

Analyst Forecasts and Price/ Earnings Ratios

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Introduction

Security valuation techniques have become increasingly sophisticated, as evidenced by advances in option pricing theory and Arbitrage Pricing Theory (APT). Despite the availability of these paradigms, the price/earnings (P/E) approach to security valuation has maintained its popularity among practicing security analysts. Much of this lasting popularity can be attributed to the apparent simplicity of the P/E approach and the difficulties inherent in implementing complex valuation models.

To implement the P/E approach, analysts must estimate the appropriate P/E multiple, which typically requires the development of a model. Unfortunately, most of the P/E models that have been developed use ad hoc empirical tests and historical data¹. One notable exception is a study by Cragg and Malkiel, which tested a theoretical P/E model using analysts' forecasts for a nonrandom sample of 175 large firms.²

This note extends the work of Cragg and Malkiel in two ways. First, it is not restricted to large firms; all firms with complete data are included in the empirical tests. Second, the model includes some factors not considered by other researchers.

Growth and Share Price

A theoretical framework for the empirical analysis requires a model of share prices based on market expectations. The availability of both expected short and long-term growth rates on the IBES (Institutional Brokers Estimate System) files suggests using the two-stage dividend/earnings growth model.³ This model assumes that dividends/earnings grow at some rate, g_s , for an initial subnormal or supernormal period, then grow at a long-term, or normal, rate of g_L . If the duration of this first period is T years, and the normal growth period lasts indefinitely, the model may be expressed as follows:

$$(1) \quad P = D \sum_{t=1}^T \frac{(1+g_s)^t}{(1+k)^t} + \frac{D_T (1+g_L)(1+k)^{-T}}{k-g_L}$$

where D represents the firm's most recent cash dividend per share (annualized), k equals the required rate of return and P the current market price per share. Dividing both sides of Equation (1) by earnings per share (EPS) gives an equation for price/earnings ratio:

$$(2) \quad P/E = \sum_{t=1}^T \frac{(D/EPS)(1+g_s)^t}{(1+k)^t} + \frac{(D_{T+1}/EPS)(1+g_L)(1+k)^{-T}}{k-g_L}$$

The model specified by Equation (2) suggests that a firm's P/E ratio is positively related to short and long term growth and the dividend payout ratio and negatively related to the required rate of return, which is a function of risk. We first tested whether these key variables are related linearly to P/E ratios. Any errors introduced by adopting a linear model when a nonlinear model may be needed will be revealed through residual analysis.

Data and Method

Our primary data source was the 1987 IBES historical monthly data file, generously provided by Lynch, Jones and Ryan, a New York brokerage firm. IBES gathers one and two-year earnings forecasts for over 3000 firms from more than 1200 security analysts. It reports the dispersion in these forecasts, as well as current equity prices and reported earnings.

All return data were obtained from the CRSP (Center for Research in Security Prices) daily returns file. Financial leverage and dividend payout information were obtained from the 1986 Compustat annual industrial file. Data from all three sources are required to estimate P/E ratios, so the analysis was limited to firms listed on all three databases (i.e., NYSE and AMEX firms). This limitation implies that the sample suffers a "survivorship bias"; that is, firms that were delisted for any reason during the 1982-86 time period are not included in the sample.

P/E multiples and expectations data were based on the April IBES figures for each year

Table I Regression Results (t-statistics in parentheses)

Year	Intercept	g_s	g_L	D/A	Beta	CVAR	R ² (%)	SE*
1982	8.43	0.139 (21.21)	0.156 (5.67)	-0.066 (-8.72)	-0.670 (-1.92)	—	63.5	2.63
	8.36	0.139 (20.65)	0.125 (5.62)	-0.068 (-8.87)	—	0.200 (0.47)	63.1	2.65
1983	7.92	0.182 (24.17)	0.423 (10.78)	-0.072 (-7.49)	0.332 (0.71)	—	74.3	3.42
	7.55	0.185 (24.16)	0.452 (14.03)	-0.069 (-7.28)	—	0.696 (0.50)	75.2	3.30
1984	10.76	0.146 (19.21)	0.215 (5.86)	-0.078 (-8.60)	-1.07 (-2.93)	—	57.6	3.61
	10.40	0.135 (17.91)	0.164 (5.61)	-0.084 (-9.74)	—	6.360 (4.19)	60.7	3.41
1985	11.38	0.224 (27.48)	0.179 (5.23)	-0.073 (-8.44)	-0.960 (-2.91)	—	63.0	3.59
	11.41	0.226 (26.85)	0.114 (3.86)	-0.080 (-9.29)	—	0.235 (2.37)	63.4	3.53
1986	15.58	0.190 (18.17)	0.362 (9.43)	-0.098 (-10.20)	-1.27 (-2.70)	—	59.6	4.11
	14.29	0.228 (21.98)	0.292 (8.53)	-0.099 (-11.04)	—	1.830 (7.90)	66.3	3.75

*Standard error of the regression model.

in the 1982-86 time period. Prior to 1982, long-term growth rates were not available on the IBES files. Prior to April of a particular year, analysts may still be forecasting earnings for the previous year. To avoid potential inconsistency, we used April data and limited the sample to companies with a December fiscal year-end.

Although previous studies relied on a single growth rate, the two-stage growth model described by Equation (2) suggests that both short and long-term growth rates are positively related to P/E ratio. For our purposes, short-term growth (g_s) was defined as the two-year geometric mean growth rate implicit in the analysts' mean forecast of earnings per share. The analysts' mean long-term growth estimate was used to measure expected long-term growth (g_L).

Risk measurement is more controversial when expectations are used to develop a testable model than when ex post data are used. The P/E model described by Equation (2) clearly states that P/E is negatively related to the required rate of return, which is a function of a security's ex ante beta coefficient according to the Capital Asset Pricing Model (CAPM). Unfortunately, we did not have access to ex ante betas. IBES provides an ex ante measure of dispersion in analysts' earnings forecasts for both one and two year projections. The disadvantage of this measure is that it is not a measure of "systematic" or "priced" risk, which, of course, is the relevant risk measure according to the CAPM or single-factor APT.

We thus faced a difficult choice-to use a theoretically correct measure of risk (beta) based on ex post data, or to use a conceptually less elegant measure that is based on ex ante data. We decided to resolve this dilemma empirically by examining both risk measures. For the second measure of risk, we used the coefficient of variation (CVAR), defined as the standard deviation in analysts' one-year forecasts divided by the corresponding mean earnings forecast. (The one-year dispersion was used because many analysts provide only one-year projections.)

All betas were estimated on the basis of the Scholes-Williams method, using daily returns from the 250 trading days prior to the month of April in each year.⁴ The CRSP equally weighted index with dividends proxied the market index.

Because financial leverage increases both beta and dispersion, leverage was included as a third measure of risk.⁵ Leverage was defined as the firm's most recent total debt-to-total-assets ratio. Because this measure is historical, the implicit assumption is that the market's expectation of future leverage is the firm's most recent financial leverage.

Results

Table I displays the yearly results from each cross sectional regression model in the 1982-86 time period. To minimize the impact of outliers, we excluded all firms with P/E ratios larger than 40; such "influential" data points can easily distort the true relationships among explanatory variables. This restriction reduced the sample by approximately 3 per cent each

year, on average. The actual number of firms for each year ranged from a low of 442 in 1983 to a high of 590 in 1985.

Although dividend payout appears in Equation (2), it was not included as an independent variable in our final cross-sectional regressions because of its high collinearity with both growth measures, leverage and beta.⁶ In other words, dividend payout does not have a significant impact on P/E that is distinct from the other variables in the model. Inclusion of dividend payout would thus not enhance the model's explanatory power or its predictive ability. Instead, it would confound the interpretation of the remaining coefficients (i.e., collinearity makes it impossible to disentangle the relative influences of the explanatory variables).

Table I shows that, with the exception of CVAR and the beta coefficients in the 1982-83 regressions, the remaining coefficients are highly significant and have the theoretically correct signs. The short and long-term earnings forecasts explain nearly half the variation in P/E ratios. The magnitudes of the t-values point to the dominant influence of the two growth measures. In fact, the explanatory power of the model (R-squared) declines only about 10 per cent when both leverage and risk are omitted from the model.

As expected, the two risk measures tested appear to have some drawbacks. Beta is statistically significant in four of the five years, and it has the correct negative sign in all years. The coefficient of variation is significant in only three years, with an unexpected positive sign. However, the coefficient of variation increases the explanatory power of the model, as evidenced by the slightly higher R-squared and smaller standard error.

A comparison of coefficients across years clearly indicates instability in the model. This instability (also found by Cragg and Malkiel during the 1961-68 period) most likely reflects changing market conditions. The market tends to value growth more highly in a bull market than in a bear market. Both leverage and beta had increasingly negative effects on P/E ratios as the bull market extended into 1986. From a practical viewpoint, it seems clear that the P/E model requires frequent revisions to maintain credibility and consistency with market conditions.

Finally, examination of the residuals reveals no unusual patterns or observations. This observed randomness indicates that our linear model provides a realistic description of the relation between P/E ratios and the explanatory variables for individual firms.

Conclusion

Experienced security analysts should have no difficulty improving the model's effectiveness. We estimated a simple model of P/E ratios, using a very diverse sample of firms. No adjustments were made for particular industries. More importantly, our short-term earnings growth rates were not adjusted for "creative accounting." These estimates could be modified to exclude the impact of extraordinary or unusual influences on earnings per share. Furthermore,

cross-sectional models could be tailored to particular industries or sectors to provide a more homogeneous population. These modifications should increase the explanatory power of the model and reduce its standard error, thus providing security analysts with a more accurate and effective valuation tool.

Footnotes

1. See, for example, V. S. Whitbeck and M. Kisor, Jr., "A New Tool in Investment Decision-Making," *Financial Analysts Journal*, May/June 1963, pp. 55-62.
2. J. G. Cragg and B. Malkiel, "Expectations and the Structure of Share Prices" (NBER Monograph, University of Chicago, 1982).
3. For a more complete discussion of dividend valuation models, see J. L. Farrell, Jr., "The Dividend Discount Model: A Primer," *Financial Analysts Journal*, November/December 1985, pp. 16-25 and E. Sorenson and D. Williamson, "Some Evidence on the Value of Dividend Discount Models," *Financial Analysts Journal*, November/December 1985, pp. 60-69
4. M. Scholes and J. Williams, "Estimating Betas from Nonsynchronous Data," *Journal of Financial Economics* (1977), pp. 309-327.
5. See R. Hamada, "The Effect of the Firm's Capital Structure on the Systematic Risk of Common Stocks," *Journal of Finance*, May 1972, pp. 435-452.
6. For a detailed discussion of the effects of multicollinearity, see J. Johnston, *Econometric Models*, 2nd ed. (New York: McGraw-Hill, 1972), pp. 159-168.