TABLE 2.—Securities Closing Trading Prices and Investor Transaction Execution Prices

Trading Day in Relation to Recommendation Date (t = 0)	Mean Ratio of Execution Prices to Day's Closing Prices for:		
	All Trades	Purchases on BUY Recommendations	Sales on SELL Recommendations
t = -10	0.998	0.999	0.997
t = - 5	1.008	0.999	1.050
t = - 1	1.012	1.015	0.997
t = 0	0.993	0.991	1.004
t = 5	1.000	1.001	0.995
t = 10	1.002	1.003*	0.992
t = 15	1.001	1.002	0.997
All Seven Days Combined	1.002	1.001	1.004

*Significantly different from 1.000 at 95-percent confidence level.

present instance because the analysis in [25] revealed that by then the sample's trading volume in the securities recommended had returned to its normal level. Hence, it did not seem appropriate to regard transactions at that stage to be recommendation-induced and price ratio comparisons to be relevant, as they were for the other dates in Table 2. In any event, the conclusion from the data is that the firm's customers did get the information in time and experienced the sort of trading execution that would have been required to give them effective access to the superior investment returns identified in Table 1.

V. Realized Rates of Return

An indication that investors took good advantage of the opportunities thereby presented can be found in a final piece of evidence: the returns realized by the investor sample on that portion of the investment round trips observed during the seven-year study period which appear to have been prompted by the firm's stock recommendations. The latter were interpreted to encompass all securities purchase-to-resale, or short-sale-to-cover, cycles that were *initiated* in the identified trading-day "response" interval t=-10 to t=+15 surrounding a recommendation of the security involved. While it obviously is an overstatement to define every such event as having been triggered by the recommendation, the associated over-all returns should still provide an unbiased measure of the experience of those individuals whose trades *were* so motivated. Thus, there is no reason to suspect that trading-price execution terms would differ on any given day for customer orders that happened to be placed in response to recent stock research reports, in contrast to those in the same securities that were generated by other influences.

The relevant summary of the sample's investment results is contained in Table 3. Tabulations of risk-adjusted realized rates of return, net of transactions costs,[7] are shown for the array of all securities round trips engaged in by the group during 1964-70 and,

[7]Which costs include commission charges, *SEC* fees, and—where applicable—New York securities transfer taxes and "odd lot" price differentials.

TABLE 3.–Post-Transaction-Cost Risk-Adjusted Realized Excess Returns on Investment Round Trips: 1964-70 Data For the Individual Investor Sample

(Continuously Compounded Annual Rates)

	All Round Trips (N = 75,123)	Recommended-Security Round Trips (N = 5,432)
A. Distribution–Decile Boundary Points:		
Decile #1	-43%	-35%
Decile #2	-21%	-16%
Decile #3	-11%	-10%
Decile #4	- 6%	- 3%
Decile #5	0%	2%
Decile #6	5%	6%
Decile #7	11%	14%
Decile #8	21%	24%
Decile #9	39%	37%
B. Parameters of the Distribution:		
Mean	0.1%	2.0%
σ	63%	48%

separately, for the subset of those round trips which were initiated in close proximity to a security's recommendation by the brokerage firm. This "bottom line" measure of actual investment experience reveals that round trips in recommended securities did, in fact, produce rates of return which exceeded those on the general run of common stocks by an average of approximately two percentage points.[8] That differential was statistically significant at the 95-percent confidence level and is, of course, consistent with the evidence from above that there was a *potential* for incremental returns of roughly the same order of magnitude from prompt trading responses to the recommendations examined. The investor sample, therefore, seemed able in practice to exploit that potential with some success.

VI. Synopsis

The matter of the value to investors of professional investment research has been considered here from the perspective of the experience of a large sample of the customers of one of the major national retail brokerage houses. Empirical evidence on securities price patterns over a seven-year period suggests that the firm's investment recommendations were generally timely, and conveyed information that would have permitted its customers to earn moderately above-average portfolio returns. Further, an examination of the investor sample's actual trading activities over the same period indicates not only that

[8] As discussed in [20], the rates of return on the individual round trips at issue were time-weighted in obtaining these mean values.

the firm's advice apparently was heeded often but also that the consequence of doing so was indeed effective transaction execution and superior rates of return on investment positions taken congruent with that advice.

REFERENCES

1. C. Bidwell, "How Good is Institutional Brokerage Research," *Journal of Portfolio Management*, (Winter 1977), pp. 26-31.
2. F. Black, "Yes, Virginia, There is Hope: Tests of the Value Line Ranking System," *Financial Analysts Journal*, (September/October 1973), pp. 10-14.
3. F. Black, M. Jensen, and M. Scholes, "The Capital Asset Pricing Model: Some Empirical Tests," in M. Jensen (ed.), *Studies in the Theory of Capital Markets*. New York: Praeger. (1972), pp. 79-121.
4. H. Cheney, "How Good are Investment Advisory Services," *Financial Executive*, (November 1969), pp. 30-35.
5. S. Colker, "An Analysis of Security Recommendation by Brokerage Houses," *Quarterly Review of Economics and Business*, (Summer 1963), pp. 19-28.
6. R. Diefenbach, "How Good is Institutional Research?," *Financial Analysts Journal*, (January/February 1972), pp. 54-60.
7. E. Fama, "Efficient Capital Markets: A Review of Theory and Empirical Work," *Journal of Finance*, (May 1970), pp. 383-417.
8. E. Fama, *Foundations of Finance*, New York: Basic Books, (1976).
9. E. Fama and J. MacBeth, "Risk, Return, and Equilibrium: Some Empirical Tests," *Journal of Political Economy*, (May-June 1973), pp. 607-636.
10. R. Ferber, "Short-Run Effects of Stock Market Services on Stock Prices" *Journal of Finance*, (March 1958), pp. 80-95.
11. J. Groth, W. Lewellen, and G. Schlarbaum, "An Analysis of Brokerage House Securities Recommendations," *Financial Analysts Journal*, (January/February 1979), pp. 32-40.
12. R. Lease, W. Lewellen, and G. Schlarbaum, "The Individual Investor: Attributes and Attitudes," *Journal of Finance*, (May 1974), pp. 413-433.
13. W. Lewellen, R. Lease, and G. Schlarbaum, "Patterns of Investment Strategy and Behavior Among Individual Investors," *Journal of Business*, (July 1977), pp. 296-333.
14. J. Lintner, "Security Prices, Risk, and Maximal Gains from Diversification," *Journal of Finance*, (December 1965), pp. 587-615.
15. P. Lloyd-Davies and M. Canes, "Stock Prices and the Publication of Second-Hand Information," *Journal of Business*, (January 1978), pp. 43-56.
16. D. Logue, and D. Tuttle, "Brokerage House Investment Advice," *Financial Review*, (1973), pp. 38-54.
17. J. McCain and J. Millar, "A Note on Public Information and Stock Prices," *Journal of Business Research*, (January 1975), pp. 61-64.
18. J. Mossin, "Equilibrium in a Capital Asset Market," *Econometrica*, (October 1966), pp. 768-783.
19. R. Ruff, "Effect of a Selection and Recommendation of a "Stock of the Month"," *Financial Analysts Journal*, (March/April 1963), pp. 41-43.
20. G. Schlarbaum, G., W. Lewellen, and R. Lease, "Realized Returns on Common Stock Investments: The Experience of Individual Investors," *Journal of Business*, (April 1978), pp. 299-325.
21. G. Schlarbaum, W. Lewellen, and R. Lease, "The Common-Stock-Portfolio Performance Record of Individual Investors," *Journal of Finance*, (May 1978), pp. 429-441.
22. W. Sharpe, "Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk," *Journal of Finance*, (September 1964), pp. 425-442.
23. W. Sharpe, *Portfolio Theory and Capital Markets*, New York: McGraw-Hill, (1970).
24. L. Shepard, "How Good is Investment Advice for Individuals?," *Journal of Portfolio Management*, (Winter 1977), pp. 32-36.
25. K. Stanley, W. Lewellen, and G. Schlarbaum, "Investor Response to Investment Research," *Journal of Portfolio Management*, forthcoming.
26. J. Stoffels, "Stock Recommendations by Investment Advisory Services: Immediate Effects on Market Price," *Financial Analysts Journal*, (March/April 1966), pp. 77-86.

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THE SUPERIORITY OF ANALYST FORECASTS AS MEASURES OF EXPECTATIONS: EVIDENCE FROM EARNINGS

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ACCURATE MEASUREMENT OF EARNINGS expectations is essential for studies of firm valuation, cost of capital and the relationship between unanticipated earnings and stock price changes. Under the rational expectations hypothesis [23], market earnings expectations should be measured by the best available earnings forecasts. Univariate time series forecasts are often used for this purpose ([1], [3], [4], [5], [12], [13], [14], [16], [18], [20]) instead of direct measures of earnings expectations such as security analysts' forecasts. Univariate time series forecasts neglect potentially useful information in other time series and therefore do not generally provide the most accurate possible forecasts [24]. Since security analysts process substantially more data than the time series of past earnings, their earnings forecasts *should* be superior to time series forecasts and provide better measures of market earnings expectations.

However, the mere existence of analysts as an employed factor in long run equilibrium means that analysts *must* make forecasts superior to those of time series models. To reach this conclusion, one need only assume that participants in the market for forecasts act in their own best interests and that both forecast producers and consumers demand forecasts solely on the basis of their predictive ability.[1] Since analysts' forecasts cost more than time series forecasts, the continued employment of analysts by profit-maximizing firms implies that analysts' forecasts must be superior to those of the lower cost factor, time series models.

Past comparisons of analysts' forecasts to sophisticated time series models conclude that analysts' forecasts are not more accurate than time series forecasts (Cragg and Malkiel (CM) [9]; Elton and Gruber (EG) [11]). This evidence plainly conflicts with basic economic theory. Hence, the predictive accuracy of analysts' forecasts is re-examined in this paper. In contrast with other studies, the results overwhelmingly favor the superiority of analysts over time series models.

Part I considers statistical tests and experimental design. Part II contains the empirical results. Summary and implications appear in Part III.

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1. We assume that forecast purchasers do not derive nonmonetary benefits from forecasts.

I. Experimental Design

A. *Statistical Evaluation of Forecast Methods*

Without direct information on the costs of imperfect forecasts to forecast users, comparative forecast accuracy is usually evaluated by comparing the error distributions of different forecast methods statistically. However, statistical comparisons in past studies ([9], [11]) utilize test statistics improperly, particularly Theil's U [25] and Student's t. In this section, after discussing the defects of these statistics for evaluating two or more forecast methods, the alternative statistical methods used in this study are introduced.[2]

Theil's U-statistic (applied to earnings) is the square root of

$$U_{ij}^2 = \frac{\sum_{t=1}^{T} (\dot{P}_{ijt} - \dot{A}_{it})^2}{\sum_{t=1}^{T} \dot{A}_{it}^2},$$

where $\dot{A}_{it}$ = change in actual earnings per share of firm i from $t-1$ to t,
$\dot{P}_{ijt}$ = predicted change in earnings per share of firm i from $t-1$ to t by forecast method j, and
T = total number of time series observations.

For its computation, it requires *time series* data on a firm's earnings *changes*.[3] Given forecast method j and earnings time series data on firm i, Theil's U compares the forecast accuracy of method j to that of a naive, no change, earnings forecast model.[4,5] Since analysts' earnings forecasts are currently available only in short time series, use of Theil's U for comparative forecast evaluation necessarily relies on small samples.[6] Larger sample sizes are possible by testing forecast methods on a cross-section of firms. Finally, no procedure is available with tests of significance which uses Theil's U to compare two forecast methods when neither is a no-change method. Direct hypothesis tests are preferable to inferences drawn from ranking the U statistics of different forecast methods.

For hypothesis tests of two forecast methods, an appropriate design is a one-sample or matched pairs case with self-pairing by firm. The members of each pair

2. Past studies also contain experimental biases: CM compare analysts' five-year forecasts with realizations over three and four-year horizons; EG compare analysts' forecasts with the "best" of nine time series models selected from the same time period in which comparisons with analysts' forecasts are made. This procedure introduces *ex post* selection bias.

3. EG computed "Theil's U" using earnings *levels* rather than *changes*. This statistic has unknown sampling properties.

4. $\dot{P}_{ijt} = \dot{A}_{it}$ and $U_{ij} = 0$ if prediction is perfect in every period. If no change is predicted in each period (i.e., $\dot{P}_{ijt} = 0$), $U_{ij} = 1$; $0 < U_{ij} < 1$ if prediction is less than perfect but better than the no-change prediction and $U_{ij} > 1$ if forecast method j is less accurate than the no-change prediction.

5. CM used *cross-sectional* rather than temporal data. This "Theil's U" statistic has unknown sampling properties because each error is drawn from a different error distribution, one for each firm.

6. EG's sample size in computing Theil's U varied between two and six.

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are the errors from the two methods; the matched pair is reduced to a single observation by taking the difference in the errors. The usual parametric test of the mean difference is the paired t-test [17]. An alternative non-parametric test of the median difference is the Wilcoxon Signed Ranks test [8].

The parametric paired t-test is inappropriate for testing mean error differences of forecast methods applied to cross-section earnings data. If applied to error measures stated in level form (e.g., $|P_{ijt} - A_{it}|$, where P_{ijt} = firm i's forecasted earnings per share for period t by method j and A_{it} = firm i's actual earnings per share in period t), the test's assumption that paired differences are drawn from the same population is violated since each error difference depends upon each firm's earnings per share level. If applied to error measures stated in ratio form (e.g., $|P_{ijt} - A_{it}|/|A_{it}|$), the distributional assumptions of the paired t-test are also unlikely to be fulfilled since ratio measures applied to earnings per share data are dominated by outliers because actual earnings per share are often close to zero.[7]

Meaningful pairwise comparisons require test statistics which are insensitive to error definition and outliers. We adopt the Wilcoxon Signed Ranks test which meets these requirements and has power comparable to the parametric paired t-test [8, p. 213].

For tests of several forecast methods, the generalization of the paired t-test, two-way analysis of variance, is inapplicable.[8] The Friedman test [8], which is based on two-way analysis of variance by ranks and is independent of error definition, is used instead.

For an error measure, we choose relative error ignoring sign, $|P_{ijt} - A_{it}|/|A_{it}|$, a metric which is likely to be of interest to forecast purchasers.[9] In any event, the Wilcoxon test statistic is insensitive to error definition (see fn. 16).

B. *Forecast Horizon*

Because economic theory provides no guidance concerning the association of analyst superiority with a particular forecast horizon, several horizons should be investigated.[10] Our choice of horizons reflects the following considerations: (i) micro-level information obtained by analysts often concerns earnings of the following several quarters or fiscal year; (ii) current fiscal and monetary policies affect earnings of the subsequent one to five quarters; (iii) published forecasts are available mainly for short horizons. We thus investigate point estimates of quarterly earnings per share for forecast horizons of one to five quarters. We also examine annual earnings forecasts. The basic time series data are quarterly primary

7. EG's cross-section parametric t-test is inappropriate. Their use of an error measure stated in terms of levels squared (mean square error) appears to compound the inherent difficulty in applying the paired t-test to cross-section earnings data (see fn. 16).

8. Preliminary tests indicated serious violation of the homogeneity of variances and additivity assumptions, basically because of error outliers. Violation of the ANOVA assumptions also prevents application below of a factorial design with sample year and forecast horizon as factors, forecast method as treatment and firm as replication.

9. For a discussion of the deficiencies of using $|P_{ijt}|$ or $|P_{ijt} + A_{it}|/2$ in the denominator see [25].

10. The forecast horizons studied in the past have been five years (CM) and one year (EG).

earnings per share before extraordinary items, adjusted for stock splits, stock dividends and other capitalization changes for the years 1951–1975.

Ex ante conditional predictions of all forecast methods are determined as follows for a sample of 50 firms for each of the four years 1972–1975. Starting with third quarter 1971 earnings (III/1971), conditional earnings per share predictions for the ith firm by the jth method are obtained for the individual quarters of 1972. The forecasts of 1972 quarterly earnings, conditional on III/1971, are denoted $P_{ij}(\text{I}/1972 \mid \text{III}/1971)$, $P_{ij}(\text{II}/1972 \mid \text{III}/1971)$, $P_{ij}(\text{III}/1972 \mid \text{III}/1971)$ and $P_{ij}(\text{IV}/1972 \mid \text{III}/1971)$. Moving ahead one quarter, predictions are again obtained for each of the four quarters of 1972 made conditional upon IV/1971 earnings data. Again moving ahead one quarter, predictions are obtained for the last three quarters of 1972 conditional upon knowledge of I/1972 earnings, etc. Table 1 shows the set of 1972 predictions so obtained. With these conditional predictions, relative forecast errors ignoring sign are computed for each forecast method j over five distinct quarterly forecast horizons for use in the quarterly error comparisons. Annual earnings forecasts for 1972 are the sum of the forecasts $P_{ij}(\text{I}/1972 \mid \text{IV}/1971)$, $P_{ij}(\text{II}/1972 \mid \text{IV}/1971)$, $P_{ij}(\text{III}/1972 \mid \text{IV}/1971)$, and $P_{ij}(\text{IV}/1972 \mid \text{IV}/1971)$, that is, the one to four period ahead point forecasts made conditional upon knowledge of the prior year's fiscal earnings.[11] After obtaining analogous forecasts for the years 1973, 1974 and 1975, quarterly and annual comparisons are repeated for these years.

TABLE 1

SUMMARY OF PREDICTIONS BY FORECAST HORIZON FOR 1972[a,b]

1 Quarter Ahead	2 Quarters Ahead	3 Quarters Ahead	4 Quarters Ahead	5 Quarters Ahead[c]
$P_{ij}(\text{I}/1972 \mid \text{IV}/1971)$	$P_{ij}(\text{I}/1972 \mid \text{III}/1971)$			
$P_{ij}(\text{II}/1972 \mid \text{I}/1972)$	$P_{ij}(\text{II}/1972 \mid \text{IV}/1971)$	$P_{ij}(\text{II}/1972 \mid \text{III}/1971)$		
$P_{ij}(\text{III}/1972 \mid \text{II}/1972)$	$P_{ij}(\text{III}/1972 \mid \text{I}/1972)$	$P_{ij}(\text{III}/1972 \mid \text{IV}/1971)$	$P_{ij}(\text{III}/1972 \mid \text{III}/1971)$	
$P_{ij}(\text{IV}/1972 \mid \text{III}/1972)$	$P_{ij}(\text{IV}/1972 \mid \text{II}/1972)$	$P_{ij}(\text{IV}/1972 \mid \text{I}/1972)$	$P_{ij}(\text{IV}/1972 \mid \text{IV}/1971)$	$P_{ij}(\text{IV}/1972 \mid \text{III}/1971)$

[a] Predictions missing from the table (e.g., $P_{ij}(\text{I}/1972 \mid \text{II}/1971)$, $P_{ij}(\text{II}/1972 \mid \text{II}/1971)$) are absent because our source of analyst data does not contain these forecasts.

[b] i and j refer to firm i and method j, respectively.

[c] Five quarter ahead are available for BJ and V only.

C. *Time Series Models and Analysts' Forecasts*

Within the class of univariate time series models, Box and Jenkins (BJ) [6] models are highly regarded for their ability to make the most efficient use of the time series data. The BJ modelling technique enables one to select the most appropriate time series model consistent with the process generating each firm's time series of quarterly earnings per share data. BJ models, by not making *a priori* assumptions about the processes generating the data, subsume autoregressive,

11. Beaver [1] concludes that a quarterly approach to predicting annual earnings is at least as good as an annual approach to predicting annual earnings. Also see [7], [19] and [22] for other aspects of the usefulness of quarterly earnings per share data.

moving average and mixed models as special cases.[12] Forecasts of individually fitted BJ models should, therefore, perform better than forecasts of a particular class of time series models applied to all firms' time series data. We adopt the BJ modelling technique in this paper. Two other time series models are also included, a "seasonal martingale" (denoted M) and a "seasonal submartingale" (S). These models have been used as standards of comparison in the earnings forecast literature and are available for forecast producers and users at minimal cost.

As a source of analysts' forecasts we choose the Value Line Investment Survey since it contains one to five quarter ahead earnings forecasts which can be accurately dated and measured. Value Line makes earnings forecasts for 1,600 firms in contrast with institutional research firms which provide fewer, more expensive forecasts. Our hypothesis test thus compares a relatively sophisticated time series model with an "average" source of analysts' forecasts.

BJ conditional forecasts are obtained by standard methods after identifying and estimating each firm's appropriate model [6].[13] Value Line's conditional forecasts are taken directly from individual issues of the Value Line Investment Survey. The Survey, published weekly, makes quarterly earnings predictions four times a year for each firm included.

To define conditional forecasts of the naive models for each firm i, let A_{it} denote the tth actual quarterly earnings per share for firm i, where $t = 1, \ldots, 96$ (I/1951–IV/1974).

Seasonal submartingale (S) conditional one to four quarter ahead forecasts at time t are

one quarter ahead	$A_{it-3} + (A_{it} - A_{it-4})$
two quarters ahead	$A_{it-2} + (A_{it} - A_{it-4})$
three quarters ahead	$A_{it-1} + (A_{it} - A_{it-4})$
four quarters ahead	$A_{it} \quad + (A_{it} - A_{it-4})$.

Seasonal martingale (M) conditional one to four quarter ahead forecasts made in period t are A_{it-3}, A_{it-2}, A_{it-1}, and A_{it}. M's forecasts for a given quarter do not change as actual earnings per share data become available. S modifies M's forecasts with the change of the latest period's quarter over that of the previous year.

Actual quarterly earnings data are announced for most firms approximately five to six weeks into the subsequent quarter. Time series forecasts then become

12. The *ad hoc* time series models used in previous studies at a time when BJ techniques were unavailable are special cases of BJ models.

13. Recent research by Froeschle [15] and diagnostic tests of Dent and Swanson [10] were helpful in identifying the BJ models in addition to the standard diagnostic tests. As an aid to identifying the BJ models, most of which had multiplicative seasonal components, theoretical autocorrelation and partial autocorrelation functions for many quarterly multiplicative seasonal models were obtained. The coefficients of the BJ models, estimated with data through IV/1974, were not re-estimated with less data for earlier periods or more data for later periods. Foster [13] has shown that coefficient re-estimation of BJ quarterly earnings models is unnecessary due to its negligible effect on forecast errors. In any event, our procedure (no re-estimation) favors BJ in nearly all comparisons with Value Line.

possible and Value Line forecasts are published, on average, forty to fifty days later.[14]

The pattern of forecasts for all models is summarized in Table 1. Note that models *M* and *S* are not used to generate five quarter ahead forecasts.

II. Empirical Results

A. *Sample Selection*

Fifty firms were randomly selected from Moody's Handbook of Common Stocks. Each firm has complete quarterly earnings data available from 1951, is included in the Value Line Investment Survey since 1971 and has a December fiscal year. The resulting sample (Appendix A) is representative of the New York Stock Exchange firms included in Moody's and Value Line. Utilities were excluded due to insufficient quarterly earnings data. Sample sizes are reduced in those rare instances when the Value Line conditional forecasts are unavailable.

B. *Annual Comparisons*

The error distributions of relative annual forecast errors are shown in Table 2 for each of the years 1972–75 using the four forecast methods, seasonal martingale (*M*), seasonal submartingale (*S*), Box-Jenkins (BJ) and Value Line (*V*). Table 2 also contains Friedman test statistics (Chi-square with 3 degrees of freedom) and Wilcoxon test statistics (Student's t with $N-1$ degrees of freedom where N is sample size). The Friedman test statistic examines the null hypothesis that *all four* error distributions are identically distributed; the Wilcoxon statistic tests the null hypothesis that the median error difference of *two* methods being compared exceeds zero.

Using the Friedman test, the null hypothesis is rejected at the 1% level in 1972, 1973 and 1975. In the 12 pairwise hypothesis tests of *V*'s errors against those of *M*, *S*, and BJ, the sign of the Wilcoxon test statistic favors Value Line in every instance. Statistical significance occurs 8 times; 6 times at the 1% level and twice at the 5% level. Thus, *V* generally produces smaller annual errors than the three time series models suggesting that Value Line annual earnings forecasts are superior to those of time series models.

As argued earlier, BJ forecasts should be superior to forecasts of *ad hoc* time series models. The annual comparisons show that the BJ models generally yield smaller forecast errors than the other time series models studied. In 8 comparisons with *M* and *S*, the Wilcoxon test favors BJ 7 times with statistical significance 3 times. These findings suggest that BJ's forecasts are superior to those of *ad hoc* naive time series models.

While the annual results provide strong support for the hypothesis of analyst superiority, they use only a fraction of the data. More powerful tests are achieved using the larger sample sizes of the quarterly data and many more comparative tests can be performed with these data. We turn next to quarterly comparisons.

14. The time interval from announcement to forecast varies from approximately 7 to 70 days for our sample firms. The fact that the Investment Survey, published in 13 installments, makes forecasts for different firms each week accounts for the variation.

TABLE 2

WILCOXON AND FRIEDMAN TEST STATISTICS AND ERROR DISTRIBUTIONS, ANNUAL COMPARISONS OF VALUE LINE AND TIME SERIES MODEL PREDICTION ERRORS, 1972–1975[c]

1972

Error Distribution[d]

	<.05	.05–.10	.10–.25	.25–.50	.50–.75	.75–1.00	>1.00
M	3	7	14	17	4	3	2
S	11	6	12	10	3	1	7
BJ	10	6	12	12	4	1	5
V	13	7	17	12	0	0	1

SAMPLE SIZE = 50
Friedman Statistic = 27.10[a]
Wilcoxon Statistics[e]

	S	BJ	*V*
M	−.55	.24	4.46[a]
S		.46	3.50[a]
BJ			3.45[a]

1973

Error Distribution[d]

	<.05	.05–.10	.10–.25	.25–.50	.50–.75	.75–1.00	>1.00
M	2	6	16	18	6	0	2
S	11	8	14	9	4	1	3
BJ	8	6	15	16	3	0	2
V	10	9	13	16	0	0	2

SAMPLE SIZE = 50
Friedman Statistic = 33.19[a]
Wilcoxon Statistics[e]

	S	BJ	*V*
M	3.15[a]	2.51[a]	4.61[a]
S		−1.89[b]	0.34
BJ			2.17[b]

1974

Error Distribution[d]

	<.05	.05–.10	.10–.25	.25–.50	.50–.75	.75–1.00	>1.00
M	8	6	12	15	4	1	4
S	12	3	11	12	6	2	4
BJ	5	8	16	13	4	0	4
V	6	7	15	13	5	0	4

SAMPLE SIZE = 50
Friedman Statistic = 4.68
Wilcoxon Statistics[e]

	S	BJ	*V*
M	−.21	2.37[a]	2.23[b]
S		1.24	1.44
BJ			0.61

TABLE 2 (*continued*)

1975

Error Distribution[d]

	<.05	.05–.10	.10–.25	.25–.50	.50–.75	.75–1.00	>1.00
M	4	7	13	10	2	3	11
S	3	5	12	7	9	4	10
BJ	7	3	13	12	2	3	10
V	7	5	18	5	3	3	9

SAMPLE SIZE = 50

Friedman Statistics = 12.84[a]

Wilcoxon Statistics[e]

	S	BJ	*V*
M	−1.77[b]	0.86	3.29[a]
S		2.99[a]	3.11[a]
BJ			1.28

[a] Significant at the 1% level, one-tailed test.

[b] Significant at the 5% level, one-tailed test.

[c] *V* = Value Line, *M* = Seasonal Martingale, *S* = Seasonal Submartingale, BJ = Box-Jenkins.

[d] Each entry below designates the number of observations for a given model whose relative error ignoring sign is within the stated fractiles.

[e] Each Wilcoxon test statistic below results from comparing the method at the top with the method on the side. Thus, positive Wilcoxon statistics indicate superiority of model on top.

C. *Quarterly Comparisons*

In each year, 1972 to 1975, quarterly forecasts are obtained for the forecast methods in the manner shown in Table 1. Relative forecast errors of all four methods are compared over 1–4 quarter forecast horizons; BJ and *V* are also compared over 5 quarter horizons. In each of the four years, sample sizes are approximately 200 for the 1 and 2 quarter ahead comparisons, 150 for the 3 quarter ahead comparisons, and 100 for the 4 quarter ahead comparisons. Test results over all horizons appear in Table 3 and are summarized in Table 4.

With minor exceptions (3 and 4 quarter horizons in 1974), the Friedman statistics are highly significant when the four methods are tested as a group; the null hypothesis of identically distributed distributions is rejected in 14 of the 16 Friedman tests. Using Wilcoxon test statistics, *V*'s errors are tested pairwise against *M*'s and *S*'s errors 16 times each and against BJ's errors 20 times. The resulting 52 hypothesis tests of *V* against *M*, *S* and BJ are summarized in Table 4A. In the 34 instances of significant Wilcoxon test statistics, *V* is statistically superior 33 times. In the remaining 18 tests, the sign of the t-statistic favors *V* 12 times. In total, *V* is favored 45 times out of 52, revealing an overwhelming dominance of *V* over the time series models.

The data are also summarized in Table 4 by the mean Wilcoxon t-value ($\bar{t}$), the estimated standard deviation of the mean t-value ($s(\bar{t})$) and the ratio $\bar{t}/s(\bar{t})$. The latter ratio is itself a t-statistic only if each t-value being averaged is drawn from the same distribution. Since the distribution of t-values is likely to depend upon the horizon, model and/or year that the experiment is conducted, we refrain from

TABLE 3

Wilcoxon and Friedman Test Statistics, Quarterly Comparisons of Value Line and Time Series Model Prediction Errors, 1972–1975[c,d]

TABLE 3

WILCOXON AND FRIEDMAN TEST STATISTICS, QUARTERLY COMPARISONS OF VALUE LINE AND TIME SERIES MODEL PREDICTION ERRORS, 1972–1975[c,d]

		Forecast Horizon												
		One Quarter			Two Quarter			Three Quarter			Four Quarter			Five Quarter
		S	BJ	*V*	*S*	BJ	*V*	*S*	BJ	*V*	*S*	BJ	*V*	*V*
1972	*M*	2.14[b]	6.87[a]	8.15[a]	0.79	5.41[a]	6.87[a]	−1.09	2.50[a]	5.77[a]	−3.09[a]	1.41	5.22[a]	—
	S	—	4.62[a]	5.25[a]	—	4.62[a]	5.57[a]	—	3.03[a]	5.42[a]	—	3.38[a]	5.30[a]	—
	BJ	—	—	1.75[b]	—	—	2.51[a]	—	—	4.09[a]	—	—	3.93[a]	3.11[a]
		Sample Size = 200			Sample Size = 200			Sample Size = 150			Sample Size = 100			Sample Size = 50
		Friedman Stat. = 73.45[a]			Friedman Stat. = 60.54[a]			Friedman Stat. = 41.14[a]			Friedman Stat. = 43.43[a]			
		S	BJ	*V*	*S*	BJ	*V*	*S*	BJ	*V*	*S*	BJ	*V*	*V*
1973	*M*	8.02[a]	8.98[a]	10.66[a]	5.81[a]	6.41[a]	8.70[a]	4.81[a]	3.52[a]	6.31[a]	2.55[a]	1.69[b]	4.63[a]	—
	S	—	−0.60	1.62	—	−1.83[b]	1.04	—	−3.57[a]	−0.02	—	−1.59	1.04	—
	BJ	—	—	2.48[a]	—	—	3.47[a]	—	—	3.34[a]	—	—	2.79[a]	1.66
		Sample Size = 199			Sample Size = 200			Sample Size = 150			Sample Size = 100			Sample Size = 50
		Friedman Stat. = 173.51[a]			Friedman Stat. = 119.91[a]			Friedman Stat. = 75.22[a]			Friedman Stat. = 29.12[a]			
		S	BJ	*V*	*S*	BJ	*V*	*S*	BJ	*V*	*S*	BJ	*V*	*V*
1974	*M*	3.35[a]	6.29[a]	6.19[a]	0.84	4.88[a]	3.78[a]	−0.25	2.59[a]	1.29	−2.69[a]	1.41	0.29	—
	S	—	2.34[a]	2.95[a]	—	2.31[b]	1.50	—	1.53	0.97	—	2.67[a]	2.80[a]	—
	BJ	—	—	1.16	—	—	−1.45	—	—	−1.04	—	—	−0.92	−2.20[b]
		Sample Size = 199			Sample Size = 199			Sample Size = 149			Sample Size = 100			Sample Size = 50
		Friedman Stat. = 47.57[a]			Friedman Stat. = 22.63[a]			Friedman Stat. = 5.40			Friedman Stat. = 2.92			
		S	BJ	*V*	*S*	BJ	*V*	*S*	BJ	*V*	*S*	BJ	*V*	*V*
1975	*M*	2.07[b]	5.76[a]	8.22[a]	−2.64[a]	3.63[a]	5.29[a]	−4.49[a]	2.93[a]	2.95[a]	4.89[a]	−0.78	−0.05	—
	S	—	4.70[a]	6.36[a]	—	6.02[a]	6.14[a]	—	6.13[a]	5.14[a]	—	3.62[a]	3.28[a]	—
	BJ	—	—	3.51[a]	—	—	1.62	—	—	−0.22	—	—	0.08	0.45
		Sample Size = 199			Sample Size = 199			Sample Size = 149			Sample Size = 100			Sample Size = 50
		Friedman Stat. = 80.32[a]			Friedman Stat. = 44.49[a]			Friedman Stat. = 33.25[a]			Friedman Stat. = 15.66[b]			

[a] Significant at the 1% level, one-tailed test.

[b] Significant at the 5% level, one-tailed test.

[c] *V* = Value Line, *M* = Seasonal Martingale, *S* = Seasonal Submartingale, BJ = Box-Jenkins.

[d] Each Wilcoxon test statistic entered in the table results from comparing method at the top with method on the side. Thus, positive Wilcoxon statistics indicate superiority of model on top.

TABLE 4

SUMMARY OF WILCOXON TEST COMPARISONS

A: Value Line vs. Time Series Models[a]

		Forecast Horizon					Forecast Model			Year			
	Total	1Q	2Q	3Q	4Q	5Q	*M*	*S*	BJ	1972	1973	1974	1975
Number of Comparisons	52	12	12	12	12	4	16	16	20	13	13	13	13
Comparisons Favorable to *V*[b]	45	12	11	9	10	3	15	15	15	13	12	9	11
Comparisons Statistically Favorable to *V*[c]	33	10	8	7	7	1	13	10	10	13	8	4	8
Comparisons Statistically Unfavorable to *V*	1	0	0	0	0	1	0	0	1	0	0	1	0
Mean Wilcoxon Test Statistic ($\bar{t}$)	3.25	4.86	3.75	2.83	2.37	.76	5.27	3.40	1.51	4.84	3.67	1.18	3.29
$\bar{t}/s(\bar{t})$[d]	8.27	5.45	4.51	3.81	3.72	.67	5.65	6.24	3.48	9.98	4.18	1.81	4.24

B: BJ vs. Naive Time Series Models

		Forecast Horizon				Forecast Model		Year			
	Total	1Q	2Q	3Q	4Q	*M*	*S*	1972	1973	1974	1975
Number of Comparisons	32	8	8	8	8	16	16	8	8	8	8
Comparisons Favorable to BJ[b]	27	7	7	7	6	15	12	8	4	8	7
Comparisons Statistically Favorable to BJ[c]	24	7	7	6	4	13	11	7	4	6	7
Comparisons Statistically Unfavorable to BJ	2	0	1	1	0	0	2	0	2	0	0
Mean Wilcoxon Test Statistic ($\bar{t}$)	3.15	4.87	3.93	2.33	1.48	3.97	2.34	3.98	1.63	3.00	4.00
$\bar{t}/s(\bar{t})$[d]	6.37	4.70	4.16	2.41	2.25	6.23	3.25	6.46	1.05	4.99	4.96

[a] *V* = Value Line, *M* = Seasonal Martingale, *S* = Seasonal Submartingale, BJ = Box-Jenkins.

[b] Comparisons are favorable if Wilcoxon statistic in Table 3 is positive.

[c] Comparisons are statistically favorable if Wilcoxon statistic in Table 3 is positive and significant at the 5% level or better.

[d] Both $\bar{t}$ and $s(\bar{t})$ are computed using the number of comparisons in each column of the Table.

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hypothesis tests on $\bar{t}$ and present $\bar{t}$ and $\bar{t}/s(\bar{t})$ without formal tests of significance. For the 52 comparisons involving *V*, the mean Wilcoxon test statistic is 3.25 and $\bar{t}/s(\bar{t})$ is 8.27.

Table 4A also decomposes the 52 comparisons of *V* with the time series models by forecast horizon, model and year.[15] The data show that Value Line's forecast superiority holds over all horizons studied with a tendency for its superiority to decline as horizon lengthens. *V*'s predominance model-by-model is, as hypothesized, quite evident with somewhat less superiority over BJ than over *M* and *S*. Turning our attention to the 20 comparisons between *V* and BJ, *V* is superior in 10 of 11 cases in which the test statistic is significant. In 5 of the remaining 9 comparisons, the sign of the Wilcoxon test statistic favors *V*. For completeness, Table 4A summarizes Wilcoxon tests by year. Again we expect *V* to be superior, on average, but have no hypothesis concerning particular years. Comparisons unfavorable to *V* tend to be confined to 1974, but even in this year, 4 of the 5 statistically significant comparisons favor Value Line.

In summary, the evidence strongly supports the hypothesis that Value Line consistently makes significantly better predictions than time series models. The statistically significant experiments overwhelmingly favor Value Line. In the remaining experiments the majority of the Wilcoxon tests also favor Value Line, providing additional support for the hypothesis of analyst superiority.

Table 4B summarizes the 32 comparisons of BJ with the naive time series models. The mean Wilcoxon test statistic is 3.15 and $\bar{t}/s(\bar{t})$ equals 6.37. In 26 cases, there are significant differences with BJ statistically superior 24 times. BJ is superior to *M* and *S* in 3 of the remaining 6 comparisons. Hence, BJ is favored in 27 of 32 comparisons, providing strong support for the hypothesis that BJ predicts earnings better than *ad hoc* time series models.

Table 4B also summarizes comparisons involving BJ by horizon, model and year. BJ's superiority over the naive models is clearly evident over each forecast horizon with a tendency for its superiority to decline as horizon lengthens. In comparison to individual models, BJ outperforms both *M* and *S* with somewhat less dominance over *S*. Turning to comparisons by year, the superiority of BJ is consistent over time, with most of the comparisons unfavorable to BJ occurring in 1973. Even in this year, the mean Wilcoxon test statistic is 1.63 and 4 of the 6 significant comparisons favor BJ.[16]

In conclusion, the quarterly and the annual comparisons provide convincing evidence both of Value Line's superiority over each of the three time series models and BJ's superiority over the naive models. The quarterly results also show that *V*'s superiority over the time series models and BJ's superiority over the naive models

15. The decomposition is an alternative to analysis of variance which is inapplicable to the error distribution (see fn. 8).

16. As noted earlier, the Wilcoxon tests should be insensitive to error definition. Wilcoxon test statistics were recomputed on annual and selected quarterly comparisons using three additional error measures, mean square error, root mean square error and relative error squared. The small changes in the test statistics left the results virtually unchanged. Parametric *t*-tests were also applied to the four error measures. Both the sign and magnitude of these test statistics were highly sensitive to error definition. The hypothesis tests using the parametric *t*-test most often gave results in disagreement with the Wilcoxon test when mean square error was chosen as the error definition. This may account for EG's results differing from ours.

are not confined to particular models, horizons, or years. The very general character of Value Line's superiority in predicting earnings, evidenced over all models, horizons, and years in 64 separate hypothesis tests involving sample sizes averaging 125, lends extraordinary support to the hypothesis of analyst superiority.

D. *Further Analysis*

The superiority of Value Line over time series models follows from the rational behavior of forecast producers and consumers and should be generalizable to other sources of analyst forecasts and other time periods. As a preliminary test of the sensitivity of our results to choice of analyst, we obtained predictions of 1975 annual earnings per share made by the Standard and Poor's Earnings Forecaster (SP) for each firm included in the 1975 annual earnings sample.[17] Wilcoxon tests of SP against M, S, and BJ favored SP, yielding t-statistics of 3.18, 2.85 and 1.45 respectively. These results are remarkably similar to those using Value Line.[18] This evidence suggests that Value Line's forecast superiority over time series models is not unique.

To ascertain whether the sample period posed unusual difficulties for time series earnings forecasting, a BJ model was fitted to the Quarterly Earnings Index of the Dow Jones Industrial Average over the 1951–1975 time period.[19] Average quarterly percentage errors ignoring sign produced by the BJ model for 1972–1975 were 7.31%, 6.61%, 9.99%, and 15.47% respectively. Since the mean and standard deviation of average percentage forecast errors over the 1951–1975 period were 10.14% and 4.38%, it appears that the 1972–1975 period was not a particularly difficult one in which to predict earnings. Indeed, from this standpoint, the 1972–1975 period is comparable to the "stable" years of the sixties, 1962–1967, studied by CM and EG.[20]

These results indicate that if appropriate hypothesis tests are applied to other analysts and time periods, the results are likely to parallel those using Value Line and the 1972–1975 time period.

E. *A Brief Investigation of Value Line Superiority*

To produce forecasts superior to time series models, Value Line must utilize information not contained in the time series of quarterly earnings. During the period between the most recent quarterly earnings announcement and the subsequent Value Line prediction, Value Line acquires incremental information which, if an important part of its total information set, may explain Value Line's

17. SP, published weekly, contains annual predictions made by Standard and Poor's and other investment firms. The SP prediction for each firm is that made by Standard and Poor's on the date closest to the Value Line prediction date.

18. V's t-statistics versus M, S, and BJ were 3.29, 3.11, and 1.28 respectively (See Table 2). A direct Wilcoxon test between V and SP favored V(t = .77).

19. The sample period, 1972–1975, may appear "unusual" since it includes peacetime wage and price controls, high inflation and inventory profits, large changes in employment and new accounting requirements. If events arising during the sample period caused the earnings generating process to change, the forecast ability of the BJ modelling technique may be hampered, unintentionally favoring the analyst.

20. The average percentage errors were 12.67%, 10.71%, 7.03%, 4.93%, 6.08% and 5.26%, respectively for 1962–1967.

superiority. Information arising during this interval is likely to be most important for predicting next quarter's earnings. Assuming that the generation of this incremental information is positively related to the passage of time, earnings should be relatively easier to predict the further Value Line's prediction date is from the most recent earnings announcement date, and one quarter horizon forecast errors should be negatively related to the corresponding intervals.

To test this hypothesis, we obtained for the firms in the 1975 one quarter horizon sample their Value Line errors and the time intervals (7–70 days) since their most recent earnings announcements. A rank correlation was applied to these variables. The insignificantly negative Spearman rho which was obtained suggests that information obtained by Value Line during this interval has a negligible effect on its ability to predict next quarter's earnings.[21] This evidence is consistent with the hypothesis that Value Line's superiority can be attributed to its use of the information set available to it on the quarterly earnings announcement date, and not to the acquisition of information arising after the quarterly earnings announcement date.

III. Summary and Implications

Basic economic theory and the equilibrium employment of analysts, a higher cost factor than time series models, imply that analysts must produce better forecasts than time series models. Past studies ([9], [11]) of comparative earnings forecast accuracy have concluded otherwise but use inappropriate parametric tests and contain experimental biases. Using nonparametric statistics which provide proper yet powerful tests, we find that (1) BJ models consistently produce significantly better earnings forecasts than martingale and submartingale models; (2) Value Line Investment Survey consistently makes significantly better earnings forecasts than the BJ and naive time series models. The findings are in accord with rationality in the market for forecasts and the long-run equilibrium employment of analysts.

If market earnings expectations are rational [23], it follows that the best available earnings forecasts should be used to measure market earnings expectations. **Given rational market expectations, our evidence of analyst superiority over time series models means that analysts' forecasts should be used in studies of firm valuation, cost of capital and the relationship between unanticipated earnings and stock price changes until forecasts superior to those of analysts are found.**[22] Past findings ([2], [21]) that share price levels are significantly better explained by analysts' earnings

21. The lack of a significant negative correlation between prediction error and time since last announcement date may occur if the interval is intentionally lengthened by Value Line in order to acquire more information about the firms whose earnings are more difficult to predict. To test this possibility, we measured each firm's prediction "difficulty" by its average one quarter horizon percentage error ignoring sign yielded by its BJ model. No significant correlation was found between this variable and the time interval between the most recent quarterly earnings announcement and the Value Line prediction date.

22. In examining the relationship between unanticipated earnings and stock price changes, for example, the sign of the forecast error from a time series is often used ([7], [12], [13]) as a device for classifying unanticipated earnings into "favorable" or "unfavorable" categories. With this methodology, BJ and *V* classify earnings differently 213 times out of the 797 one quarter ahead forecasts in our sample.

forecasts than by those of time series models are consistent with our evidence and with market rationality.

The hypothesis of analyst superiority versus univariate time series models is derived from basic economic theory and is not limited to the case of earnings. It is therefore applicable to all types of forecasts subject to the market test. There is no presumption that other, non-market forecasts such as those made by corporate executives or government agencies should be better (or worse) than those generated by univariate time series models.

Appendix A

Sample Firms

Abbott Laboratories
Allegheny Ludlum Industries, Inc.
American Airlines, Inc.
Anaconda Company
Boeing Company
Borg-Warner Corporation
Braniff International Corporation
Caterpillar Tractor Company
Champion International Corporation
Chrysler Corporation
Clark Equipment Company
Colgate-Palmolive Company
Continental Can Company, Inc.
Curtiss-Wright Corporation
Cutler-Hammer, Inc.
Eastern Airlines, Incorporated
Eastman Kodak Company
Flintkote Company
Freeport Minerals Company
Fruehauf Corporation
GATX Corporation
General Electric Company
Goodrich (B. F.) Company
Gulf Oil Corporation
Homestake Mining Company
International Business Machines Corporation
International Paper Co.
Kennecott Copper Corporation
Leheigh Portland Cement Co.
Ligget Group Inc.
Lowenstein (M.) & Sons, Inc.
Nabisco, Inc.
National Distillers & Chemical Corporation
National Steel Corporation

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Pullman, Incorporated
Raybestos-Manhattan, Inc.
Republic Steel Corporation
Standard Brands, Inc.
Standard Oil Company of Indiana
Sterling Drug, Incorporated
St. Regis Paper Company
Timken Company
United States Gypsum Company
United States Steel Corporation
United Technologies Corp.
Wrigley (W. M.) Jr. Company

REFERENCES

1. W. H. Beaver. "The Information Content of the Magnitude of Unexpected Earnings," Unpublished Manuscript, 1974.
2. F. W. Bell. "The Relation of the Structure of Common Stock Prices to Historical, Expectational and Industrial Variables," *Journal of Finance* (March 1974), pp. 187–197.
3. H. Benishay. "Variability in Earnings-Price Ratios of Corporate Equities," *American Economic Review* (March 1961), pp. 81–94.
4. G. Benston. "Published Corporate Accounting Data and Stock Prices," *Empirical Research in Accounting: Selected Studies, 1967*. Supplement to Vol. 5, *Journal of Accounting Research*, pp. 1–54.
5. R. S. Bower and D. H. Bower. "Risk and the Valuation of Common Stock," *Journal of Political Economy* (May/June 1969), pp. 349–362.
6. G. E. P. Box and G. M. Jenkins. *Time Series Analysis: Forecasting and Control* (San Francisco: Holden-Day, 1970).
7. P. Brown and J. Kennelly. "The Informational Content of Quarterly Earnings: An Extension and Some Further Evidence," *Journal of Business* (July 1972), pp. 403–415.
8. W. J. Conover. *Practical Nonparametric Statistics* (New York: John Wiley & Sons, Inc., 1971).
9. J. G. Cragg and B. G. Malkiel. "The Consensus and Accuracy of Some Predictions of the Growth of Corporate Earnings," *Journal of Finance* (March 1968), pp. 67–84.
10. W. T. Dent and J. A. Swanson. "On Forecast Error in Autoregressive Integrated Moving Average Models," Working Paper No. 75-3, College of Business Administration, The University of Iowa, February 1975.
11. E. J. Elton and M. J. Gruber. "Earnings Estimates and the Accuracy of Expectational Data," *Management Science* (April 1972), pp. 409–424.
12. G. Foster. "Stock Market Reaction to Estimates of Earnings per Share by Company Officials," *Journal of Accounting Research* (Spring 1973), pp. 25–37.
13. ———. "Quarterly Accounting Data: Time Series Properties and Predictive-Ability Results," *Accounting Review*, (January 1977), pp. 1–21.
14. I. Friend and M. Puckett. "Dividends and Stock Prices," *American Economic Review* (September 1964), pp. 656–682.
15. J. R. Froeschle. "The Analysis of Seasonal Time Series," Doctoral Dissertation, The University of Iowa, 1975.
16. N. Gonedes. "Properties of Accounting Numbers: Models and Tests," *Journal of Accounting Research* (Autumn 1973), pp. 212–237.

17. W. L. Hays and R. L. Winkler. *Statistics: Probability, Inference and Decision* (New York: Holt, Rinehart and Winston, Inc., 1971).
18. R. C. Higgins. "Growth, Dividend Policy and Capital Costs in the Electric Utility Industry," *Journal of Finance* (September 1974), pp. 1189–1201.
19. J. E. Kiger. "An Empirical Investigation of NYSE Volume and Price Reactions to the Announcement of Quarterly Earnings," *Journal of Accounting Research* (Spring 1972), pp. 113–128.
20. R. H. Litzenberger and C. U. Rao. "Estimates of the Marginal Time Preference and Average Risk Aversion of Inventors in Electric Utility Shares 1960–66," *The Bell Journal of Economics and Management Science* (Spring 1971), pp. 265–277.
21. B. G. Malkiel and J. G. Cragg. "Expectations and the Structure of Share Prices," *American Economic Review* (September 1970), pp. 601–617.
22. R. G. May, "The Influence of Quarterly Earnings Announcements in Investor Decisions as Reflected in Common Stock Price Changes," *Empirical Research in Accounting: Selected Studies, 1971*. Supplement to Vol. 9, *Journal of Accounting Research*, pp. 119–163.
23. J. F. Muth. "Rational Expectations and the Theory of Price Movements," *Econometrica* (July 1961), pp. 315–335.
24. C. R. Nelson. "Rational Expectations and the Predictive Efficiency of Economic Models," *The Journal of Business* (July 1975), pp. 331–343.
25. H. Theil, *Applied Economic Forecasting* (Amsterdam: North-Holland Publishing Company, 1966).

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Predicting Long-term Earnings Growth: Comparisons of Expected Return Models, Submartingales and Value Line Analysts

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ABSTRACT

This paper derives four–five year predictions of growth rates of accounting earnings per share implicit in four expected return models commonly used in financial research. A comparison of such growth rates with those produced and reported by Value Line analysts and those generated by a submartingale model revealed the following: two expected return models—the Sharpe–Lintner–Mossin model and the Black model—were significantly more accurate than the submartingale model, though not significantly more accurate than the other return models. However, the growth rate forecasts provided by Value Line significantly outperformed all the other models tested—none of which relied on the direct input of a security analyst.

KEY WORDS Forecasting Earnings growth Comparisons Empirical study Analysts Value Line

An extensive body of literature evaluates the short-run (less than 15 months) earnings forecasts of security analysts and time-series models.[1] The importance of this subject to accounting and finance is that a variety of applications such as firm valuation, cost of capital, and event studies require the measurement of earnings expectations. However, except for a recent paper by Moyer *et al.* (1983), little work has been done to this point in studying long-run earnings forecasts. Moreover, a potential source of earnings forecasts—expected return models—has been overlooked.

This paper evaluates the accuracy of long-term forecasts of growth rates of annual earnings per share. Six sources of forecasts are used: a submartingale model, the *Value Line Investment Survey*, and four expected return models. Each expected return model is combined with the Gordon Shapiro constant growth model. Further, certain expected return models use the beta coefficient and, as such, lend insight into the usefulness of beta in a forecasting context.

The paper comprises three sections. Section 1 describes the six forecasting sources and states the

[1] See Cragg and Malkiel (1968), Elton and Gruber (1972), Barefield and Comiskey (1975), Brown and Rozeff (1978), Abdel-khalik and Thompson (1977–78), Crichfield *et al.* (1978), Givoly and Lakonishok (1979), Collins and Hopwood (1980), Jaggi (1980), Elton *et al.* (1981), Hopwood *et al.* (1981), Fried and Givoly (1982) and Imhoff and Pare (1982) for studies of analyst forecasts and time-series models. See Ball and Watts (1972), Brooks and Buckmaster (1976), Albrecht *et al.* (1977), Watts and Leftwich (1977), Foster (1977), Griffin (1977), Brown and Rozeff (1979), Lorek (1979), Hopwood and McKeown (1981), Hopwood *et al.* (1981) and Manegold (1981) for studies of the time-series properties of earnings.

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hypotheses. Tests of the hypotheses are presented in Section 2. Section 3 offers tentative conclusions.

1. FORECASTING SOURCES AND HYPOTHESES

This section (1) describes how six sets of growth rate forecasts of earnings per share are derived and (2) discusses the formal hypotheses to be tested.

Submartingale model

Evidence that measured annual accounting income is a submartingale or some similar process can be found in Ball and Watts (1972), Albrecht *et al.* (1977), and Watts and Leftwich (1977).[2] Although measured (reported) annual earnings per share may not be precisely a submartingale, a submartingale process is included because of its appearance in numerous studies as a benchmark forecasting technique. Another reason for including the submartingale model is to compare its forecasts to those reported in the *Value Line Investment Survey*. Such comparisons have been done for forecasts of three to fifteen months (Brown and Rozeff, 1978) but not forecasts of four to five years.

The submartingale model (SUB), as used here, estimates the expected annual growth rate of accounting earnings per share as the average compound annual rate of growth of earnings per share of the ten-year period preceding the test period. These historical growth data are obtained from various issues of the *Value Line Investment Survey*.

Value Line forecasts

The *Value Line Investment Survey* (VL) contains forecasts of earnings per share made by the Value Line security analysts for time periods four to five years into the future. After adjustment for capital changes, these forecasts, in conjunction with actual earnings per share in the base period, are converted to VL forecasts of a compound annual growth rate for each firm in the sample.

The importance of testing analyst forecasts is explained by Brown and Rozeff (1978). They argue that since analyst forecasts are purchased in a free market they are likely to be informed forecasts with a marginal value exceeding that of less costly forecast alternatives. According to this reasoning, the VL forecasts should be more accurate than the SUB forecasts and those derived from the expected return models (stated next).

Expected return model forecasts

A technique that has not previously been exploited to obtain earnings forecasts is to use expected stock rate of return models in conjunction with the Gordon–Shapiro (1956) constant growth model. This subsection shows how to extract earnings per share growth rate forecasts from these models. First, the four expected stock rate of return models are explained. Secondly, the paper proceeds to show how growth rate forecasts are obtained.

Four expected return models

The four models of how the market sets expected rates of return on securities are:

(1) the comparison returns (CMR) model (Masulis, 1980; Brown and Warner, 1980),
(2) the market adjusted returns (MAR) model (Latane and Jones, 1979; Brown and Warner, 1980),
(3) the Sharpe–Lintner–Mossin (SLM) model (Sharpe, 1964; Lintner, 1965; Mossin, 1966),
(4) the Black (BLK) model (Black, 1972).

[2] For example, Ball and Watts (1972, p. 680) conclude: 'Consequently, our conclusion ... is that income can be characterized on average as a submartingale or some similar process.'

The CMR model assumes that the expected return on stock i at time T ($E(R_{iT})$) is an expectation that is specific to each security. However, a risk parameter such as the beta coefficient is not explicitly included in the expected return calculation. Instead, the expected stock return at time T is measured as the arithmetic mean of the realized returns of the stock in a prior period. To the extent that individual means of stock return distributions differ as a reflection of risk differences, the CMR model allows for individual differences in risk. This model (see Masulis, 1980) has been tested by Brown and Warner (1980) who found that it compared favourably with alternative expected return models in detecting abnormal performance.

The MAR model states that the expected return on stock i at time T equals the expected return on the market (denoted $E(R_{MT})$), which is the same for all stocks. As for the CMR model, no beta coefficient is used in calculating expected returns. However, unlike the CMR model, the MAR model does not allow for individual risk differences among stocks, since all stocks are assumed to have the same expected return, namely, the expected market return. To estimate expected market returns, an arithmetic average of past returns on the equally-weighted (Center for Research in Securities Prices) CRSP index is used.

The SLM model is infrequently referred to as the capital asset pricing model or CAPM. It is used in its *ex ante* form:

$$E(R_{iT}) = R_{fT} + [E(R_{MT}) - R_{fT}]\beta_i \tag{1}$$

where

R_{fT} = interest rate on a U.S. Treasury security over the forecast horizon,
β_i = beta coefficient of stock i expected to prevail over the forecast horizon.

This study examines two annual growth rate forecasts over two non-overlapping horizons of five years and four years. The five year forecast period is 1968–1972 and its base year is 1967. The four year forecast period is 1973–1976 and its base year is 1972. In estimating expected returns using the SLM model, R_{fT} for the forecast period 1968–1972 is taken as the yield-to-maturity on a five year U.S. Government security as of December 1967. Similarly, for the forecast period 1973–1976, R_{fT} is the yield-to-maturity on a four year U.S. Government security as of December 1972.[3]

$E(R_{MT})$ is estimated precisely in the same manner as in the CMR model, namely, as an average over past realized market returns.

The beta coefficients of individual stocks were estimated in two ways. First, the expected beta was measured as the historical beta coefficient of the stock over the 84 months up to and including month T. This beta was simply the covariance of the stock's returns with the market divided by the variance of the market's returns over the sample period. Secondly, in an attempt to obtain a more accurate estimate of the future expected beta, the tendency of betas to regress towards the value 1.0 noted by Blume (1971) was taken into account. The method for doing this is Blume's method.[4]

The last expected return model is the BLK model. This can be stated in *ex ante* form (Black, 1972) as:

$$E(R_{iT}) = E(R_{ZT}) + [E(R_{MT}) - E(R_{ZT})]\beta_i \tag{2}$$

where $E(R_{ZT})$ is the expected return on the minimum variance portfolio whose return is

[3] Schaefer (1977) points out the pitfalls of using yield-to-maturity as a surrogate for the interest rate on a no-coupon bond. Livingston and Jain (1982) estimate the biases involved. Since for bonds of maturity four to five years, the coupon bias is confortably small (of the order of ten basis points), the effect is neglected in this paper.

[4] For example, to adjust the betas computed over the 1961–1967 time period, the betas of all stocks on the CRSP file from the 1954–1960 period were regressed on the betas of the same stocks from the 1947–1953 period. The resulting regression coefficients were then used to adjust linearly the 1961–1967 betas.

uncorrelated with the return on the market portfolio. Unlike R_{fT} in the SLM model, $E(R_{ZT})$ is not observable at time T. Historical returns are frequently used to estimate this model (Black *et al.*, 1972). When this is done, the BLK model can be written

$$E(R_{iT}) = \bar{\gamma}_0 + \bar{\gamma}_1 \beta_i \tag{3}$$

$\bar{\gamma}_0$ and $\bar{\gamma}_1$ are arithmetic averages of monthly estimates of $E(R_{ZT})$ and $E(R_{MT}) - E(R_{ZT})$. The estimation method of Fama and Macbeth (1973) was used to obtain the gamma estimates.[5]

The forecasting model can now be formulated by obtaining $\bar{\gamma}_0$ and $\bar{\gamma}_1$ as of time T and using these as estimates of future gammas. The procedure is legitimate since Fama and Macbeth have shown that the gamma variables are stationary and have autocorrelations that are essentially nil.

Obtaining growth rate forecasts

Suppressing the time subscript T for simplicity, the expected return of security i according to model j is denoted $E(R_{ij})$. Given the expected rate of return of security i from model j, each model's expected growth rate of earnings per share will be extracted by assuming that each firm possesses investment opportunities which are expected to provide a constant rate of growth of earnings in perpetuity. In other words, the 'constant growth' model is assumed to hold for each stock (Gordon and Shapiro, 1956, Miller and Modigliani, 1961).

Let g_{ip} be firm i's rate of price increase, g_{id} be its rate of growth of dividends per share, and g_{ie} be its rate of growth of earnings per share. In the constant growth model, the expected rate of return of security i is given by:

$$E(R_i) = \frac{\tilde{P}_{i1} + \tilde{D}_{i1} - P_{i0}}{P_{i0}} = \frac{\tilde{D}_{i1}}{P_{i0}} + \frac{\tilde{P}_{i1} - P_{i0}}{P_{i0}} \tag{4}$$

where

$\tilde{P}_{i1}$ = random end-of-period price per share
$\tilde{D}_{i1}$ = random end-of-period dividend per share
P_{i0} = current price per share
D_{i0} = current dividend per share.

Hence:

$$\frac{\tilde{D}_{i1}}{P_{i0}} + \frac{\tilde{P}_{i1} - P_{i0}}{P_{i0}} = \frac{D_{i0}(1 + g_{id})}{P_{i0}} + g_{ip} \tag{5}$$

Assuming $g_{id} = g_{ip} = g_i$

$$E(R_i) = \frac{D_{i0}(1 + g_i)}{P_{i0}} + g_i \tag{6}$$

A key assumption to obtain the constant growth is that the firm's payout ratio of dividends from earnings is constant. This ensures the equality of the growth rates of dividends, earnings, and price per share. Violation of the constant payout ratio assumption occurs for a variety of reasons such as a change in the firm's investment opportunities or a change in its financing mix. To the extent that the constant growth model fails to describe the firm's expected rate of return, the derived estimates of g_i will contain measurement error which will bias the tests against the expected return models.

[5] I am grateful to Gary Schlarbaum for supplying these estimates.

Since each expected return model estimates $E(R_i)$ by $E(R_{ij})$, equation (6) can be solved to obtain model j's implicit forecast of g_i, denoted g_{ij} or:

$$g_{ij} = \frac{E(R_{ij}) - D_{i0}/P_{i0}}{1 + D_{i0}/P_{i0}} \tag{7}$$

Hence, by estimating $E(R_{ij})$ and observing the current dividend yield, a forecast by model j of the firm i's growth rate of earning per share, g_{ij}, is extracted.

Statement of hypotheses

The empirical results in this paper will be interpreted with reference to several hypotheses, which are presented and discussed below:

> *Hypothesis* 1. Expected return models that use *ex ante* information on stock beta coefficients contain implicit earnings per share growth rate forecasts that are not more accurate than the implicit earnings per share growth rate forecasts of expected return models that do not use information on beta coefficients.

The SLM and BLK models include beta information whereas the CMR and MAR models do not. Rejection of Hypothesis 1 means that the beta-based expected return models can be employed to obtain forecasts of earnings per share which are superior to those obtained from the non-beta stock return models. Assuming that earnings growth rates observed for a future period reflect the prices and the expected returns established at the start of the period, rejection of Hypothesis 1 provides an indication that the market, in setting expected returns, uses betas or their informational equivalent as opposed to neglecting betas as the CMR and MAR do.

The forecasts of the expected return models can also be compared with the SUB model forecasts. These comparisons provide a natural check on whether the expected return models combined with the constant growth model are producing forecasts that are reasonably competitive with the process which, at least approximately, generates annual earnings.

> *Hypothesis* 2. Expected return models contain implicit earnings per share growth rate forecasts that are not more accurate than the forecasts of the growth rate of earnings per share derived using the submartingale model of earnings.

A third test compares the forecasting ability of the VL model with the expected return models. If the procedure used in this paper to extract forecasts from the expected return models was efficient enough to extract forecasts that reflected all information available to the market, then the VL model forecasts would not be more accurate than the expected return model forecasts. Since the procedure used is clearly crude compared to the information processing of analysts, it is anticipated that Hypothesis 3 will be rejected in favour of VL.

> *Hypothesis* 3. The VL forecasts of the growth rate of earnings per share are no more accurate than the earnings forecasts of the expected return models.

Finally, since the lengthy literature comparing analyst forecasts with those of time series models is confined to short forecast horizons (see footnote 1), it is of interest to compare the VL forecasts with the SUB forecasts over the long forecast horizons used in this paper.

> *Hypothesis* 4. The VL forecasts of the growth rate of earnings per share are no more accurate than the forecasts of the SUB model.

Rejection of Hypothesis 4 in favour of VL superiority would provide further evidence of analyst forecast superiority relative to time-series models.

2. TESTS OF HYPOTHESES

Samples

Two replications of the experiment were conducted. In the first, time T was year-end 1967 and forecasted earnings were for 1972. The first 253 firms (in alphabetical order) were selected from the CRSP tape which met the criteria: (1) return data available during 1961-1967; (2) covered by the *Value Line Investment Survey* as of December 1967; (3) December fiscal year; and (4) positive earnings per share in 1967 and 1972. The second replication set T at December 1972. The sample size was 348. The criteria were similar with the corresponding changes in dates, namely, return data available during 1966–1972 and positive earnings per share in the base year 1972 and test year 1976.

The reasons for these criteria follow. The requirement that a sample firm have return data on the CRSP tape in the base period allowed computation of the firm's beta coefficient using this data source. The firm had to be covered by the *Value Line Investment Survey* to allow forecast comparisons to be made. Use of the December fiscal year-end ensured that all six model forecasts were based on comparable amounts of data relative to the fiscal year. Furthermore, the VL model forecasts had to be conditional only on annual earnings of the base year. The requirements of positive earnings per share in the base and test years allowed for positive growth rates. (The positive earnings criterion, as it turned out, was not binding in the first test period. In the second period, ten firms were eliminated because of this criterion.)

Although it is unlikely that the sample selection procedures materially affected the outcomes of the experiments, they did result in noticeably less risky sample firms than the market as a whole. The average beta for both samples was 0.85. As such, the test results may not generalize to the entire population of firms.

Test procedures

Because January 1935 was the starting date for calculating the BLK model estimates, that date was the starting point for most of the other return calculations. Thus, in estimating the CMR model, a stock's mean monthly stock return was found by averaging its returns over the history of the stock available since January 1935. In estimating mean market returns, the average of monthly returns was found over the time period beginning in January 1935. The market index was the equally-weighted return index of all stocks on the CRSP tape. Finally, in estimating the gammas for the BLK model, the monthly averages were also taken over the period starting in 1935.[6]

The SLM model requires risk-free returns and, for this purpose, yields-to-maturity on U.S. Government Bonds of the relevant maturity were employed. The data source was *Moody's Municipal and Government Manual*.

Let a_i = growth rate of actual earnings per share for firm i and g_{ij} = growth rate of forecasted earnings per share for firm i by method j. In each test period, a vector of errors $|a_i - g_{ij}| = e_{ij}$ may be calculated for each method j, where e_{ij} is the absolute value of the difference between the forecasted and realized growth rates. For hypothesis tests of two models, an appropriate design is a one-sample or matched-pairs case with self-pairing by firm. The members of each pair are errors, e_{ij}, from the two models, which are reduced to a single observation by taking the difference in the errors. The t-test is the usual parametric test of the mean difference and the Wilcoxon signed ranks test is an alternative non-parametric test of the median difference. Both tests were conducted. But since the results were similar, only the paired t-test results are reported.

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[6] All tests were also conducted using mean returns calculated over the most recent 84 months. The results were essentially the same as those reported in the paper. If anything, the longer estimation period benefited the CMR model.

Results

Table 1 contains summary statistics of the error distributions generated by the models when regression-adjusted betas were employed.

The average of deviations, $a_i - g_{ij}$, was computed for all sample firms. Such deviations measure the average bias of the forecast models. It appears that, in period 1, all the models tended to overforecast earnings growth. In period 2, the average deviation of the return models was slight, whereas VL tended to overforecast on average. However, the fraction of firms overestimated by VL (58.0 per cent) was quite close to the fractions for the other models. This suggests that the sample average deviation for VL was heavily influenced by a few firms.

Table 1. Summary statistics of error distributions*†

	Error measure	SUB	MAR	CMR	SLM	BLK	VL
Period 1, 1967–1972	Average deviation	−0.001	−0.062	−0.051	−0.049	−0.051	−0.046
	MABE	0.115	0.112	0.117	0.105	0.106	0.088
	MSE	0.046	0.032	0.034	0.031	0.031	0.018
	RMSE	0.213	0.178	0.184	0.176	0.177	0.135
	% Forecasts overestimated	56.1	81.8	72.7	72.3	73.5	64.0
Period 2, 1972–1976	Average deviation	0.040	−0.002	0.012	0.011	0.008	−0.030
	MABE	0.146	0.140	0.147	0.137	0.137	0.118
	MSE	0.071	0.067	0.070	0.066	0.066	0.031
	RMSE	0.266	0.258	0.265	0.256	0.256	0.175
	% Forecasts overestimated	47.2	58.9	53.4	52.9	53.7	58.0

* MAR = Market adjusted return; SUB = Submartingale; CMR = Comparison return; SLM = Sharpe-Lintner-Mossin; BLK = Black; VL = Value Line.
† Based on adjusted betas for the SLM and BLK models.

The mean absolute error (MABE), defined as the sample average of $|a_i - g_{ij}|$, better reflects the overall forecasting performance of the models since it takes into account the average error size. In period 1, VL's MABE was lowest at 0.088, followed by SLM and BLK at 0.105 and 0.106, while the other three models had MABE's between 0.112 and 0.117. Two other summary error measures, which give greater weight to large deviations, are mean square error or MSE (the sample average of $(a_i - g_{ij})^2$) and root mean squared error or RSME (the square root of MSE). Using these measures of forecast accuracy, VL was most accurate followed by the four expected return models all of which were more accurate than SUB.

In time period 2, VL had the most accurate forecasts. Using MABE, it again appears that SLM and BLK had smaller errors than the CMR, MAR, and SUB models. Using MSE, all models other than VL appear to have approximately equal forecast accuracy.

Table 2 contains the t-statistics for all paired comparisons over both sample periods and using both the historical beta and the regression-adjusted beta. In reading this table, a positive t-statistic means that the model at the top has lower errors than the model at the side. Since the results are very similar for both beta estimation methods, the discussion concentrates on the regression-adjusted beta case.

In both sample periods, both the SLM and BLK models produced smaller errors at high levels of confidence than the two non-beta expected return models −MAR and CMR. Hypothesis 1 is thus rejected. If one were attempting to gauge the market's expectation of future earnings growth via

Table 2. Parametric *t*-statistics, comparisons of six model's earnings prediction errors for two time periods*†

		Historical beta							Regression-adjusted beta					
		SUB	MAR	CMR	SLM	BLK	VL		SUB	MAR	CMR	SLM	BLK	VL
Period 1, 1967–1972	SUB	—	0.59	−0.50	1.32	1.17	2.69‡	SUB	—	0.59	−0.50	1.76¶	1.58‡	2.69‡
	MAR	—	—	−1.70¶	1.74¶	1.37	3.72‡	MAR	—	—	−1.70¶	4.93‡	4.29‡	3.72‡
	CMR	—	—	—	3.32‡	3.00‡	4.50‡	CMR	—	—	—	4.35‡	3.96‡	4.50‡
	SLM	—	—	—	—	−7.12‡	3.06‡	SLM	—	—	—	—	−8.22‡	2.72‡
	BLK	—	—	—	—	—	3.21	BLK	—	—	—	—	—	2.88‡
Period 2, 1972–1976	SUB	—	1.58	−0.40	2.88‡	2.84‡	2.90‡	SUB	—	1.58	−0.40	2.78‡	2.68‡	2.90‡
	MAR	—	—	−2.25§	2.38§	2.48§	2.35§	MAR	—	—	−2.25§	3.06‡	3.13‡	2.35§
	CMR	—	—	—	3.77‡	3.76‡	2.92‡	CMR	—	—	—	3.83‡	3.72‡	2.92‡
	SLM	—	—	—	—	−0.59	1.86¶	SLM	—	—	—	—	−1.60	1.93¶
	BLK	—	—	—	—	—	1.88¶	BLK	—	—	—	—	—	1.96§

* MAR = Market adjusted return; SUB = Submartingale; CMR = Comparison return; SLM = Sharpe-Lintner-Mossin; BLK = Black; VL = Value Line.

† A positive test statistic indicates superiority (lower forecast error) of model on top as compared with model on side; a negative test statistic indicates superiority of model on side. Forecast error is mean absolute error (MABE).

‡ Significant at the 1 per cent level, two-tailed test.

§ Significant at the 5 per cent level, two-tailed test.

¶ Significant at the 10 per cent level, two-tailed test.

the market's expected rate of return and the revealed dividend yield, then one would be better off employing either of the two models that use beta. The consistency of the results over the two test periods strengthens the conclusion that use of the beta coefficient enhances the predictability of expected rate of return and hence earnings growth.

To check on the efficacy of the procedure by which the expected return model forecasts were extracted, those models were compared with the SUB model. For the non-beta models, the t-statistics were less than ordinary conventional levels in both of the test periods. A comparison of MAR against SUB produced t-statistics of -0.50 and -0.40. These results indicate that Hypothesis 2 cannot be rejected for the non-beta models, although the MAR model provided slight indication of outperforming the SUB model.

For the SLM and BLK models, the t-statistics were positive and significant in both time periods. A comparison of SLM against SUB yielded t-statistics of 1.76 and 2.78, whereas in similar comparisons, BLK yielded 1.58 and 2.68. This is reasonable evidence for rejecting Hypothesis 2 in favour of the alternative hypothesis that SLM and BLK produce smaller errors than SUB. From another point of view, this result is impressive: a relatively simple manipulation of the expected return models, involving extrapolation of the expected market return and the stock's beta coefficient and subtraction of the stock's dividend yield, produced earnings forecasts that were more accurate than a well known time-series model of annual earnings. This interpretation indicates that the SLM and BLK expected return models appear to capture an important aspect of the market's return generating mechanism, and that the forecast extraction procedure has reasonable power.

The next hypothesis tests involve the VL forecasts. It is clear that Hypothesis 3 can be rejected at high levels of significance. By wide margins, VL produced lower forecast errors than all the expected return models, including the more accurate SLM and BLK models.

The last comparison, Hypothesis 4, evaluates VL against the TS model. In both samples, the forecasts of earnings per share growth were statistically superior to those of the TS model. This provides additional evidence that security analysts produce more accurate forecasts than time-series models.

The results of the tests were quite uniform in the two time periods. The average analyst error in forecasting the future annual growth rate for the following four to five year period tended to be about 1.7 per cent below the errors of the SLM and BLK expected return models, whereas the errors of the latter two models were about 0.7–1.2 per cent below the errors of the remaining models, including the SUB model.

3. CONCLUSIONS

This paper has shown that expected return models commonly used in the finance literature contain implicit forecasts of the growth rate of accounting earnings per share. For the comparison returns model (CMR) and the market-adjusted returns model (MAR), the resulting forecasts were no less accurate than a submartingale model. On the other hand, for the Sharpe-Lintner-Mossin (SLM) and Black (BLK) models, the forecasts were significantly more accurate than those generated by the submartingale model.

Evidence that security analysts forecasts are more accurate than those of less costly alternatives is also provided. The forecasts of four to five year growth rates of earnings per share produced and reported in the *Value Line Investment Survey* were shown to be more accurate than *all* of the other models tested—none of which required the direct input of a security analyst.

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REFERENCES

Abdel-khalik, A. R. and Thompson, R. B., 'Research on earnings forecasts: the state of the art', *The Accounting Journal*, 1 (1977-78), 180-209.

Albrecht, W., Lookabill, L. and McKeown, J., 'The time series properties of annual earnings', *Journal of Accounting Research*, 15 (1977), 226-244.

Ball, R. and Watts, R., 'Some time series properties of accounting income', *The Journal of Finance*, 27 (1972), 663-681.

Barefield, R. and Comiskey, E., 'The accuracy of analysts' forecasts of earnings per share', *Journal of Business Research*, 3 (1975), 241-252.

Black, F., 'Capital market equilibrium with restricted borrowing', *The Journal of Business*, 45 (1972), 444-454.

Black, F., Jensen, M. C. and Scholes, M., 'The capital asset pricing model: some empirical tests'. In Jensen, M. C. (ed.), *Studies in the Theory of Capital Markets*, New York: Praeger, 1972, pp. 79-121.

Blume, M., 'On the assessment of risk', *The Journal of Finance*, 26 (1971), 1-10.

Brooks, L. D. and Buckmaster, D. E., 'Further evidence of the time series properties of accounting income', *The Journal of Finance*, 31 (1976), 1359-1373.

Brown, L. D. and Rozeff, M. S., 'The superiority of analyst forecasts as measures of expectations: evidence from earnings', *The Journal of Finance*, 33 (1978), 1-16.

Brown, L. D. and Rozeff, M. S., 'Univariate time-series models of quarterly accounting earnings per share: a proposed model', *Journal of Accounting Research*, 17 (1979), 179-189.

Brown, S. J. and Warner, J. B., 'Measuring security price performance', *Journal of Financial Economics*, 8 (1980), 205-258.

Collins, W. A. and Hopwood, W. S., 'A multivariate analysis of annual earnings forecasts generated from quarterly forecasts of financial analysts and univariate time series models', *Journal of Accounting Research*, 18 (1980), 390-406.

Cragg, J. G. and Malkiel, B. G., 'The consensus and accuracy of some predictions of the growth of corporate earnings', *The Journal of Finance*, 23 (1968), 67-84.

Critchfield, T., Dyckman, T. and Lakonishok, J., 'An evaluation of security analysts' forecasts', *The Accounting Review*, 53 (1978), 651-668.

Elton, E. J. and Gruber, M. J., 'Earnings estimates and the accuracy of expectational data', *Management Science*, 19 (1972), 409-424.

Elton, E. J., Gruber, M. J. and Gultekin, M., 'Professional expectations: accuracy and diagnosis of errors', *Research paper*, Graduate School of Business Administration, New York University, New York, 1981.

Fama, E. F. and Macbeth, J. D., 'Risk return, and equilibrium: empirical tests', *Journal of Political Economy*, 8 (1973), 607-636.

Foster, G., 'Quarterly accounting data: time series properties and predictive-ability results', *The Accounting Review*, 52 (1977), 1-21.

Fried, D. and Givoly, D., 'Financial analysts' forecasts of earnings: a better surrogate for market expectations', *Journal of Accounting and Economics*, 4 (1982), 85-107.

Givoly, D. and Lakonishok, J., 'The information content of financial analysts' forecasts of earnings', *Journal of Accounting and Economics*, 1 (1979), 1-21.

Gordon, M. and Shapiro, E., 'Capital equipment analysis: the required rate of profit', *Management Science*, 3 (1956), 102-110.

Griffin, P. A., 'The time-series behaviour of quarterly earnings: preliminary evidence', *Journal of Accounting Research*, 15 (1977), 71-83.

Hopwood, W. S. and McKeown, J. C., 'An evaluation of univariate time-series earnings models and their generalization to a single input transfer function', *Journal of Accounting Research*, 19 (1981), 313-322.
Hopwood, W. S., McKeown, J. C. and Newbold, P., 'Power transformations in time-series models of quarterly earnings per share', *The Accounting Review*, 56 (1981), 927-933.
Imhoff, E. A. Jr. and Pare, P. V., 'Analysis and comparison of earnings forecast agents', *Journal of Accounting Research*, 20 (1982), 429-439.
Jaggi, B., 'Further evidence on the accuracy of management forecasts vis-à-vis analysts' forecasts', *The Accounting Review*, 55 (1980), 96-101.
Latane, H. A. and Jones, C. P., 'Standardized unexpected earnings—1971-1977', *The Journal of Finance*, 34 (1979), 717-724.
Lintner, J., 'The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets', *Review of Economics and Statistics*, 47 (1965), 13-37.
Livingston, M. and Jain, S., 'Flattening of bond yield curves for long maturities', *The Journal of Finance*, 37 (1982), 157-167.
Lorek, K. S., 'Predicting annual net earnings with quarterly earnings time-series models', *Journal of Accounting Research*, 17 (1979), 190-204.
Manegold, J. G., 'Time-series properties of earnings: a comparison of extrapolative and component models', *Journal of Accounting Research*, 19 (1981), 360-373.
Masulis, R. W., 'The effects of capital structure change on security prices: a study of exchange offers', *Journal of Financial Economics*, 8 (1980), 139-177.
Miller, M. H. and Modigliani, F., 'Dividend policy, growth, and the valuation of shares', *The Journal of Business*, 34 (1961), 411-433.
Mossin, J., 'Equilibrium in a capital asset market', *Econometrica*, 34 (1966), 768-783.
Moyer, C., Chatfield, R. E. and Kelley, G. D., 'Long-term earnings forecasts and the cost of equity capital for electric utilities', *Research paper*, Texas Tech University, 1983.
Schaefer, S., 'The problem with redemption yields', *Financial Analysts Journal*, 33 (1977), 49-57.
Sharpe, W. F., 'Capital asset prices: a theory of market equilibrium under conditions of risk', *The Journal of Finance*, 19 (1964), 425-454.
Watts, R. and Leftwich, R., 'The time series of annual accounting earnings', *Journal of Accounting Research*, 15 (1977), 253-271.

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6. With reference to page 30, lines 8-24, please provide a copy of the relevant material from the book.

RESPONSE:

See Attachment AG-DR-03-006.

WITNESS RESPONSIBLE: Roger A. Morin

Chapter 5
DCF Application

The purpose of the DCF model is to estin
shareholders, or cost of equity capital. From
cost of equity is the sum of the expected di
expected growth, g. It would be a relatively
company's cost of equity capital if investc
observable. Projections of dividends and grc
be looked up, its stock price observed, and
based on this one-firm sample. Reality is not so convenient, however, and the purpose of this chapter is to analyze the practical problems involved in applying the DCF model. The conceptual material of the previous chapter will be cast into practical perspective. The chapter reviews the practical implementation of the DCF model, the difficulties encountered, and potential tools and solutions to circumvent those difficulties.

Section 5.1 briefly describes readily available computerized sources of investment information useful in the implementation of the DCF approach. In Section 5.2, the issues of the appropriate dividend yield and stock price to employ are discussed. In Sections 5.3 through 5.5, methods of estimating expected growth are outlined, including historical growth, analysts' forecasts, and sustainable growth. Chapters 6 and 7 discuss two additional issues, both of which are reflected in the dividend yield component: the flotation cost allowance and the quarterly version of the annual DCF model. Chapter 8 stresses the need to broaden the sample to include other investment alternatives, and discusses the design of comparable risk groups of companies through the use of risk filters. Other complications that arise in determining the cost of equity, such as the absence of market data, the case of subsidiary utilities, and violation of DCF assumptions are also discussed in that chapter.

5.1 Data Sources

Several techniques described in this and subsequent chapters rely on the availability of historical and forecast information. The most widely used and comprehensive data bases in the determination of the cost of capital are briefly reviewed in this section[1] A wealth of investment information is

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[1] An exhaustive catalogue of sources of investment information is contained in the following investments textbooks: Cohen, Zinbarg, and Zeikel (1987), Sharpe and Alexander (1990), and Francis (1988).

Historical Growth Rates Versus Analysts' Forecasts

Obviously, historical growth rates as well as analysts' forecasts provide relevant information to the investor with regard to growth expectations. In view of the empirical evidence and the conceptual discussion of the previous sections, and provided no structural shift in industry fundamentals have occurred, equal weight should be accorded to DCF results based on history and those based on analysts' forecasts. Each proxy for expected growth brings information to the judgment process from a different light. Neither proxy is without blemish, each has advantages and shortcomings. Historical growth rates are available and easily verifiable, but may no longer be applicable if structural shifts have occurred. Analysts' growth forecasts may be more relevant since they encompass both history and current changes, but are nevertheless imperfect proxies.

5.5 Growth Estimates: Sustainable Growth Method

Another method, alternately referred to as the "ploughback," "sustainable growth," and "retention ratio" method, was used by investment analysts to predict future growth in earnings and dividends. In this method the fraction of earnings expected to be retained by the company, *b*, is multiplied by the expected return on book equity, *r*. That is,

$$g = b \times r$$

The conceptual premise of the method, enunciated in Chapter 4, Section 4, is that future growth in dividends for existing equity can only occur if a portion of the overall return to investors is reinvested into the firm instead of being distributed as dividends.

For example, if a company earns 12% on equity, and pays all the earnings out in dividends, the retention factor, *b*, is zero and earnings per share will not grow. Conversely, if the company retains all its earnings and pays no dividends, it would grow at an annual rate of 12%. Or again, if the company earns 12% on equity and pays out 60% of the earnings in dividends, the retention factor is 40%, and earnings growth will be 40% x 12% = 4.8% per year.

In implementing the method, the retention rate, *b*, should be the rate that the market expects to prevail in the future. If no explicit forecast is available, it is reasonable to assume that the utility's future retention ratio will, on average, remain unchanged from its present level. Or, it can be estimated by taking a weighted average of past retention ratios as a proxy for the future on the grounds that utilities' target retention ratios are usually, although not always, stable.[11]

Both historical and forecast values of r can be used to estimate g, although forecast values are superior. The use of historical realized book returns on equity rather than the expected return on equity is questionable since reliance on achieved results involves circular reasoning. Realized returns are the results of the regulatory process itself, and are also subject to tests of fairness and reasonableness. As a gauge of the expected return on book equity, either direct published analysts' forecasts of the long-run expected return on equity, or authorized rates of return in recent regulatory cases can be used as a guide. As a floor estimate, it seems reasonable for investors to expect allowed equity returns by state regulatory commissions to be in excess of the current cost of debt to the utility in question.

Another way of estimating the return on equity investors are expecting was proposed by Copeland (1979). Since earnings per share, E, can be stated as dividends per share, D, divided by the payout ratio $(1 - b)$, the earnings per share capitalized by investors can be inferred by dividing the current dividend by an expected payout ratio. Since most utilities follow a fairly stable dividend policy, the possibility of error is less when estimating the payout than when estimating the expected return on equity or the expected growth rate. Using this approach, and denoting book value per share by B, the expected return on equity is:

$$r = E/B = (D/(1 - b))/B \tag{5-9}$$

Estimates of the expected payout ratio can be inferred from historical 10-year average payout ratio data for utilities. Since individual averages frequently tend to regress toward the grand mean, the historical payout ratio needs to be adjusted for this tendency, using statistical techniques for predicting future values based on this tendency of individual values to regress toward the grand mean over time.

An application of the sustainable growth method is shown in the following hypothetical example.

[11] Statistically superior predictions of future averages are made by weighting individual past averages with the grand mean, with the variance within the individual averages and the variance across individual averages serving as weights. See Efron and Morris (1975) for an excellent discussion of this method.

EXAMPLE 5-1

Southeastern Electric's sustainable growth rate is required for an upcoming rate case testimony. As a gauge of the expected return on equity, authorized rates of return in recent decisions for Eastern U.S. electric utilities as reported by Value Line for 1993 and 1994 averaged 12%, with a standard deviation of 1%. In other words, the majority of those utilities were authorized to earn 12%, with the allowed return on equity ranging from 11% to 13%. As a gauge of the expected retention ratio, the average 1993 payout ratio of 34 eastern electric utilities as compiled by Value Line was 60%, which indicates an average retention ratio of 40%, with a standard deviation of some 5%. This was consistent with the long-run target retention ratio indicated by the management of The Southeastern Electric. It is therefore reasonable to postulate that investors expect a retention ratio ranging from 35% to 45% for the company with a likely value of 40%. In Table 5-4 below, expected retention ratios of 35% to 45% and assumed returns on equity from 11% to 13% are combined to produce growth rates ranging from 3.8% to 5.4% with a likely value of 4.6%.

TABLE 5-4
ILLUSTRATION OF THE SUSTAINABLE GROWTH METHOD
EXPECTED GROWTH RATE: $g + br$

Expected Retention Ratio (b)	Expected Return on Book Equity (r) 11%	12%	13%
35%	3.85%	4.20%	4.55%
40%	4.40%	4.80%	5.20%
45%	4.95%	5.40%	5.85%

It should be pointed out that published forecasts of the expected return on equity by analysts such as Value Line are sometimes based on end-of-period book equity rather than on average book equity. The following formula[12] adjusts the reported end-of-year values so that they are based on average common equity, which is the common regulatory practice:

[12] The return on year-end common equity, r, is defined as $r = E/B_t$, where E is earnings per share, and B is the year-end book value per share. The return on average common equity, r_a, is defined as:

$$r_a = E/B_a$$

$$r_a = r_t \frac{2B_t}{B_t + B_{t-1}} \tag{5-10}$$

where r_a = return on average equity

r_t = return on year-end equity as reported

B_t = reported year-end book equity of the current year

B_{t-1} = reported year-end book equity of the previous year

The sustainable growth method can also be extended to include external financing. From Chapter 4, the expanded growth estimate is given by:

$$g = br + sv$$

where b and r are defined as previously, s is the expected percent growth in number of shares to finance investment, and v is the profitability of the equity investment. The variable s measures the long-run expected stock financing that the utility will undertake. If the utility's investments are growing at a stable rate and if the earnings retention rate is also stable, then s will grow at a stable rate. The variable s can be estimated by taking a weighted average of past percentage increases in the number of shares. This measurement is difficult, however, owing to the sporadic and episodic nature of stock financing, and smoothing techniques must be employed. The variable v is the profitability of the equity investment and can be measured as the difference of market price and book value per share divided by the latter, as discussed in Chapter 4.

---

12 (continued)

where B_a = average book value per share. The latter is by definition:

$$B_a = \frac{B_t + B_{t-1}}{2}$$

where B_t, is the year-end book equity per share and B_{t-1} is the beginning-of-year book equity per share. Dividing r by r_a and substituting:

$$\frac{r}{r_a} = \frac{E/B_t}{E/B_a} = \frac{B_a}{B_t} + \frac{B_t + b_{t-1}}{2B_t}$$

Solving for r_a, a formula for translating the return on year-end equity into the return on average equity is obtained, using reported beginning-of-the year and end-of-year common equity figures:

$$r_a = r \frac{2B_t}{B_t + B_{t-1}}$$

AG-DR-03-007

REQUEST:

7. With reference to page 36, lines 1-3, please provide copies of studies that relate allowed returns to Q ratios.

RESPONSE:

See Attachment AG-DR-03-007 from Dr. Morin's book.

WITNESS RESPONSIBLE: Roger A. Morin

Chapter 10
Market-to-Book and Q-Ratios

This chapter discusses the Market-to-Book (M/B) Ratio and its relationship with the cost of capital. Section 10.1 establishes the formal relationship between the allowed return on equity, the cost of equity, and the M/B ratio. Section 10.2 demonstrates how the DCF cost of equity figure can be theoretically transformed into an appropriate allowed return on equity, based on a target M/B ratio. The importance of maintaining an M/B slightly in excess of 1.0 is underscored. Section 10.3 discusses the estimation of cost of equity capital based on the multivariate statistical analysis of the determinants of M/B ratios. Section 10.4 describes the Q-Ratio approach to determining the cost of equity capital. Section 10.5 critically evaluates the role of M/B ratios in regulation and concludes that regulators should largely remain unconcerned with such ratios because they are determined by exogenous market forces and are outside the direct control of regulators. M/B ratios are largely the end result of the regulatory process itself rather than its starting point.

In Chapter 1, it was suggested that if regulators set the allowed rate of return equal to the cost of capital, the utility's earnings will be just sufficient to cover the claims of the bondholders and shareholders. No wealth transfer between ratepayers and shareholders will occur.

The direct financial consequence of setting the allowed return on equity, r, equal to the cost of equity capital, K, is that share price is driven toward book value per share. Intuitively, if $r > K$, and is expected to remain so, then market price will exceed book value per share since shareholders are obtaining a return in excess of their opportunity cost. But if $r < K$, and is expected to remain so, market price will be below book value per share since the utility is failing to achieve its opportunity cost. A simple idealized example will illustrate this important point.

EXAMPLE 10-1

Consider a utility with a book value of equity per share of $10, and let us say that the market's required return on equity is 12% for firms in that risk class. If the $10 book value of equity is allowed to earn $1.20 per share, or 12%, the market price will set at $10, since the market's required return at that price will be also $1.20/$10, or 12%. If, on the other hand, the $10 book equity per share is allowed to earn say only 6%, the market price has to fall to $5.00 in order for the market's required return to be 12%, that is, $0.60/$5, or 12%.

On the negative side, the method is vulnerable to "curve fitting" excesses. The temptation is strong to include a multitude of explanatory variables that may or may not have any economic validity. The inclusion of explanatory variables should rest on strong defensible economic arguments, rather than on empirical elegance and spectacular explanatory power. Another drawback of the approach is that the user requires a solid understanding of econometric estimation techniques. It is important that the assumptions of linear regression techniques be well understood and verified for possible violation. Checks for multicolinearity between the explanatory variables, measurement error biases, omitted variables biases, and scale effects should be conducted. The stability of the coefficients over time is also necessary if the econometric model is to be useful for forecasting equity-costs. The major drawback of the approach is that it is only as valid as the DCF model on which its rests. As discussed in the previous chapter, the DCF model is very fragile in particular capital market conditions.

One common error in specifying M/B models is to use the currently allowed book return on equity, rather than the expected return, as one of the explanatory variables. The stock price that appears in the numerator of the M/B ratio reflects the return expected by investors to be granted, and not the return currently allowed or currently earned. If the model is estimated using actual return, the estimated coefficient for that variable will be biased, since the actual M/B ratio will be different from what is justified by the current return on equity. The coefficient of return on equity will thus be invalid, and use of the method to infer the cost of equity capital will lead to distorted values of equity costs.

All the earlier caveats that share price will only be driven toward book value under knife-edge circumstances deserve reiteration.

10.4 The Q-Ratio

The Q-ratio can be used to establish an appropriate target M/B ratio for a company. The Q-ratio is defined as the ratio of the market value of a firm's securities to the replacement cost of its assets. A control group of comparable unregulated companies is used to establish an appropriate Q-ratio. This ratio is multiplied by the replacement cost value of equity-financed assets in a subject utility to obtain a target market price that measures the replacement cost market value of the equity. The target M/B ratio employs the target market price, and the return on book equity required to support the target M/B ratio is computed from the transformation relationship of Equation 10-8:

$$r = P_Q / B\,(K - g) + g \qquad (10\text{-}15)$$

where P_Q = target market price computed from the target Q-ratio.

Rationale

The market value of a firm's securities clearly exerts an important influence on the firm's incentive to invest in capital projects. If the market value of a firm's stocks and bonds exceeds the cost of establishing productive capacity, there is an incentive to raise capital and establish new productive capacity, since such investments increase stock price. Conversely, if the market value of a firm's securities is less than the current cost of establishing productive capacity, there is a disincentive to invest in new plant, since such investments would decrease stock price, and investors could exercise the option to liquidate the firm's assets at a value in excess of the equity value.

In the long-run, for a competitive industry, the possibility of free entry and exit of firms in a competitive industry would ensure that the market value of a firm's securities equals the replacement cost of its assets. Otherwise, the possibility of entry and exit into the industry would trigger the addition or deletion of further production, thereby altering product prices, profits, and finally market values until such an equality prevailed.

ABR — need to check Tobin + Brainard 1971

The relationship between the market value of a firm's securities and the replacement cost of its assets is embodied in the Q-ratio, first developed by Tobin and Brainard (1971). The Q-ratio is defined as follows:

$$Q = \frac{\text{Market Value of a Firm's Securities}}{\text{Replacement Cost of Firm's Assets}}$$

+ spacing? betw words

If $Q > 1.0$, a firm has an incentive to invest because the value of the firm's securities exceeds the replacement cost of assets, that is, the firm's return on its investments exceeds its cost of capital. Conversely, if $Q < 1.0$, a firm has a disincentive to invest in new plant. In final long-run equilibrium, the Q-ratio is driven to 1.0.

The Q-Ratio and Regulation

The language of the *Hope* decision strongly suggests that the objective of regulation is to target a utility's profits at a level commensurate with the profits earned by competitive firms of comparable risk. Since in the unregulated sector, competitive forces will assure that over long periods of time the Q-ratio will be 1.0, regulators should provide public utilities with a return sufficient to realize an expected average Q-ratio of 1.0.

In the short-run, temporary disequilibriums occur so that unregulated firms will not necessarily achieve Q-ratios of 1.0. Consistent with the comparable earnings doctrine and the capital attraction standard of *Hope*, a utility's profits should be targeted at a level commensurate with the actual profits earned by firms of similar risk. By this standard, the end result of the rate setting process is a stock price that implies a Q-ratio equal to the aggregate Q-ratio for a sample of comparable risk unregulated firms. In other words, under the Q-ratio standard, the allowed return should be set so that the ratio of market value to replacement cost is the same for regulated and unregulated firms of comparable risk.

Earlier in this chapter, it was argued that the cost of equity should be translated into an allowed rate of return such that the M/B ratio will be slightly in excess of 1.0 in order to prevent dilution of book value when new stock is sold. But these considerations only relate to dilution of nominal book value. The Q-ratio extends this argument to include protection from dilution in real terms. In an inflationary period, the replacement cost of a firm's assets may increase more rapidly than its book equity. To avoid the resulting economic confiscation of shareholders' investment in real terms the allowed rate of return should produce a M/B ratio that provides a Q-ratio of 1.0 or a Q-ratio equal to that of comparable firms.

To implement the standard, the cost of equity derived from DCF, CAPM, and Risk Premium methodologies is translated into the fair equity return consistent with a Q-ratio equivalent to that of comparable unregulated firms. In other words, the cost of book equity is the return required to be earned on the utility's book equity such that the investor will receive the required return *K* and the stock price maintains a Q-ratio equal to that of comparable firms. The issue of setting the allowed rate of return at a level sufficient to equate the Q-ratio of a regulated utility with the Q-ratio of comparable risk unregulated firms is discussed in Litzenberger (1980) and Harlow ~~(1984).~~ (1984A, 1984B).

Data Sources

The U.S. Council of Economic Advisers in a previous annual Economic Report of the President (1979) developed aggregate estimates of the Q-ratio for the corporate sector as a measure of the incentive for corporate investment in plant and equipment. These aggregate Q-ratio estimates employed data items from both the national income and product accounts and from the flow of funds accounts in order to arrive at the ratio of the market values of corporate debt and equity to the replacement cost of assets. As a proxy for asset replacement cost, an estimate of net depreciable assets and inventories repriced for the effects of inflation was used. These data items are not easily reconcilable with items in the balance sheet of an individual firm, however.

Spacing

A simple balance sheet method to calculate Q-ratios for individual firms uses the following formula:

$$Q = \frac{MVE + FVD}{RC} \tag{10-16}$$

where MVE = market value of equity, including convertible preferred, if any

MVE = RC - FVD

RC = replacement cost of "net assets"

FVD = face value of debt, straight preferred, and investment tax credits

"Net assets" are total assets at replacement cost less current liabilities other than debt, and less deferred credits other than the investment tax credit. For the replacement cost of assets, either trended original cost or the actual replacement cost data required by the SEC in 10K reports can be used.

It is important to note that the face value of debt and preferred, rather than their market value, is used in calculating the numerator of the Q-ratio. This is due to the particular nature of the regulatory process. To determine a utility's overall allowed rate of return, the embedded cost of debt and preferred stock is used. As a result, ratepayers bear the gains and losses associated with the use of senior capital raised in the past. Utility's shareholders neither benefit nor lose by the change in the market prices of the senior capital brought about by changes in interest rates. Accordingly, the use of the market values of senior capital is not appropriate when computing utility Q-ratios.

Based on the latter qualification, a just and reasonable price for a public utility's stock should be determined by subtracting the book value rather than the market value of senior capital from the replacement cost of assets. Litzenberger (1980) describes the final regulatory standard implied by the Q-ratio as follows. A fair and reasonable stock price should result in a ratio Q_r of the market value of the utility's equity to the value of its equity at adjusted replacement cost that is equal to the Q-ratio for a comparable group of unregulated firms. The value of the utility's equity at adjusted replacement cost is in turn defined as the historical book value of its equity plus the difference between its net plant and equipment at replacement cost and at historical cost.

Implementation

The general procedure for applying the Q-ratio approach to the determination of equity cost consists of 4 steps:

Step 1: Obtain a sample of comparable risk unregulated companies, using the risk filter techniques described in earlier chapters.

Step 2: Calculate the Q-ratio for each company in the sample, as per Equation 10-16, using the replacement costs of their net plant and equipment and inventories contained in their 10K reports and the market value of their publicly traded debt and equity securities.

Step 3: Calculate the target M/B ratio that would result in a Q_r ratio equal to the equity ratio for the comparable group of unregulated firms. The numerator of the target M/B ratio is the value of the specified utility's equity at replacement cost calculated using replacement cost data.

Step 4: Use transformation Equation 10-8 to convert the utility's cost of equity capital into a fair return on equity.

EXAMPLE 10-8

The following example is adapted from Litzenberger (1988). The cost of equity capital for Eastern Power Company derived from the DCF, Risk Premium, and CAPM methodologies is 15%, consisting of a 5% growth and a 10% expected dividend yield. For reasons of consistency, the same group of unregulated comparable risk firms used in the execution of the DCF method is retained for computing the reference Q-ratio. The average Q-ratio for this group of risk-equivalent companies is 0.85, computed from the application of Equation 10-18 to each company. To estimate the target M/B ratio, the value of common equity at adjusted replacement cost is first estimated from the information contained in the current annual report:

VALUE OF EASTERN POWER COMPANY'S EQUITY
AT ADJUSTED REPLACEMENT COST
($000,000)

Common Equity	$150
Minority Interest Common Equity	$ 5
Convertible Preferred	$ 2
Value of Equity at Historical Cost	$157
Difference between Net Plant at Replacement and Historical Cost	$ 80
Value of Common Equity at Adjusted Replacement Cost	$237

The target M/B ratio for the Eastern Power Company is calculated as follows:

Value of Equity at Replacement Cost	$237
Comparable risk firms Q-ratio	0.80
Target Market Value of Equity	$190
Value of Common Equity at Historical Cost	$157
Target M/B Ratio	1.21

Lastly, the cost of equity capital of 15% is translated into the allowed equity return, which will produce the target M/B ratio of 1.21, using Equation 10-8:

$$r = M/B(K - g) + g$$

$$= 1.21\ (15\% - 5\%) + 5\%$$

$$= 17.1\%$$

Drawbacks of the Approach

At the practical level, the results of the Q-ratio approach can only be as accurate as the replacement cost data on which it is based, typically derived from 10K reports. The lack of verifiability and the subjective nature of these data are likely deterrents from use of the method. For non-publicly traded companies, the problem of generating suitable replacement cost data is even more formidable; trended original cost proxies could serve instead. At the conceptual level, despite the convincing logic of the method and despite the economic foundation on which it rests, the basic premise that the M/B ratios of utilities should be more consistent with those prevailing for comparable industrials is controversial. A substantial burden would be imposed on utility ratepayers by implementing the method, while it is questionable whether investors' returns would be ameliorated. A quotation from Kahn makes the point:

> . . . any attempt of a regulatory commission to permit investors the higher return would only be self-defeating. Investors would respond to the higher earnings per share by bidding up the prices of the securities to the point new purchases would earn only the old cost of capita investments. The only beneficiaries would be those

AG-DR-03-008

REQUEST:

8. With reference to page 46, lines 1-7, please provide the raw data and regression results as cited. Please include both a hard copy and an electronic copy in Microsoft Excel format with all data, formulas, and regression results intact.

RESPONSE:

See table at Attachment AG-DR-03-008. Due to copyright restrictions, Ibbotson Associates does not allow electronic dissemination of proprietary data.

WITNESS RESPONSIBLE: Roger A. Morin

Size-Decile Portflios of the NYSE/AMEX/NASDAQ
Summary Statistics of Annual Returns

Decile	Geometric Mean	Arithmetic Mean	Standard Deviation
1	9.6%	11.4%	19.27%
2	10.9%	13.2%	22.00%
3	11.3%	13.8%	23.81%
4	11.3%	14.4%	26.10%
5	11.7%	15.0%	26.94%
6	11.8%	15.5%	27.97%
7	11.6%	15.7%	30.17%
8	11.9%	16.7%	33.65%
9	12.2%	17.7%	36.77%
10	14.0%	21.8%	45.67%

Source: Ibbotson Associates 2005 Valuation Yearbook
page 132

Regression of Geometric Mean vs Std. Deviatio

Regression Output:		
Constant		0.077481
Std Err of Y Est		0.004049
R Squared		0.879899
No. of Observations		10
Degrees of Freedom		8
X Coefficient(s)	0.132782	
Std Err of Coef.	0.017344	
t-value	7.655751	

Regression of Arithmetic Mean vs Std. Deviatio

Regression Output:		
Constant		0.049574
Std Err of Y Est		0.004046
R Squared		0.98193
No. of Observations		10
Degrees of Freedom		8
X Coefficient(s)	0.361301	
Std Err of Coef.	0.017329	
t-value	20.84996	

Attorney General First Set Data Requests
ULH&P Case No. 2005-00042
Date Received: July 29, 2005
Response Due Date: August 9, 2005

AG-DR-03-009

REQUEST:

9. With reference to page 64, lines 18-23, for Dr. Morin's group of gas companies, please provide the alternative expected growth rates in earnings as opposed to dividends, since Dr. Morin does not believe that they are expected to grow at the same rate in the future.

RESPONSE:

Growth rates in earnings as opposed to dividends are provided with Dr. Morin's testimony on Exhibit RAM-5 in column 3 for the gas companies in Dr. Morin's sample.

WITNESS RESPONSIBLE: Roger A. Morin

REQUEST:

10. On pages 2-4 of Mr. Riddle's rebuttal testimony, he provides extensive testimony with respect to heating degree day calculations, including calculation of the Mean Percent Error (MPE) for various time periods. Please provide all calculations, assumptions and workpapers used to generate all of the MPE results that are presented in this testimony.

RESPONSE:

See Attachment AG-DR-03-010.

WITNESS RESPONSIBLE: James A. Riddle

Request for Information by the Attorney General Concerning the Rebuttal Testimony of The Union Light, Heat, and Power Company - #10

Calculation of MPE

	Actual HDD	Normal HDD										
2000	5,187	4,950	5,148	5,133	5,035	5,093	4,984	5,029	5,038	5,042	5,028	5,018
2001	4,672	4,950	5,148	5,133	5,035	5,093	4,984	5,029	5,038	5,042	5,028	5,018
2002	4,940	4,950	5,148	5,133	5,035	5,093	4,984	5,029	5,038	5,042	5,028	5,018
2003	5,182	4,950	5,148	5,133	5,035	5,093	4,984	5,029	5,038	5,042	5,028	5,018
2004	4,847	4,950	5,148	5,133	5,035	5,093	4,984	5,029	5,038	5,042	5,028	5,018
= (normal-actual) / actual		(0.0457)	(0.0075)	(0.0104)	(0.0293)	(0.0181)	(0.0391)	(0.0305)	(0.0287)	(0.0280)	(0.0307)	(0.0326)
= (normal-actual) / actual		0.0595	0.1019	0.0987	0.0777	0.0901	0.0668	0.0764	0.0783	0.0792	0.0762	0.0741
= (normal-actual) / actual		0.0020	0.0421	0.0391	0.0192	0.0310	0.0089	0.0180	0.0198	0.0206	0.0178	0.0158
= (normal-actual) / actual		(0.0448)	(0.0066)	(0.0095)	(0.0284)	(0.0172)	(0.0382)	(0.0295)	(0.0278)	(0.0270)	(0.0297)	(0.0316)
= (normal-actual) / actual		0.0213	0.0621	0.0590	0.0388	0.0508	0.0283	0.0375	0.0394	0.0402	0.0373	0.0353
= sum of rows 11 thru 15		(0.0077)	0.1920	0.1769	0.0780	0.1365	0.0266	0.0720	0.0811	0.0851	0.0710	0.0609
= (sum of rows 11 thru 15) / 5		**-0.15%**	**3.84%**	**3.54%**	**1.56%**	**2.73%**	**0.53%**	**1.44%**	**1.62%**	**1.70%**	**1.42%**	**1.22%**

AG-DR-03-011

REQUEST:

11. On page 6 of Mr. Riddle's rebuttal testimony, he states that the Attachment to AG-DR-01-130 were not the calculation of FT forecasted volumes as were requested, but "simply serve to indicate that FT sales have shown a historical decline in the past." If this is the case, then the Company's response to AG-DR-01-130 was not responsive and did not provide the calculations requested. Please try again to answer AG-DR-01-130, specifically provide all calculations, assumptions and workpapers that were used to forecast a 24% decrease in FT volumes.

RESPONSE:

All calculations, assumptions and workpapers used to prepare the forecast, including FT volumes, have been previously submitted in response to AG-DR-02-049 and AG-DR-01-111.

WITNESS RESPONSIBLE: James A. Riddle

AG-DR-03-012

REQUEST:

12. Attachment JAR Rebuttal-2 contains calculations based on actual billed volumes. Please provide the same exhibit, but with the calculations based on weather normalized volumes instead of actual billed volumes.

RESPONSE:

See Attachment AG-DR-03-012.

WITNESS RESPONSIBLE: James A. Riddle

Request for Information by the Attorney General Concerning the Rebuttal Testimony of The Union Light, Heat, and Power Company - #12

Exhibit JAR Rebuttal - 2 - WN

The Union Light Heat & Power Company
Weather Normal Billed Firm Transportation Sales Volumes
For the Years 2000 through 2004 and 12 months Ended April 2005

Billed Volumes (Mcf)	2000	2001	2002	2003	2004	12 Months Ended April 2005
FT - Commercial	154,456	156,543	165,043	174,315	160,658	176,906
FT - Industrial	942,119	1,051,024	872,685	968,057	1,045,209	1,021,877
FT- Other Public Authority	131,289	124,089	140,473	141,959	140,690	142,008
Total Actual Sales	1,227,864	1,331,656	1,178,201	1,284,331	1,346,557	1,340,791
Year to Year Annual Percentage Change in Sales Volumes					4.85%	-0.43%
Average Annual Growth Rate 2000 to 2004					**2.33%**	

Exhibit JAR Rebuttal - 3 - WN

COMPARSION OF YEAR-TO-DATE VOLUMES

Firm Gas Retail Sales	2004 (Mcf)	2005 (Mcf)	2004-2005 % Change
Residential	4,704,169	4,845,419	
Commercial	2,330,161	2,034,914	
Industrial	281,650	352,239	
Governmental/OPA	371,574	359,505	
Total	7,687,554	7,592,077	-1.24%

Firm Gas Transportation Sales	2004 (Mcf)	2005 (Mcf)	2004-2005 % Change
Residential	0	0	
Commercial	78,014	102,759	
Industrial	506,554	494,759	
Governmental/OPA	84,366	89,112	
Total	668,934	686,630	**2.65%**

Firm Gas Total Sales	2004 (Mcf)	2005 (Mcf)	2004-2005 % Change
Residential	4,704,169	4,845,419	
Commercial	2,408,175	2,137,673	
Industrial	788,204	846,998	
Governmental/OPA	455,940	448,617	
Total	8,356,488	8,278,707	**-0.93%**

Exhibit JAR Rebuttal - 4 - WN

CALCULATION OF FORECASTED RETAIL SALES GROWTH RATE USING THE KINLOCH METHOD

Volumes (1)

	2003	2004	2003-2004 Change	2003-2004 % Change
Retail				
Residential	7,190,041	6,853,180	(336,861)	
Commercial	3,161,012	3,087,609	(73,403)	
Industrial	470,334	451,787	(18,547)	
Other	542,173	537,151	(5,022)	
Total Retail	11,363,560	10,929,727	(433,833)	**(3.82%)**

(1) ULH&P Schedule I-5

Exhibit JAR Rebuttal - 5 - WN

CALCULATION OF FORECASTED RETAIL SALES VOLUMES USING THE KINLOCH METHOD

Volumes (1)

	2003	2004	Growth Rate
Retail			
Residential (RS)	7,190,041	6,853,180	-4.69%
Non-Residential (GS)	4,173,519	4,076,547	-2.32%
Total Retail	11,363,560	10,929,727	-3.82%

RS Historic Test Year ending Oct. 31, 2004	7,086,139
GS Historic Test Year ending Oct. 31, 2004	3,843,621
Weather Normalization Adjustment Factor (2)	1.0375
RS WN Historic Test Year	7,351,869
GS WN Historic Test Year	3,987,757
RS Annual Growth Rate	-4.69%
GS Annual Growth Rate	-2.32%
RS 23 Month Growth Rate	-8.98%
GS 23 Month Growth Rate	-4.45%
Forecast Retail Sales Volume	
RS 12 Months ending Sept 30, 2006	6,691,687
GS 12 Months ending Sept 30, 2006	3,810,166
Retail Sales 12 Months ending Sept 30, 2006	10,501,854

(1) ULH&P WPFR-9v
(2) Exhibit DHBK - 8

Exhibit JAR Rebuttal - 7 - WN

COMPARSION OF YEAR-TO-DATE ACTUAL VOLUMES TO FORECAST

Firm Gas Total Sales	Actual 2005 (Mcf)	Forecast 2005 (Mcf)	2004-2005 % Change
Residential	4,845,419	4,674,203	
Commercial	2,137,673	2,121,380	
Industrial	846,998	727,730	
Governmental/OPA	448,617	457,698	
Total	8,278,707	7,981,011	**-3.60%**

Attorney General First Set Data Requests
ULH&P Case No. 2005-00042
Date Received: July 29, 2005
Response Due Date: August 9, 2005

AG-DR-03-013

REQUEST:

13. Attachment JAR Rebuttal-3 contains calculations based on actual billed volumes. Please provide the same exhibit, but with the calculations based on weather normalized volumes instead of actual billed volumes.

RESPONSE:

See Attachment AG-DR-03-013.

WITNESS RESPONSIBLE: James A. Riddle

Exhibit JAR Rebuttal - 3 - WN

COMPARSION OF YEAR-TO-DATE VOLUMES

Firm Gas Retail Sales	2004 (Mcf)	2005 (Mcf)	2004-2005 % Change
Residential	4,704,169	4,845,419	
Commercial	2,330,161	2,034,914	
Industrial	281,650	352,239	
Governmental/OPA	371,574	359,505	
Total	7,687,554	7,592,077	-1.24%

Firm Gas Transportation Sales	2004 (Mcf)	2005 (Mcf)	2004-2005 % Change
Residential	0	0	
Commercial	78,014	102,759	
Industrial	506,554	494,759	
Governmental/OPA	84,366	89,112	
Total	668,934	686,630	**2.65%**

Firm Gas Total Sales	2004 (Mcf)	2005 (Mcf)	2004-2005 % Change
Residential	4,704,169	4,845,419	
Commercial	2,408,175	2,137,673	
Industrial	788,204	846,998	
Governmental/OPA	455,940	448,617	
Total	8,356,488	8,278,707	**-0.93%**

REQUEST:

14. Attachment JAR Rebuttal-4 contains calculations based on actual billed volumes. Please provide the same exhibit, but with the calculations based on weather normalized volumes instead of actual billed volumes.

RESPONSE:

See Attachment AG-DR-03-014.

WITNESS RESPONSIBLE: James A. Riddle

Exhibit JAR Rebuttal - 4 - WN

CALCULATION OF FORECASTED RETAIL SALES GROWTH RATE USING THE KINLOCH METHOD

Volumes (1)

	2003	2004	2003-2004 Change	2003-2004 % Change
Retail				
Residential	7,190,041	6,853,180	(336,861)	
Commercial	3,161,012	3,087,609	(73,403)	
Industrial	470,334	451,787	(18,547)	
Other	542,173	537,151	(5,022)	
Total Retail	11,363,560	10,929,727	(433,833)	**(3.82%)**

(1) ULH&P Schedule I-5

Attorney General First Set Data Requests
ULH&P Case No. 2005-00042
Date Received: July 29, 2005
Response Due Date: August 9, 2005

AG-DR-03-015

REQUEST:

15. Attachment JAR Rebuttal-5 contains calculations based on actual billed volumes. Please provide the same exhibit, but with the calculations based on weather normalized volumes instead of actual billed volumes.

RESPONSE:

See Attachment AG-DR-03-015.

WITNESS RESPONSIBLE: James A. Riddle

Exhibit JAR Rebuttal - 5 - WN

CALCULATION OF FORECASTED RETAIL SALES VOLUMES USING THE KINLOCH METHOD

Volumes (1)

	2003	2004	Growth Rate
Retail			
Residential (RS)	7,190,041	6,853,180	-4.69%
Non-Residential (GS)	4,173,519	4,076,547	-2.32%
Total Retail	11,363,560	10,929,727	-3.82%

RS Historic Test Year ending Oct. 31, 2004	7,086,139
GS Historic Test Year ending Oct. 31, 2004	3,843,621
Weather Normalization Adjustment Factor (2)	1.0375
RS WN Historic Test Year	7,351,869
GS WN Historic Test Year	3,987,757
RS Annual Growth Rate	-4.69%
GS Annual Growth Rate	-2.32%
RS 23 Month Growth Rate	-8.98%
GS 23 Month Growth Rate	-4.45%
Forecast Retail Sales Volume	
RS 12 Months ending Sept 30, 2006	6,691,687
GS 12 Months ending Sept 30, 2006	3,810,166
Retail Sales 12 Months ending Sept 30, 2006	10,501,854

(1) ULH&P WPFR-9v
(2) Exhibit DHBK - 8

Attorney General First Set Data Requests
ULH&P Case No. 2005-00042
Date Received: July 29, 2005
Response Due Date: August 9, 2005

AG-DR-03-016

REQUEST:

16. Attachment JAR Rebuttal-7 contains calculations based on actual billed volumes. Please provide the same exhibit, but with the calculations based on weather normalized volumes instead of actual billed volumes.

RESPONSE:

See Attachment AG-DR-03-016.

WITNESS RESPONSIBLE: James A. Riddle

Exhibit JAR Rebuttal - 7 - WN

COMPARSION OF YEAR-TO-DATE ACTUAL VOLUMES TO FORECAST

Firm Gas Total Sales	Actual 2005 (Mcf)	Forecast 2005 (Mcf)	2004-2005 % Change
Residential	4,845,419	4,674,203	
Commercial	2,137,673	2,121,380	
Industrial	846,998	727,730	
Governmental/OPA	448,617	457,698	
Total	8,278,707	7,981,011	**-3.60%**

AG-DR-03-017

REQUEST:

17. With regard to page 2 of the rebuttal testimony of Mr. Torok, please provide the following information regarding the subject of property taxes:

    a. As stated in Mr. Torok's testimony, the Company's tentative valuation of its property in 2004 was $400,551,451 while the final assessed value was approximately $298,000,000. What were the corresponding tentative property valuations and final assessed values for the years 2003 and 2002?

    b. Provide the basis, calculations and calculation components in support of the statement of Mr. Torok on page 2, lines 15-16, that Mr. Henkes asserts that the Company should expect to achieve a reduction in the 2005 tentative assessment of approximately 57% [Note: a reduction of 57% of the 2005 tentative assessment of $543,548,261 would imply a final assessed value of $233,725,752. How is this number derived and where is it reflected on page 2 of Mr. Torok's testimony or anywhere in Mr. Henkes' testimony?]

RESPONSE:

a. See Attachment to KyPSC-DR-04-013.

b. The Company has calculated an estimated property tax of $6,516,356 on the tentative property valuation of $543,548,261, of which $3,156,395 relates to its gas operations. Mr. Henkes recommends a property tax expense amount of $2,014,755. Mr. Torok's testimony should have said Mr. Henkes asserts that the Company should expect to achieve a reduction of 36% of the 2005 tentative assessment.

WITNESS RESPONSIBLE: Alexander J. Torok

Attorney General First Set Data Requests
ULH&P Case No. 2005-00042
Date Received: July 29, 2005
Response Due Date: August 9, 2005

AG-DR-03-018

REQUEST:

18. With regard to Mr. Torok's testimony pages 3 and 4 (through line 2), is Mr. Torok agreeing with Mr. Henkes that the ADIT associated with unbilled revenue should be removed for ratemaking purposes in this case? Please provide a definitive answer.

RESPONSE:

Yes, the ADIT associated with Unbilled Revenue-Fuel should be removed for ratemaking purposes.

WITNESS RESPONSIBLE: Alexander J. Torok

REQUEST:

19. With regard to the excess deferred income taxes associated with the reduction in the Kentucky income tax rate to 7% discussed on page 4 of Mr. Torok's rebuttal testimony, please provide the following information:

a. The response to AG-2-32 indicates that the reduction in the KY income tax rate created "protected" excess deferred income taxes for the Company's gas operations of $1,451,437. Is this latter amount a deferred asset or a deferred liability? If a deferred asset, explain why this is a deferred asset rather than a deferred liability.

b. The response to AG-2-33 indicates that the reduction in the KY income tax rate from 8.25% to 7% has created "unprotected" excess deferred income taxes of $526,919. The Company now asserts that this "excess" deferred income tax amount of $526,919 represents a deferred asset, i.e., a prepaid ADIT balance. Please explain in detail why this is a deferred asset rather than a deferred liability given that we are dealing with an income tax reduction [i.e., the KY deferred taxes were previously accrued at a rate of 8.25% with the expectation that they would "reverse" at the same rate of 8.25%. However, these KY deferred taxes will now "reverse" at a rate of 7%. Why doesn't this create an excess deferred tax balance to be returned to the ratepayers rather than the Company's claim that this has created a deferred tax shortfall to be charged to the ratepayers?]

RESPONSE:

a. The "protected" excess deferred income taxes are a deferred liability.

b. Please refer to the Company's response to KyPSC-DR-04-014.

WITNESS RESPONSIBLE: Alexander J. Torok