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

M. S. ROZEFF
University of Iowa, Iowa City, Iowa, U.S.A.

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

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[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.

[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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Author's biography:
Michael S. Rozeff is Professor of Finance at the University of Iowa. He received his MBA from University of Illinois and PhD from the University of Rochester. His papers have appeared in *Journal of Accounting and Economics*, *Journal of Finance*, *Journal of Financial Economics*, *Journal of Financial and Quantitative Analysis*, and other journals. His principal current research interest is in how stock markets price such firm-specific factors as size, systematic risk, and dividend yield.

Author's address:
Michael S. Rozeff, College of Business Administration, The University of Iowa, Iowa City, Iowa 52242, U.S.A.