
THE THEORETICAL PRICE-EARNINGS RATIO MODEL: EMPIRICAL EVIDENCE

Dean R. Longmore
Idaho State University
Pocatello, Idaho

Charles R. Idol
Texas Credit Union League
Arlington, Texas

Gary R. Wells
Idaho State University
Pocatello, Idaho

In an earlier article, the fundamental factors affecting common stocks' price-earnings (PE) ratios were theoretically investigated [3]. The proposed "theoretical model" established that the determinants of PE ratios are operating return on assets (positive), systematic business risk (negative), and an ambiguous relationship with the dividend payout ratio, financial leverage, and the firm's tax rate. Functionally, the "theoretical model" follows:

$$PE = \emptyset ({}^{+}r, {}^{-}\beta_u, {}^{?}b, {}^{?}L, {}^{?}T) \quad (1)$$

where

- r = the firm's operating profitability ratio (the ratio of EBIT to total assets),
- β_u = the systematic business risk of an unlevered firm,
- b = the expected dividend payout ratio,
- L = the firm's financial leverage factor, calculated as the book-value ratio of total debt to common equity,
- T = the firm's marginal income tax rate.¹

¹ The symbol \emptyset implies that the dependent variable on the LHS of the equation is influenced by the causal variables enclosed in the parenthesis on the RHS of the equation. The directional (i.e., first partial derivative) effects of these separate influences are denoted by the sign ("+" for positive and "-" negative) above each causal variable. A "?" above a causal variable suggests that its influence on the dependent variable is conditional.

Traditional theory (“traditional model”) suggests that the PE ratio is positively influenced by earnings’ growth and dividend payout, but negatively by risk [1,2,4,5].

$$PE = \begin{matrix} + & + & - \\ \emptyset & (g, b, R) \end{matrix} \quad (2)$$

where

- g = growth in earnings per share,
R = risk measurement of earnings variability.

The purpose of this paper is to compare the PE explanatory powers of the “theoretical model” and the “traditional model.” It is hypothesized that the explanatory powers of the “theoretical model” will exceed those of the “traditional model.”

Empirical Tests

To empirically test the “theoretical model” [Equation (1)] and the “traditional model” [Equation(2)], a sample of 259 industrial firms having sufficient historical data on the COMPUSTAT TAPES over the ten years 1969-1978 was selected.² Average values over the ten-year span for each firm’s price-earnings ratio (PE), operating profitability ratio (r), dividend payout ratio (b), financial leverage factor (L), and marginal tax rate (T) were calculated.

To estimate a firm’s systematic business risk (β_U), a “market” operating profitability ratio for the 259 firms was constructed during each of the ten years. The regression coefficient obtained by regressing a firm’s annual operating profitability ratios against the market’s operating profitability ratios over the ten years was used as a proxy measure of each firm’s β_U . The variance, denoted VAR(r), of each firm’s ten annual operating profitability ratios was calculated to reflect total business risk during the ten-year span. Each firm’s compound growth (g) in earnings per share between 1969 and 1978 was also calculated. Measurements of both the firm’s total business risk and its earnings’ growth (VAR(r) and g, respectively) were necessary so that empirical results obtained from both the “theoretical model” and the “traditional model” could be compared.

With the average PE ratio being the dependent variable, two stepwise multivariate regressions were run on the sample of 259 firms. In the first run, the five casual variables (r, β_U , b, L, T) from the “theoretical model” were included as independent variables. In the second run, causal variables [g, b, L, VAR(r)] associated with the “traditional model” were included as independent variables; the risk dimension should be captured by inclusion of

² The 1969-78 time span was chosen to reduce the impact of interest rate volatility on the sample firms’ PE ratios. Over this ten-year span, interest rates were both relatively low and stable, whereas rates were generally rising between 1979-81 and falling between 1982-86.

measurements for both the firm's overall business risk and its financial leverage factor. The results of these two runs are presented in Table 1.

Table 1

Regression Results for All Firms (N=259)

Run No.	Model Tested	Regression Equation (Refer to Notes)	Adj. R ²	Regression F Stat.
1	Theoretical Equation (1)	PE=16.8 + 24.9r - .5β _u - 1.2L - 18.0T (6.01)** (3.05)** (2.08)* (3.93)**	.20	16.83**
2	Traditional Equation (2)	PE=12.2 + 2.9g - 1.8L + 2.0b (.71) (2.78)** (.91)	.03	3.67*

- Notes:
- 1) ** indicates statistical significance at the 1% level.
 - 2) * indicates statistical significance at the 5% level.
 - 3) The number beneath each regression coefficient is the coefficient's t statistic.
 - 4) In Run #1, the dividend payout ratio (b) failed to enter into the regression equation due to its lack of meaningful statistical significance with the PE ratio in a multivariate context.
 - 5) In Run #2, the total business risk measure [VAR(r)] didn't enter into the regression equation due to its lack of statistical significance with the PE ratio.

The outcome of the first regression run provides empirical support for the "theoretical model." The regression's R² (.20) was significant at the 1% level (F_{.01} = 3.41). Both the operating profitability ratio (r) and systematic business risk (β_u) had expected directional effects on the PE ratio; further, from their t statistics, both variables were statistically significant at the 1% level. Additionally, both the marginal tax rate (T) and the financial leverage factor (L) had statistically significant influences on the PE ratio. The dividend payout ratio's (b) statistical association with the PE ratio was so weak that it failed to enter into the regression equation.

When the "traditional model" was tested with the second regression run, the regression's modest R² (.03) was statistically significant at the 5% level (F_{.05} = 2.65). However, the only variable to have a statistical significance (at least at the 5% level) with the PE ratio was the financial leverage factor (L). As in the first regression run, L's coefficient had a negative sign. Thus, for the study's 259 firms, the "traditional model" performed very poorly compared to the "theoretical model."

To examine whether the regression's R²s could be improved using a more homogeneous sample of firms, the two regressions were rerun on the firms in the sample which comprised the chemical process industry. As the regression run results shown in Table 2 clearly indicate, the "theoretical model" outperformed the "traditional model." In both cases, the R²s were much higher for the industry group (.51 for the "theoretical model" and .15 for the

“traditional model”) than for the general population of firms.³ However, even though the R²s improved with the more homogeneous group of firms, the structural characteristics of the regression equations remained unchanged from those reported in Table 1.

Table 2

Regression Results for Firms in the Chemical Process Industry (SIC 20XX)

Run No.	Model Tested	Regression Equation (Refer to Notes)	Adj. R ²	Regression F Stat.
1	Theoretical Equation (1)	PE=15.3 + 35.4r - .9β _u - 2.1L - 16.7T (6.34)** (3.32)** (1.83) (2.30)**	.51	20.81**
2	Traditional Equation (2)	PE=11.0 + 14.5g - 4.2L + 8.0b (1.75) (2.74)** (1.84)	.15	5.27**

- Notes:
- 1) ** indicates statistical significance at the 1% level.
 - 2) * indicates statistical significance at the 5% level.
 - 3) The number beneath each regression coefficient is the coefficient's t statistics.
 - 4) Due to the lack of statistical significance with the PE ratio, the dividend payout ratio (b) did not enter into the regression equation.
 - 5) Due to the lack of statistical significance with the PE ratio, the total business risk measurement [VAR(r)] did not enter into the regression equation.

Conclusion

The empirical results established the superiority of the “theoretical model” over the “traditional model” in explaining price-earnings ratios. As suggested in the earlier article, decisions to unconditionally enhance a firm’s price-earnings ratio should strive either to increase operating profitability or to lower systematic business risk. On the other hand, decisions affecting a firm’s financial structure, dividend policy, and tax strategy are less definitive on a firm’s price-earnings ratio.

³By forming an even more homogeneous industry grouping from the chemical industry, the R²s could be increased further to .62 for the “theoretical model.”

References

1. Beaver, W. and Morse, D. "What Determines Price-Earnings Ratios?" Financial Management (Summer 1975), pp. 53-64
2. Bell, F. "The Relationship of the Structure of Common Stock Prices to Historical Expectations and Industrial Variables." Journal of Finance (March 1974), pp. 187-197.
3. Idol, Charles R., Longmore, Dean R. and Wells, Gary R. "Financial Theory and the Factors Affecting Common Stocks' Price-Earnings Ratios." Journal of Financial and Strategic Decisions (Fall 1988), pp. 29-42.
4. Malkiel, B. and Cragg, J. "Expectations and the Structure of Share Prices." American Economic Review (September 1970), pp. 601-617.
5. Whitbeck, V. and Kisor, M. "A New Tool in Investment Decision-Making." Financial Analysts Journal (May-June 1963), pp. 55-62.