.5%	4.8%	4.8%	4.6%	4.8%	5.0%	4.6%	4.2%	*estimates*		Avg Ann'l Div'd Yield	*4.3%*
						969.8	1055.8	1040.6	972.1	1031.1	1446.5	1584.8	2064.2	2089.6	2186.3	*2620*	*2700*	Revenues ($mill) A	*3000*
						81.6	82.0	68.6	68.8	84.6	89.9	55.7	112.3	98.0	104.8	*90.0*	*95.0*	Net Profit ($mill)	*115*
						37.7%	36.9%	35.6%	36.0%	36.1%	39.6%	34.0%	38.0%	38.2%	37.4%	*38.0%*	*38.0%*	Income Tax Rate	*38.0%*
						8.4%	7.8%	6.6%	7.1%	8.2%	6.2%	3.5%	5.4%	4.7%	4.8%	*3.5%*	*3.6%*	Net Profit Margin	*3.8%*
						37.6%	41.1%	40.3%	41.5%	43.1%	41.7%	45.7%	43.8%	40.9%	39.5%	*39.0%*	*39.0%*	Long-Term Debt Ratio	*39.0%*
						59.4%	56.2%	57.1%	56.1%	54.8%	56.3%	52.4%	54.3%	57.2%	58.6%	*59.0%*	*59.0%*	Common Equity Ratio	*59.0%*
						941.1	1049.0	1064.8	1218.5	1298.2	1400.8	1462.5	1454.9	1443.6	1478.1	*1515*	*1575*	Total Capital ($mill)	*1780*
						1130.6	1217.1	1319.5	1402.7	1460.3	1519.7	1606.8	1874.9	1915.6	1969.7	*2120*	*2270*	Net Plant ($mill)	*2550*
						10.1%	9.3%	8.0%	7.1%	7.9%	7.9%	5.3%	9.1%	8.2%	8.5%	*6.0%*	*6.0%*	Return on Total Cap'l	*6.5%*
						13.9%	13.3%	10.8%	9.7%	11.4%	11.0%	7.0%	13.7%	11.5%	11.7%	*10.0%*	*10.0%*	Return on Shr. Equity	*10.5%*
						14.4%	13.7%	11.1%	9.9%	11.7%	11.2%	7.2%	14.0%	11.7%	12.0%	*10.0%*	*10.0%*	Return on Com Equity	*11.0%*
						5.6%	5.1%	2.5%	1.8%	3.7%	3.8%	NMF	6.2%	4.1%	4.6%	*2.5%*	*3.0%*	Retained to Com Eq	*4.0%*
						62%	63%	78%	82%	69%	67%	112%	56%	65%	62%	*74%*	*72%*	All Div'ds to Net Prof	*64%*

CAPITAL STRUCTURE as of 6/30/06
Total Debt $726.8 mill. **Due in 5 Yrs** $520.0 mill.
LT Debt $581.8 mill. **LT Interest** $40.0 mill.
(LT interest earned: 4.6x; total interest coverage: 4.2x)
Pension Assets-9/05 $691.7 mill. **Oblig.** $691.2 mill.
Preferred Stock $28.2 mill. **Pfd Div'd** $1.3 mill.

Common Stock 48,773,729 shs. as of 7/31/06

MARKET CAP: $1.5 billion (Mid Cap)

CURRENT POSITION ($MILL.)	2004	2005	6/30/06
Cash Assets	6.6	4.8	88.1
Other	426.3	476.2	454.3
Current Assets	432.9	481.0	542.4
Accts Payable	179.0	204.9	172.4
Debt Due	156.3	91.0	145.0
Other	77.6	115.5	147.8
Current Liab.	412.9	411.4	465.2
Fix. Chg. Cov.	449%	460%	450%

ANNUAL RATES of change (per sh)	Past 10 Yrs.	Past 5 Yrs.	Est'd '03-'05 to '09-'11
Revenues	7.5%	14.5%	*6.0%*
"Cash Flow"	5.0%	6.5%	*2.0%*
Earnings	4.5%	6.0%	*1.5%*
Dividends	1.5%	1.5%	*2.0%*
Book Value	4.0%	3.0%	*3.5%*

Fiscal Year Ends	QUARTERLY REVENUES ($ mill.) A Dec.31	Mar.31	Jun.30	Sep.30	Full Fiscal Year
2003	560.0	851.1	373.2	279.9	2064.2
2004	585.3	862.2	356.9	285.2	2089.6
2005	623.4	929.8	349.0	284.1	2186.3
2006	909.3	1070.4	346.9	*293.4*	*2620*
2007	*960*	*1010*	*380*	*350*	*2700*

Fiscal Year Ends	EARNINGS PER SHARE A B Dec.31	Mar.31	Jun.30	Sep.30	Full Fiscal Year
2003	1.10	1.61	d.05	d.36	2.30
2004	.81	1.62	d.08	d.37	1.98
2005	.88	1.63	d.17	d.23	2.11
2006	.91	1.16	d.01	*d.21*	*1.85*
2007	*.95*	*1.40*	*d.15*	*d.25*	*1.95*

Cal-endar	QUARTERLY DIVIDENDS PAID C■ Mar.31	Jun.30	Sep.30	Dec.31	Full Year
2002	.315	.318	.318	.318	1.27
2002	.318	.32	.32	.32	1.28
2003	.32	.325	.325	.325	1.30
2004	.325	.333	.333	.333	1.32
2005	.333	.338	.338		

BUSINESS: WGL Holdings, Inc. is the parent of Washington Gas Light, a natural gas distributor in Washington, D.C. and adjacent areas of VA. and MD. to resident'l and comm'l users (1,092,198 meters). Hampshire Gas, a federally regulated sub., operates an underground gas-storage facility in WV. Non-regulated subs.: Wash. Gas Energy Svcs. sells and delivers natural gas and provides energy related products in the D.C. metro area; Wash. Gas Energy Sys. designs/installs comm'l heating, ventilating, and air cond. systems. American Century Inv. own 9.3% of common stock; Off./dir. less than 1% (1/06 proxy). Chrmn. & CEO: J.H. DeGraffenreidt, Inc.: D.C. and VA. Addr.: 1100 H St., N.W., Washington, D.C. 20080. Tel.: 202-624-6410. Internet: www.wglholdings.com.

WGL Holdings posted solid results in the seasonally weak fiscal third quarter (ended June 30th). It reported a share net loss of $0.01, which excluded the results from the recently sold American Combustion Industries subsidiary, significantly ahead of last year's figure. The results were driven by lower operation and maintenance expense, utility customer growth, and improved performance at the retail energy-marketing business. In fact, income from this segment nearly doubled from the year-ago period, to $6.1 million, thanks to higher gross margins from the sale of natural gas and electricity. This should help push nonutility earnings to about $0.21 a share this year, with additional improvements likely in 2007.

WGL expects to file a pair of rate increases. One will soon be with the Virginia State Corporation Commission, and another with the Maryland Public Service Commission next spring. The primary need for the Maryland rate increase is to recover costs associated with the Prince George's County rehabilitation program. The project is scheduled to be completed in 2008 at a $144 million price tag. If this project is fully recovered through a rate increase, which is probable, WGL should realize a $0.16-a-share boost to earnings.

The company is slated to spend about $855 million on capital improvement projects out to 2010. WGL expects to begin construction on its LNG storage facility in late 2008 pending regulatory approval, two years later than previously anticipated due to zoning and other legal challenges, and scheduled to be completed by the 2011-2012 winter. However, until approval is granted WGL will explore other opportunities to meet its peak day requirements to serve its customers.

These shares are best suited for conservative investors. The dividend yield stands at 4.5%, above the industry average, while the stock's Safety rank is 1 (Highest). Long term, we look for Washington Gas to add about 25,000–30,000 new utility customers annually, thanks to the new home construction expected in its service areas over the next 20 years. The stock, which is not well ranked for performance is dependable for income. But its price range only inches up over time.

Evan I. Blatter *September 15, 2006*

(A) Fiscal years end Sept. 30th.
(B) Based on diluted shares. Excludes nonrecurring losses: '01, (13¢); '02, (34¢); discontinued operations: '06, (3¢).
Next earnings report due early Nov.
(C) Dividends historically paid early February, May, August, and November. ■ Dividend reinvestment plan available.
(D) Includes deferred charges and intangibles. '05: $150.0 million, $3.08/sh.
(E) In millions, adjusted for stock split.

Company's Financial Strength	A
Stock's Price Stability	100
Price Growth Persistence	70
Earnings Predictability	60

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 231
Witness: Don Murry

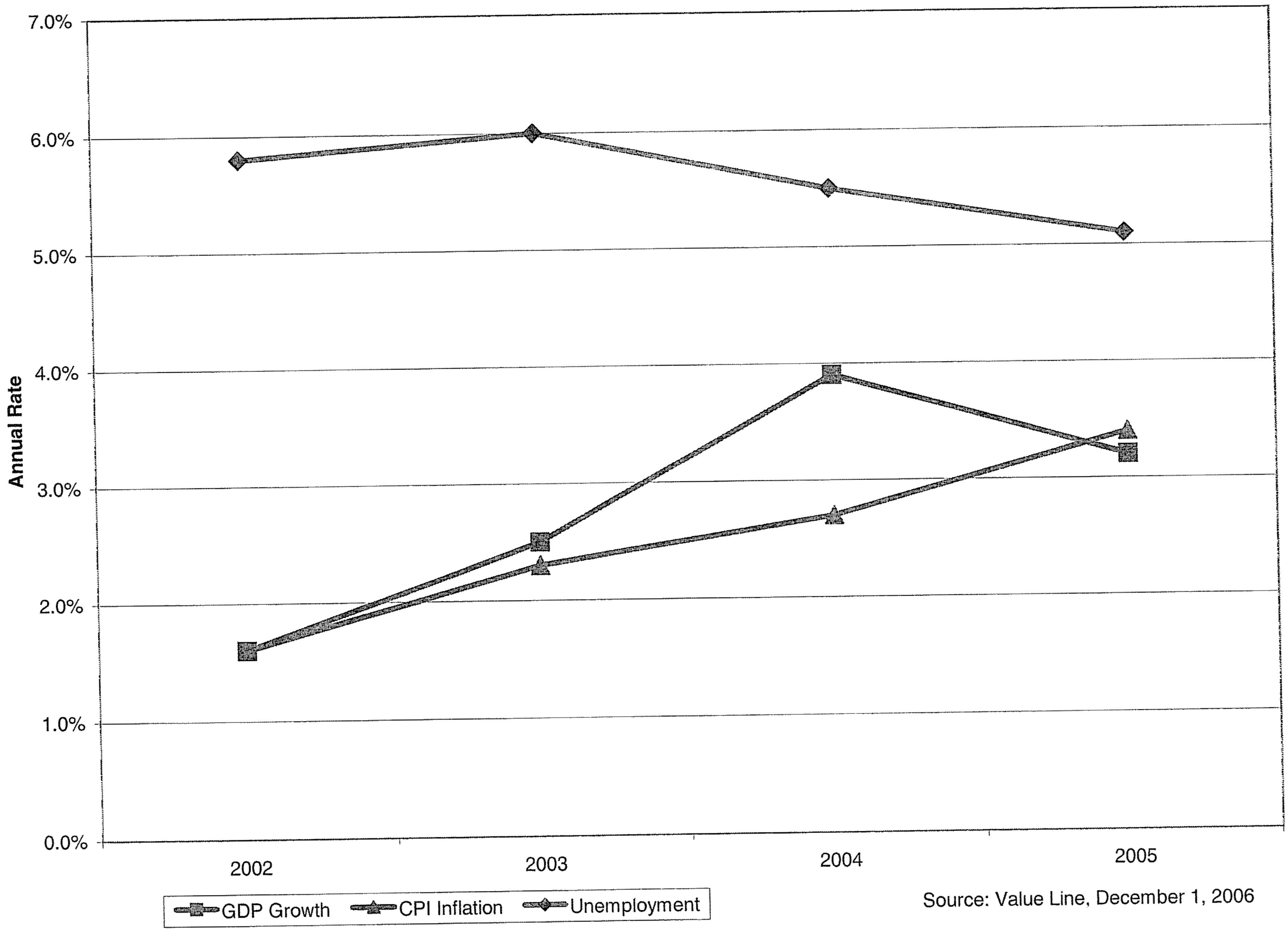
Data Request:

Please provide electronic copies (Microsoft Excel) of all pages of the following Schedules, with all formulas and data intact: Schedules DMA[sic]-5, 6, 7, 8, 9, 10, 11, 12, 13,14,15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, and 29.

Response:

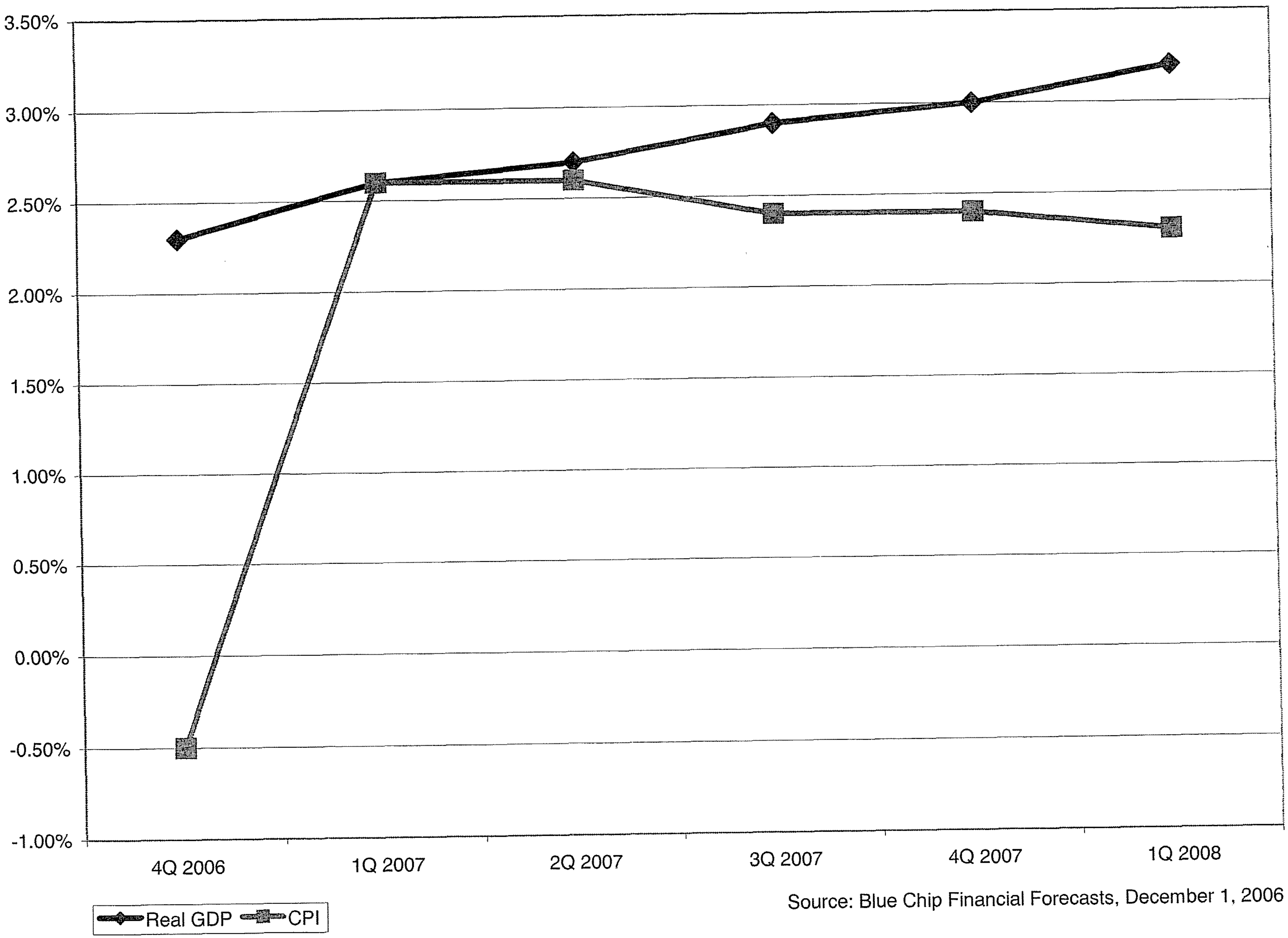
Please see the attached spreadsheet labeled AG DR1-231 ATT1.

Atmos Energy Corporation
Historical Economic Statistics
2002 to 2005



Source: Value Line, December 1, 2006

Atmos Energy Corporation
Blue Chip Economic Forecasts



Source: Blue Chip Financial Forecasts, December 1, 2006

Atmos Energy

Interest Rates

Blue Chip Forecasts

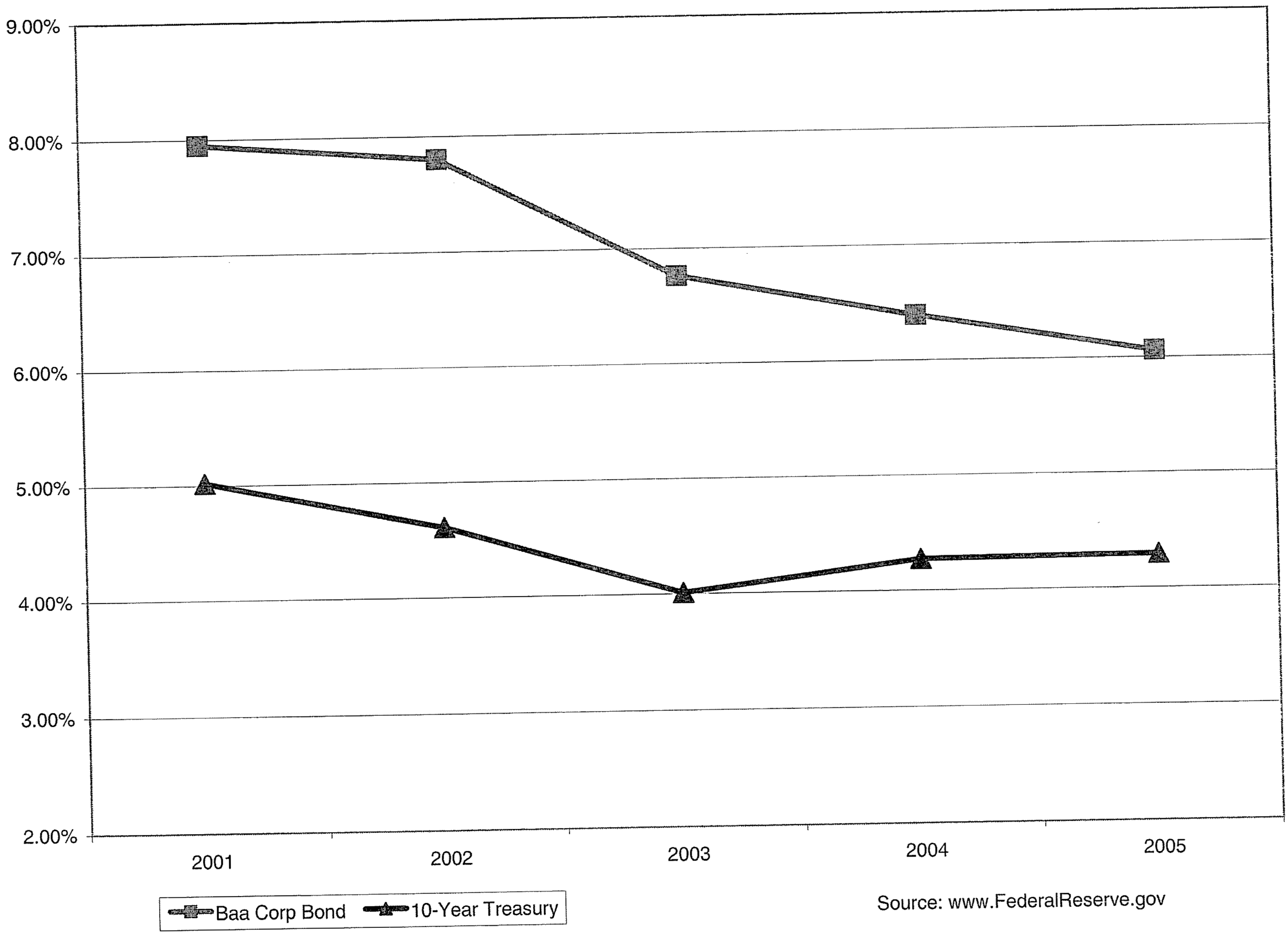
Quarter	Real GDP	CPI
3Q 2006	1.60%	3.00%
4Q 2006	2.30%	-0.50%
1Q 2007	2.60%	2.60%
2Q 2007	2.70%	2.60%
3Q 2007	2.90%	2.40%
4Q 2007	3.00%	2.40%
1Q 2008	3.20%	2.30%

Atmos Energy

Economic Data

Year	GDP Growth	CPI Inflation	Unemployment
2001	0.8%	2.8%	4.8%
2002	1.6%	1.6%	5.8%
2003	2.5%	2.3%	6.0%
2004	3.9%	2.7%	5.5%
2005	3.2%	3.4%	5.1%
2006	3.2%	2.0%	4.6%

Atmos Energy Corporation
History of Long-Term Interest Rates



Source: www.FederalReserve.gov

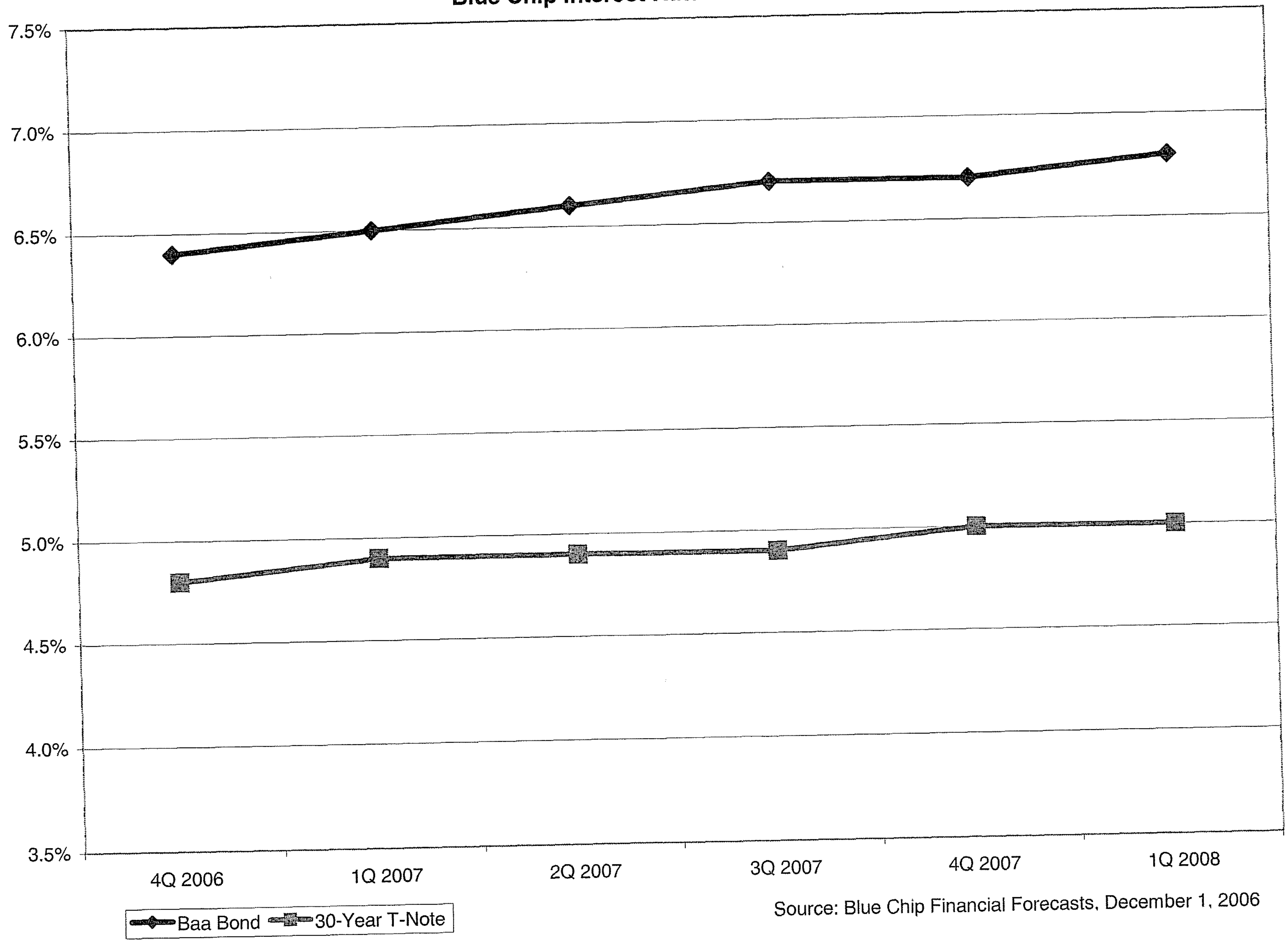
Atmos Energy

Interest Rates

Federal Reserve

Year	Baa Corp Bond	10-Year Treasury
2001	7.95%	5.02%
2002	7.80%	4.61%
2003	6.76%	4.01%
2004	6.39%	4.27%
2005	6.06%	4.29%

Atmos Energy Corporation
Blue Chip Interest Rate Forecasts



Source: Blue Chip Financial Forecasts, December 1, 2006

Quarter	Baa Bond	30-Year T-Note
3Q 2006	6.6%	5.0%
4Q 2006	6.4%	4.8%
1Q 2007	6.5%	4.9%
2Q 2007	6.6%	4.9%
3Q 2007	6.7%	4.9%
4Q 2007	6.7%	5.0%
1Q 2008	6.8%	5.0%

Atmos Energy Corporation

Projected Capital Structure

	Percent of Total
Long Term Debt	51.80%
Common Equity	48.20%
Total	100.00%

Source :
Atmos Energy Corporation Work Papers

Atmos Energy Corporation

Comparable Gas Companies

Comparison of Common Equity Ratios

Company	2002	2003	2004	2005	2006E	Forecast '09-'11
Atmos Energy Corp.	46.1%	49.8%	56.8%	42.3%	43.0%	45.0%
AGL Resources	41.7%	49.7%	46.0%	48.1%	49.0%	51.5%
New Jersey Resources	49.4%	61.9%	59.7%	58.0%	58.0%	63.0%
NICOR, Inc.	64.5%	60.3%	60.1%	62.5%	64.0%	68.0%
Northwest Natural Gas	51.5%	50.3%	54.0%	53.0%	53.0%	53.0%
Piedmont Natural Gas	56.1%	57.8%	56.4%	58.6%	56.5%	58.0%
Southwest Gas	34.1%	34.0%	35.8%	36.2%	39.3%	43.5%
WGL Holdings, Inc.	52.4%	54.3%	57.2%	58.6%	59.0%	59.0%
Comparable Companies' Averages	50.0%	52.6%	52.7%	53.6%	54.1%	56.6%

Source: Value Line Investment Survey

Atmos Energy Corporation

Comparable Gas Companies

Comparison of Common Shares Outstanding

Company	2002	2003	2004	2005	2006E	Forecast '09-'11	Growth 06-'11
Atmos Energy Corp.	41.68	51.48	62.80	80.54	82.00	100.00	21.95%
AGL Resources	56.70	64.50	76.70	77.70	77.90	78.30	0.51%
New Jersey Resources	27.67	27.23	27.74	27.55	28.10	28.50	1.42%
NICOR, Inc.	44.01	44.04	44.10	44.18	44.50	44.90	0.90%
Northwest Natural Gas	25.59	25.94	27.55	27.58	27.75	28.00	0.90%
Piedmont Natural Gas	66.18	67.31	76.67	76.70	75.00	72.50	-3.33%
Southwest Gas	33.29	34.23	36.79	39.33	41.50	45.00	8.43%
WGL Holdings, Inc.	48.56	48.63	48.67	48.65	48.70	48.80	0.21%

Source: Value Line Investment Survey

Atmos Energy Corporation

Embedded Costs of Long - Term Debt

As of June 30, 2008

Debt Series	13 Month Average Amount Outstanding	Interest Rate	Effective Interest Cost
First Mortgage Bonds	$6,730,769	10.430%	$702,019
Unsecured Note	$1,151,654	10.000%	$115,165
Unsecured Note	$1,151,654	10.000%	$115,165
Debentures	$150,000,000	6.750%	$10,125,000
7.375% Sr Note 2001-2011	$350,000,000	7.375%	$25,812,500
5.125% Sr Note 2003-2013	$250,000,000	5.125%	$12,812,500
Medium Term Notes	$10,000,000	6.670%	$667,000
Medium Term Notes	$10,000,000	6.270%	$627,000
Unsecured Notes	$300,000,000	6.020%	$18,060,000
Unsecured Notes	$400,000,000	4.000%	$16,000,000
Unsecured Notes	$500,000,000	4.950%	$24,750,000
Unsecured Notes	$200,000,000	5.950%	$11,900,000
Columbus IDB	$760,530	7.900%	$60,082
Wells Fargo Equip. Lease	$978,435	5.650%	$55,282
US Bancorp	$1,462,137	5.590%	$81,733
Pulaski	$69,231	8.000%	$5,538
Total Long-Term Debt Outstanding	$2,182,304,410		$121,888,985
Less Unamortized Debt Discount	$2,775,329		
Amortization of Debt Discount			$11,074,648
Total	$2,179,529,081		$132,963,633
Embedded Cost of Long-Term Debt			6.10%

[redacted]

Atmos Energy Corporation, KY
Case No. 2006-00464
AVERAGE ANNUALIZED LONG-TERM DEBT
as of June 30, 2008

EXHIBIT LMS-2

Data:_____Base Period___X___Forecasted Period
Type of Filing:___X____Original________Updated
Workpaper Reference No(s).

Schedule J-3
Sheet 2 of 2
Witness:

Line No.	ISSUE	13 Mth Average Amount OUTSTANDING	Interest Rate	EFFECTIVE ANNUAL Cost	COMPOSITE Interest Rate
	(A)	(B)	(C)	(D)	(E=D/B)
1	First Mortgage Bonds	$6,730,769	10.43%	$702,019	
2	Unsecured Note	1,151,654	10.00%	115,165	
3	Unsecured Note	1,151,654	10.00%	115,165	
4	Debentures	150,000,000	6.75%	10,125,000	
5	7.375% Sr Note 2001-2011	350,000,000	7.38%	25,812,500	
6	5.125% Sr Note 2003-2013	250,000,000	5.13%	12,812,500	
7	Medium Term Notes	10,000,000	6.670%	667,000	
8	Medium Term Notes	10,000,000	6.270%	627,000	
9	Unsecured Notes	300,000,000	6.02%	18,060,000	
10	Unsecured Notes	400,000,000	4.00%	16,000,000	
11	Unsecured Notes	500,000,000	4.95%	24,750,000	
12	Unsecured Notes	200,000,000	5.95%	11,900,000	
13	Columbus IDB	760,530	7.90%	60,082	
14	Wells Fargo Equipmt Lease	978,435	5.65%	55,282	
15	US Bancorp	1,462,137	5.59%	81,733	
16	Pulaski	69,231	8.00%	5,538	
17					
18	Amortization of debt discount			11,074,648	
19	Unamorized Debt Discount	(2,775,329)			
20	Total LONG-TERM DEBT	$2,179,529,081		$132,963,633	6.10%
21					
22					

Atmos Energy Corp.

Comparable Gas Companies

Comparison of Standard and Poor's and Value Line Financial Ratings

Company	Value Line Financial Strength	S&P Rating	S&P Business Position
Atmos Energy Corp.	B+	BBB	4
AGL Resources	B++	A-	4
New Jersey Resources	A	A+	2
NICOR, Inc.	A	AA	3
Northwest Natural Gas	A	AA-	1
Piedmont Natural Gas	B++	A	2
Southwest Gas	B	BBB-	3
WGL Holdings, Inc.	A	AA-	3
Comparable Companies' Median	A	A+	3.0

Sources: Value Line Investment Survey
www.standardandpoors.com

Atmos Energy Corporation

Comparable Gas Companies

Comparison of Value Line's Safety and Timeliness Rank

	Safety Rank	Timeliness Rank
Atmos Energy Corp.	2	3
AGL Resources	2	4
New Jersey Resources	1	4
NICOR, Inc.	3	3
Northwest Natural Gas	1	3
Piedmont Natural Gas	2	4
Southwest Gas	3	3
WGL Holdings, Inc.	1	4
Comparable Companies' Average	1.9	3.6

Source: Value Line Investment Survey

Atmos Energy Corporation

Comparable Gas Companies

Comparison of Returns on Common Equity

	2002	2003	2004	2005	2006E	Five Year Average
Atmos Energy Corp.	10.4%	9.3%	7.6%	8.5%	9.0%	9.0%
AGL Resources	14.5%	14.0%	11.0%	12.9%	13.0%	13.1%
New Jersey Resources	15.7%	15.6%	15.3%	17.0%	16.0%	15.9%
NICOR, Inc.	17.5%	12.3%	13.1%	12.5%	13.0%	13.7%
Northwest Natural Gas	8.5%	9.0%	8.9%	9.9%	10.0%	9.3%
Piedmont Natural Gas	10.6%	11.8%	11.1%	11.5%	12.0%	11.4%
Southwest Gas	6.5%	6.1%	8.3%	6.4%	9.5%	7.4%
WGL Holdings, Inc.	7.2%	14.0%	11.7%	12.0%	10.0%	11.0%
Comparable Companies' Averages	11.5%	11.8%	11.3%	11.7%	11.9%	11.7%

Source: Value Line Investment Survey

Atmos Energy Corporation

Comparable Gas Companies

Comparison of Returns on Total Capital

Company	2002	2003	2004	2005	2006E
Atmos Energy Corp.	6.8%	6.2%	5.8%	5.3%	5.5%
AGL Resources	8.1%	8.9%	6.3%	7.9%	8.0%
New Jersey Resources	8.7%	10.7%	10.1%	11.2%	10.5%
NICOR, Inc.	12.2%	8.3%	8.8%	9.4%	10.0%
Northwest Natural Gas	5.9%	5.7%	5.9%	6.5%	7.0%
Piedmont Natural Gas	7.8%	8.6%	7.8%	8.2%	8.5%
Southwest Gas	4.3%	4.2%	5.0%	4.3%	5.5%
WGL Holdings, Inc.	5.3%	9.1%	8.2%	8.5%	6.0%
Comparable Companies Averages	7.5%	7.9%	7.4%	8.0%	7.9%

Source: Value Line Investment Survey

Atmos Energy Corporation

Comparable Gas Companies

Comparison of Dividends per Share

Company	2002	2003	2004	2005	2006E	Growth '02-'06
Atmos Energy Corp.	1.18	1.20	1.22	1.24	1.26	1.65%
AGL Resources	1.08	1.11	1.15	1.30	1.50	8.54%
New Jersey Resources	1.20	1.24	1.30	1.36	1.45	4.82%
NICOR, Inc.	1.84	1.86	1.86	1.86	1.86	0.18%
Northwest Natural Gas	1.26	1.27	1.30	1.32	1.38	2.19%
Piedmont Natural Gas	0.80	0.82	0.85	0.91	0.96	4.90%
Southwest Gas	0.82	0.82	0.82	0.82	0.82	0.00%
WGL Holdings, Inc.	1.27	1.28	1.30	1.32	1.35	1.54%
Comparable Companies' Averages	1.18	1.20	1.23	1.27	1.33	3.17%

Source: Value Line Investment Survey

Atmos Energy Corporation

Comparable Gas Companies

Comparison of Dividend Payout Ratios

Company	2002	2003	2004	2005	2006E	Five Year Average
Atmos Energy Corp.	82%	70%	77%	73%	69%	74.2%
AGL Resources	52%	53%	49%	52%	57%	52.6%
New Jersey Resources	56%	51%	49%	50%	52%	51.6%
NICOR, Inc.	63%	88%	84%	81%	75%	78.2%
Northwest Natural Gas	79%	72%	69%	63%	62%	69.0%
Piedmont Natural Gas	83%	74%	66%	68%	72%	72.6%
Southwest Gas	70%	72%	49%	65%	44%	60.0%
WGL Holdings, Inc.	112%	56%	65%	62%	74%	73.8%
Comparable Companies' Averages	73.6%	66.6%	61.6%	63.0%	62.3%	65.4%

Source: Value Line Investment Survey

Atmos Energy Corporation

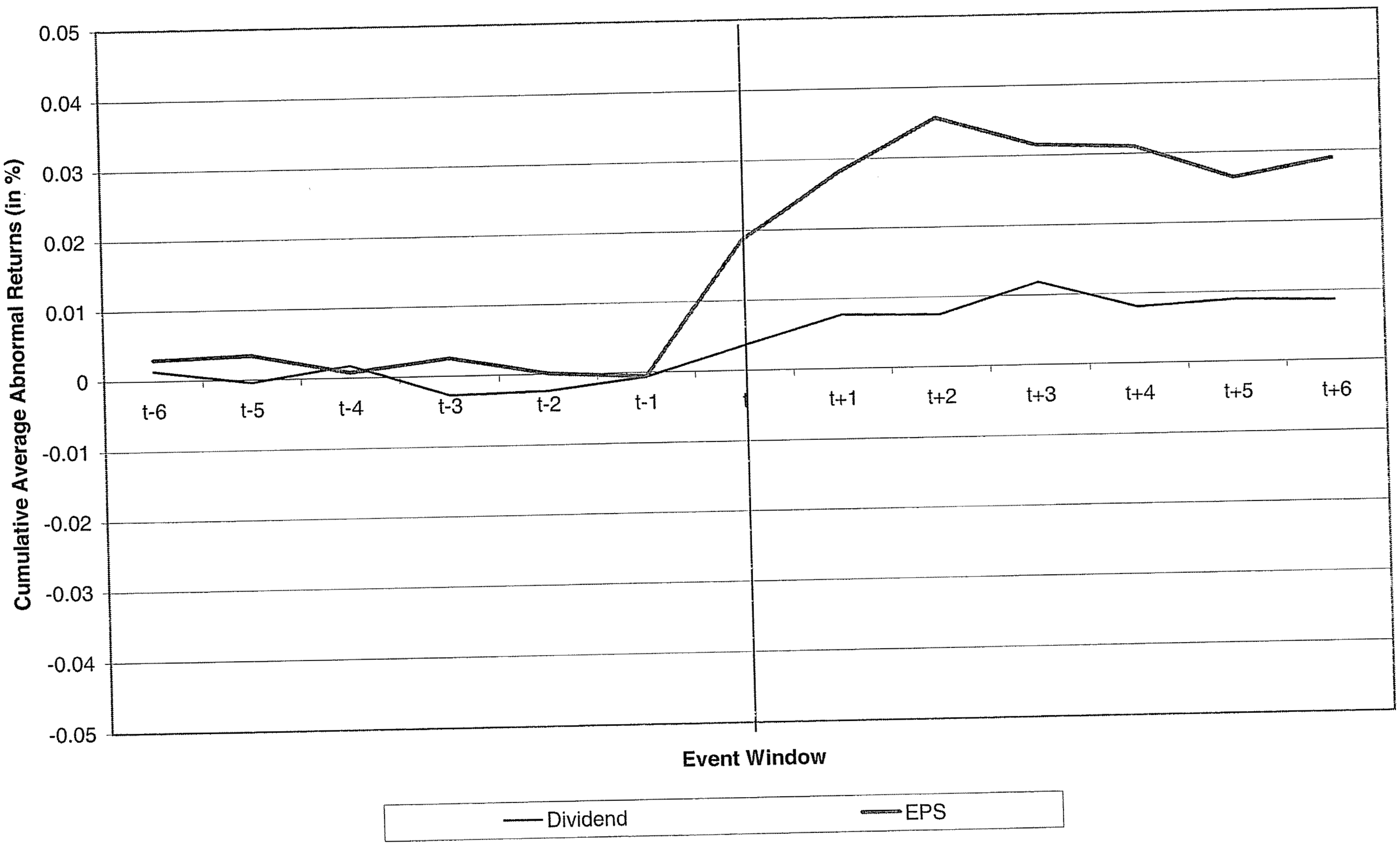
Comparable Gas Companies

Comparison of Average Annual P/E Ratio

Company	2002	2003	2004	2005	Current	Forecast '09-'11
Atmos Energy Corp.	15.2	13.4	15.9	16.1	15.6	13.0
AGL Resources	12.5	12.5	13.1	14.3	14.2	15.0
New Jersey Resources	14.7	14.0	15.3	16.8	20.6	17.0
NICOR, Inc.	13.1	15.8	15.9	17.3	17.2	16.0
Northwest Natural Gas	17.2	15.8	16.7	17.0	16.7	15.0
Piedmont Natural Gas	18.4	16.7	16.6	17.9	18.9	19.0
Southwest Gas	19.9	19.2	14.3	20.6	17.6	18.0
WGL Holdings, Inc.	23.1	11.1	14.2	14.7	14.4	14.0
Comparable Companies' Averages	17.0	15.0	15.2	16.9	17.1	16.3

Source: Value Line Investment Survey

Stock Price Responses to Positive Dividend and EPS Announcements Greater than Expected (Cumulative Average Abnormal Returns)



Comparison of the stock price responses to dividend and EPS surprises: CAAR

Event Date	t-9	t-8	t-7	t-6	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5	t+6	t+7	t+8	t+9
Dividend Surprise	0.001	0.001	0.000	0.001	0.000	0.002	-0.003	-0.002	-0.001	0.004	0.008	0.007	0.012	0.008	0.009	0.009	0.009	0.010	0.010
EPS Surprise (adjusted for base p	0.011	0.010	0.009	0.003	0.003	0.001	0.003	0.000	-0.001	0.019	0.028	0.036	0.032	0.031	0.026	0.029	0.026	0.030	0.031

Atmos Energy Corporation

Comparable Gas Companies

Discounted Cash Flow Growth Rate Summary

	2001 TO 2010 Estimate			Value Line Five Year Historical			Projections Value Line		S & P
	EPS	DPS	Book Value	EPS	DPS	Book Value	EPS	DPS	EPS
Atmos Energy Corp.	7.38%	1.70%	6.70%	6.5%	2.0%	8.5%	7.0%	2.0%	6.0%
AGL Resources	7.52%	5.51%	8.38%	13.5%	2.0%	8.5%	4.5%	6.5%	4.0%
New Jersey Resources	6.06%	4.21%	6.72%	8.5%	3.0%	7.0%	4.5%	4.5%	5.0%
NICOR, Inc.	-0.55%	1.59%	3.27%	-3.5%	3.5%	1.5%	4.0%	1.5%	4.0%
Northwest Natural Gas	5.48%	3.48%	3.68%	5.0%	1.0%	3.5%	7.0%	4.0%	5.0%
Piedmont Natural Gas	6.53%	4.91%	4.47%	5.0%	5.0%	6.5%	6.0%	5.5%	4.0%
Southwest Gas	7.50%	0.00%	3.68%	-0.5%	0.0%	3.0%	9.0%	0.0%	3.0%
WGL Holdings, Inc.	4.34%	1.83%	3.31%	6.0%	1.5%	3.0%	1.5%	2.0%	3.0%
Comparable Companies' Averages	5.27%	3.07%	4.79%	4.86%	2.29%	4.71%	5.21%	3.43%	4.00%

Sources:
Value Line Investment Survey
Standard & Poor's Earnings Guide

Atmos Energy Corporation

Comparable Gas Companies

Dividend Growth Rate DCF Using 52-Week Share Prices

	Share Prices		2006	52 Week Yields		2000-02	2009-11E	Growth	Cost of Capital	
	Low	High	Dividend	Low	High	DPS	DPS	Rate	Low	High
Atmos Energy Corp.	25.55	33.09	1.28	3.87%	5.01%	1.16	1.35	1.70%	5.57%	6.71%
AGL Resources	33.74	40.00	1.58	3.95%	4.68%	1.08	1.75	5.51%	9.46%	10.19%
New Jersey Resources	41.49	53.16	1.50	2.82%	3.62%	1.17	1.70	4.21%	7.03%	7.82%
NICOR, Inc.	38.72	49.92	1.92	3.85%	4.96%	1.75	2.02	1.59%	5.43%	6.54%
Northwest Natural Gas	32.83	42.15	1.42	3.37%	4.33%	1.25	1.70	3.48%	6.84%	7.80%
Piedmont Natural Gas	23.21	28.38	1.00	3.52%	4.31%	0.76	1.17	4.91%	8.43%	9.22%
Southwest Gas	26.04	38.96	0.82	2.10%	3.15%	0.82	0.82	0.00%	2.10%	3.15%
WGL Holdings, Inc.	27.04	33.55	1.38	4.11%	5.10%	1.26	1.48	1.83%	5.95%	6.94%
Comparable Companies' Averages	31.87	40.87	1.37	3.39%	4.31%	1.16	1.52	3.07%	6.46%	7.38%

Sources:
Value Line Investment Survey
Wall Street Journal

Atmos Energy Corporation

Comparable Gas Companies

Dividend Growth Rate DCF Using Current Share Prices

	Share Prices		Current	Current Yields		2000-02	2009-11E	Growth	Cost of Capital	
	Low	High	Dividend	Low	High	DPS	DPS	Rate	Low	High
Atmos Energy Corp.	32.20	32.59	1.28	3.93%	3.98%	1.16	1.35	1.70%	5.63%	5.68%
AGL Resources	38.47	39.00	1.58	4.05%	4.11%	1.08	1.75	5.51%	9.56%	9.62%
New Jersey Resources	51.32	51.94	1.50	2.89%	2.92%	1.17	1.70	4.21%	7.09%	7.13%
NICOR, Inc.	48.92	49.53	1.92	3.88%	3.92%	1.75	2.02	1.59%	5.46%	5.51%
Northwest Natural Gas	40.68	41.35	1.42	3.43%	3.49%	1.25	1.70	3.48%	6.91%	6.97%
Piedmont Natural Gas	27.59	28.06	1.00	3.56%	3.62%	0.76	1.17	4.91%	8.47%	8.54%
Southwest Gas	37.38	38.04	0.82	2.16%	2.19%	0.82	0.82	0.00%	2.16%	2.19%
WGL Holdings, Inc.	32.82	33.29	1.38	4.15%	4.20%	1.26	1.48	1.83%	5.98%	6.04%
Comparable Companies' Averages	39.60	40.17	1.37	3.44%	3.50%	1.16	1.52	3.07%	6.52%	6.57%

Sources:
Value Line Investment Survey
Yahoo! FINANCE

Atmos Energy Corporation

Comparable Gas Companies

Earnings Growth Rate DCF Using 52-Week Share Prices

	Share Prices		2006	52 Week Yields		2000-02	2009-11E	Growth	Cost of Capital	
	Low	High	Dividend	Low	High	EPS	EPS	Rate	Low	High
Atmos Energy Corp.	25.55	33.09	1.28	3.87%	5.01%	1.32	2.50	7.38%	11.25%	12.39%
AGL Resources	33.74	40.00	1.58	3.95%	4.68%	1.54	2.95	7.52%	11.47%	12.20%
New Jersey Resources	41.49	53.16	1.50	2.82%	3.62%	1.94	3.30	6.06%	8.88%	9.68%
NICOR, Inc.	38.72	49.92	1.92	3.85%	4.96%	2.94	2.80	-0.55%	3.29%	4.41%
Northwest Natural Gas	32.83	42.15	1.42	3.37%	4.33%	1.76	2.85	5.48%	8.85%	9.80%
Piedmont Natural Gas	23.21	28.38	1.00	3.52%	4.31%	0.99	1.75	6.53%	10.06%	10.84%
Southwest Gas	26.04	38.96	0.82	2.10%	3.15%	1.17	2.25	7.50%	9.61%	10.65%
WGL Holdings, Inc.	27.04	33.55	1.38	4.11%	5.10%	1.60	2.35	4.34%	8.45%	9.44%
Comparable Companies' Averages	31.87	40.87	1.37	3.39%	4.31%	1.71	2.61	5.27%	8.66%	9.57%
Comparable Companies' Averages without NICOR Inc.									9.55%	10.44%

Sources:
Value Line Investment Survey
Wall Street Journal

Atmos Energy Corporation

Comparable Gas Companies

Earnings Growth Rate DCF Using Current Share Prices

	Share Prices		Current	Current Yields		2000-02	2009-11E	Growth	Cost of Capital	
	Low	High	Dividend	Low	High	EPS	EPS	Rate	Low	High
Atmos Energy Corp.	32.20	32.59	1.28	3.93%	3.98%	1.32	2.50	7.38%	11.31%	11.36%
AGL Resources	38.47	39.00	1.58	4.05%	4.11%	1.54	2.95	7.52%	11.57%	11.62%
New Jersey Resources	51.32	51.94	1.50	2.89%	2.92%	1.94	3.30	6.06%	8.95%	8.98%
NICOR, Inc.	48.92	49.53	1.92	3.88%	3.92%	2.94	2.80	-0.55%	3.32%	3.37%
Northwest Natural Gas	40.68	41.35	1.42	3.43%	3.49%	1.76	2.85	5.48%	8.91%	8.97%
Piedmont Natural Gas	27.59	28.06	1.00	3.56%	3.62%	0.99	1.75	6.53%	10.10%	10.16%
Southwest Gas	37.38	38.04	0.82	2.16%	2.19%	1.17	2.25	7.50%	9.66%	9.70%
WGL Holdings, Inc.	32.82	33.29	1.38	4.15%	4.20%	1.60	2.35	4.34%	8.48%	8.54%
Comparable Companies' Averages	39.60	40.17	1.37	3.44%	3.50%	1.71	2.61	5.27%	8.71%	8.76%
Comparable Companies' Averages without NICOR Inc.									9.61%	9.66%

Sources:
Value Line Investment Survey
Yahoo! FINANCE

Atmos Energy Corporation

Comparable Gas Companies

Projected Growth Rate DCF Using 52-Week Share Prices

	Share Prices		2006	52 Week Yields		EPS Estimates		Cost of Capital	
	Low	High	Dividend	Low	High	Value Line	S&P	Low	High
Atmos Energy Corp.	25.55	33.09	1.28	3.87%	5.01%	7.00%	6.00%	10.87%	12.01%
AGL Resources	33.74	40.00	1.58	3.95%	4.68%	4.50%	4.00%	7.95%	9.18%
New Jersey Resources	41.49	53.16	1.50	2.82%	3.62%	4.50%	5.00%	7.32%	8.62%
NICOR, Inc.	38.72	49.92	1.92	3.85%	4.96%	4.00%	4.00%	7.85%	8.96%
Northwest Natural Gas	32.83	42.15	1.42	3.37%	4.33%	7.00%	5.00%	8.37%	11.33%
Piedmont Natural Gas	23.21	28.38	1.00	3.52%	4.31%	6.00%	4.00%	7.52%	10.31%
Southwest Gas	26.04	38.96	0.82	2.10%	3.15%	9.00%	3.00%	5.10%	12.15%
WGL Holdings, Inc.	27.04	33.55	1.38	4.11%	5.10%	1.50%	3.00%	5.61%	8.10%
Comparable Companies' Averages	31.87	40.87	1.37	3.39%	4.31%	5.21%	4.00%	7.10%	9.81%

Sources:
Value Line Investment Survey
Wall Street Journal
Standard & Poor's Earnings Guide

Atmos Energy Corporation

Comparable Gas Companies

Projected Growth Rate DCF Using Current Share Prices

	Share Prices		Current	Current Yields		EPS Estimates		Cost of Capital	
	Low	High	Dividend	Low	High	Value Line	S&P	Low	High
Atmos Energy Corp.	32.20	32.59	1.28	3.93%	3.98%	7.00%	6.00%	10.93%	10.98%
AGL Resources	38.47	39.00	1.58	4.05%	4.11%	4.50%	4.00%	8.05%	8.61%
New Jersey Resources	51.32	51.94	1.50	2.89%	2.92%	4.50%	5.00%	7.39%	7.92%
NICOR, Inc.	48.92	49.53	1.92	3.88%	3.92%	4.00%	4.00%	7.88%	7.92%
Northwest Natural Gas	40.68	41.35	1.42	3.43%	3.49%	7.00%	5.00%	8.43%	10.49%
Piedmont Natural Gas	27.59	28.06	1.00	3.56%	3.62%	6.00%	4.00%	7.56%	9.62%
Southwest Gas	37.38	38.04	0.82	2.16%	2.19%	9.00%	3.00%	5.16%	11.19%
WGL Holdings, Inc.	32.82	33.29	1.38	4.15%	4.20%	1.50%	3.00%	5.65%	7.20%
Comparable Companies' Averages	39.60	40.17	1.37	3.44%	3.50%	5.21%	4.00%	7.16%	9.00%

Sources:
Value Line Investment Survey
Standard & Poor's Earnings Guide
Yahoo! FINANCE

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	52-Week		Current		2007		---------------- DIVIDENDS		
	High	Low	High	Low	Dividend	2000	2001	2002	2000-02
Atmos Energy Corp.	33.09	25.55	32.59	32.20	1.28	1.14	1.16	1.18	1.16
AGL Resources	40.00	33.74	39.00	38.47	1.58	1.08	1.08	1.08	1.08
New Jersey Resources	53.16	41.49	51.94	51.32	1.50	1.15	1.17	1.20	1.17
NICOR, Inc.	49.92	38.72	49.53	48.92	1.92	1.66	1.76	1.84	1.75
Northwest Natural Gas	42.15	32.83	41.35	40.68	1.42	1.24	1.25	1.26	1.25
Piedmont Natural Gas	28.38	23.21	28.06	27.59	1.00	0.72	0.76	0.80	0.76
Southwest Gas	38.96	26.04	38.04	37.38	0.82	0.82	0.82	0.82	0.82
WGL Holdings, Inc.	33.55	27.04	33.29	32.82	1.38	1.24	1.26	1.27	1.26
Comparable Companies' Averages	40.87	31.87	40.17	39.60	1.37	1.13	1.16	1.18	1.16

Sources : Value Line Investment Survey
09/15/2006
Wall Street Journal
12/07/2006

s Energy Corporation
ırable Gas Companies
06 Cost of Capital

	S ----------------			------------------- EARNINGS -------------------					
	2009-11E	01 to 10 GR	2000	2001	2002	2000-02	2009-11E	01 to 10 GR	2000
Atmos Energy Corp.	1.35	1.70%	1.03	1.47	1.45	1.32	2.50	7.38%	12.28
AGL Resources	1.75	5.51%	1.29	1.50	1.82	1.54	2.95	7.52%	11.50
New Jersey Resources	1.70	4.21%	1.79	1.95	2.09	1.94	3.30	6.06%	12.43
NICOR, Inc.	2.02	1.59%	2.94	3.01	2.88	2.94	2.80	-0.55%	15.56
Northwest Natural Gas	1.70	3.48%	1.79	1.88	1.62	1.76	2.85	5.48%	17.93
Piedmont Natural Gas	1.17	4.91%	1.01	1.01	0.95	0.99	1.75	6.53%	8.26
Southwest Gas	0.82	0.00%	1.21	1.15	1.16	1.17	2.25	7.50%	16.82
WGL Holdings, Inc.	1.48	1.83%	1.79	1.88	1.14	1.60	2.35	4.34%	15.31
Comparable Companies' Averages	1.52	3.07%	1.69	1.77	1.67	1.71	2.61	5.27%	13.97

Sources : Value Line Investment Survey
09/15/2006
Wall Street Journal
12/07/2006

	BOOK VALUE				
	2001	2002	2000-02	2009-11E	01 to 10 GR
Atmos Energy Corp.	14.31	13.75	13.45	24.10	6.70%
AGL Resources	12.19	12.52	12.07	24.90	8.38%
New Jersey Resources	13.20	13.06	12.90	23.15	6.72%
NICOR, Inc.	16.39	16.55	16.17	21.60	3.27%
Northwest Natural Gas	18.56	18.88	18.46	25.55	3.68%
Piedmont Natural Gas	8.63	8.91	8.60	12.75	4.47%
Southwest Gas	17.27	17.91	17.33	24.00	3.68%
WGL Holdings, Inc.	16.24	15.78	15.78	21.15	3.31%
Comparable Companies' Averages	14.64	14.80	14.47	21.87	4.79%

Sources : Value Line Investment Survey
09/15/2006
Wall Street Journal
12/07/2006

Yahoo Finance Share Prices										
Atmos Energy Corporation										
	Atmos Energy Corp.		AGL Resources		New Jersey Resources		NICOR, Inc.		Northwest Natural Gas	
Date	High	Low	High	Low	High	Low	High	Low	High	Low
27-Nov-06	32.51	31.96	37.73	37.18	51.86	50.8	49.02	48.08	40.17	39.12
28-Nov-06	32.09	31.9	37.88	37.32	51.5	50.96	48.84	48.21	40.17	39.38
29-Nov-06	32.63	32.15	38.58	37.88	51.78	51.23	49.53	48.74	40.96	40.23
30-Nov-06	32.78	32.48	38.83	38.32	51.8	51.35	49.92	49.1	41.27	40.85
01-Dec-06	32.75	32.32	38.61	38.11	51.76	51.06	49.58	48.76	41.43	40.8
04-Dec-06	32.86	32.44	39.33	38.65	51.86	51.4	49.8	49.46	41.9	40.98
05-Dec-06	32.85	32.73	39.72	39.12	52.54	51.89	49.83	49.5	42.15	41.55
06-Dec-06	32.87	32.57	39.82	39.55	52.14	51.69	49.69	49.38	41.95	41.47
07-Dec-06	32.7	31.91	39.93	39.4	52.08	51.52	49.62	49.11	41.83	41.37
08-Dec-06	31.9	31.5	39.55	39.21	52.05	51.28	49.46	48.9	41.69	41.08
Average	32.594	32.196	38.998	38.474	51.937	51.318	49.529	48.924	41.352	40.683

Yahoo Finance Share						
Atmos Energy Corpor						
	Piedmont Natural Gas		Southwest Gas		WGL Holdings, Inc.	
Date	High	Low	High	Low	High	Low
27-Nov-06	27.65	27.07	36.98	36.32	33.18	32.33
28-Nov-06	27.53	26.9	37.11	36.32	32.78	32.3
29-Nov-06	27.95	27.59	37.84	37.1	33.26	32.92
30-Nov-06	28.02	27.66	37.87	37.42	33.3	32.9
01-Dec-06	27.95	27.29	37.57	36.77	33.08	32.33
04-Dec-06	28.12	27.73	38.38	37.34	33.42	32.94
05-Dec-06	28.38	27.99	38.96	38.29	33.55	33.25
06-Dec-06	28.38	28.09	38.5	38.23	33.49	33.29
07-Dec-06	28.44	28.05	38.63	38.21	33.5	33.13
08-Dec-06	28.2	27.53	38.53	37.83	33.35	32.85
Average	28.062	27.590	38.037	37.383	33.291	32.824

Atmos Energy Corporation

Comparable Gas Companies

Size Adjusted Capital Asset Pricing Model

	Risk Free Return	Beta	Equity Risk Premium	Adjusted Equity Risk Premium	Size Premium	Cost of Equity
Atmos Energy Corp.	4.78%	0.75	7.10%	5.33%	1.02%	11.13%
AGL Resources	4.78%	0.95	7.10%	6.75%	1.02%	12.55%
New Jersey Resources	4.78%	0.80	7.10%	5.68%	1.81%	12.27%
NICOR, Inc.	4.78%	1.20	7.10%	8.52%	1.02%	14.32%
Northwest Natural Gas	4.78%	0.75	7.10%	5.33%	1.81%	11.92%
Piedmont Natural Gas	4.78%	0.80	7.10%	5.68%	1.02%	11.48%
Southwest Gas	4.78%	0.85	7.10%	6.04%	1.81%	12.63%
WGL Holdings, Inc.	4.78%	0.80	7.10%	5.68%	1.81%	12.27%
Comparable Companies' Average	4.78%	0.88	7.10%	6.24%	1.47%	12.49%

Sources :
Value Line Investment Survey
Ibbotson Associates 2006 SBBI Yearbook: Valuation Edition
Federal Reserve Statistical Release

Atmos Energy Corporation

Comparable Gas Companies

Historical Capital Asset Pricing Model

	Market Total Returns	Long-Term Corporate Bonds Return	Risk Premium	Beta	Adjusted Risk Premium	Aaa Corporate Bonds Return	Cost of Equity
Atmos Energy Corp.	14.85%	6.20%	8.65%	0.75	6.49%	5.33%	11.82%
AGL Resources	14.85%	6.20%	8.65%	0.95	8.22%	5.33%	13.55%
New Jersey Resources	14.85%	6.20%	8.65%	0.80	6.92%	5.33%	12.25%
NICOR, Inc.	14.85%	6.20%	8.65%	1.20	10.38%	5.33%	15.71%
Northwest Natural Gas	14.85%	6.20%	8.65%	0.75	6.49%	5.33%	11.82%
Piedmont Natural Gas	14.85%	6.20%	8.65%	0.80	6.92%	5.33%	12.25%
Southwest Gas	14.85%	6.20%	8.65%	0.85	7.35%	5.33%	12.68%
WGL Holdings, Inc.	14.85%	6.20%	8.65%	0.80	6.92%	5.33%	12.25%
Comparable Companies' Average	14.85%	6.20%	8.65%	0.88	7.60%	5.33%	12.93%

Sources :
Value Line Investment Survey
Ibbotson Associates 2006 SBBI Yearbook: Valuation Edition
Federal Reserve Statistical Release

Atmos Energy Corporation

Comparable Gas Companies

Summary of Discounted Cash Flow and Capital Asset Pricing Analysis

	Comparable Gas Companies		Atmos Energy Corporation	
	Low	High	Low	High
Capital Asset Pricing Model				
Size Adjusted Capital Asset Pricing Model		12.49%		11.13%
Historical Capital Asset Pricing Model		12.93%		11.82%
52-Week Discounted Cash Flow				
Using Earnings Growth Rates	9.55%	10.44%	11.25%	12.39%
Using Projected Growth Rates	7.10%	9.81%	10.87%	12.01%
Current Discounted Cash Flow				
Using Earnings Growth Rates	9.61%	9.66%	11.31%	11.36%
Using Projected Growth Rates	7.16%	9.00%	10.93%	10.98%

Sources: Schedules DAM-20 through DAM-25

Atmos Energy Corporation

Recent Increase in Returns on Common Equity

By Industry Group

Industry	Earnings 2003	2004	2005	2006	Percent Increase 2003-2006
Atmos	9.30%	7.60%	8.50%	9.00%	-0.30%
Building Materials	13.50%	15.30%	16.00%	16.00%	2.50%
Cement & Aggregates	9.40%	14.50%	19.50%	22.50%	13.10%
Chemical/Diversified	15.20%	16.20%	19.70%	19.50%	4.30%
Healthcare Information	12.50%	16.10%	15.10%	15.50%	3.00%
Household Products	33.50%	34.60%	39.80%	18.50%	-15.00%
Insurance (Life)	9.30%	9.60%	10.80%	11.00%	1.70%
Machinery	11.90%	16.50%	19.20%	20.00%	8.10%
Railroad	8.60%	9.30%	11.50%	11.50%	2.90%
Tire & Rubber	0.30%	6.80%	18.90%	17.00%	16.70%
Three Month Treasury Security*	1.03%	1.40%	3.22%	5.04%	4.01%

* The Week Ending December 1 is used for the 2006 Three Month Treasury Security

Sources: Value Line Investment Survey
Federal Reserve

Atmos Energy Corporation

Projected Cost of Capital

	Percent of Total	Embedded Cost Low	Middle	High	Weighted Cost of Capital Low	Middle	High
Long Term Debt	51.80%	6.10%	6.10%	6.10%	3.16%	3.16%	3.16%
Common Equity	48.20%	11.50%	11.75%	12.00%	5.54%	5.66%	5.78%
Total Capital	100.00%				8.70%	8.82%	8.94%

Source:
Atmos Energy Corporation Work Papers

Atmos Energy Corporation

Comparable Gas Companies

Comparison of After-Tax Times Interest Earned Ratios

Atmos Energy Corp.	@11.50% ROE	2.75
	@11.75% ROE	2.79
	@12.00% ROE	2.83
AGL Resources		2.95
New Jersey Resources		4.56
NICOR, Inc.		5.91
Northwest Natural Gas		2.77
Piedmont Natural Gas		3.54
Southwest Gas		1.50
WGL Holdings, Inc.		3.62
Comparable Companies' Average		3.55

Source : Value Line Investment Survey

Atmos Energy Corporation
Comparison of After-Tax Times Interest Earned Ratios

	LTD Interest (1)	LTD Out (2)	LTD Rate (3)	2005 LTD Ratio (4)	Wtd Cost of LTD (5)	Pref Divd. (6)	Pref Out (7)
Atmos Energy Corp.			6.10%	51.80%	3.16%	N/A	N/A
			6.10%	51.80%	3.16%	N/A	N/A
			6.10%	51.80%	3.16%	N/A	N/A
AGL Resources	100.00	1632.00	6.13%	51.90%	3.18%	0.00	0.00
New Jersey Resources	22.00	333.80	6.59%	42.00%	2.77%	0.00	0.00
NICOR, Inc.	20.00	470.20	4.25%	37.40%	1.59%	0.03	0.60
Northwest Natural Gas	31.00	492.00	6.30%	47.00%	2.96%	0.00	0.00
Piedmont Natural Gas	40.00	625.00	6.40%	41.40%	2.65%	0.00	0.00
Southwest Gas	85.00	1166.90	7.28%	63.80%	4.65%	0.00	0.00
WGL Holdings, Inc.	40.00	581.80	6.88%	39.50%	2.72%	1.30	28.20
Comparable Companies' Average	48.29	757.39	0.06	0.46	0.03	0.19	4.11

SOURCE: September 15, 2006 Value Line Investment Survey

Atmos Energy Corporation

Comparison of After-Tax Times Interest Earned Ratios

	Pref Rate (8)	Pref Ratio (9)	Wtd Cost of Pref (10)	Earned Equity Rate (11)	Equity Ratio (12)	Wtd of Cost Equity (13)	Wtd Cost of Capital (14)
Atmos Energy Corp.	0.00%	0.00%	0.0000%	11.5%	48.20%	5.54%	8.70%
	0.00%	0.00%	0.0000%	11.8%	48.20%	5.66%	8.82%
	0.00%	0.00%	0.0000%	12.0%	48.20%	5.78%	8.94%
AGL Resources	0.00%	0.00%	0.00%	12.90%	48.10%	6.20%	9.39%
New Jersey Resources	0.00%	0.00%	0.00%	17.00%	58.00%	9.86%	12.63%
NICOR, Inc.	5.00%	0.10%	0.01%	12.50%	62.50%	7.81%	9.41%
Northwest Natural Gas	0.00%	0.00%	0.00%	9.90%	53.00%	5.25%	8.21%
Piedmont Natural Gas	0.00%	0.00%	0.00%	11.50%	58.60%	6.74%	9.39%
Southwest Gas	0.00%	0.00%	0.00%	6.40%	36.20%	2.32%	6.96%
WGL Holdings, Inc.	4.61%	1.90%	0.09%	12.00%	58.60%	7.03%	9.84%
Comparable Companies' Average	0.01	0.00	0.00	0.12	0.54	0.06	0.09

SOURCE: September 15, 2006 Value Line Investment Survey

Atmos Energy Corporation

Comparison of After-Tax Times Interest Earned Ratios

	Times Interest Earned (15)
Atmos Energy Corp.	2.75
	2.79
	2.83
AGL Resources	2.95
New Jersey Resources	4.56
NICOR, Inc.	5.91
Northwest Natural Gas	2.77
Piedmont Natural Gas	3.54
Southwest Gas	1.50
WGL Holdings, Inc.	3.62
Comparable Companies' Average	3.55

SOURCE: September 15, 2006 Value Line Investment Survey

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 232
Witness: Laurie Sherwood

Data Request:

Please provide electronic copies of the following items sponsored by Laurie M. Sherwood: FR 10(8)(c), FR 10 (9)(h)(11), FR 10(9)(u), and FR 10(10)(j). For the electronic version (Microsoft Excel), please keep all data and equations intact.

Response:

The excel file on the attached CD includes FR 10(9)h 11, which also covers the requirement in FR 10(8)c as it applies to the portion of the requirement sponsored by Laurie Sherwood. The file also includes schedules in support of FR 10(10)j. Electronic schedules supporting the item in FR10(9)u sponsored by Laurie Sherwood are provided in response to KPSC DR2-32 (c) and (d).

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 233
Witness: Laurie Sherwood

Data Request:

Please provide all work papers associated with the development of the following items sponsored by Laurie M. Sherwood: FR 10(8)(c), FR 10 (9)(h)(11), FR 10(9)(u), and FR 10(10)(j). Please provide the work papers in hard copy as well as electronic formats. For the electronic version (Microsoft Excel), please keep all data and equations intact.

Response:

For FR 10(8)c, FR 10(9)h 11 and FR 10(10)j, please refer to response to AG 1-214. For FR 10(9)u, please see response to KPSC DR 2-32 (c) & (d). Electronic files for both of these responses are included on the included CD.

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 234
Witness: Laurie Sherwood

Data Request:

With respect to page 4, lines 1-15, and FR 10(10)(j), please provide (a) the company's actual capital structure as of the end current fiscal year as well as the end of the test year, (b) a list of all assumptions, adjustments, and pro forma financings made to the actual capital structure in arriving at the recommended capital structure, (c) an electronic version of all work papers used in developing the capital structure. For the electronic version (Microsoft Excel), please keep all data and equations intact.

Response:

Please see the response to KPSC DR 214.

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 235
Witness: Laurie Sherwood

Data Request:

With respect to page 6, lines 1-8, please provide the Company's quarterly capitalization amounts and ratios, both including and excluding short-term debt, for the past three years. Please provide the data in both paper and electronic (Microsoft Excel) formats. For the electronic version, please keep all data and equations intact.

Response:

Please see attached schedule and CD.

Atmos Energy Corporation, KY
Case No. 2006-00464
Capital Structure Summary
AG DR 1-235

	Mar-06	% of Total Capital w/o ST Debt	% of Total Capital w/ ST Debt	Jun-06	% of Total Capital w/o ST Debt	% of Total Capital w/ ST Debt	Sep-06	% of Total Capital w/o ST Debt	% of Total Capital w/ ST Debt	Dec-06	% of Total Capital w/o ST Debt	% of Total Capital w/ ST Debt
Equity	1,706,290,715	43.9%	41.9%	1,664,555,394	43.3%	41.3%	1,648,098,144	43.0%	39.7%	1,920,456,737	46.8%	44.2%
Long-Term debt (including curr mat.)	2,184,427,797	56.1%	53.6%	2,184,082,478	56.7%	54.2%	2,183,548,011	57.0%	52.7%	2,181,941,525	53.2%	50.2%
Short Term Notes Payable - daily avg	186,226,613		4.6%	179,760,000		4.5%	314,803,500		7.6%	240,125,806		5.5%
Total Capitalization	4,076,945,125	100.0%	100.0%	4,028,397,872	100.0%	100.0%	4,146,449,655	100.0%	100.0%	4,342,524,068	100.0%	100.0%

	Mar-05	% of Total Capital w/o ST Debt	% of Total Capital w/ ST Debt	Jun-05	% of Total Capital w/o ST Debt	% of Total Capital w/ ST Debt	Sep-05	% of Total Capital w/o ST Debt	% of Total Capital w/ ST Debt	Dec-05	% of Total Capital w/o ST Debt	% of Total Capital w/ ST Debt
Equity	1,632,270,572	41.9%	41.9%	1,616,010,262	42.5%	42.5%	1,602,421,868	42.3%	41.9%	1,632,744,369	42.8%	39.6%
Long-Term debt (including curr mat.)	2,260,704,171	58.1%	58.1%	2,186,880,299	57.5%	57.5%	2,186,367,572	57.7%	57.1%	2,184,783,121	57.2%	53.0%
Short Term Notes Payable - daily avg	-		0.0%	3,000,000		0.1%	36,963,333		1.0%	303,849,194		7.4%
Total Capitalization	3,892,974,743	100.0%	100.0%	3,805,890,561	100.0%	100.0%	3,825,752,772	100.0%	100.0%	4,121,376,684	100.0%	100.0%

	Mar-04	% of Total Capital w/o ST Debt	% of Total Capital w/ ST Debt	Jun-04	% of Total Capital w/o ST Debt	% of Total Capital w/ ST Debt	Sep-04	% of Total Capital w/o ST Debt	% of Total Capital w/ ST Debt	Dec-04	% of Total Capital w/o ST Debt	% of Total Capital w/ ST Debt
Equity	932,849,078	51.7%	51.6%	926,845,629	51.6%	51.6%	1,133,458,925	56.6%	56.6%	1,539,077,985	40.5%	40.3%
Long-Term debt (including curr mat.)	872,717,450	48.3%	48.3%	869,184,266	48.4%	48.4%	868,549,846	43.4%	43.4%	2,261,069,589	59.5%	59.3%
Short Term Notes Payable - daily avg	1,390,323		0.1%	-		0.0%	-		0.0%	15,231,452		0.4%
Total Capitalization	1,806,956,852	100.0%	100.0%	1,796,029,895	100.0%	100.0%	2,002,008,771	100.0%	100.0%	3,815,379,026	100.0%	100.0%

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 236
Witness: Laurie Sherwood

Data Request:

With respect to page 6, lines 9-22, please provide copies of all documents filed with the SEC in conjunction with debt and equity financings over the period from 2004 to the present.

Response:

Please follow the links below for publicly available copies (at www.sec.gov) of responsive filings:

http://www.sec.gov/Archives/edgar/data/731802/000095013406022539/0000950134-06-022539-index.htm

http://www.sec.gov/Archives/edgar/data/731802/000095013406022850/0000950134-06-022850-index.htm

http://www.sec.gov/Archives/edgar/data/731802/000119312504042208/0001193125-04-042208-index.htm

http://www.sec.gov/Archives/edgar/data/731802/000119312504055309/0001193125-04-055309-index.htm

http://www.sec.gov/Archives/edgar/data/731802/000119312504101617/0001193125-04-101617-index.htm

http://www.sec.gov/Archives/edgar/data/731802/000095013404009766/0000950134-04-009766-index.htm

http://www.sec.gov/Archives/edgar/data/731802/000095013404010080/0000950134-04-010080-index.htm

http://www.sec.gov/Archives/edgar/data/731802/000095013404013042/0000950134-04-013042-index.htm http://www.sec.gov/Archives/edgar/data/731802/000095013404015074/0000950134-04-015074-index.htm

http://www.sec.gov/Archives/edgar/data/731802/000095013404015140/0000950134-04-015140-index.htm

http://www.sec.gov/Archives/edgar/data/731802/000095013404015315/0000950134-04-015315-index.htm

http://www.sec.gov/Archives/edgar/data/731802/000095013404015509/0000950134-04-015509-index.htm

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 237
Witness: Laurie Sherwood

Data Request:

Please provide copies of all presentations made by investment banking and/or consultants hired by the Company in association with financings over the period 2004 to the present.

Response:

Information responsive to this data request (and labeled AG DR1-237 ATT1 thru ATT5) is being filed subject to the terms of a confidentiality petition accompanying Atmos' responses to the Attorney General's Initial Data Requests.

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 238
Witness: Laurie Sherwood

Data Request:

Does the Company maintain a separate capital structure for its seven different regulated gas divisions? If so, please provide quarterly capitalization amounts and ratios, including and excluding short-term debt, for each division over the 2004-2006 period.

Response:

Atmos Energy does not maintain a separate capital structure for any regulated natural gas division. These operating divisions are legally part of a single parent company.

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 239
Witness: Laurie Sherwood

Data Request:

With respect to page 8, lines 1-12, please provide the Company's use of short-term debt on a monthly basis for (a) the past year and (b) as projected for the future test year. Please specify the amounts outstanding and the interest rate charged. Please provide the data in both paper and electronic (Microsoft Excel) formats. For the electronic version, please keep all data and equations intact.

Response:

Please see attached schedule and electronic file on the attached CD. Also, for details on derivation of test-year short-term debt outstanding, see the response to KPSC DR2-34(c).

Use of Short-Term Debt
AG DR 1-239

	Daily Average ST Debt Outstanding	Interest	Interest Rate (Excluding Commitment Fees)
Oct-05	156,300,161	559,247	4.213%
Nov-05	236,930,933	850,790	4.369%
Dec-05	303,849,194	1,196,412	4.636%
Jan-06	268,228,226	1,098,201	4.821%
Feb-06	186,207,821	689,325	4.826%
Mar-06	186,226,613	780,243	4.933%
Apr-06	148,120,000	622,580	5.114%
May-06	167,400,000	748,134	5.262%
Jun-06	179,760,000	792,830	5.366%
Jul-06	250,205,645	1,187,465	5.588%
Aug-06	272,648,355	1,291,065	5.575%
Sep-06	314,803,500	1,436,296	5.551%
Oct-06	376,837,452	1,777,477	5.554%
Nov-06	393,379,333	1,797,259	5.559%
Dec-06	240,125,806	1,133,972	5.560%
Jan-07	100,675,806	474,691	5.552%
Feb-07	59,592,857	252,651	5.527%
<u>Test Year</u>			
Jul-07	118,196,996	560,157	5.580%
Aug-07	97,734,336	463,180	5.580%
Sep-07	76,742,900	351,966	5.580%
Oct-07	126,093,051	597,577	5.580%
Nov-07	179,846,433	824,830	5.580%
Dec-07	215,143,813	1,019,605	5.580%
Jan-08	179,005,866	848,341	5.580%
Feb-08	96,087,414	411,307	5.580%
Mar-08	104,640,031	495,908	5.580%
Apr-08	91,926,877	421,604	5.580%
May-08	96,293,572	456,352	5.580%
Jun-08	104,924,231	481,214	5.580%

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 240
Witness: Laurie Sherwood

(Note: We believe there is a discrepancy in the data request. Ms. Sherwood's testimony contains 14 pages. We believe the DR refers to page 9 of Ms. Sherwood's testimony lines 15-23. We trust that staff concurs and will advise us if we are incorrect.)

Data Request:

With respect to page 15, lines 21-25, please provide the Company's current cost of short-term debt and the methodology used to compute that rate. Please provide copies of all relevant documents indicating the methodology.

Response:

Please see the response to KPSC DR 2-34(c) and the electronic file provided in response to AG DR 1-239.

Atmos Energy Corporation, Kentucky
Case No. 2006-00464
Attorney General Initial Data Request Dated February 20, 2007
DR Item 241
Witness: Laurie Sherwood

Data Request:

With respect to Exhibits LMS-1,LMS-2, and LMS-3, please provide (a) an electronic copy of Exhibits LMS-1, LMS-2, and LMS-3, (b) all calculations involved in the determining the "Less Unamortized Debt Discount" and "Annualized Amortization of Debt Exp. & Debt Discount" (c) data, methodology, and assumptions used in determining the "End Int Rate for each bond issue," (d) copies of the relevant work papers used in developing the long-term debt cost rate and Exhibits LMS-1 and LMS-2, (e) copies of the relevant work papers used in developing the amount of short-term debt and the short-term debt cost rate, as well as Exhibits LMS-3. Please provide the data and work papers in both paper and electronic (Microsoft Excel) formats. For the electronic version, please keep all data and equations intact.

Response:

(a) Please see electronic copies on attached CD.
(b) Please see attached schedules and electronic copies on attached CD.
(c) Please see response to KPSC DR 2-34(a) and (b).
(d) Please see response to AG DR 1-214.
(e) Please see response to KPSC DR 2-34(c).

AG DR 1-241 (b)
Unamortized Debt Discount

Monthly Amortization = $37,011.00

	ATMOS		Unamortized Balance
Base Year	Mar-06		3,552,561
Base Year	Apr-06		3,515,550
Base Year	May-06		3,478,539
Base Year	Jun-06		3,441,528
Base Year	Jul-06		3,404,517
Base Year	Aug-06		3,367,506
Base Year	Sep-06		3,330,495
Base Year	Oct-06		3,293,484
Base Year	Nov-06		3,256,473
Base Year	Dec-06		3,219,462
Base Year	Jan-07		3,182,451
Base Year	Feb-07		3,145,440
Base Year	Mar-07		3,108,429
13-Month Avg	**Mar-07**	**$**	**3,330,495**
Interim	Apr-07		3,071,418
Interim	May-07		3,034,407
Test Year	Jun-07		2,997,396
Test Year	Jul-07		2,960,385
Test Year	Aug-07		2,923,374
Test Year	Sep-07		2,886,363
Test Year	Oct-07		2,849,352
Test Year	Nov-07		2,812,341
Test Year	Dec-07		2,775,330
Test Year	Jan-08		2,738,319
Test Year	Feb-08		2,701,308
Test Year	Mar-08		2,664,297
Test Year	Apr-08		2,627,286
Test Year	May-08		2,590,275
Test Year	Jun-08		2,553,264
13-Month Avg	**Jun-08**	**$**	**2,775,330**

Prospectus Supplement
May 15, 2001
(To Prospectus Dated November 7, 2000)

5/22/01
rec'd funds

7500

$350,000,000

ATMOS

Atmos Energy Corporation

7 3/8% Senior Notes due 2011

The Company

- We distribute and sell natural gas to over one million residential, commercial, industrial, agricultural and other customers in Colorado, Georgia, Illinois, Iowa, Kansas, Kentucky, Louisiana, Missouri, Tennessee, Texas and Virginia. We also transport natural gas for others through our distribution system and provide energy management and gas marketing services.

The Offering

- Use of Proceeds: We intend to use the net proceeds from the offering to fund our acquisition of the assets of Louisiana Gas Service Company and LGS Natural Gas Company.
- Delivery: We expect that delivery of the notes will be made to investors on or about May 22, 2001, in book-entry form, through the facilities of The Depository Trust Company.

The Notes

- Maturity: May 15, 2011
- Interest Payments: Interest on the notes is payable on May 15 and November 15, beginning on November 15, 2001.
- Redemption: We may redeem the notes prior to maturity, in whole or in part, at a redemption price equal to the greater of the principal amount of the notes and the make-whole price described in this prospectus supplement.
- Ranking: The notes rank equally with all of our other unsecured and unsubordinated indebtedness.
- The notes will not be listed on any securities exchange or included in any automated quotation system.

	Per Note	Total
Public offering price[(1)]	99.940%	$349,790,000
Underwriting discount	0.650%	$ 2,275,000
Our proceeds before expenses	99.290%	$347,515,000

[(1)]Plus accrued interest from May 22, 2001, if settlement occurs after that date.

Neither the Securities and Exchange Commission nor any state securities commissic disapproved of these securities or determined if this prospectus supplement or the attache truthful or complete. Any representation to the contrary is a criminal offense.

1

Banc of America Securities LLC

Banc One Capital Markets, Inc.

First Union Securities, Inc.

Fleet Securities, I

2

PROSPECTUS SUPPLEMENT
(To Prospectus Dated June 25, 1998)

$150,000,000

Atmos Energy Corporation

ATMOS

6¾% Debentures due 2028

Interest on the Debentures is payable semi-annually on January 15 and July 15 of each year, commencing January 15, 1999. The Debentures may be redeemed at any time at the option of Atmos Energy Corporation (the "Company"), in whole or in part, at a Redemption Price equal to the sum of (i) the principal amount of the Debentures being redeemed plus any accrued interest thereon to but not including the Redemption Date and (ii) the Make-Whole Premium (as hereinafter defined), if any. See "Description of Debentures".

The Debentures initially will be represented by a single global security registered in the name of The Depository Trust Company ("DTC"), or its nominee. Except under the limited circumstances described herein, beneficial interests in the Debentures will be shown on, and transfers thereof will be effected only through, records maintained by DTC or its participants. Except as described herein, Debentures in definitive form will not be issued. See "Description of Debt Securities — Book-Entry Debt Securities" in the accompanying Prospectus. The Debentures have been approved for listing on the New York Stock Exchange, subject to official notice of issuance.

THESE SECURITIES HAVE NOT BEEN APPROVED OR DISAPPROVED BY THE SECURITIES AND EXCHANGE COMMISSION OR ANY STATE SECURITIES COMMISSION NOR HAS THE SECURITIES AND EXCHANGE COMMISSION OR ANY STATE SECURITIES COMMISSION PASSED UPON THE ACCURACY OR ADEQUACY OF THIS PROSPECTUS SUPPLEMENT OR THE PROSPECTUS. ANY REPRESENTATION TO THE CONTRARY IS A CRIMINAL OFFENSE.

	Price to Public(1)	Underwriting Discount(2)	Proceeds to Company(1) (3)
Per Debenture	99.115%	.875%	98.240%
Total	$148,672,500	$1,312,500	$147,360,000

(1) Plus accrued interest, if any, from July 27, 1998.

(2) The Company has agreed to indemnify the Underwriters against certain liabilities, including liabilities under the Securities Act of 1933, as amended. See "Underwriting".

(3) Before deducting expenses payable by the Company estimated at $240,000.

The Debentures are offered by the several Underwriters, subject to prior sale, w accepted by the Underwriters, subject to approval of certain legal matters by couns certain other conditions. The Underwriters reserve the right to withdraw, cancel or mc orders in whole or in part. It is expected that delivery of the Debentures will be m facilities of DTC on or about July 27, 1998.

Merrill Lynch & Co. **NationsBanc Montgomer**
Edward D. Jones & Co., L.P.

The date of this Prospectus Supplement is July 22, 1998.

PROSPECTUS SUPPLEMENT
(To Prospectus dated January 30, 2002)

$250,000,000

ATMOS energy

Atmos Energy Corporation

5⅛% Senior Notes due 2013

The notes will bear interest at the rate of 5⅛% per year. Interest on the notes will be payable on January 15 and July 15 of each year, beginning July 15, 2003. The notes will mature on January 15, 2013. We may redeem the notes at any time prior to maturity, in whole or in part, at a redemption price described in this prospectus supplement. See "Description of the Notes — Optional Redemption."

The notes are unsecured and rank equally with all of our other existing and future unsubordinated debt. The notes will be issued only in registered form in denominations of $1,000 and integral multiples of $1,000.

The notes will not be listed on any securities exchange or included in any automated quotation system.

Neither the Securities and Exchange Commission nor any state securities commission has approved or disapproved of the notes or determined if this prospectus supplement and the accompanying prospectus are truthful and complete. Any representation to the contrary is a criminal offense.

	Price to Investors(1)	Underwriting Discount	Proceeds, Before Expenses, to Us
Per Note	99.915%	0.650%	99.265%
Total	$249,787,500 1	$1,625,000	$248,162,500

(1) Plus accrued interest from January 16, 2003, if settlement occurs after that date.

The notes are expected to be delivered in book-entry form through The Depository Trust Company on or about January 16, 2003.

Banc One Capital Markets, Inc. 3

DISCOUNT = $212,500

SG Cowen

SunTrust Robinson Humphrey

Wachovia Securities 4 250,000,000

Banc of America Securities LLC 4 249,787,500

KBC Financial Products USA Inc. 1 212,500

U.S. Bancorp Piper Jaffray

Hibernia Southcoast Capital, Inc.

The date of this prospectus supplement is January 13, 2003.

5

1,837,500

ATMOS energy

Offering Terms

Tranche:	3 Year	5 Year	10 Year	30 Year
Security Type:	Senior Unsecured FRN	Senior Unsecured Notes	Senior Unsecured Notes	Senior Unsecured Notes
Ratings: (Moodys/S&P/Fitch)	Baa3/BBB/BBB+	Baa3/BBB/BBB+	Baa3/BBB/BBB+	Baa3/BBB/BBB+
Principal Amount:	$300,000,00[illegible]	$400,000,000	$500,000,000	$200,000,000
Pricing Date:	October 18, 200[illegible]	October 18, 2004	October 18, 2004	October 18, 2004
Settlement Date:	October 22, 2004	October 22, 2004	October 22, 2004	October 22, 2004
Maturity Date:	October 15, 2007	October 15, 2009	October 15, 2014	October 15, 2034
Pricing Benchmark:	3 Month LIBOR	3.375% of October 2009	4.250% of August 2014	5.375% of February 2031
Benchmark Price:	-	100-9 3/4	101-19	107-27
Benchmark Yield:	Two Business Days Prior to Interest Payment Dates	3.308%	4.051%	4.844%
Reoffer Spread:	37.5 bps	T + 78 bps	T + 90 bps	T + 115 bps
Reoffer Yield (%):	-	4.088%	4.951%	5.994%
Coupon (%):	3ML + 37.5	4.000%	4.950%	5.950%
	100.00%	99.608%	99.993%	99.392%
	$300,000,000	$398,432,000	$499,965,000	$198,784,000
	0.35%	0.60%	0.65%	0.875%
	$1,050,000	$2,400,000	$3,250,000	$1,750,000
	99.650%	99.008%	99.343%	98.517%
	$298,950,000	$396,032,000	$496,715,000	$197,034,000
	3ML + 49.5	T + 92.5 bps	T + 98.4 bps	T + 121.4 bps
	Callable on each payment date, Starting April 17, 2006	MWC + 15 bps	MWC + 20 bps	MWC + 25 bps
	January 15, 2005	April 15, 2005	April 15, 2005	April 15, 2005
	Jan 15, April 15, July 15, Oct 15	April 15 & October 15	April 15 & October 15	April 15 & October 15
	0.20%	0.35%	0.40%	0.50%
	0.15%	0.25%	0.25%	0.25%
	Actual/360	30/360	30/360	30/360
	049560 AD 7	049560 AE 5	049560 AF 2	049560 AG 0
	US049560AD79	US049560AE52	US049560AF28	US049560AG01

Merrill Lynch & Co. (50%)

Banc of America Securities LLC (9.8%), JPMorgan (9.8%), SunTrust Robinson Humphrey (9.8%)

SG Corporate & Investment Banking (8%), KBC Financial Products USA Inc. (5.3%), Paper Jaffray (5.3%)

Wachovia Securities (2%)

4, 5, 6

Merrill Lynch