THE CONSENSUS AND ACCURACY OF SOME PREDICTIONS OF THE GROWTH OF CORPORATE EARNINGS

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FOR YEARS ECONOMISTS HAVE EMPHASIZED the importance of expectations in a variety of problems.[1] The extent of agreement on the significance of expectations is almost matched, however, by the paucity of data that can be considered even reasonable proxies for these forecasts. One area in which expectations are highly important is the valuation of the common stock of a corporation. The price of a share is—or should be—determined primarily by investors' current expectations about the future values of variables that measure the relevant aspects of corporations' performance and profitability, particularly the anticipated growth rate of earnings per share.[2] This theoretical emphasis is matched by efforts in the financial community where security analysts spend considerable effort in forecasting the future earnings of companies they study. These forecasts are of particular interest because one can observe divergence of opinion among different individuals dealing with the same quantities. This paper is devoted to the analysis of a small sample of such predictions and certain related variables obtained from financial houses.[3]

I. NATURE AND SOURCES OF DATA

The principal data used in this study consisted of figures representing the expected growth of earnings per share for 185 corporations[4] as of the end of 1962 and 1963. These data were collected from five investment firms. The participants were recruited through requests to two organizations. One was a group of firms who used computers for financial analysis and who met periodically to discuss mutual problems, the other was the New York Society of

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1. A number of studies of anticipations data have been collected in two National Bureau Volumes [12] and [13]. Some more recent work on the assessment of expectations or forecasts has been done by Zarnowitz [16].

2. The classic theoretical statement of the anticipations view of the determination of share valuation may be found in J. B. Williams [15]. This position is also adopted in the standard textbook in the field [3]. The emphasis on the importance of earnings growth may also be found in [4], [5], and [19].

3. One of the few attempts to conduct a study of this type was made by the Continental Illinois Bank and Trust Company of Chicago [1] in 1963. The bank collected a sample of earnings estimates one year in advance from three investment firms. An analysis of these projections revealed that the financial firms tended to overestimate earnings and that over-all quality of the estimates tended to be poor.

4. The 185 companies for which the growth-rate estimates were made tended to be the large corporations in whose securities investment interest is centered. This selection was made on the basis of availability of data and was not chosen as a random sample.

Financial Analysts. As a result, eleven firms agreed to participate in the proposed study. From the original eleven, however, only five were able to supply comparable sets of long-term earnings forecasts for use in this study.[5] Even among these five there was not complete overlap in the corporations for which predictions were available. One of them had no data for 1962. For only two were data available for the full set of 185 companies.

Of the five participating firms, two are large New York City banks heavily involved in trust management, one is an investment banker and investment adviser doing mainly an institutional brokerage business, one is a mutual fund manager, and the remaining firm does a general brokerage and investment advisory business. We would not argue that these estimates give an accurate picture of general market expectations. It would, however, seem reasonable to suggest that they are representative of opinions of some of the largest professional investment institutions and that they may not be wholly unrepresentative of more general expectations. Since investors consult professional investment institutions in forming their own expectations, individuals' expectations may be strongly influenced—and so reflect—those of their advisers.[6] Also, insofar as investors follow the same sorts of procedures as those used by security analysts in forming expectations, the investors' expectations would resemble those of the analysts. It should be noted, however, that security analysts are not limited to published data in forming their expectations. They frequently visit the companies they study and discuss the corporations' prospects with their executives.

Each growth-rate figure was reported as an average annual rate of growth expected to occur in the next five years. At first thought, such a rate of growth depends on what earnings are expected to be in five years' time and on the base-year earnings figures. However, this dependence need not be very great if the growth rate is regarded more as a parameter of the process determining earnings than as an arithmetic quantity linking the current value to the expected future value. Discussion with the suppliers of the data indicated that all firms were attempting to predict the same future figure, the long-run average ("normalized") earnings level, abstracting from cyclical or special circumstances. The bases used were less clear. Some firms explicitly used their estimates of "normalized" earnings during the year in which the prediction was made. Others provided different figures as bases: in one case the firm estimated actual earnings, in another a prediction of earnings four years in the future was furnished. These differences did not seem to be reflected in the growth rates, however, since attempts to adjust the rates for differences in

5. We are deeply grateful to the participating firms, who wish to remain anonymous. Not all volunteers were able to supply data useful to this study, either because the actual supply of data would have been too burdensome (being kept for internal records in a form that made their extraction difficult) or because the data supplied were not comparable to data used here (either being of a short-term nature or being made at different dates). Because one of our main objectives is to examine differences and similarities in predictions of the same quantities, such data were not used in the present paper.

6. That several of our participating firms find it worthwhile to publish these projections and provide them to their customers provides *prima facie* evidence that a certain segment of the market places some reliance on such information in forming its own expectations.

base figures introduced rather than removed disparities among the predictions.

The growth rates were given as single numbers for each corporation. No indication was provided of the confidence with which these point estimates were held. One firm did provide an instability index of earnings which represented a measure of the past variability of earnings (around trend) adjusted by the security analyst to indicate potential future variability. Moreover, two firms provided quality ratings, which classified companies into three or four quality categories.

Two of the firms provided estimates of past growth rates as well as predictions. The figures represented perceived growth over the past 8-10 years, the past 4-5 years, the past 6 years, and the last year. It may seem unnecessary to rely on the participating firms for estimates of historic growth rates. However, the past growth of a company's earnings is not, in any meaningful sense, a well-defined concept. Earnings—being basically a small difference between two large quantities—can exhibit large year-to-year fluctuations. They also can be negative, which creates problems for most mechanical calculations. In addition, the accounting definition of earnings is not an exact conformity with the economically relevant concept of profits or return on investors' capital. For these reasons, calculated growth rates are sensitive to the particular method employed and the period chosen for the calculation. Consequently, such calculations may be a poor reflection of what growth is generally considered to have been, and may not be useful in assessing the past performance of corporations. Furthermore, it may be supposed that in assessing security analysts' predictions of growth their own estimates of past growth are more likely to be relevant than objectively calculated rates. The extent of agreement among the two types of measures is among the subjects considered in the next section.

Our participating firms also supplied an industrial classification. While other classifications are available, the concept of industry is not really precise enough to get a fixed, unquestionable assignment of corporations to industries. Particular problems are presented by conglomerate companies. Perceived industry may be more relevant than any other grouping when investigating anticipations. The classification we use represents a consensus about industry among our participants. Where disagreements occurred (as was often the case with conglomerates), the corporation was simply classified as "miscellaneous." The classification represented considerable aggregation over finer classifications and only eight industries were distinguished. These were:

1) Electricals and Electronics
2) Electric Utilities
3) Metals
4) Oils
5) Drugs and Specialty Chemicals
6) Foods and Stores
7) "Cyclical"—including companies such as automobile and aircraft manufacturers, and meat packers
8) "Miscellaneous"

II. Agreement among Predictors

The agreement among the growth-rate projections is described and summarized in this section. In the course of this description, the extent of agreement about base-earnings figures and the closeness of the projections to past, perceived, and calculated growth rates are also considered.

A. *Comparisons of Predictions of Future Growth Rates.*

The extent of agreement among the predictors about future growth rates is summarized in Table 1. Of the five predictors, the correlations among predictors A, B, C and E were all roughly of the same orders of magnitude.[7] Predictor D showed some tendency towards lower agreement. (Predictor D also had the highest average growth forecast and standard deviation for the companies for which it and others made forecasts.) Over-all agreement among

TABLE 1
Agreement Among Growth-Rate Predictions*

I. Correlation Coefficients

(Simple correlations in lower left portion, Spearman rank correlations in upper right portion)

	1962					1963				
	A	B	C	D		A	B	C	D	E
A	1.000	.768	.751	.388	A	1.000	.795	.717	.374	.709
B	.840	1.000	.728	.597	B	.832	1.000	.760	.518	.821
C	.889	.819	1.000	.690	C	.854	.764	1.000	.750	.746
D	.563	.621	.848	1.000	D	.537	.567	.898	1.000	.450
					E	.827	.835	.889	.704	1.000

II. Kendall's Coefficient of Concordance for Ranks of Companies by Different Predictors

	Predictors	(A,B,C)	(A,B,D)	(A,B,C,D)	(A,B,C,D,E)
1962		.82	.73	.78	
1963		.83	.71	.81	.79

III. Proportions of Total Variance Due to Variance in Average Predictions

	Predictors	(A,B,C)	(A,B,D)	(A,B,C,D)	(A,B,C,D,E)
1962		.87	.70	.79	
1963		.85	.68	.83	.87

* The numbers of observations on which this table and other tables are based varies between cells. For the correlations, the numbers of observations are reported below:

	1962				1963				
	A	B	C		A	B	C	D	
B	185			B	185				
C	60	60		C	62	62			
D	178	178	58	D	182	182	61		
				E	125	125	39	124	

For other comparisons, the number of observations is the minimum of the numbers of observations used to compute the correlations.

7. The analysis is presented mainly for the raw growth figures, but very similar impressions would be obtained from examining their logarithms.

the predictors is further summarized in the second and third parts of Table 1, which show the values of Kendall's coefficient of concordance and the proportion of total variance of the predictions that can be accounted for by differences in the mean prediction among companies.[8] It may be remarked that the entries in Table 1 are based on different numbers of observations. In each case, we used the maximum number of observations (companies) for which a comparison could be made. The impressions to be gained from Table 1 would be little changed, however, by basing all calculations only on the set for which all predictors provided data.

Though Table 1 suggests considerable agreement, the lack of agreement it also reveals can hardly be considered negligible. In addition to the lack of correlation, there were also some systematic differences among the predictors. For the matched set of observations the means and the standard deviations were of roughly the same sizes. However, the differences among the central tendencies were significant according to both parametric and nonparametric tests.

B. *Analysis of Predictions Within Industrial Classifications.*

One might suspect that the correlations among the predictors reflect little more than consensus about the industries that are expected to grow most rapidly rather than agreement about the relative rates of growth of firms within industries. This possibility was investigated by decomposing the correlation coefficients into two parts, one due to correlation within industries (r_w) and one due to correlation among the industry means (r_a).

$$r = r_w + r_a$$

where

$$r_w = \frac{\sum_{j=1}^{J}\sum_{i=1}^{N_j}(x_{ij} - \bar{x}_j)(y_{ij} - \bar{y}_j)}{\sqrt{\sum_{j=1}^{J}\sum_{i=1}^{N_j}(x_{ij} - \bar{x})^2 \sum_{j=1}^{J}\sum_{i=1}^{N_j}(y_{ij} - \bar{y})^2}},$$

and

$$r_a = \frac{\sum_{j=1}^{J} N_j(\bar{x}_j - \bar{x})(\bar{y}_j - \bar{y})}{\sqrt{\sum_{j=1}^{J}\sum_{i=1}^{N_j}(x_{ij} - \bar{x})^2 \sum_{j=1}^{J}\sum_{i=1}^{N_j}(y_{ij} - \bar{y})^2}}$$

with

8. The values shown in all parts of Table 1 are significant well beyond the conventionally used levels of significance. We may note that Tukey's test for interaction in a two-way analysis of variance [11, pp. 129-37]—the typical model in which the breakdown of variance used in Part 3 of Table 1 is employed—indicated a small but highly "significant" proportion of variance attributable to interaction. However, the usual analysis-of-variance model does not seem appropriate for this data, not only because of interactions, but also because of possible lack of homogeneity of variance.

x_{ij}, y_{ij} being the i^{th} observations in the j^{th} class (industry),
N_j being the number of observations in the j^{th} class,
J being the number of classes,
$\bar{x}_j$, $\bar{y}_j$ being the averages within the classes, and
$\bar{x}$, $\bar{y}$ being the over-all averages.

This decomposition indicated that agreement concerning industry growth rates is not the major factor accounting for the correlations among the forecasts. The first part of Table 2 shows the values of r_a using the industrial classification obtained from the participating firms. As comparison with Table 1 shows, only a small part of the correlations among the predictions are due to correlations among the industry means. Further light can be shed on this question by calculating the partial correlations between the predictions, holding industry classification constant. The second panel of Table 2 reveals

TABLE 2
INDUSTRIAL CLASSIFICATION AND AGREEMENT AMONG PREDICTORS

I. Values of r_a

	1962				1963			
	A	B	C		A	B	C	D
B	.299			B	.305			
C	.285	.323		C	.230	.315		
D	.090	.184	.300	D	.057	.137	.317	
				E	.266	.348	.366	.194

II. Partial Correlations Holding Industrial Classification Constant

	1962				1963			
	A	B	C		A	B	C	D
B	.799			B	.786			
C	.861	.760		C	.838	.690		
D	.656	.665	.887	D	.657	.650	.861	
				E	.828	.790	.897	.777

that these partial correlations tended to be only slightly less than the simple correlations and, in the case of Predictor D, the partial correlations were actually higher.

It is also interesting to examine the extent to which the correlations among predictors' forecasts varied over the different industry groups. This should indicate whether certain industry groups are more difficult to forecast in an *ex ante* sense. The correlations among forecasters tended to be lowest in the oil and cyclical industry groups, and highest for electric utility companies. These differences were significant for all pairs of predictions considered. Ranking the correlations over industries, and then comparing these ranks among pairs of predictors, showed substantial concordance over the ordering of the correlations.[9]

9. The test for individual pairs of predictions was the likelihood-ratio test. Note that the ranking comparison is not based on independent observations so a statistical test of the concordance is not appropriate. This suggests that the "significance" of the over-all correlations mentioned earlier should really be treated only as descriptive indications of their sizes. The hypothesis that

C. *Comparisons of Predictions and Past Growth Rates.*

The extent of agreement among the predictors can usefully be evaluated by comparisons of the predicted growth rates with earlier predictions and with the past growth rates of earnings. The correlations of the 1963 predictions with the 1962 ones were: .94, .95, .96, and .88 for predictors A through D respectively. All of these are considerably higher than the correlations of the predictions with each other. On the other hand, changes in expected growth rates were not highly correlated among predictors.[10]

TABLE 3
PREDICTIONS AND PAST GROWTH RATES*
(CORRELATIONS OF PREDICTED WITH PAST GROWTH RATES)

	1962				1963				
	A	B	C	D	A	B	C	D	E
g_{p1}	.78	.68	.75	.41	.85	.73	.84	.56	.67
g_{p2}	.75	.67	.72	.51	.79	.69	.80	.58	.76
g_{p3}	.77	.71	.82	.61	.75	.72	.79	.70	.74
g_{p4}	.34	.37	.59	.44	.33	.45	.70	.75	.58
g_{c1}	.55	.46	.65	.32	.63	.52	.61	.30	.58
g_{c2}	.67	.60	.68	.18	.72	.58	.73	.20	.56
g_{c3}	.75	.63	.73	.17	.79	.66	.76	.17	.57
g_{c4}	.82	.68	.79	.24	.83	.69	.79	.29	.60

* g_{p1} is 8-10 year historic growth rate supplied by A
g_{p2} is 4-5 year historic growth rate supplied by A
g_{p3} is 6 year historic growth rate supplied by D
g_{p4} is preceding 1 year growth rate supplied by D
g_{c1} is log-regression trend fitted to last 4 years
g_{c2} is log-regression trend fitted to last 6 years
g_{c3} is log-regression trend fitted to last 8 years
g_{c4} is log-regression trend fitted to last 10 years.

Correlations of the predictions with eight past growth figures are shown in Table 3. Four of these past growth rates were supplied by the participating firms and represent the firms' perceptions of the growth of earnings per share that had occurred in different preceding periods. The others were calculated as the coefficient in the regression of the logarithms of earnings per share on time over the past 4, 6, 8, and 10 years. These correlations generally are not much lower than those found in comparing the predictions with each other. Among the perceived past growth rates, the correlations are apt to be lowest with the growth rates over the most recent year. With the calculated growth rates, there

the correlations are all zero within industries could, however, be rejected well beyond conventional significance levels. Predictor C was dropped from these tests due to paucity of data in many industries.

10. These correlations, for the participants supplying data in both years were:

	A	B	C
B	.19		
C	.04	.04	
D	.07	.11	.29

Only the two largest of these correlations would be significant at the .05 level.

was a tendency for the correlations to increase with the length of period over which the calculations were made.[11]

These comparisons of past with predicted growth rates suggest that the apparent agreement among the predictors may reflect little more than use by all of them of the historic figures. In investigating this possibility, the partial correlations among the predictions, holding constant past perceived growth rates, holding constant past calculated growth rates, and holding both sets constant were calculated. The first two sets of partial correlations were not much smaller than the simple correlations. Holding both sets constant produced the partial correlations shown in Table 4. These are considerably

TABLE 4
PARTIAL CORRELATIONS OF PREDICTIONS
HOLDING PAST GROWTH RATES CONSTANT

	1962				1963			
	A	B	C		A	B	C	D
B	.49			B	.49			
C	.49	.18		C	.25	.03		
D	.35	.39	.22	D	.56	.46	.40	
				E	.56	.62	−.11	.51

NUMBERS OF OBSERVATIONS

	1962				1963			
	A	B	C		A	B	C	D
B	111			B	112			
C	49	49		C	50	50		
D	111	111	49	D	112	112	50	
				E	78	78	36	78

smaller than the simple correlations, though all but the four smallest entries would be significant beyond the .05 level. Thus, while a substantial part of the agreement among predictors appears to result from their use of historic growth figures, there is also evidence that security analysts tend to make similar adjustments to the past growth rates.[12]

Examination of the correlations among past growth rates help both to evaluate the correlations among the predictions and to indicate the sensitivity of measurements of growth rates to the methods by which they were calculated. Table 5 presents correlations between 13 such past growth rates for our 1962 data. The correlations between the different measures of past growth are fairly low. When exactly the same data are used in the calculations, however, the

11. This effect was also found when the calculated growth rates were based on either 1) the regression of earnings per share on time; or, 2) the appropriate root of the ratio of earnings per share at the end of the period to earnings at the beginning.

12. The numbers of observations on which Table 4 is based are considerably smaller than those for which predictions were available. Only a small part of this loss was due to inability to calculate past growth rates due to negative earnings figures. Much more important was the fact that the predictors did not give numerical figures for past growth rates when these would be negative. One might think that the companies for which past growth rates were easily calculated would be ones with highest simple correlations among the predictors. However, the only cases for which this appeared to be true were the correlations of predictor D with A, B, and E.

correlations among the growth rates calculated by different methods are relatively high, though probably not so high that the choice of method of calculation would be a matter of no importance. Finally, the perceived growth rates furnished by the security firms tend to be more highly correlated with the growth rates calculated over longer periods. The increase in correlation coefficients did not continue, however, when calculations over more than ten years were made and, as shown in Table 5, it stopped before ten years in some cases. Correlations for other periods and for the 1963 data were of about the same magnitude as those in Table 5.

TABLE 5
PAST GROWTH CORRELATIONS, 1962*

	g_{p1}	g_{p2}	g_{p3}	g_{p4}	g_{c1}	g_{c2}	g_{c3}	g_{c4}	g_{c5}	g_{c6}	g_{c7}	g_{c8}
g_{p2}	.70											
g_{p3}	.82	.87										
g_{p4}	.49	.39	.37									
g_{c1}	.34	.47	.48	.15								
g_{c2}	.68	.74	.76	.05	.62							
g_{c3}	.81	.89	.97	.15	.49	.90						
g_{c4}	.93	.80	.87	.27	.41	.75	.93					
g_{c5}	.14	.19	.25	.39	.38	.24	.16	.15				
g_{c6}	.34	.46	.47	.14	.96	.59	.45	.37	.53			
g_{c7}	.92	.67	.78	.32	.48	.67	.83	.95	.33	.46		
g_{c8}	.36	.56	.49	.23	.99	.63	.50	.43	.40	.90	.51	
g_{c9}	.87	.75	.88	.18	.46	.77	.93	.99	.17	.40	.91	.43

* $g_{p1} - g_{p4}$, $g_{c1} - g_{c4}$ as defined in footnote to Table 3
g_{c5} is 1 year growth rate calculated from first differences of logarithm
g_{c6} is 4 year growth rate calculated from average of first differences of logs
g_{c7} is 10 year growth rate calculated from average of first differences of logs
g_{c8} is 4 year growth rate calculated from regression of earnings on time
g_{c9} is 10 year growth rate calculated from regression of earnings on time

D. *Comparisons of Predictions with Price-Earnings Ratios.*

Finally, we may examine the extent of agreement among predictors by comparing their forecasts with the price-earnings ratios of the corresponding securities. By utilizing a normative valuation model (see e.g., [4] or [8]) it is possible to calculate an implicit growth rate from the market-determined earnings multiple of a security. Thus, comparisons of the predictions with price-earnings ratios may be interpreted as examinations of the relationship between the forecasts and market-expected growth rates. Correlations with two versions of the price-earnings ratio are shown in Table 6. The prices used were the closing prices for the last day of the year. The earnings were either the actual earnings or the average of the base-earnings figures supplied by A and B for their growth rates. These latter figures represent "normalized" or trend-earnings figures. Specifically, they represent an attempt to estimate what earnings would be in the absence of cyclical or special factors. The correlation coefficients in the table are about the same as those obtained when the forecasts were compared with each other. Since price-earnings ratios are

TABLE 6
CORRELATIONS OF PREDICTIONS WITH PRICE-EARNINGS RATIOS*

	1962				
	A	B	C	D	
P/E	.76	.80	.86	.56	
P/NE	.82	.83	.83	.55	
	1963				
	A	B	C	D	E
P/E	.77	.74	.86	.67	.85
P/NE	.81	.76	.80	.60	.85

* P/E is the price/earnings ratio. P/NE is price/average of base (normalized) earnings of A and B.

affected by several variables other than expected growth rates, this exercise underscores the extent of disagreement among the forecasters.

III. ACCURACY OF PREDICTIONS

In assessing the forecasting abilities of the predictors, we encountered one major difficulty. The five years in the future for which the forecasts were made have not yet elapsed. As a result, we were forced to compare the forecasts with the realized growth of actual and normalized earnings (as estimated by Predictors A and B) through 1965. Since the latter figures represent what earnings are thought to be on their long-run growth path, perhaps not too much violence is done to the intentions of the forecasters by making these a standard of comparison.

A. *Method of Evaluation.*

The forecasts were evaluated by the use of simple correlations and by the inequality coefficient,[13]

$$U^2 = \frac{\Sigma(P_i - R_i)^2}{\Sigma R_i^2}, \tag{1}$$

where P_i is the predicted and R_i the realized growth rates for the i^{th} company. It will be noticed that the inequality coefficient, in effect, gives a comparison between perfect prediction ($U^2 = 0$) and a naive prediction of zero growth for all corporations ($U^2 = 1$).

We also investigated the extent to which errors in predictions were related to 1) errors in predicting the average over-all earnings growth of the sample firms; 2) errors in predicting the average growth rate of particular industries; and 3) errors in predicting the growth rates of firms within industries. To accomplish this, we decomposed the numerator of (1) into three parts. The first comes from the average prediction for all companies not being equal to the average realization. The second part arises from differences among the

13. Note that this is similar to the inequality coefficient introduced by Theil [14].

average industry predictions not being equal to the corresponding differences in industry realizations. The third arises from the differences in predictions for the corporations within an industry not being the same as the differences in realization.[14] The proportions of U^2 arising from these three sources will be called U^M, U^{BI}, and U^{WI} respectively for mean errors, between-industry errors, and within-industry errors.

B. *Over-all Accuracy of the Forecasts.*

Statistics summarizing the forecasting abilities of the predictors and the success of using perceived past growth rates to predict the future are presented in Table 7. By and large, the correlations of predicted and realized growth rates are low, though most of them are significantly greater than zero, and the inequality coefficients are large. The major exception to this is Predictor C's forecasts. However, this apparent superiority is largely illusory since C tended to concentrate on large, relatively stable companies and, we suspect, predictions were made only when there was *a priori* reason to believe that the forecasts would be reliable. That this conjecture has some validity is borne out by the fact that the set of companies for which C made forecasts had a lower average instability index than did our whole sample. Moreover, all the other forecasts, including the perceived past growth rates, did better for this set of companies than for the larger set.[15]

Several additional points about the over-all accuracy of the forecasts are worth mentioning. First, the forecasts based on perceived past growth rates, including even growth over the most recent year, do not perform much differently from the predictions. There seems to be no clear-cut forecasting advantage to the careful and involved procedures our predictors employed over their perceptions of past growth rates either in terms of correlation or of the inequality coefficient.

Second, all predictors had a better record than the no-growth forecast for each company. However, it is possible to find a single growth rate that would yield lower mean square errors than any of the predictions. This is a result of the average realized growth rates being considerably higher than the average

14. Letting P_{kj} and R_{kj} be the predicted and realized growth rates for the k^{th} company ($k = 1, \ldots, N_j$) in the j^{th} industry ($j = 1, \ldots, J$), we can write the numerator of (1) as:

$$\sum_{j=1}^{J}\sum_{k=1}^{N_j}(P_{kj}-R_{kj})^2=\left[\sum_{j=1}^{J}N_j(\bar{P}-\bar{R})^2\right]+\left[\sum_{j=1}^{J}N_j\{(\bar{P}_j-\bar{P})-(\bar{R}_j-\bar{R})\}^2\right]$$
$$+\left[\sum_{j=1}^{J}\sum_{i=1}^{N_j}\{(P_{kj}-\bar{P}_j)-(R_{kj}-\bar{R}_j)\}^2\right],$$

when $\bar{P}_j$, $\bar{R}_j$ are the averages for the j^{th} industry and $\bar{P}$ and $\bar{R}$ are the overall means. The three terms in square brackets are the ones referred to in the text.

15. For this smaller group of companies, the differences among predictors was far less than is suggested by Table 7. It is worth noting that C had a higher correlation and lower inequality index than the others in 1962 (with D a very close second), but both D and E were slightly better on the matched set in 1963.

TABLE 7
ACCURACY OF PREDICTIONS

Predictor	A	B	C	D	g_{p1}	g_{p2}	g_{p3}	g_{p4}
I. 1962 Predictions Compared with Growth of Actual Earnings 1962-1965								
Correlation	.07	.16	.66	.45	.22	−.01	.23	.16
U	.80	.78	.57	.67	.74	.88	.74	.78
U^M	.31	.32	.20	.24	.17	.12	.10	.20
U^{BI}	.11	.10	.08	.06	.11	.04	.04	.12
U^{WI}	.58	.58	.71	.70	.73	.84	.75	.68
Number of Observations	185	185	60	178	168	140	140	145
II. 1962 Predictions Compared with Growth of Normalized Earnings 1962-1965								
Correlation	.26	.32	.68	.45	.23	.16	.38	.09
U	.74	.72	.57	.62	.72	.80	.67	.76
U^M	.25	.25	.08	.13	.09	.12	.09	.19
U^{BI}	.07	.06	.06	.08	.08	.07	.05	.08
U^{WI}	.68	.69	.86	.79	.83	.80	.86	.73
Number of Observations	180	180	59	175	164	136	138	142

Predictor	A	B	C	D	E	g_{p1}	g_{p2}	g_{p3}	g_{p4}
III. 1963 Predictions Compared with Growth of Actual Earnings 1963-1965									
Correlation	.05	.16	.78	.47	.29	.20	.31	.22	.55
U	.85	.84	.59	.73	.81	.78	.75	.77	.62
U^M	.33	.34	.27	.28	.40	.20	.19	.16	.27
U^{BI}	.12	.11	.11	.07	.11	.09	.06	.06	.05
U^{WI}	.54	.55	.62	.66	.49	.70	.74	.79	.69
Number of Observations	185	185	62	182	125	167	143	138	169
IV. 1963 Predictions Compared with Growth of Normalized Earnings 1963-1965									
Correlation	.27	.29	.70	.34	.49	.36	.52	.41	.32
U	.78	.78	.61	.70	.74	.69	.64	.67	.69
U^M	.35	.35	.22	.23	.40	.22	.33	.23	.12
U^{BI}	.07	.06	.08	.09	.09	.08	.09	.05	.06
U^{WI}	.58	.59	.70	.68	.50	.70	.57	.72	.82
Number of Observations	180	180	61	177	123	163	139	136	165

expectation of each predictor. This may simply indicate a failure to anticipate the continuation of the expansion through the period considered, but it may also reflect the underestimation of change frequently found in investigating forecasts.[16]

Third, with the exception of the past growth rate in the year immediately preceding the forecast date, all predicted and perceived past growth rates were better at predicting the average normalized growth rates than the actual ones. However, whether this is because normalized earnings gave a better picture

16. See, for example, Zarnowitz [16]. Since almost all the actual growth rates were positive, we do not know whether underestimation of change would also characterize predictions when earnings were generally declining. No forecasters predicted a negative rate of growth.

of the true growth of corporations or because normalized earnings calculations are influenced by past growth-rate forecasts is open to question.

C. *Analysis of the Forecasts by Industrial Categories.*

Turning to the industry breakdown of the forecasts, we find that failure to forecast industry means (U^{BI}) accounted for only a very small proportion of the inequality coefficient. The main sources of inequality were the within-industry errors.

Looking at the correlations of predictions with future growth rates within industries permits us to assess which industries were most difficult to forecast in an *ex post* sense. The extent to which forecasters found the various indus-

TABLE 8
RANK SCORES OF CORRELATIONS OF PREDICTIONS AND REALIZATIONS SUMMED OVER PREDICTORS*

	1962-65 Growth of Actual Earnings	1962-65 Growth of Normalized Earnings	1963-65 Growth of Actual Earnings	1963-65 Growth of Normalized Earnings	Total
Industry					
1)	20	23	20	28	91
2)	18	22	14	25	79
3)	9	11	24	14	58
4)	10	10	8	7	35
5)	5	7	24	26	62
6)	8	5	5	10	28
7)	14	15	20	20	69
8)	24	15	29	14	82
Kendall's W	.76	.74	.72	.65	.32

* Entries are sums of ranks over predictors for correlations of predictions with growth rates indicated in column headings.

tries difficult to predict is indicated in Table 8. To calculate the table, we first ranked each predictor's correlation coefficients between his forecasts and realizations over the eight industry groups. The industry for which the predictor had the most difficulty (worst correlation) was given a rank of one. In Table 8, we present the sums of the ranks for each industry over the four predictors.[17] If the difficulty ranking for all predictors was identical, the rank totals would be 4 for the most difficult industry (in 1963 when there are four predictors compared), 8 for the next most difficult, etc., and the coefficient of concordance (Kendall's W) would be unity. For each of the sets presented, the values of Kendall's W are significant (beyond the .05 level) as were the differences between industries for the correlation coefficients for each predictor.[18] Correlation coefficients between forecasts and realizations tended to

17. Predictor C could not be included in this calculation because of a lack of observations in some industries.

18. The latter, however, was tested only on the basis of the asymptotic distribution of the correlation coefficient and the assumption that the data were distributed normally.

be highest in industries (1) electricals and electronics, (8) "miscellaneous," and (2) electric utilities; they were lowest in (6) foods and stores and (4) oils. Industry (5) drugs, showed very low correlations for the 1962 predictions and high ones for the 1963 predictions. Similar patterns emerged, though more weakly, when perceptions of past growth rates over more than one year were used as forecasts. It is interesting to note that certain industries which were "difficult to forecast" in an *ex ante* sense (see Section II. B) actually turned out to be difficult to predict, *ex post*. For example, there was high (low) agreement among predictors concerning the growth rates for the electric utilities (oils) and also high (low) correlation between predictions and realizations.

In general, we had little success in associating forecasting success with any industry or company characteristics. The differences between industries in forecasting success were only moderately related either to the average growth rates to be realized or to the variances of the realized growth rates. Two of the industries where the highest correlations were found, industries (1) and (2), had respectively the highest and the lowest average growth rates and variances. The third industry where success occurred, (8), fell in the middle range for both quantities. The rank-totals of the last column of Table 8 had a rank correlation with the rank-totals for average growth rates of .14 and of .37 with the rank-totals for the variances.

To further investigate how forecasting ability was related to company characteristics, the corporations were classified according to the quality ratings supplied by two of the predicting firms. There was a tendency for the correlations to be lowest (and negative) in the poorest-quality grouping, but they did not get systematically higher with quality, the highest correlations tending to occur in the middle classes. Similarly, classifying by high, low, or medium values of the instability index showed no pronounced differences in performance. The forecasting performances were again worst for the lowest-quality corporations and best in the middle category. When the corporations were classified by high, medium, or low price-earnings multiple, or past growth rate of earnings, or future growth rates of earnings, sales or assets, no pronounced or significant patterns emerged.

IV. An Appraisal of the Forecasts

The rather poor over-all forecasting performances of the predictors and the fact that their past perceptions of growth rates were about as reliable forecasts as their explicit predictions raises two questions: 1) Does any naive forecasting device based on historic data yield as good forecasts as the painstaking efforts of security analysts? 2) Is it the basically volatile nature of earnings that explains our results and would the predictions appear more accurate if they were taken to be forecasts of more stable measures of the growth of corporations?

To investigate the first of these questions, past growth rates calculated on the basis of arithmetic and logarithmic regressions and on the geometric means of first ratios, calculated over periods up to 14 years, were compared with

TABLE 9
CORRELATIONS OF CALCULATED PAST GROWTH RATES ON REALIZATIONS*

	Growth of Actual Earnings 1962-65	Growth of Normalized Earnings 1962-65	Growth of Actual Earnings 1963-65	Growth of Normalized Earnings 1963-65
	I. Correlations			
g_{c1}	.03	.42	.01	.26
g_{c2}	−.15	.19	−.15	.06
g_{c3}	−.13	.15	−.16	.02
g_{c4}	−.10	.09	−.11	−.02
g_{c5}	.22	.62	.18	.46
g_{c6}	.12	.51	.06	.34
g_{c7}	.01	.24	−.01	.12
g_{c8}	−.02	.37	−.03	.23
g_{c9}	−.12	.09	−.14	−.01
	II. Inequality Coefficients			
g_{1c}	.93	.79	.93	.85
g_{c2}	1.03	.95	1.01	.96
g_{c3}	.95	.88	.96	.91
g_{c4}	.88	.82	.90	.86
g_{c5}	1.27	1.22	1.11	1.08
g_{c6}	.89	.73	.90	.80
g_{c7}	.83	.75	.86	.80
g_{c8}	.98	.85	.96	.87
g_{c9}	.89	.83	.91	.86

* For definition of g's see footnote to Table 5.

the realized growth rates through 1965. A selection of these comparisons based on data ending in 1962 is found in Table 9.[19]

It is interesting to note first that the calculated growth rates tend to be more closely correlated with the growth rates of normalized earnings than with the growth rates of actual earnings. This is an even more pronounced feature of the calculated growth rates than of the data considered earlier. Second, while the correlations of the calculated growth rates with the realized growth rates tended to be lower than those found for the predictions and perceptions, and fewer of them differed significantly from zero, these differences are not pronounced. However, unlike the earlier data, the calculations seem to have almost no forecasting ability, a finding similar to that of I. M. D. Little [7] for British corporations. Among the calculated rates, those for shorter periods of time tend to be somewhat better in terms of correlation than those for longer ones, a feature highlighted by the strong showing of the growth rates calculated over only one year (g_{c5}). Third, while one would have expected that extrapolations using as the last year for the calculation the same year that is used for the first year in calculation of the realization would have a lower correlation than extrapolations where the data ended a year earlier, in

19. The figures there are typical both of what was found when other periods were used and of the comparisons of calculations ending in 1961 and 1963 with the perceived growth after 1962 and 1963 respectively.

fact the reverse tendency manifested itself. Finally, among the possible ways of calculating growth rates, those based on the geometric means of the first ratios surpassed those based on regressions.

The superiority of the past perceived growth rates over the calculated ones should not be taken too seriously, however, for it was largely due to the fact that negative perceived growth rates were not reported by our participants. The survey respondents only indicated that the rates were negative. As a result, companies for which this was true had to be dropped from the sample when correlations of realized with perceived past growth rates were made. When we dropped the companies whose past calculated growth rates were negative (in order to put the calculated and perceived growth rates on a similar basis), the correlation coefficients of the calculated with the realized growth rates were raised. For example, with this change the first row of Table 9 would read

.30 .53 .17 .42

which compares favorably with the data in Table 7. Similar improvements occurred using the other types of calculated growth rates.

The possibilities of obtaining useful forecasts from simple extrapolation were also examined by calculating growth rates over the four preceding years[20] for (1) earnings plus depreciation, (2) earnings before taxes, (3) sales, (4) assets, and (5) share prices. The correlations of these growth rates calculated to the end of 1962, both with 1962-1965 and 1963-1965 earnings growth and the growth rates of the same variables, are shown in the first five rows of Table 10. It will be noticed that both the levels and the variation of these correlation coefficients are quite similar to those found for the predictions and perceptions of past growth and the equivalently calculated past growth rates of earnings. There was also no marked tendency for the extrapolations to do better at predicting their own growth rates than the growth rates of normalized earnings, but they tended to be better at predicting their own rates than the growth of actual earnings.

The last two rows of Table 10 show the correlations of the price-earnings ratio and the price-to-normalized-earnings ratio with the actual future growth of earnings. As mentioned earlier, these ratios have implicit in them a forecast of the rate of growth anticipated by the market. We find that, in terms of correlation, the market-determined earnings multiples perform no differently from the other predictors we have considered.

A similar picture emerged when the predictions and perceptions of growth rates of earnings were used to predict the growth that would occur in these same variables through the end of 1965. With the exception of the growth of price, the performance of the predictions and perceptions were about the same in terms of correlation as those shown when they were used to forecast the growth of normalized earnings. The inequality coefficients were, if anything, slightly lower. For price growth, however, these forecasts had virtually

20. Other periods and methods of calculating growth rates were also used. The ones presented tended to be very slightly better than the others and are comparable to the most successful of the longer-term earnings extrapolations.

TABLE 10
EXTRAPOLATIONS FROM OTHER SERIES AS PREDICTORS OF EARNINGS AND OWN GROWTH RATES*
(CORRELATION COEFFICIENTS)

	Growth of Actual Earnings 1962-65	Growth of Normalized Earnings 1962-65	Growth of Actual Earnings 1963-65	Growth of Normalized Earnings 1963-65	Growth Rate of Corresponding Variable 1962-65	Growth Rate of Corresponding Variable 1963-65
g_{e1}	.11	.39	.05	.27	.28	.20
g_{e2}	.29	.21	.42	.30	.24	.38
g_{e3}	.23	.37	.15	.29	.39	.31
g_{e4}	.29	.46	.47	.60	.63	.27
g_{e5}	.04	.34	—.03	.20	—.06	.05
P/E	.21	.25	.13	.18	—	—
P/NE	.14	.35	.08	.21	—	—

* g_{e1} is growth of earnings plus depreciation
g_{e2} is growth of earnings plus taxes
g_{e3} is growth of sales
g_{e4} is growth of assets
g_{e5} is growth of price of stock
P/E is price-earnings ratio at end of 1962
P/NE is price-normalized earnings ratio at end of 1962
The period used for the calculations of the growth rates was 1958-62 and the rates were calculated as

$$g = \sqrt[4]{V_{62} / V_{58}}$$ where V_{62} and V_{58} are the values of the variables.

no merit, with even poorer performance than they had for the growth of actual earnings.

V. CONCLUSION

In this paper, we have examined the characteristics of a small sample of security analysts' predictions of the long-run earnings growth of corporations. The extent of agreement among the different predictors was considered and their forecasting abilities assessed. Evidence has recently accumulated [7] that earnings growth in past periods is not a useful predictor of future earnings growth. The remarkable conclusion of the present study is that the careful estimates of the security analysts participating in our survey, the bases of which are not limited to public information, perform little better than these past growth rates. Moreover, the market price-earnings ratios themselves were not better than either the analysts' forecasts or the past growth rates in forecasting future earnings growth.

We must be cautious, however, in overgeneralizing these results. We did not have data to investigate directly whether the performance of the predictions of growth in the period considered were atypical of the usual forecasting abilities of such forecasts. The question is important, however, since it can be argued that the peculiarities of the expansion that occurred after the date of the forecasts made the period especially difficult to forecast. Moreover, our work is hampered by the fact that only a few firms were able to participate in our survey. It may also be that shorter-term earnings predictions are con-

siderably more successful relative to naive forecasting methods. Fortunately, we are presently collecting additional data that will help shed light on these conjectures and permit a study of the generation of earnings forecasts and their usefulness in security evaluation.

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