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THE ROLE OF FUNDAMENTAL VARIABLES IN EXPLAINING STOCK PRICES: CANADIAN EVIDENCE

By

Kobana Abukari, B.Sc. Admin (1993), M.A. (1997)

A thesis submitted to
the Faculty of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of
Master of Management Studies

School of Business

Carleton University

Ottawa, Ontario

December 13, 1999

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**“THE ROLE OF FUNDAMENTAL VARIABLES IN EXPLAINING
STOCK PRICES: CANADIAN EVIDENCE”**

submitted by Kobana Abukari, B.Sc., M.A.
in partial fulfillment of the requirements for
the degree of Master of Management Studies

Thesis Supervisor

Director, School of Business

Carleton University

January 21, 2000

Abstract

This study empirically tests a number of stock pricing models that are based on fundamental variables to determine the extent to which models that link fundamentals to stock prices are supported in Canadian stock markets. Using a cross-section of Toronto Stock Exchange listed firms over the 1992-1996 period, the study documents high explanatory power for stock pricing models based on the following frameworks: Edwards-Bell-Ohlson (EBO), economic profit or economic value created (EVC), price-to-earnings, price-to-sales, and court accepted formulas. The results of this study indicate that fundamental variables play an important role in stock pricing in Canada. Also, findings in this study provide support for the value relevance of two major corporate policy issues: dividend policy and capital structure.

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Chapter One: Introduction

1.1 Background

In market economies, pricing of tradable assets play a central role in the allocation of resources. Thus, there is a great need to understand the underlying factors that explain prices of assets. Finance theory generally posits that the value of a stock or share is equal to the present value of its expected future payoffs. However, there has not been any uniquely identified set of variables that completely approximate the expected future payoffs, and hence those parameters that totally explain stock prices.

The desire to understand the pricing of stocks in the absence of a uniform set of variables that proxy for the expected future payoffs has led to a mushrooming of stock pricing models. While almost all stock pricing models and frameworks are theoretically based, a number of empirical studies (mostly using U.S. and U.K. data) have attempted to validate these theoretical postulates over the years. Additionally, while most empirical papers have focused on returns models, there seems to be an increased interest, in recent times (i.e. in the 1990s), in price level models.

Notwithstanding the fact that several factors have been hypothesized in the extant literature to link to stock prices, there appears to be a convergence towards the belief that fundamental variables¹ (predominantly earnings, book values and cash flows) are the most important variables in the pricing of stocks.² This observation is supported by the

¹ For the purpose of this thesis, fundamental variables are indicators of company financial performance as reflected in financial statements as well as parameters that reflect the stock market participants' perceptions of company performance.

² For example, by exploiting the accounting attribute of earnings aggregation and expanding the period over which earnings are determined, Easton et al. (1992) observed major improvements between earnings

countless number of empirical papers (e.g. Bernard, 1995; Collins et al., 1997; Kothari and Shanken, 1992; Easton et al., 1992; and Rees, 1997) that have presented persuasive evidence showing that variation in stock prices can be explained by variations in dividends, earnings, cash flows and other fundamentals. But other studies (Amir and Lev (1996) for example) are not completely supportive of the view that fundamental variables account for the variation in stock prices in every situation.

The greater need for an understanding of stock pricing on one hand, and the absence of a uniform set of variables deemed to explain stock prices on the other, has made stock pricing an important concern to practitioners and a fertile area for research.

1.2 Purpose of Study

The need for further research on stock pricing to throw more light on this important subject, notwithstanding, a survey of the literature reveals an almost complete lack of empirical evidence on price levels valuation using Canadian data.³ The purpose of this study is therefore to fill this gap by providing empirical evidence on the parameters that explain stock prices in Canada. This study tested only price level models (and not returns models) that link fundamental variables to stock prices.

and returns, and came to the conclusion that investors 'buy earnings'. Tully (1999) also asserted that every stock's price is the product of its earnings and the price that investors are willing to pay for those earnings, also known as the P/E multiple.

³ See Table 1 under the literature review section. An inspection of the table clearly shows the absence of Canadian studies.

1.3 Objectives of Study

The first objective of this study is to use the available fundamental data on companies listed on the Toronto Stock Exchange (TSE) to understand the factors that explain cross-sectional variations in stock prices. A number of empirical price level models were therefore tested to assess their applicability in the Canadian environment. The findings in this study indicate that not only do stock price models based on fundamental variables have high explanatory power, but also that most of the major fundamental variables have a significant impact on the prices in Canadian stock markets. In addition, the study's findings provide support for the value relevance of two major corporate policy issues: dividend policy and capital structure. Inter alia, it was found that equity investors of TSE listed firms consider the levels of both dividends and debt when it comes to the pricing of stocks.

The second objective of this study is to determine the relative importance or contribution of various explanatory variables in the different empirical models. In this regard, the results of this thesis confirm the applicability of the findings reported in the U.S. to Canada. In particular, it was found that book value of equity contributes more than earnings to the basic EBO model⁴. This finding is consistent with results reported by Collins et al. (1997) using U.S. data.

⁴ The basic EBO model, based on the Edwards-Bell-Ohlson (EBO) framework, relates a stock's price to book value and capitalized earnings.

1.4 Organization of Study

The remainder of the study is organized as follows. Chapter Two is devoted to a review of the relevant literature. Chapter Three outlines some methodological issues while Chapter Four discusses the data and sample. Results of the study are presented and analyzed in Chapter Five, and Chapter Six presents the conclusion. The seventh and final chapter is devoted to the benefits and limitations of the study as well as some suggested directions for future research.

Chapter Two: Literature Review

The literature on stock pricing is a mixed bag. Estep (1985, pp. 26) asserted that Professor John Stuart Mill as early as 1848 wrote that “happily, there is nothing in the laws of value which remains for the present or any future writer to clear up; the theory of the subject is complete”. Mill’s confidence and satisfaction with the quantum of work already done on valuation in the 19th century, notwithstanding, the general consensus seems to be that the theory of pricing financial assets (and for that matter stocks or shares) is incomplete. Completeness of the theory of stock pricing will require that the intrinsic value/price of an asset, obtained by using an accepted pricing model, should not radically deviate from the observed market price of the asset. But as Jacobs and Levy (1988, pp. 47) observed, there is “a growing body of literature suggesting that prices deviate from value, and that such departures can be substantial and long-lasting.”

In addition, although a number of stock pricing models and hypotheses have been developed in the literature, there has not yet been any identification of one uniformly most powerful pricing model that dominates every other stock pricing model in every situation. For example, dividend discount models (DDM) are seen as being well supported theoretically, and are by far the most popular pricing models.⁵ However, by making inroads into the DDM literature and Miller and Modigliani’s (1961) dividend irrelevancy proposition, Penman (1992) coins the term ‘dividend conundrum’ to describe the situation where stock prices are seen to be based on future dividends and yet observed dividends do not tell us anything about prices. Lee (1996) also noted that dividends are a

⁵ See for example Penman (1992), who notes that expressions for pricing the fundamental security have not advanced much beyond the dividend discount formula.

poor surrogate for the increment in firm value because they measure wealth distribution, not wealth creation.

Discounted cash flow pricing models are also popular and widely used and yet they have not escaped criticism on theoretical grounds. Penman (1992) again points out a conundrum with respect to stock pricing techniques based on cash flows. In his opinion, because ex post cash flows are unobservable⁶, “we are faced with a similar conundrum to that in forecasting dividends: value can be expressed as the present value of future cash flows, but observed cash flows are uninformative about value” (pp. 474). In addition, Lee (1996) has professed that by ascribing all of a firm’s value to its future earnings (cash flow) stream, discounted cash flow valuations ignore the value-relevant information in balance sheets.

The inevitable effect of this debate is that the literature on stock pricing is so voluminous that trying to touch on every aspect of the subject matter in a single study would be an exercise in futility. To ensure brevity, therefore, only literature relevant to the objectives of this paper will be reviewed. Table 1 presents a summary of some empirical papers based on stock price levels.

⁶ To support the unobservable nature of ex post cash flows, Penman refers to Ohlson’s (1990) argument that realized cash flows at $t + \tau$ reflect not only cash flows projected at time t but also cash flows from investments made between t and $t + \tau$. “Ex post, there is no way of disentangling them” – Penman (1992, pp. 474).

Table 1: Previous Empirical Findings on Levels Valuation

Author(s) & Year	Dependent Variable	Independent Variables/Sign of Coefficient*/t-value	Study period (sample size)**	Country of study	R ² / (Adj. R ²)***
Wilcox (1984)	Ln(P/B)	ROE. +; (t-values not reported)	1981 (949)	U.S.	No R ²
Stewart (1990)	Δ MVA	Δ EVA. +; (no t-value reported)	1983-84 & 1987-88 (613)	U.S.	.97
Chauvin & Hirschey (1993)	Market value	Cash flow. +, 34.2; growth. +, 1.85; risk. -, -2.4; market share. +, 2.3; advertising. +, 17.2; R&D. +, 18.6	1988-90 (4,653)	U.S.	.44
Damodaran (1994)	P/B	Payout. +; beta. -; earnings growth rate over 5 years. +; ROE. +; (t-values not reported)	1988 (sample size not reported)	U.S.	.8405
Bernard (1995)	Price	Book value. +, 5.4; abnormal earnings (AE) $\tau=1$. +, 3.3; AE $\tau=2$. -, 1.3; AE $\tau=4$. +, 2.8	1978-93 (Sample size not stated)	U.S.	.68
McCarthy & Schneider (1995)	Market value of equity	Only '92 results: (Assets less goodwill). +, 5.9; goodwill. +, 5.5; liabilities. -, -5.3; income. +, 3.7	1988-92 (6216)	U.S.	.84
Damodaran (1996)	P/S	Payout. +; beta. -; earnings growth rate over 5 years. +; margin. +; (t-values not reported)	1995 (sample size not reported)	U.S.	.7726
Green, Stark & Thomas (1996)	(MV-BV)/BV	1/BV. +, 1.5; residual inc./BV. +, 8.0; R&D/BV. +, 47.9	1990-92 (662)	U.K.	.91
O'Byrne (1996)	MV/Cap.	Ln(Cap). -; (EVA ⁺ /c)/Cap. +; (EVA ⁻ /c)/Cap. +; (t-values not reported)	1985-93 (6,551)	U.S.	.42
Collins, Maydew & Weiss (1997)	Price	Book value. +, 132.2; earnings. +, 141.9	1953-93 (115,154)	U.S.	(.54)
Kramer & Pushner (1997)	MVA	Model (M)1: EVA. +, 31.0 Model (M)2: NOPAT. +, 43.7	1982-92 (8,712)	U.S.	M 1: .09 M 2: .18
Rees (1997)	Price	Retained earnings. +, 9.8; dividends. +, 18.1; investment. +, 5.7; book value + total debt. +, 7.3; total debt. -, 3.7.	1987-95: (8,287)	U.K.	(.64)
Tiras et al. (1998)	Price / BV	BV/BV. +, 70.2; EPS/BV. +, 28.4	1991-95 (2005)	U.S.	.33
Hand and Landsman (1999)	MVE	Results for only dividend paying stocks: BV. +, 7.8; CORENI. +, 15.7; DV. +, 6.2; NETCAP. +, 2.5	1974-1996 (Sample size not clearly stated)	U.S.	(.82)

BV is book value; AE is abnormal earnings; EPS is earnings per share; R&D is research and development expenditures; EVA⁺ is positive economic value added; EVA⁻ is negative economic value added; Δ EVA is change in economic value added; Δ MVA is change in market value added; NOPAT is net operating profits after taxes; Cap is capital employed; MVA is market value added; P/B is price/book ratio, P/S is price/sales ratio; Δ denotes change; MV is market value; CORENI is core earnings; NETCAP is net capital contributions; and, c is weighted average cost of capital.

*The sign of the coefficient is denoted as + for a positive coefficient and - for a negative coefficient. The values beside the +/- sign of the coefficients indicate the magnitude of the t-statistic reported for the variable concerned.

** The values in brackets after the years represent sample sizes.

*** The values in brackets represent Adjusted R²s while the others are the R²s.

2.1 Theoretical Underpinnings of Empirical Studies

As can be seen from Table 1, there have been numerous empirical price level models tested in the literature. Even though there may not be a mutually exclusive way of categorizing these models, based on the insights gained from the literature review, they have been grouped into stock pricing models based on the following theoretical frameworks: Edwards-Bell-Ohlson (EBO), economic profit or economic value created (EVC), price-to-earnings (P/E) multiples, price-to-book (P/B) multiples, price-to-sales (P/S) multiples and court accepted formulas.

The several classes of stock pricing models notwithstanding, it is argued that most of the models are equivalent when their respective future payoffs are forecasted to infinity (Penman and Sougiannis, 1998). Since the option of forecasting payoffs to infinity is not practically feasible in the real world, only finite horizon forecasts are possible. Consequently, the different stock pricing models will give different results – making it worthwhile to determine which model approximates actual results best. A brief review of the theoretical underpinnings of models based on the EBO and EVC frameworks is provided below. The other models based on the P/E, P/B, P/S and Court Accepted formula frameworks are discussed later since they are largely empirically based.

2.1.1 EBO Models

Stock pricing models based on the Edwards-Bell-Ohlson (EBO) framework, which combine the dividend discount model with a clean surplus relation, posit the value of a stock's price based on the book value of equity and the present value of future expected abnormal earnings. In his paper, for example, Ohlson (1995) modeled a basic firm's value to be the weighted average of capitalized current earnings (adjusted for dividends) and current book value.

2.1.2 Economic Profit or Economic Value Created Models

O'Byrne (1996) argues that to be able to develop accurate valuation models, one needs an operating performance measure that is consistent with discounted cash flow and that the economic value added measure provides such an operating performance measure.⁷

Economic value added or economic value created (EVC), generally perceived as the 'economic profits' that are capitalized by the market in arriving at market value added, is the 'residual income' left over from operating profits after the cost of capital has been earned (Stewart III, 1990). The theory of economic profits stipulates that the value of a business is determined by its ability to generate returns in excess of its cost of capital and the amount of such investment (Walbert, 1994). EVC is obtained by subtracting a company's capital charge (cost of capital multiplied by capital) from its net operating

⁷ Other acronyms, such as economic value created or EVC (see Armitage and Jog, 1996) and shareholder value added (SVA), have been proposed to describe an identical framework.

profits after taxes. A positive EVC indicates that a company is creating economic value while a negative EVC signifies that a company is destroying value.

2.2 Empirical Stock Pricing Models Based on the EBO framework

2.2.1 EBO Models based on Historical Financial Information

Most empiricists have simplified the EBO basic expression of firm value to be a function of earnings and book value. This simplified basic expression serves as only a first approximation since almost all empiricists generally extend the basic model to include other fundamental variables. Collins et al. (1997), Rees (1997), Amir and Lev (1996), Tiras et al. (1998), among others, have all extended the basic EBO analysis. Curiously, almost all the empirical researchers ignore the discounting part in the EBO framework. The motivation for leaving out the discounting aspect may be partly due to Maydew's (1993) findings (cited by Collins et al., 1997) that allowing discount rates to vary across firms does not significantly improve the explanatory power of the model. Some of the extensions to the basic EBO formulation are considered next.

Arguing that a number of other key financial variables – notably capital structure, dividend policy and capital expenditures – are also indicators of value, Rees offered the following extension to the basic EBO pricing model:

$$P_{it} = b_0 + b_1 DV_{it} + b_2 RE_{it} + b_3 (BV_{it} + TD_{it}) - b_4 TD_{it} + b_5 IV_{it} + e_{it}$$

where P_{it} is the price per share for ordinary equity for firm i at year end t , BV_{it} is the book value of equity per share, DV_{it} and RE_{it} are the ordinary dividends per share and retained earnings per share for firm i in year t , IV_{it} is investments per share and TD_{it} is the total

book value of debt per share including non-ordinary equity capital such as preference shares. See Appendix A for definitions of the variables used in testing the different models in this study.

Using a sample of U.K. firms, Rees found evidence to support the hypothesis that dividends and investments (or capital expenditures) are also value-relevant in a model that includes earnings and book value. An inspection of Rees' correlation matrix table, however, reveals a higher correlation between total capital (i.e. book value plus total debt) and book value (.943) as well as total capital and total debt (.838). One can surmise that these variables may suffer from multicollinearity. While Rees acknowledges the possibility of variance inflation and some potential instability in the results, his experimentation with alternative outlier deletion methods as a way of combating the multicollinearity is not completely satisfactory.

Though Rees' evidence supports his hypothesis about dividends and capital expenditures, his results could not support his expectations about the value relevance of debt because he could not reject the null hypothesis that the absolute value of the debt coefficient is equal to that of total capital. There may be several reasons for this lack of support, but two potential explanations for this result are worthy of mention. Firstly, it has been observed that one of the econometric problems of multicollinearity is the possibility of increased variance of the regression coefficients, which makes it difficult to reject the null hypothesis. It is therefore likely that the multicollinearity is affecting Rees' results. A second explanation to this insignificance may be that debt does not signal value.

Hand and Landsman (1999) employed Ohlson's (1995, 1998) equity pricing model to determine the extent to which the pricing of dividends reflect the Miller and Modigliani's one-to-one displacement property, and if there is a divergence from dividend displacement, to explain its direction and magnitude. Using annual cross-sections of NYSE, AMEX and NASDAQ firms over the 1974-1996 period, Hand and Landsman present evidence showing that dividends are materially positively priced – in sharp contrast with the negative relation predicted by dividend displacement. The authors also found that the positive pricing of dividends is at least three times larger for firms experiencing losses than for profitable firms. Their explanation for these results is that firms experiencing losses use dividends to signal future profitability while managers of profitable firms use dividends, to a lesser degree, to alleviate concerns about the misuse of free cash flows.

Motivated by the EBO framework, Green et al. (1996) also modeled excess firm value (the difference between market value and book value) as a function of book value, residual income, research and development (R&D) expenditures, plus a number of control variables including market share, firm's debt to equity ratio, average industry's debt to equity ratio, to mention a few. The central objective of Green et al.'s paper hinged on evaluating the value relevance of research and development expenditures. Although the evidence they presented is somewhat mixed⁸, their results, on balance, lean in favor of the interpretation that, on average, the market values research and development expenditures.

⁸ While the coefficients of residual income and R&D were consistently positive and significant at the 5% level when regressed with all cases in their sample, the R&D variable was barely significant at the 10% level when the authors deleted cases considered outliers.

Chauvin and Hirschey (1993) also documented findings that show that cash flows, risk, growth, market share, advertising and R&D are significantly associated with market value. Since the primary objective of their paper was to test the impact of advertising and R&D on market values, the authors concluded, based on the large positive and consistent influences of advertising and R&D on market value, that spending on advertising and R&D appear to help investors form appropriate expectations concerning the size and variability of future cash flows.

In order to explore the market perception of goodwill and whether or not the market to some degree values goodwill as it values other assets, McCarthy and Schneider (1995) studied a sample of U.S. firms that report goodwill on their balance sheets. They find significant association between market value of equity (dependent variable) and the set of independent variables comprising book value of goodwill, book value of assets less book value of goodwill, book value of liabilities and net income. It was therefore concluded that the market perceives goodwill as an asset and incorporates the information in the valuation of the firm. Jennings et al. (1996) also report results that indicate a strong positive cross-sectional association between equity values and recorded goodwill amounts, after controlling for other components of net assets. They however noted a somewhat weak negative association between equity values and goodwill amortization, after controlling for other components of expected earnings.

The evidence presented above depicts strong relationships between fundamental variables and stock prices. While those strong associations may be the case in many situations, there have also been reported instances of marginal relationships between

fundamental variables and stock prices. For instance, questions have been raised about the value relevance of financial information in technology-based, high-growth sectors.

Amir and Lev (1996) examined the value relevance of financial and nonfinancial information of independent cellular companies and found financial information (earnings, book values and cash flows) to be mainly irrelevant in the valuation of such companies on a stand-alone basis. It is only when financial information is combined with nonfinancial information (such as total population size in the licensed service area and penetration rate), and when adjustments are made for the excessive expensing of intangibles, that some of the financial variables contribute to the explanation of stock prices. The authors asserted that these findings demonstrate the complementarity between financial and nonfinancial information and also indicate that the traditional focus of accounting researchers on the former is overly restrictive and may lead to unwarranted conclusions.

2.2.2 EBO Models based on Earnings Forecasts

Also following the EBO framework, Bernard (1995) proposed an empirical stock pricing regression equation (based on book value and expected residual income) as follows:

$$P_{jt} = \alpha_0 + \alpha_1 bv_{jt} + \sum_{\tau=1}^4 \alpha_{\tau+1} E_t[x_{jt+\tau} - r bv_{jt+\tau-1}] + \varepsilon_t$$

where P_{jt} is price per share of stock j at time t , bv_{jt} is book value per share of stock j at time t . r is the discount rate and $x_{jt+\tau}$ is earnings per share for stock j in period $t+\tau$. Using data in the CRSP and COMPUSTAT databases and Value Line's earnings forecasts as

surrogates for market participants' ex ante earnings expectations, Bernard reported a 68% R^2 for his model as compared to the 29% R^2 for a model with expected dividends.

Providing additional support to stock pricing models that use future abnormal earnings is Fairfield's (1994) compelling argument that in a competitive economy, the series of abnormal earnings for a given firm will converge to zero. According to Fairfield, this implies that models based on abnormal earnings focus on a problem that is tractable.

It should be noted that Bernard's (1995) formulation requires the forecasting of earnings. In general, however, there are some issues about using historical earnings for predicting future earnings. In their "higgledy piggledy growth in America" study, Lintner and Glauber (1967) examined the relative instability of a number of financial variables including earnings for different periods (5 and 10 year growth trends) and found the inter-period correlations of growth rates in aggregate earnings, earnings per share (EPS), earnings before interest and taxes and operating income to be weak. The authors therefore concluded that there is a "great deal of randomness in the world; financial data, especially growth rates, clearly provide no exception" (pp. 662) and that to rely on simple projections of past observed time-growth rates is to give "hostages to fortune".

Damodaran (1996) also reports results of a recent study that uses growth rates in two five-year time periods – 1981-1985 and 1986-1990. While the correlation coefficient for earnings growth in Damodaran's study is positive, it is not significantly different from zero. This implies that firms with high growth in earnings in one period are no more or less likely to grow faster in the next period, thus casting doubts on the ability to successfully predict earnings growth rates based on historical growth rates information.

Fuller et al. (1992), on the other hand, found that while the distribution of earnings changes across all stocks is similar to a random distribution, a test by earnings/price (E/P) quintiles does not produce results that are consistent with earnings changes being randomly distributed. This indicates that market participants “do a good job of forecasting future ‘excess’ earnings changes on average” – according to Fuller et al. (1992, pp. 38).

The evidence on the ability to predict earnings (required for testing Bernard’s model) is therefore mixed.

2.2.3 Comment

One problem with empirical models based on the EBO framework is that while the theoretical EBO models do not include an intercept term, the empirical ones do include an intercept. Considering the econometric problems of regressions through the origin, however, there are more advantages for the empirical models that include an intercept. In particular, the intercept term may provide some protection against problems associated with omitted variables.

2.3 Empirical EVC-based Stock Pricing Models

Empirical stock pricing models based on EVC have their roots in the Miller and Modigliani’s (1961) paper in which they demonstrated that the value of a firm is related to its current and expected future operating cash flows. Reworking the Miller and Modigliani’s (1961) valuation equation, O’Byrne (1996) and Sirower and O’Byrne

(1998) decomposed the total market value of a firm (based on economic value/profit) into its known and expectational components. O'Byrne (1996) then proposed a simple economic profit regression model in which market value linearly depends on capital and the present value of EVC. O'Byrne also suggested an extended economic profit regression model along the following lines:

$$MV / Cap = a + b(\ln(Cap)) + d((EVC^+ / c) / Cap) + f((EVC^- / c) / Cap) + e$$

where MV is market value, Cap is capital employed, EVC^+ equals EVC if EVC is positive (and zero otherwise) and EVC^- equals EVC if EVC is negative (and zero otherwise). EVC is defined as net operating profit after tax (NOPAT) less a capital charge (given as $c \cdot \text{capital}$, where c is the weighted average cost of capital). The justification for the inclusion of the EVC^+ and EVC^- terms is to recognize that the market puts a much higher multiple on positive EVC than it does on negative EVC. The size adjustment is also to recognize that market multiples of capital tends to decline with company size.

O'Byrne assessed the performance of his extended economic profit model with a sample of 6,551 company years from the 1993 Stern Stewart Performance 1000 database. He reported that the extended economic profit model explained 42% of the variation in the market value/capital ratio. The author also experimented with a series of regressions based on changes in these variables and observed that while five-year changes in economic profit explain 55% of the variation in five-year changes in market value, ten-year changes in economic profit explain 74% of the variation in ten-year changes in market value. He therefore contends that the economic profit model has a superior

explanatory power than an earnings (NOPAT) model (which has been shown elsewhere to be very instrumental in explaining returns⁹).

Armitage and Jog (1996) plotted the return on capital (i.e. NOPAT divided by capital employed) to cost of capital (r/c) ratio against the market value to capital invested (V/K) ratio for TSE firms in the merchandising sector from 1989 to 1994 and found a strong relationship (R^2 of 82%) between V/K and EVC. A graph of the V/K ratio and earnings per share (EPS) showed a poor relationship (coefficient of correlation of 2%) between V/K and EPS for firms within the same merchandising sector over the same period.

Stewart III (1990) formed a sample of 613 companies into 25 portfolios ranked by economic profit and changes in economic profit. He found a strong correlation between economic profit and market value added (MVA) and even more pronounced correlation between changes in economic profit and changes in MVA. This strong correlation led the author to conclude that MVA matches in lockstep with economic profit.

Some recent studies have however questioned the dominance of economic profit models over earnings (NOPAT) models. Kramer and Pushner (1997), for instance, reported lower explanatory power when they regressed economic profit on market value added (MVA – defined as total market value of a firm's equity plus book value of its debt less invested capital) than when NOPAT is regressed on MVA. Kramer and Pushner (1997) also experimented with several variants of their simple regression models

⁹ Easton et al. (1992) show that earnings explain an increasing proportion of the variation in shareholder return as the measurement period is extended to longer and longer periods. They show, among other things, that although the current year's earnings explain only 5% of the variation in that year's stock returns, ten years of corporate earnings explain 63% of variation in ten-year returns. Consequently, they hypothesize that the long-run correlation between aggregate earnings and shareholder returns will asymptotically approach one.

including the use of standardized values and regression based on changes in MVA. Their conclusion that the market seems more focused on profit than on economic value created is not totally supported. In exhibits 7 and 3 of their paper, for example, the explanatory power of the economic profit regression completely dominates that of the NOPAT regression.

Biddle et al. (1997) critique O'Byrne's (1996) study for constraining the NOPAT model and drawing conclusions on the superiority of economic profit over NOPAT on that basis. After making the same adjustments to NOPAT, economic profit and earnings before extraordinary items (EBEI) models, Biddle et al. found that the EBEI regression has a significantly higher association with firm value ($R^2 = 53\%$) than the economic profit regression (50%) and a NOPAT regression (49%). While the difference between the EBEI R^2 and the economic profit R^2 was found to be statistically significant at the 5% level, the difference between the NOPAT and economic profit R^2 s was not statistically different from zero.

In the light of these criticisms leveled against models based on economic profit, O'Byrne (1997) came to the economic profit framework's defense arguing that the recent studies that challenge the usefulness of economic profit/value in "explaining market value and shareholder return have significant shortcomings in methodology" (pp. 54). According to O'Byrne, these recent studies focus on shareholder return, not excess shareholder return; the studies do not use expected economic profit improvement as a variable in explaining shareholder return; these studies do not recognize that investors put a much higher multiple on positive economic profit than they do on negative economic

profit; and that the studies fail to realize that their earnings models are really earnings and capital (i.e. economic profit) models.

2.4 Empirical Stock Pricing Models based on P/E Ratio

In the literature, a number of empiricists have proposed stock-pricing models based on the price-to-earnings (P/E) ratio. P/E multiples associate the price of a company's stock to its current earnings. Citing Fuller and Farrell (1987) as their reference, Hickman and Petry (1990) indicated that with some simplifying assumptions, a P/E multiple may be shown to be a function of a firm's beta, growth rate, and dividend payout ratio. The authors maintain that although this relationship is not necessarily linear, P/E multiples may be regressed on expected growth, beta and payout. Hickman and Petry tested a number of valuation models and found that the performance of the P/E model dominated that of the dividend discount model. Because Hickman and Petry's study focused on determining the prediction errors of various valuation models, their results were reported differently and do not therefore fit the reporting style of Table 1. As a result, their results are not included in Table 1.

One of the shortfalls of stock pricing models based on P/E multiples stem from the fact that the ratio is meaningless if a company has negative earnings. Under a variety of economic conditions, negative earnings are not uncommon. The normalization of earnings has been suggested as a way of mitigating the problems of negative current earnings. P/E multiples have also come under attack on the grounds that earnings, as artifacts of the accounting system, can be subject to the whims and caprices of the accounting methods chosen, and can, to some extent, be manipulated by management.

2.5 Empirical P/B Stock Pricing Models

Empirical stock pricing models have also been developed around the price-to-book (P/B) ratio. Using the Gordon dividend discount framework, Damodaran (1994) models the P/B multiple as a function of ROE, the payout ratio, the growth rate, and beta.

Damodaran used CRSP and COMPUSTAT data from 1987 to 1991 and reported fairly good R^2 s for each of the years from 1987 to 1991 (inclusive). The lowest R^2 was 84%, reported in 1988 and the highest R^2 of 88.5% was reported in 1989 and 1990. While the regression coefficients came out as expected, Damodaran did not report the significance levels of the various variables.

Wilcox (1984) plotted P/B ratios as a function of ROE for a sample of 949 Value Line stocks and reported the existence of a strong linear relationship (stronger than the relationship between Price/three-year average earnings and Value Line's estimated 10-year growth rate in EPS). Wilcox also compared the P/B and P/normalized earnings models and concluded that the "P/B-ROE model appears to be superior (in terms of its mean squared error) to price-earnings ratio models when applied to historical data for the majority of companies covered by the Value Line Investment Survey" (pp. 58).

One major advantage of stock pricing models based on the P/B ratio (and other ratio-type stock pricing models) rests on the fact that they can facilitate the achievement of some relative comparability by normalizing for differences in firm size, which can be huge in some cases. On the downside, on rare occasions (i.e. when net book value is negative), the P/B ratio can be negative. In such situations, the ratio becomes meaningless.

2.6 Empirical Stock Pricing Models based on P/S Multiples

Another class of empirical stock pricing models has been built around price-to-sales (P/S) multiples. Stock pricing models based on P/S multiples are generally regarded as superior models for various reasons. Their superiority mainly stems from the fact that they are not subject to the same problems that beset P/E multiples. It has been argued, for example, that P/S can never become negative. In addition, such models are deemed to tie in perfectly well with corporate strategy. Inter alia, it makes it possible to understand the effects of changes in pricing policies on firm value.

Stock pricing models based on P/S have recently received solid theoretical support from Leibowitz (1997). In presenting his theoretical framework, Leibowitz effectively argues that in a global business environment with a high degree of integration among financial markets, the dream of having “an exclusive lock on being the low-cost producer” (pp. ix) will remain illusive because any one company’s advantage of geographical locale, more efficient production sites or cheap labor can always be replicated by a sufficiently strong competitor. Consequently, strategic positioning capable of commanding high firm value will largely be the result of “premium pricing across a range of product markets” (pp. ix). The author believes that firm value depends on the ability to sustain pricing power to achieve positive franchise margins on a significant portion of sales as well as accessing new markets that support a high level of sales growth. Leibowitz models the intrinsic value of a firm’s equity to be a function of book value and franchise margins on current and/or future sales.

Damodaran (1996) offers an empirical P/S regression model that is linearly dependent on four fundamental variables: dividend payout, growth rate in earnings, beta and profit margin. Using the COMPUSTAT and CRSP databases to extract information on these variables, Damodaran did a cross-sectional regression for 1995 and reported an R^2 of 77.26%. He also found that all the variables have regression coefficients congruent with his expectations.

Like the other stock pricing models, P/S models also have their weaknesses. P/S multiples have been criticized as being inappropriate for firms that have problems with fiscal discipline, financial prudence and cost control.

2.7 Court Accepted Stock Pricing Formulas

Court accepted formulas are algorithms applied by courts in some well-known legal cases in order to determine the value of a firm (mostly privately held corporations). Hickman and Petry (1990) suggest two empirical stock pricing regression equations based on two widely cited court cases. The first equation, based on the Bader case is presented below:

$$P_i = a_0 + a_1(EP S_i)(PE_i) + a_2 \frac{DV_i}{DVYLD_i} + a_3 BV_i$$

where P_i is year-end price per share, $EP S_i$ is most recent earnings per share, DV_i is most recent dividends per share, BV_i is most recent book value per share, PE_i is industry average price earnings ratio, and $DVYLD_i$ is industry average dividend yield. The second regression equation suggested by Hickman and Petry is based on the Central Trust case and involves substituting $[(BV_i)(BVM)]$ for BV_i where BVM is the industry's market-to-

book value multiple. In their comparative evaluation of valuation models, Hickman and Petry (1990) found that the performance of the dividend discount model is dominated by the performance of court accepted formulas

The inclusion of industry variables in stock pricing is perhaps one of the most distinguishing features of court accepted formulas. As Hickman and Petry (1990) noted, financial research has indicated that an industry factor may be a significant contributor to stock returns and, therefore, in determining stock prices.

The problem with court accepted formulas revolve around the use of regimentally determined coefficients for the variables specified. Also, such formulas are mainly used to determine the value of firms that are not publicly traded. Using these formulas to estimate the value of a publicly held firm thus requires some adjustments. In particular, one variable – discount factor for lack of liquidity – needs to be removed from the original court accepted formulas in order that they can be applied to public companies. Hickman and Petry made this adjustment before offering the above empirical regression equations. Additionally, the rigid coefficients used by the U.S. courts need to give way to flexibly determined coefficients from the data in different countries.

2.8 Summary of Empirical Models to be tested

It is clear from the literature review above that there are a number of empirically based price levels valuation models. Since all the models cannot be tested in one study for want of time and resources, only the models listed in Table 2 will be tested in this study.

Table 2: Models to be tested

Dependent Variable	Independent variables (expected sign of Coefficient)*
1) Price	Model a: BV (+), EPS (+) Model b: BV (+), free cash flows (+)
2) Price	BV (+), DV (+), RE (+), [BV+TD] (+), TD (-), IV (+) – all per share values
3) Price	BV (+), $\sum$ future expected abnormal earnings (+)
4) MV/Cap	[EVC/c]/Cap. (+); will also run for NOPAT and free cash flows (FCF)
5) MV/Cap	Ln[Capital] (-), [EVC [*] /c]/Cap. (+), [EVC [*] /c]/Cap. (+); additional runs for NOPAT and FCF
6) P/E	Beta (-), growth rate (+), dividend payout (?)
7) P/B	Dividend payout (?), beta (-), earnings growth rate (+), ROE (+)
8) P/S	Dividend payout (?), growth rate in earnings (+), beta (-), profit margin (+)
9) Price	EPS*industry PE (+), DV/(DVYLD _{industry}) (?), BV (+)
10) Price	EPS*industry PE (+), DV/(DVYLD _{industry}) (?), BV*industry market to book multiple (+)

P or Price is TSE quoted price per share; DV is ordinary dividends; RE is retained earnings; TD is total debt; IV is investment; ROE is return on equity; BV is book value; EPS is earnings per share; DVYLD is dividend yield; P/E is price/earnings ratio; P/B is price/book ratio; P/S is price/sales ratio; EVC is economic value created; NOPAT is net operating profits after taxes; Cap is capital employed; MVA is market value added; MV is market value; and, c is weighted average cost of capital.

*The (+)/(-) indicates the expected sign of the coefficient. A (+) means a positive coefficient is expected while a (-) means a negative coefficient is expected. The (?) indicates that the expected sign of the coefficient concerned is not known with certainty.

Chapter Three: Methodological Issues

3.1 Ordinary Least Squares Regression

Ordinary least squares (OLS) regression is by far the most dominant technique used in the literature. Among others, Rees (1997), O'Byrne (1996), and Green et al. (1996) have used OLS. This study also employed the OLS regression methodology. A review of Rees' extended model highlighted the possibility of multicollinearity. In this study, two variables (i.e. total debt per share and total capital per share) in the extended/full EBO model suggested by Rees were in a collinear relation. In addition to the traditional method of dealing with multicollinearity – outlier deletion, this study also implemented the technique of ridge regression. See Appendix B for a review of this technique.

3.2 Forecasting Earnings

There are a number of ways that can potentially be used in the forecasting of earnings for the purpose of testing models based on forecasted earnings.

In the first place, a number of extrapolative models have been suggested as being appropriate for capturing the time series behavior of earnings. The martingale model, for instance, posits that tomorrow's earnings are the same as today's earnings. There is also the martingale with a two-year drift model (see Clarkson et al. – 1992) and the random walk with a one-year drift (see McConomy, 1997). The problem with these naïve models is that they are most appropriate for forecasting next period's earnings. Given that this

study was interested in forecasting earnings for a period of five years, it was thought that there would be little value added by using mechanical models. In addition, it has been reported that naïve models have high prediction errors (even for the one-year-ahead earnings forecasts). In his study of initial public offerings, McConomy (1997), for example, finds that for the full sample of 161 firms with sufficient information to facilitate the estimation of earnings using a random walk with drift, earnings were on average underestimated by 245.7%. It was only when firms with relative prediction errors over $\pm 100\%$ were excluded from the sample that bias was reduced to an average of -2%. While this is a great improvement, the fact that the sample size had to be reduced by 33.5% calls for some concern.

There are also sophisticated time series methodologies that are deemed to be more effective in forecasting earnings. Seasonal autoregressive integrated moving average (SARIMA) models are, for example, said to be very powerful in forecasting earnings since they include a seasonal variable and earnings (quarterly earnings in particular) are perceived to have a strong seasonality component (see Foster, 1977). Despite the appeal of SARIMA models, their use in this study was seen to be inappropriate because this study had five years of data for each sample firm but time series models require a lot of data to ensure a reasonable degree of estimation accuracy (see Damodaran, 1996). Consequently, time series models were not used in this study since the possibility of large estimation errors cannot be completely salvaged. Also, the SARIMA models are mainly used for forecasting quarterly earnings but this study is based on annual earnings.

Analysts' forecasts of earnings could have also been used in this study, but were unfortunately unavailable.

In the light of the above problems, this study assumed that the ex post realizations of earnings are equal to their ex ante expectations. The use of ex post realized earnings is justified by an argument advanced by Clarkson et al. (1992, pp.613) to the effect that “the ex post realization will be an unbiased estimate” of the market’s ex ante expectations. With this assumption, the ex post realized values were substituted into the Bernard’s (1995) stock pricing equation. This type of research design has been used in many other studies (e.g. Penman and Sougiannis, 1998). It should be emphasized, however, that deducing ex ante earnings expectations from ex post realizations assumes that ex post realizations are equal to their ex ante rational expectations. Whether or not this is a reasonable assumption is contestable.

3.2.1 Negative Earnings

Cases that had negative values for variables that were supposed to be divisors in the various regression equations were excluded. The aim was to avoid having ratios like the P/E ratio and P/B ratio become negative – which will make them meaningless. In the P/E stock pricing model, for instance, firms with negative earnings were excluded since earnings has to be a divisor in order to get the P/E ratio. Potential methods that could have been employed to deal with negative earnings, in particular, include: (i) the use of average EPS for the last five years if a firm’s current EPS (to be used as a divisor) is negative, and (ii) following Arnott (1985), the use of $\max(\text{EPS}_t, \text{EPS}_{t-1})$. For consistency with other studies (e.g. Damodaran 1994), this study simply deleted all cases having negative values on variables that were to be used as divisors in the pricing models tested.

3.3 Robustness Test: Cross Validation

To determine how well the estimated equations will perform in predicting for new samples from the same population, Stein's formula was used. Stein's formula attempts to estimate the predictive power of various regressions for other samples from the same population, and is given by (see Stevens, 1992):

$$\hat{\rho}_c^2 = 1 - \left(\frac{n-1}{n-k-1} \right) * \left(\frac{n-2}{n-k-2} \right) * \left(\frac{n+1}{n} \right) * (1 - R^2)$$

where n is the sample size and k is the number of predictors. For each of the models tested, Stein's formula was computed from the regression output.

3.4 Heteroscedasticity

Heteroscedasticity is a violation of one of the classical assumptions,¹⁰ which requires the observations of the error term to be drawn from a distribution that has a constant variance (Studenmund, 1992). In the presence of heteroscedasticity, therefore, the variance of the error term is not constant across observations. It has been argued in the literature that the downside of using price level models as opposed to returns models is the fact that heteroscedasticity¹¹ is almost guaranteed when levels models are used. White's (1980) test¹² was used to formally test for heteroscedasticity, and the null hypothesis of no heteroscedasticity was rejected for all the models. Since the models

¹⁰ The classical assumptions have to be met in order for the OLS procedure to be considered the best linear unbiased estimator (BLUE).

¹¹ In the presence of heteroscedasticity, the coefficient estimates are still unbiased except that OLS is no longer the most efficient way of estimating the coefficients because of large variances.

¹² The reason for choosing the White's test is because it makes the least assumptions. The need to facilitate comparison with other studies also necessitates the use of the White's test since almost all the price level

tested are heteroscedastic, the t-statistics were derived from White's (1980) heteroscedastic consistent variance-covariance matrices. SAS outputs t-statistics based on White's heteroscedastic consistent variance-covariance matrices when requested.

3.5 Outliers

Following Collins et al. (1997) outliers deleted were defined as the top and bottom 0.5% of cases for the major variables in the different models – book value, price and earnings in the EBO models and EVC, MV/Cap, NOPAT and FCF in the EVC models – as well as yearly cases with studentized residuals greater than 4 (in absolute value terms).

3.6 Variable Importance

Most of the models tested in this paper have more than one predictor variable. In such situations, it is always worthwhile to determine the relative importance of each independent variable to the regression equation. Therefore, another objective of this study is to determine the relative contribution that the variables in a model make to that model.

In this study, a theoretically well-supported measure of variable importance, credited to Pratt (1987) was used. The measure, which uses the concept of total variance explained assignable to each independent variable, allots importance to a variable in proportion to the product of its standardized regression coefficient (i.e. its total effects)

studies employ the White's procedure. Finally, the condition that the sample size be at least 30 is also satisfied.

and its simple correlation with the response variable (i.e. its direct effects). The Pratt's measure has been extended and simplified by Thomas et al. (1996, 1998) using the geometric approach. It is this extended measure that was actually used in this study. The extended measure is given by:

$$d_j = \tilde{\beta}_j \tilde{\rho}_j / R^2$$

where d_j is the percent importance, $\tilde{\rho}_j$ is the simple correlation between the predictor and the response and $\tilde{\beta}_j$ is the standardized regression coefficient.

Chapter Four: Data and Sample

4.1 Source of Data

The data for this study is obtained from the Stock Guide database version 2.3.375, released in September 1998. This database, which serves as a repository for historical financial statements and other market and non-market information, provided the data needed for this study including cash flows, earnings, dividends, debt, investments, book values, stock prices, etc. The data used were all year-end data including stock prices.

The year-end stock price is used in the regressions because of the justification provided by a number of authors. Collins and Kothari (1989) showed in their study that the 'best' event window (i.e. one giving the highest explanatory power) concludes before the end of the relevant financial year. Barth et al. (1992) also found that results are not sensitive to using either year-end prices or later prices. These findings imply that it might not be necessary to defer the date on which firm value is measured beyond the balance sheet date, and hence the reason for regressing year-end accounting data on the year-end stock prices.

4.2 Period of Study

This study is based on a five-year sample period from 1992 to 1996. Following other studies (e.g. Li, 1995), a year, for the purposes of sample classification only, starts from July of the year concerned and ends in June of the following year. For example, the

1996 sample is made up of firms whose year-ends fall between July of 1996 and June of 1997.

4.3 Sample Selection Criteria

For a firm to qualify for inclusion in the sample, it had to meet predefined sample selection criteria. The reason for this was to help mitigate against certain problems that may be associated with firms in some industries or firms with some attributes. Specifically, for a firm to qualify for inclusion in the sample, the following criteria had to be met:¹³

1. The firm must be a TSE listed firm.
2. The firm should not be engaged in mining and exploration without production, and gold and precious minerals extraction. The reason for excluding these firms is because of the fact that their valuation may be largely contingent upon the quantum of deposits (or expected deposits) they have, and not upon fundamental variables.
3. The firm must not belong to the following industries: utilities, financial services and insurance. The reason for their exclusion is because the relationship between value and accounting numbers is very different for these firms compared to firms in other industries (see for example Rees, 1997 and Fama and French, 1992).¹⁴
4. The firm must have (at the end of the fiscal year) all required data including, but not limited to, book values, price, earnings, and cash flows in the Stock Guide database.

¹³ Essentially, these selection criteria are along the same lines as those outlined in Li (1995) and Srivastava (1996).

¹⁴ Sample selection criteria 2 and 3 effectively excluded the following Stock Guide-classified industry numbers: #10, 11, 13, 14, 77, 79, 90, 92, 95, 96, and 97.

5. The firm must have (i) traded year-end closing price of at least \$1.0 in 1989 dollars, (ii) total annual revenue of at least \$1.5 million in 1989 dollars, and (iii) year-end total assets base of at least \$3.0 million in 1989 constant dollars. All dollars are denominated in Canadian funds. The reasons for these size conditions are manifold. First, these conditions will weed out thinly traded stocks whose residuals are reported to be serially correlated. Second, this will eliminate very small companies, thus leaving a sample of stocks more representative of those firms from which institutional investors choose.

Table 3 summarizes the number of firms selected in each year by applying the sample selection criteria. The firms are reclassified into a condensed group, which is motivated and based on the 14 industry groups identified for the classification of TSE 300 composite index firms. See Appendix C for the reclassification of Stock Guide industry groups into condensed groups.

Table 3: Distribution of Sample by Condensed Group and by Year

Condensed Group	1992	1993	1994	1995	1996	Total
Oil & Gas	42	69	80	83	117	391
Paper & Forest Products	18	20	23	24	25	110
Consumer Products	39	49	51	62	69	270
Industrial Products	83	110	129	142	172	636
Real Estates	16	14	18	21	25	94
Transportation & Environmental Services	8	12	13	16	15	64
Pipelines	3	3	3	3	3	15
Communications & Media	24	29	34	37	41	165
Merchandising	46	58	64	70	75	313
Conglomerates	6	6	7	7	6	32
Total	285	370	422	465	548	2,090

Sampled firms by industry and by year. Outliers deleted were defined as the top and bottom 0.5% of cases for earnings per share, price and book value per share as well as cases with yearly studentized residuals greater than 4 (in absolute value terms) in the basic EBO model. The industry classification is based on the Toronto Stock Exchange's (TSE) 14-industry group classification.

Chapter Five: Empirical Results

At the onset, the study set out to test a number of stock pricing models so as to determine the extent to which fundamental variables are linked to stock prices. The results of this study's empirical evaluation of the stock pricing models are presented and discussed in this chapter. Table 4 summarizes the major findings of the study. See Appendix A for definitions of the variables used in testing the different models. For simplicity, only the significance levels of the variables, the R^2 and adjusted R^2 of the different models, the sign of the regression coefficients and whether or not the results are consistent with expectations are indicated. The details and discussion are presented in different sections of this chapter.

Table 4: Summary of Findings

	Price	Price	Price	Price	Price	Price	Price	MV/Cap	MV/Cap	MV/Cap	P/B	P/E	P/S
Book Value	***,-,C	-	***,-,C	***,-,C	***,-,C	***,-,C	-	-	-	-	-	-	-
Earnings	***,-,C	-	-	-	-	-	-	-	-	-	-	-	-
Dividends	-	***,-,C	-	-	-	-	-	-	-	-	-	-	-
Retained Earnings	-	***,-,C	-	-	-	-	-	-	-	-	-	-	-
Total Debt	-	***,-,C	-	-	-	-	-	-	-	-	-	-	-
Total Capital	-	***,-,C	-	-	-	-	-	-	-	-	-	-	-
Investment	-	***,-,C	-	-	-	-	-	-	-	-	-	-	-
Abn. Earnings, $\tau=1$	-	-	***,-,C	-	-	-	-	-	-	-	-	-	-
Abn. Earnings, $\tau=2$	-	-	-	-	-	-	-	-	-	-	-	-	-
Abn. Earnings, $\tau=3$	-	-	-	-	-	-	-	-	-	-	-	-	-
Abn. Earnings, $\tau=4$	-	-	-	-	-	-	-	-	-	-	-	-	-
EPS*(P/E) or (EVCPS)*(P/E)	-	-	-	***,-,C	***,-,C	(***,-,C)	(***,-,C)	-	-	-	-	-	-
DV/(DVYLD _{industry})	-	-	-	***,-,C	***,-,C	***,-,C	***,-,C	-	-	-	-	-	-
(BV)*(BVM)	-	-	-	-	***,-,C	***,-,C	***,-,C	-	-	-	-	-	-
(EVC*/c)/Capital	-	-	-	-	-	-	-	***,-,C	-	-	-	-	-
(EVC/c)/Capital	-	-	-	-	-	-	-	***,-,C	-	-	-	-	-
ln(Capital)	-	-	-	-	-	-	-	***,-,C	***,-,C	***,-,C	-	-	-
(NOPAT*/c)/Capital	-	-	-	-	-	-	-	***,-,C	***,-,C	-	-	-	-
(NOPAT/c)/Capital	-	-	-	-	-	-	-	***,-,C	***,-,C	-	-	-	-
(FCF*/c)/Capital	-	-	-	-	-	-	-	-	***,-,C	-	-	-	-
(FCF/c)/Capital	-	-	-	-	-	-	-	-	***,-,C	-	-	-	-
Beta	-	-	-	-	-	-	-	-	-	-	Insig.	Insig.	***,-,C
Earnings Growth	-	-	-	-	-	-	-	-	-	-	***,-,C	Insig.	***,-,C
ROE	-	-	-	-	-	-	-	-	-	-	Insig.	-	-
Payout	-	-	-	-	-	-	-	-	-	-	Insig.	***,-	Insig.
Margin	-	-	-	-	-	-	-	-	-	-	-	-	***,-,I
R ²	0.5718	0.6227	0.565	0.5738	0.6053	0.6443	0.6173	0.2964	0.2906	0.2078	0.014	0.5463	0.2197
Adj. R ²	0.5714	0.6218	0.557	0.5732	0.6048	0.6401	0.6127	0.2952	0.2893	0.2064	0.009	0.5443	0.2157

*** means significant at the 1% level; ** means significant at the 5% level; Insig. means the coefficient is insignificant; the plus (+) sign means the coefficient is positive; the minus (-) sign indicates that the regression coefficient is negative; the C means the coefficient is consistent with expectations; I means the coefficient is inconsistent with expectations; the column headings are the dependent variables and the row titles are independent variables. This implies that each model is read column-wise.

5.1 EBO Models

5.1.1 EBO Models based on Historical Financial Information

Basic EBO Model

Tables 5 and 6 present descriptive statistics and Pearson's correlations for the variables used in the EBO models based on historical financial information. An examination of the descriptive statistics (reported in Table 5) indicates that over the five-year period of this study, Canadian companies, on average, earned positive earnings per share (EPS). Of the EPS of 41¢ that Canadian companies earn on average, 13¢ per share are paid out as dividends to ordinary shareholders and 28¢ per share are retained. The

average stock price is about \$9.14. While the average book value per share is about \$5.65, the debt per share is \$5.56 – making the total capital per share to equal \$11.21. It appears that Canadian companies are highly indebted, having on average, a dollar of debt for every dollar of equity (i.e. book value of equity). The table of descriptive statistics also shows that Canadian companies are not myopic because they have not relegated capital expenditures to the background. Over the five years of this study, Canadian companies on average incurred capital expenditures per share of about \$1.77.

Except for the dividend variable (which has a median of zero), the means and medians of the other variables are close to each other. A median of zero on dividends is not a phenomenon peculiar to Canada alone. Hand and Landsman (1999) in their study of U.S. firms noted that the “percentage of firms paying dividends has plummeted from a high of 72% in 1977 to only 31% in 1996.” From their study, the average percentage of firms paying dividends for the 1992-1996 period is about 33% while the average in this study is about 37%. For simplicity, discussion of the median values in the rest of this study will be provided only if they are radically different from the mean values.

Table 5: Descriptive Statistics for the Basic EBO Model

Variable	Mean	Median	Standard Deviation
Sample = 2,090			
Price (P)	9.144	7.178	7.253
Earnings per share (EPS)	0.406	0.306	0.770
Book Value per share (BV)	5.651	4.024	5.177
Dividends per share (DV)	0.130	0.000	0.389
Retained Earnings per share (RE)	0.277	0.245	0.783
Total Capital per share (BV+TD)	11.209	6.693	19.403
Total Debt per share (TD)	5.559	1.969	17.190
Capital Investments per share (IV)	1.765	0.799	3.134

The correlation matrix (Table 6) reveals that the correlation coefficients among the explanatory variables are generally quite low with the exception of the correlation between total capital per share and total debt per share. In models that include both of these variables as explanatory variables, this high correlation (.97), which is a clear manifestation of multicollinearity, may potentially lead to variance inflation and some instability in the estimated coefficients. As will be seen later, these two variables are indeed, in a collinear relation with each other since the variance inflation factors (VIFs) associated with these variables are generally higher than the recommended maximum¹⁵ level of VIFs for which no action is required. This extreme case of multicollinearity led to the implementation of ridge regression in this study.¹⁶

Table 6: Pearson Correlations

	P	EPS	RE	DV	BV [BV+TD]	TD
EPS	0.560					
RE	0.385	0.875				
DV	0.334	0.218	-0.282			
BV	0.713	0.473	0.283	0.367		
[BV+TD]	0.306	0.125	-0.002	0.251	0.536	
TD	0.131	-0.001	-0.087	0.173	0.304	0.967
IV	0.393	0.249	0.176	0.138	0.387	0.287
						0.207

For the remaining models to be tested in this study, Pearson's Correlations tables for a particular model will only be produced if there is a high correlation between any two explanatory variables in that model. This is to ensure brevity.

Other model diagnostics were obtained in order to determine the presence or otherwise of problems in the estimated models. A look at the normal probability plot of the standardized residuals (Appendix D) does not suggest the violation of the normality

¹⁵ Studenmund (1992) noted that while VIFs greater than 5 is commonly used as a rule of thumb to conclude that multicollinearity is severe, he observed that other authors have suggested 10 as the maximum threshold, indicating that VIFs greater than 10 should induce some action.

assumption. The maximum Cook Distance statistic is 0.057 – significantly lower than the suggested threshold of 1. This provides us with the assurance that there are no influential data points that could have potentially impacted on regression coefficients. For consistency with the published literature on stock pricing (e.g. Collins et al., O’Byrne, etc.), this study adopted the standard way of dealing with outliers.

The results of the basic EBO model are reported in Table 7. A two-tier estimation technique was adopted for the basic EBO model. The first tier involved estimation of the model on the pooled sample, while the second tier entailed the estimation of the model on a yearly basis.

¹⁶ Other correlations (e.g. EPS and RE), though higher, are not talked about because the variables concerned were not included together in the same model.

Table 7: Results of the Basic EBO Model

	a_0	a_1	a_2	R^2	Adj. R^2	Cases
Pooled Sample	3.477	2.702	0.809	0.5718	0.5714	2090
<i>t-stat</i>	23.44***	12.85***	25.37***			
<i>VIF</i>		1.29	1.29			
1992	3.343	2.232	0.781	0.5864	0.5834	285
<i>t-stat</i>	9.75***	5.33***	12.76***			
<i>VIF</i>		1.03	1.03			
1993	3.582	2.956	0.864	0.5965	0.5943	370
<i>t-stat</i>	11.49***	5.08***	10.85***			
<i>VIF</i>		1.20	1.20			
1994	3.05	2.80	0.72	0.6451	0.6434	422
<i>t-stat</i>	9.76***	6.86***	10.1***			
<i>VIF</i>		1.40	1.40			
1995	3.731	1.891	0.764	0.5176	0.5155	465
<i>t-stat</i>	11.34***	4.41***	10.68***			
<i>VIF</i>		1.56	1.56			
1996	3.524	4.094	0.848	0.6000	0.5986	548
<i>t-stat</i>	11.46***	8.28***	12.3***			
<i>VIF</i>		1.51	1.51			

The estimated model is:

$$P_{it} = a_0 + a_1 E_{it} + a_2 BV_{it} + e_{it}$$

The *t*-statistics are based on White's heteroscedastic consistent standard errors. *** means significant at the 1% level. Outliers deleted were defined as the top and bottom 0.5% of cases for earnings per share, price and book value per share as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).

An examination of the regression coefficients in Table 7 reveals that the coefficients are of the expected signs and of magnitudes comparable to those reported in U.S. studies. The coefficients of earnings per share and book value per share (in the pooled regressions as well as the yearly regressions) are positive – indicating positive relationships between these variables and stock price – which are congruent with what was expected *ex ante*. The pooled sample coefficients of 2.702 on earnings and 0.809 on book value¹⁷ are quite similar to the 3.44 earnings coefficient and 0.92 book value coefficient reported by Collins et al. (1997) for U.S. firms over the 1983-93 period.

¹⁷ In this section, reference to any of the variables is on a per share basis unless otherwise stated.

However, they are not too close, especially the earnings coefficient, to those reported by Rees (1997) using U.K. data. Rees reported a coefficient of 4.045 on earnings and 0.569 on book value. Even though one cannot be conclusively assertive (since the two studies cover different periods), it can be reasonably stated that U.K. equity investors emphasize more on earnings and less on book value in comparison to Canadian investors. The t-statistics, which are based on White's (1980) heteroscedastic consistent standard errors, show that the results are highly significant even at the 0.01 level.

Except for the 1995 and 1996 coefficients on earnings, an inspection of the yearly results shows that the coefficients on book value and earnings are generally stable and comparable to those of the pooled regression. Since neither interdependence of errors nor non-stationarity in data are problems of yearly cross-sectional regressions, financial econometricians (e.g. Rees, 1997) suggest the comparison of yearly results to pooled results in order to gauge whether or not these problems may be present in the pooled regressions. Since the yearly results of this study are very similar to the pooled results, one can conclude that neither interdependence nor non-stationarity in the data will significantly affect the results of the pooled regressions. For the remaining models to be tested in this study, results of the yearly regressions will only be reported if the yearly estimates do not appear to be stable, and are radically different from the pooled regression estimates.

In connection with the constant term, price level valuation theory has not suggested a reasonable magnitude. As a result, it is difficult to tell if the intercepts in the various models in this study are too high or do suggest the possibility of omitted variables. Compared to Rees' (1997) study, the intercept in this study's basic EBO model

is generally higher than the 0.8 intercept reported by Rees. However, because most of the U.S. studies do not report either the magnitude or the significance of the constant term, it is very difficult to compare the magnitudes of the constant term in Canada and the U.S. Only Bernard (1995) reported the magnitude of the constant term in his empirical evaluation of the EBO model using forecasted earnings. In order not to compare apples and oranges, it is important to compare the EBO intercept based on forecasted earnings to his results. This study reports a constant term of 2.8 while the intercept reported by Bernard is 5.8. By all accounts, the intercept reported by Bernard is larger than this study's intercept.

The basic EBO model has a satisfactory explanatory power. Both the R^2 and adjusted R^2 of the pooled sample are 57%. The R^2 of 57% implies that 57% of the variation in price (the dependent variable) is accounted for by variation in earnings and book value (the independent variables). This R^2 is slightly higher than the 54% R^2 reported by Rees. The yearly R^2 s range from 52% in 1995 to 65% in 1994. It is worth noting that apart from 1995 and 1994, the yearly R^2 s are generally close to the pooled sample's R^2 of 57%.

The correlation between earnings and book value is low, suggesting that multicollinearity is not a problem in this model. To further ensure that multicollinearity is not a problem, there is the need to obtain the variance inflation factors (VIFs). The VIFs are used to detect the severity of multicollinearity by revealing the degree to which one independent variable can be explained by all the other predictor variables in the regression equation. The higher the VIFs, the more severe the problem of multicollinearity. While most econometricians argue that one needs to be concerned with

multicollinearity when the VIF is greater than 10, others have suggested a threshold of 5. From Table 7, the VIFs are generally low, with the highest being 1.6, suggesting that multicollinearity is not a problem in this basic EBO model.

An estimation of a variant of the basic EBO model where earnings was replaced with free cash flows to equity did not yield good results (see Appendix E). The free cash flow coefficient was not statistically different from zero. Also, the model had a slightly lower explanatory power, with an R^2 of 54%.

Extended EBO Models

Table 8 reports the results of the extended EBO models (which are based on historical financial information). To facilitate the comparison of the results of this study with Rees' (1997) results, the models are run on the pooled sample. The table incorporates the results of the basic EBO model (restated in the first column), the 'full' EBO model suggested by Rees (1997), and a number of partial versions of the 'full' model. The full and partial models are discussed in the ensuing paragraphs. Rees argued that the partial versions of the full model would help in determining the sensitivity of results to alternative specifications. A scan of Table 8 indicates that the coefficients of the variables and their significance are quite stable across the different specifications. The models also have good explanatory power with both R^2 's and adjusted R^2 's ranging from 58% to 62%.

Table 8: Tests of Extended EBO Models

	Basic	Dividend	Debt	Dividend & Debt	Capital Investment	Full
Intercept	3.477	3.506	3.495	3.505	3.291	3.324
<i>t</i> -stat	23.44***	24.83***	24.66***	24.86***	21.57***	21.78***
E	2.702	-	2.560	-	2.587	-
<i>t</i> -stat	12.85***	-	12.59***	-	12.6***	-
VIF	1.29	-	1.33	-	1.34	-
DV	-	4.017	-	3.970	-	3.641
<i>t</i> -stat	-	8.36***	-	8.06***	-	7.98***
VIF	-	1.43	-	1.42	-	1.45
RE	-	2.597	-	2.533	-	2.356
<i>t</i> -stat	-	13.21***	-	12.9***	-	11.68***
VIF	-	1.34	-	1.38	-	1.44
IV	-	-	-	-	0.233	0.404
<i>t</i> -stat	-	-	-	-	3.11***	6.12***
VIF	-	-	-	-	1.21	1.51
BV	0.809	0.760	-	-	0.783	-
<i>t</i> -stat	25.37***	23.64***	-	-	23.75***	-
VIF	1.29	1.42	-	-	1.50	-
BV+TD	-	-	0.821	0.788	-	0.779
<i>t</i> -stat	-	-	26.11***	23.79***	-	23.12***
VIF	-	-	20.51	22.30	-	9.10
TD	-	-	-0.843	-0.810	-	-0.859
<i>t</i> -stat	-	-	-24.09***	-22.72***	-	-19.7***
VIF	-	-	20.20	21.46	-	7.84
R ²	0.5718	0.5908	0.5843	0.5923	0.6103	0.6227
Adj. R ²	0.5714	0.5902	0.5837	0.5915	0.6097	0.6218
Cases	2090	2080	2081	2080	2022	2021
b ₁ - b ₂ = 0		10.20		9.80		9.50
<i>p</i> -value		[0.00]		[0.00]		[0.00]
b ₃ - b ₄ = 0			635.99	544.97		467.25
<i>p</i> -value			[0.00]	[0.00]		[0.00]

The full model estimated is:

$$P_{it} = b_0 + b_1 DV_{it} + b_2 RE_{it} + b_3 (BV_{it} + TD_{it}) - b_4 TD_{it} + b_5 IV_{it} + e_{it}$$

The *t*-statistics are based on White's (1980) heteroscedastic consistent standard errors. The tests of the equality of beta coefficients are Chi-square tests using asymptotic standard errors of parameter estimates, which are also based on White's heteroscedastic consistent covariance matrices. *** means significant at the 1% level. Outliers deleted were defined as the top and bottom 0.5% of cases for earnings per share, price and book value per share as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).

Financial Variables in Stock Pricing: Dividends

The role of dividends in stock pricing has received a great deal of attention in the literature, albeit, without a unified conclusion. Opposing views have emerged from the literature. On one hand, dividends are said to be value relevant (e.g. Gordon, 1962), and on the other, dividends are seen to affect neither current stock price nor returns to shareholders (e.g. Miller and Modigliani, 1961).

Financial economists (e.g. Rees, 1997) who use levels models and are interested in testing the value relevance of dividends generally separate earnings into two components – dividends and retained earnings. For dividends to signal value, its coefficient should not only be significantly different from zero, but it should as well be significantly greater than the retained earnings coefficient.

The second column, fourth column and sixth column of Table 8 present models that incorporate the dividend variable. As can be seen from the table, both the dividends and retained earnings coefficients are significantly different from zero, with the dividend coefficient being greater than the retained earnings coefficient. Using Chi-square tests based on consistent covariance matrices, the hypothesis that the dividend coefficient is equal to the retained earnings coefficient is convincingly rejected at the 0.01 level in all the models that include the dividend and retained earnings variables. The results of this study show that investors of TSE listed stocks consider the levels of dividends in the determination of stock prices. This could imply that the market regards dividends as a medium used by firms to signal their current and long-term financial health and prospects. In a world characterized by information asymmetry, therefore, dividends can be a credible way of signaling to the market, firms' management private information

about the future prospects of their firms. This finding also indicates that the dividend displacement notion (which hypothesizes a negative relationship between dividends and price) is rejected in this study. It is worth noting that the findings here are consistent with those reported by Rees (1997) and Hand and Landsman (1999).

It is also evident from Table 8 that the coefficient on book value falls from 0.809 (in the basic model) to 0.760 (in the dividend model in column two). Rees (1997) noted that one implication of Ali and Zarowin's (1992) analysis is that book value of equity would be expected to play a stronger role in stock pricing where earnings include a substantial transitory component. It can be concluded from this finding (which is consistent with those reported by Rees) that payment of a high level of dividends is indicative of the fact that earnings is of a more permanent nature and not transitory.¹⁸

Hand and Landsman (1999), in their study, explored two plausible propositions for a positive relation between dividends and value: profitability signaling and free cash flow mitigation. In relation to the profitability-signaling hypothesis, the authors opine that managers use dividends as a costly but credible signal of their private information. Their expectation, in this case, is that the dividend effect will be more valuable for firms experiencing losses than for firms with positive current earnings. According to the authors, the free cash flow mitigation hypothesis posits that "managers have private information about the agency costs of free cash flow generated by the firm, and that by paying dividends can credibly signal that they are high quality managers who are not going to waste free cash flows" (pp. 2-3). Under this scenario, they expect the dividend

¹⁸ Where earnings are transitory, it may be more difficult for companies to maintain a high dividend payout and therefore equity will be more important in the valuation of these companies.

effect to be strong when free cash flow is high, which is most likely when current earnings are positive.

To assess the applicability of the two hypotheses in the Canadian environment, the sample was divided into three groups. One group consists of firms experiencing losses – firms with negative net profit margin. An equal number of firms with the highest net profit margin (net profit as a percentage of sales) were also formed into another group – the group consisting of the most profitable firms. The rest of the companies (those with positive net margins but could not get into the group consisting of the most profitable firms) were then formed into a third group. Table 9 presents the results of this analysis.

Table 9: Tests of the Dividend Model Segmented by Net Margin

	Negative Net Margin Group	Middle Net Margin Group	Top Net Margin Group
Intercept	3.761	2.587	3.809
<i>t</i> -value	13.60***	13.66***	10.57***
RE	0.582	3.091	3.997
<i>t</i> -value	2.19**	8.21***	5.50***
DV	1.614	4.252	6.961
<i>t</i> -value	4.33***	5.52***	6.33***
BV	0.570	0.783	0.703
<i>t</i> -value	9.18***	16.89***	6.26***
R ²	0.3479	0.6589	0.5219
Adj. R ²	0.343	0.6581	0.5183
Cases	400	1280	400
$c_1 - c_2 = 0$	16.29	2.71	7.84
<i>p</i> -value	[0.00]	[0.0998]	[0.00]
DV/RE Ratio	2.77	1.38	1.74

The equation estimated is:

$$P_{it} = c_0 + c_1 DV_{it} + c_2 RE_{it} + c_3 BV_{it} + e_{it}$$

The *t*-statistics are based on White's (1980) heteroscedastic consistent standard errors. The tests of the equality of beta coefficients are Chi-square tests using asymptotic standard errors of parameter estimates. *** means significant at the 1% level; ** means significant at the 5% level. Outliers deleted were defined as the top and bottom 0.5% of cases for earnings per share, price and book value per share as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).

From Table 9, while the hypothesis that the dividend coefficient is equal to the retained earnings coefficient is completely rejected at the 1% level for both the negative

net margin group and the highest net margin group, that hypothesis can only be rejected at the 10% level for the middle net margin group. This signifies that the dividend effect is relatively stronger in the two extreme groups. Additionally, the dividend coefficient for the group with negative net margin is approximately 2.8 times the retained earnings coefficient whilst the highest net margin group has a coefficient on dividends approximately 1.7 times the retained earnings coefficient. The fact that the dividend coefficient is significantly greater than the retained earnings coefficient and larger in proportionate terms for the negative net margin group implies that dividends as a signaling vehicle is very valuable for firms experiencing losses – a result which supports the profitability signaling hypothesis. The results for the highest net margin group also indicate that dividends are a valuable signal for profitable firms, thus supporting the free cash flow mitigation hypothesis. However, the results much strongly support the profitability-signaling hypothesis (1.6 times stronger) than the free cash flow mitigation hypothesis. The results in this study are therefore consistent with Hand and Landsman's (1999) findings.

To determine if alternative profitability segmentation could impact this study's results, the dividends signal was also explored using return on equity (ROE) instead of net income as a percentage of sale (net profit margin). Firms with negative ROE were formed into one group and an equal number of firms with the highest ROE were formed into a second group. Firms in the middle were also formed into a third group. The results of such segmentation are shown in Table 10.

Table 10: Tests of the Dividend Model Segmented by ROE

	Negative ROE	Middle ROE	High ROE
Intercept	3.767	2.697	3.713
<i>t-value</i>	13.33***	14.00***	9.88***
RE	0.598	3.851	2.388
<i>t-value</i>	2.15**	7.43***	2.89***
DV	1.629	4.801	5.351
<i>t-value</i>	4.29***	5.62***	3.6***
BV	0.571	0.742	0.843
<i>t-value</i>	8.95***	13.85***	3.7***
R ²	0.3413	0.657	0.4435
Adj. R ²	0.3362	0.6562	0.4392
Cases	393	1282	393
$c_1 - c_2 = 0$	16.32	1.70	5.45
<i>p-value</i>	[0.00]	[0.19]	[0.02]
DV/RE Ratio	2.73	1.25	2.24

The equation estimated is:

$$P_{it} = c_0 + c_1 DV_{it} + c_2 RE_{it} + c_3 BV_{it} + e_{it}$$

The *t*-statistics are based on White's (1980) heteroscedastic consistent standard errors. The tests of the equality of beta coefficients are Chi-square tests using asymptotic standard errors of parameter estimates. *** means significant at the 1% level; ** means significant at the 5% level. Outliers deleted were defined as the top and bottom 0.5% of cases for earnings per share, price and book value per share as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).

The results are essentially the same as those based on net profit margin. The ratio of the dividend coefficient to the retained earnings coefficient is higher for the two extreme groups than the middle group – suggesting that the dividend signal is strong for loss-making firms and for highly profitable firms. This supports both the profitability signaling and free cash flow mitigation hypotheses. However, the profitability-signaling hypothesis is much stronger (1.22 times stronger) than the cash flow mitigation hypothesis. The results of this alternative definition of profitability are therefore consistent with Hands and Landsman (1999). For the middle ROE group, however, while the dividend coefficient is significantly different from zero, its magnitude is statistically the same as the retained earnings coefficient – implying that for this group, the dividend signal is not very valuable. The consistency of findings, despite the use of different profitability measures, shows that the results are fairly robust.

Rees (1997) also argued that signals of value are expected to be particularly influential in the presence of severe information asymmetry, and that information asymmetry is expected to be inversely related to firm size. He hypothesizes that stronger dividend signaling is expected for small firms. To test this hypothesis, the total sample was segmented into three separate samples based on market capitalization. One sample is made up of cases with the lowest 25% market capitalization, a second sample composed of observations falling in the highest 25% market capitalization quartile and a third sample consisting of the middle 50% of the cases (see Table 11).

Table 11: Tests of the Dividend Model Segmented by Market Capitalization

	Low 25%	Middle 50%	High 25%
Intercept	1.960	4.192	7.539
<i>t-value</i>	23.56***	23.15***	17.70***
RE	1.072	1.577	3.040
<i>t-value</i>	6.79***	7.44***	7.71***
DV	2.301	2.374	4.533
<i>t-value</i>	6.76***	7.43***	5.13***
BV	0.405	0.694	0.605
<i>t-value</i>	12.68***	19.68***	9.63***
R ²	0.6882	0.5091	0.5156
Adj. R ²	0.6864	0.5077	0.5127
Cases	520	1040	520
$c_1 - c_2 = 0$	16.66	10.68	2.89
<i>p-value</i>	[0.00]	[0.00]	[0.09]
DV/RE Ratio	2.15	1.51	1.49

The equation estimated is:

$$P_{it} = c_0 + c_1 DV_{it} + c_2 RE_{it} + c_3 BV_{it} + e_{it}$$

The *t*-statistics are based on White's (1980) heteroscedastic consistent standard errors. The tests of the equality of beta coefficients are Chi-square tests using asymptotic standard errors of parameter estimates. *** means significant at the 1% level. Outliers deleted were defined as the top and bottom 0.5% of cases for earnings per share, price and book value per share as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).

As can be seen from Table 11, the dividend signal is very strong for the lowest capitalization group (with 25% of cases) and the middle capitalization group (with 50% of cases). For these two groups, the hypothesis that the dividend coefficient is equal to the retained earnings coefficient is strongly rejected at the 1% significance level in favor

of the conclusion that the dividend coefficient is greater than the retained earnings coefficient. However, the same hypothesis can only be rejected at the 10% level for the sample with the highest 25% market capitalization. What is more interesting is the fact that the ratio of the dividend coefficient to the retained earnings coefficient is 2.15 for the lowest capitalization group – which is higher than the ratio of 1.51 for the middle group. The middle group's ratio is also higher than the ratio for the highest capitalization group. The dividend signal is therefore stronger for 'smaller' companies than for 'medium' companies and also stronger for 'medium' companies compared to the 'biggest' companies. These results, thus, support Rees' proposition that signals of value are expected to be particularly stronger where information asymmetry is severe. While the results in this study are totally supportive of the 'information asymmetry' hypothesis, Rees' (1997) own findings could only lend partial support to this hypothesis but were not consistently in accord with the hypothesis.

This study also explored the dividend model from another angle – which, for the sake of brevity, will be referred to as the 'growth' angle. For the purposes of testing the dividend signal from the growth angle, growth was obtained by subtracting the sum of book value and the perpetual value of current economic profit or economic value created (EVC) from current market value, and this difference expressed over market value. The use of this proxy is based on Miller and Modigliani's (1961) argument that a firm's value can be broken down into two components: one component is associated with the assets currently held by the company and the other is related to the value of its growth

opportunities.¹⁹ To ascertain whether or not the dividend signal is much stronger for firms with low growth rates than for those with high growth rates, the total sample was segmented into three sub-samples, with each sub-sample being formed into a group. One group contains firms with negative growth rates. An equal number of firms with the highest growth rates were formed into a different group. The remaining firms were formed into a third group (the middle growth firms). The results of this segmentation are reported in Table 12.

Table 12: Tests of the Dividend Model Segmented by Growth

	Negative Growth	Middle Growth	Highest Growth
Intercept	3.624	4.062	2.428
<i>t-value</i>	6.93***	12.36***	6.59***
RE	0.994	2.980	-0.222
<i>t-value</i>	4.25***	4.32***	-5.48***
DV	7.933	6.477	2.212
<i>t-value</i>	26.17***	5.55***	1.14
BV	0.401	0.687	0.545
<i>t-value</i>	4.19***	7.26***	5.49***
R ²	0.8396	0.5985	0.4631
Adj. R ²	0.8374	0.5975	0.4559
Cases	228	1234	228
$c_1 - c_2 = 0$	655.03	14.23	1.58
<i>p-value</i>	[0.00]	[0.00]	[0.21]
DV/RE Ratio	7.98	2.17	

The equation estimated is:

$$P_{it} = c_0 + c_1 DV_{it} + c_2 RE_{it} + c_3 BV_{it} + e_{it}$$

The *t*-statistics are based on White's (1980) heteroscedastic consistent standard errors. The tests of the equality of beta coefficients are Chi-square tests using asymptotic standard errors of parameter estimates. *** means significant at the 1% level. Outliers deleted were defined as the top and bottom 0.5% of cases for earnings per share, price and book value per share as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).

The results in Table 12 are very interesting. The dividend signal is very strong, both in absolute terms and in relative terms for firms experiencing negative growth. The dividend coefficient is 7.98 times the retained earnings coefficient for the negative

¹⁹ In the literature (see O'Byrne 1996 for example), the growth value has been defined to equal the

growth sample. For the middle growth companies, the dividend coefficient is 2.17 times the retained earnings coefficient. For the group with the highest growth rate, the dividend signal is not even significant. For this group, the dividend coefficient is not significantly different from zero, indicating that the dividend signal is not valuable for high growth companies. The implication emanating from this finding is that high growth firms should concentrate on reinvesting internally generated funds than paying dividends while low growth firms should consider dividend policy as one corporate strategy, in their portfolio of strategies, that could lead to shareholder wealth creation.

To test the sensitivity of the study's sub-sampling to alternative segmentation, the total sample was re-segmented, this time, into quartiles based on the growth proxy. The 25% of companies that had the lowest growth rates were formed into a group. A second group was formed consisting of the 25% of companies with the highest growth rates. The remaining 50% of companies were also formed into a group. The results of this alternative segmentation are shown in Table 13.

difference between market value and the sum of book value of capital and the present value of current economic profit.

Table 13: Tests of the Dividend Model Alternatively Segmented by Growth

	Low 25%	Middle 50%	High 25%
Intercept	3.827	3.700	3.193
<i>t-value</i>	8.49***	11.06***	10.24***
RE	1.031	4.716	-0.20838
<i>t-value</i>	3.17***	5.03***	-5.85***
DV	8.075	6.628	2.671
<i>t-value</i>	15.89***	4.56***	1.62
BV	0.472	0.693	0.670
<i>t-value</i>	5.55***	5.78***	9.46***
R ²	0.7843	0.6395	0.4217
Adj. R ²	0.7827	0.6382	0.4176
Cases	423	844	423
C ₁ – c ₂ = 0	191.14	4.03	3.08
<i>p-value</i>	[0.00]	[0.04]	[0.08]
DV/RE Ratio	7.83	1.41	

The equation estimated is:

$$P_{it} = c_0 + c_1 DV_{it} + c_2 RE_{it} + c_3 BV_{it} + e_{it}$$

The *t*-statistics are based on White's (1980) heteroscedastic consistent standard errors. The tests of the equality of beta coefficients are Chi-square tests using asymptotic standard errors of parameter estimates. *** means significant at the 1% level. Outliers deleted were defined as the top and bottom 0.5% of cases for earnings per share, price and book value per share as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).

As can again be seen from the table, the results are essentially the same – the dividend signal is highest for the lowest growth companies, followed by companies whose growth rates fall in the middle 50%. For the highest growth companies, the dividend coefficient is again statistically indistinguishable from zero. These sensitivity results indicate that the sub-sampling techniques used in this study are fairly robust.

Financial Variables in Stock Pricing: Debt

The use of debt as a signal of value has received some attention in the finance literature (e.g. Ross, 1977). One argument presented is that the management of successful corporations has an incentive to, and might choose financial variables like dividend policy and/or financial leverage as vehicles of signaling to the investing public the future prospects of their firms. Additional to the incentive of being truthful, the management of unsuccessful firms cannot imitate the actions of their successful counterparts since they

do not have sufficient cash flows to meet the ‘commitments’ of financial leverage and dividend policy.

Rees (1997) asserts that if debt signals value, then total capital (book value plus total debt) should be positively related to price and non-equity capital (total debt) should be negatively related to price. As well, the absolute value of the total capital coefficient should be significantly larger than the absolute value of the coefficient on debt. Columns three, four and six of Table 8 present models that incorporate the debt variable.²⁰

In each of the models, the coefficients on total capital and total debt are significantly different from zero. Also, the total capital coefficient is positive in every single situation while the coefficient on total debt is negative in every situation. However, the hypothesis that the absolute value of the total capital coefficient is significantly larger than the absolute value of the debt coefficient is persuasively rejected at the 0.01 level. In every situation, the absolute value of the total debt coefficient is significantly larger than the absolute value of the total capital coefficient. The findings in this thesis differ from Rees’ (1997). He found the absolute values of the two coefficients to be statistically the same. There are two plausible explanations for the findings in this study.

The first explanation may be that the level of debt sends a negative signal to the stock market. Since this may be true in some cases²¹, it was deemed necessary to further explore the debt model. The total sample was once again grouped into three samples based on the debt-to-equity (i.e. book value of equity) ratio. All firms that had a debt to

²⁰ Although the discussion of the debt results may be adversely affected by multicollinearity, the generalizability is helped by the fact that ridge regression results provide corroborating evidence.

²¹ For instance when a company uses too much debt, the chances of bankruptcy increase because of the possibility that the company may fail to meet its interest commitment and creditors may, as a result, force the company into bankruptcy.

equity ratio greater than one²² were thought to have too much debt and were therefore formed into one group. An equal number of companies with the lowest debt to equity ratios were also composed into another group while the remainder of the companies were put into a third group. The results of this segmentation are presented in Table 14.

Table 14: Tests of the Debt Model Segmented by Debt-to-Equity Ratio

	Low D/E Group	Middle Group	High D/E Group (D/E>1)
Intercept	4.279	3.064	2.990
<i>t-stat</i>	16.82***	15.14***	10.51***
E	3.195	2.469	2.278
<i>t-stat</i>	7.16***	7.86***	7.15***
<i>VIF</i>	1.44	1.35	1.21
[BV + TD]	0.762	1.030	0.834
<i>t-stat</i>	14.96***	13.86***	12.13***
<i>VIF</i>	1.55	10.66	67.71
TD	-0.647	-1.369	-0.850
<i>t-stat</i>	-7.10***	-7.98***	-11.66***
<i>VIF</i>	1.15	9.70	67.57
R ²	0.5644	0.6089	0.5814
Adj. R ²	0.5621	0.6076	0.5793
Cases	579	922	580
d ₁ - d ₂ = 0	128.56	98.13	141.47
<i>p-value</i>	[0.00]	[0.00]	[0.00]

The model estimated is:

$$P_{it} = d_0 + d_1(BV_{it} + TD_{it}) - d_2TD_{it} + d_3E_{it} + e_{it}$$

The *t*-statistics are based on White's (1980) heteroscedastic consistent standard errors. The tests of the equality of beta coefficients are Chi-square tests using asymptotic standard errors of parameter estimates. *** means significant at the 1% level. Outliers deleted were defined as the top and bottom 0.5% of cases for earnings per share, price and book value per share as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).

For the low debt to equity (D/E) ratio group, the absolute value of the total debt coefficient is significantly smaller than the absolute value of the coefficient on total capital. This result is congruent with the hypothesis that debt signals value. However, for the middle group and high debt/equity group, the absolute value of the debt coefficient is significantly larger than the absolute value of the total capital coefficient. These results

²² The use of one as the cutoff point is to ensure that there is enough cases in the groups so as to circumvent problems related to small samples.

may indicate that while the market views debt as a positive signal of future performance for firms with low debt/equity ratio, more debt by highly leveraged firms could increase the probability of bankruptcy, which could be detrimental to equity holders, and hence the reason why investors of TSE listed stocks may be perceiving the debt of highly leveraged companies as a negative signal of value.

The sensitivity of the debt model based on the debt-to-equity ratio was tested, this time however, instead of using book value of equity, the market value of equity was used. Firms with a debt-to-market value of equity ratio greater than 1 were formed into one group. An equal number of firms with the lowest debt-to-market value of equity ratio were formed into a second group. A third group was formed consisting of the middle cases. Results of this redefinition are presented in Table 15.

Table 15: Tests of the Debt Model Segmented by Debt-to-Market Value of Equity Ratio

	Low D/E Group	Middle Group	High D/E Group (D/E>1)
Intercept	4.633	2.672	2.427
<i>t-stat</i>	14.55***	16.91***	9.87***
E	3.361	2.161	1.595
<i>t-stat</i>	6.02***	8.63***	5.61***
VIF	1.37	1.53	1.12
[BV + TD]	0.721	0.806	0.610
<i>t-stat</i>	9.63***	18.4***	12.11***
VIF	1.40	5.65	57.56
TD	8.698	-0.451	-0.602
<i>t-stat</i>	3.84***	-5.38***	-10.96***
VIF	1.04	4.70	57.47
R ²	0.5233	0.6837	0.6047
Adj. R ²	0.5198	0.6829	0.6017
Cases	409	1262	410
d ₁ - d ₂ = 0	12.23	103.67	133.24
<i>p-value</i>	[0.00]	[0.00]	[0.00]

The model estimated is:

$$P_{it} = d_0 + d_1(BV_{it} + TD_{it}) - d_2TD_{it} + d_3E_{it} + e_{it}$$

The *t*-statistics are based on White's (1980) heteroscedastic consistent standard errors. The tests of the equality of beta coefficients are Chi-square tests using asymptotic standard errors of parameter estimates. *** means significant at the 1% level. Outliers deleted were defined as the top and bottom 0.5% of cases for earnings per share, price and book value per share as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).

An examination of Table 15 reveals that the debt coefficient is negative and statistically smaller (in absolute value terms) than the absolute value of the total capital coefficient for the middle and highest debt-to-market value of equity groups. This implies that debt is a valuable signal for these groups.²³ For the lowest debt-to-market value of equity group, however, the debt coefficient is positive and significantly larger than the total capital coefficient. This implies that for the group with the lowest debt-to-market value of equity ratio, debt is a very valuable signal, and a very dominant variable. These results are consistent with the fact that Canadian companies are, on average, lowly

²³ Though the debt signal appears to be statistically significant for the two groups, the difference between the TD and [BV+TD] coefficients look trivially small for the high D/E ratio group. Therefore, there may be more to the debt signal for this group (e.g. practical significance vs. statistical significance). Future research should be directed at investigating the debt signal in more detail.

leveraged – if leverage is defined based on market value of equity and not book value of equity.

When the debt model was analyzed from the point of view of profitability (ROE used as a proxy for profitability), the hypothesis that debt is positively priced for profitable firms could not be supported. The total sample was partitioned into three separate samples. One sample was made up of firms with negative ROE. An equal number of firms with the highest ROE were grouped into another sample. The remaining companies were classed into a third group. The results of this segmentation are shown in Table 16.

Table 16: Tests of the Debt Model Segmented by ROE

	Negative ROE	Middle ROE	Highest ROE
Intercept	3.699	2.691	3.718
<i>t-stat</i>	12.55***	14.65***	9.37***
E	0.463	3.995	2.152
<i>t-stat</i>	1.58	7.84***	2.47**
VIF	1.07	2.38	4.57
[BV + TD]	0.621	0.783	1.040
<i>t-stat</i>	9.04***	16.28***	4.23***
VIF	59.49	12.75	138.10
TD	-0.637	-0.821	-1.094
<i>t-stat</i>	-8.82***	-15.06***	-4.37***
VIF	59.05	9.33	127.45
R ²	0.3379	0.654	0.4364
Adj. R ²	0.3328	0.6532	0.432
Cases	393	1283	393
d ₁ - d ₂ = 0	79.93	249.40	18.50
<i>p-value</i>	[0.00]	[0.00]	[0.00]

The model estimated is:

$$P_{it} = d_0 + d_1(BV_{it} + TD_{it}) - d_2TD_{it} + d_3E_{it} + e_{it}$$

The *t*-statistics are based on White's (1980) heteroscedastic consistent standard errors. The tests of the equality of beta coefficients are Chi-square tests using asymptotic standard errors of parameter estimates. *** means significant at the 1% level; ** means significant at the 5% level. Outliers deleted were defined as the top and bottom 0.5% of cases for earnings per share, price and book value per share as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).

It was thought that profitable firms may not need debt, and that when they use some debt, in addition to the fact that their weighted average cost of capital falls, they are

also signaling to the market that there are good times ahead. And this should lead to a positive pricing of debt for profitable firms. However, the results do not support this thought. An examination of the table highlights the possibility that debt is negatively priced for profitable firms as well as loss-making firms. The reason for this result may be that the highly profitable firms are on average moderately indebted while the firms experiencing losses are less indebted because the market shies away from debt instruments issued by these firms. The fact that the debt coefficient increases (in absolute value terms) as ROE increases may partly lend support to this assertion.

A second possible explanation for the absolute value of the debt coefficient being larger than the absolute value of the total capital coefficient in all situations (in Table 8) is that extreme multicollinearity is causing some instability in the estimates. The correlation between total debt and total capital is very high suggesting the presence of multicollinearity. A look at the variance inflation factors for these two variables does confirm that they are in a collinear relation, and in the presence of multicollinearity, the possibility of some instability in the results cannot be completely discounted. It is therefore possible that the results in this study are somehow impacted by the multicollinearity.

One way of dealing with the multicollinearity is to drop variables. Thomas et al. (1998), however, noted that dropping variables is not always an appropriate way of dealing with multicollinearity. Ridge regression was therefore implemented.

Figure 1: Ridge Plot

A ridge plot is presented in Figure 1 for the debt only model (column 3 of Table 8). By experimenting with different ridge constants, k s, it was determined that a k value of 0.03 was more appropriate for the debt only model because the VIFs for debt and total capital had reduced to 4.32 and 4.37 respectively. The regression coefficients still have the same signs, and this time, the debt coefficient of -0.368 is lower, in absolute terms, than the total capital coefficient of 0.396. At a ridge constant of about 0.03, parameter estimates for the debt and dividend model (column 4 of Table 8) are also quite stable with VIFs of 4.36 and 4.23 for total capital and total debt, and regression coefficients of 0.367 and -0.345 for total capital and total debt. Finally, with a ridge constant of about 0.03, the total capital and debt variables for the full model have VIFs of 4.20 and 3.71 and coefficients of 0.554 and -0.566 respectively. While no mention will be made of the value relevance of debt under this ridge regression analysis (because of the fact that the ridge procedure introduces a small amount of bias into the regression coefficients), it is worth mentioning that the results of the ridge analysis do not change the conclusions about the

various EBO models. If anything, they add to the robustness of the EBO model results reported so far.

Capital Investment Model

From Table 8, the capital investment variable is positively associated with price and its coefficient is significantly different from zero. This is consistent with the conclusion that the market positively prices capital investment. This finding is in accord with Rees' (1997) findings that capital expenditures signal value.

Overall

The results presented this far show that the EBO models based on historical financial information are quite robust. In addition, the dividend, debt and investment signals are quite valued in Canadian stock markets. The retained earnings, book value and total capital coefficients are also value relevant.

5.1.2 EBO Models based on Forecasted Earnings

An EBO model based on forecasted earnings (the Bernard model) was also tested in this study. However, by using a five-year sample period for this study and assuming that ex-post realized earnings are equal to market participants' ex ante expectations of earnings, the number of years available to be used in testing the Bernard's empirical model was severely restricted. Because Bernard suggested the forecasting of earnings for at least four years, this study could only use the 1992 sample and still get four years of future data (i.e. from 1993-1996). If, for instance, the 1993 sample was to be used in

addition, it will imply that only three years of data going forward will be available, which falls below the threshold suggested by Bernard.

Descriptive statistics for the variables used in testing the Bernard's model are provided in Table 17. In 1992, the average stock, which changed hands at a price of about \$8, had a book value of about \$6. The average abnormal earnings for $\tau=1$ through $\tau=4$ is positive. It has been argued that in a competitive environment, the series of abnormal earnings will converge to zero over time. Based on this argument, the expectation was that the abnormal earnings would gravitate towards zero over the years and not diverge from zero as can be seen from the table. The divergence may be due to the fact that the competitive advantage period in Canada is significantly greater than four years, in which case companies can still reap abnormal earnings beyond four years.

Table 17: Descriptive Statistics for EBO Models based on Forecasted Earnings

Variable	Mean	Median	Standard Deviation
Sample size = 275			
Price	8.218	6.375	6.300
Book Value	5.962	4.268	5.305
Abnormal Earnings, $\tau=1$	0.015	0.092	0.663
Abnormal Earnings, $\tau=2$	0.159	0.185	0.736
Abnormal Earnings, $\tau=3$	0.116	0.088	0.824
Abnormal Earnings, $\tau=4$	0.176	0.149	0.670

The regression results of the EBO models based on forecasted earnings are reported in Table 18. The first column of the table (labeled Model 1) presents results that conform to the model tested by Bernard in his 1995 study. Problems related to data availability made Bernard estimate the equation without a variable for period $\tau=3$. That model is replicated in the first column of Table 18.

Table 18: Tests of the EBO Models based on Forecasted Earnings

	Model 1	Model 2
Intercept	2.757	2.754
<i>t-stat</i>	7.75***	7.80***
Book Value	0.895	0.898
<i>t-stat</i>	13.29***	13.61***
<i>VIF</i>	1.03	1.03
Abnormal Earnings, $\tau=1$	1.909	1.910
<i>t-stat</i>	3.16***	3.13***
<i>VIF</i>	1.47	1.47
Abnormal Earnings, $\tau=2$	0.182	-0.014
<i>t-stat</i>	0.28	-0.02
<i>VIF</i>	1.59	1.87
Abnormal Earnings, $\tau=3$	-	0.432
<i>t-stat</i>	-	1.03
<i>VIF</i>	-	1.67
Abnormal Earnings, $\tau=4$	0.382	0.204
<i>t-stat</i>	0.80	0.40
<i>VIF</i>	1.25	1.44
R^2	0.5647	0.5666
Adj. R^2	0.5582	0.5585
Cases	275	275

The model estimated is:

$$P_{it} = a_0 + a_1 BV_{it} + \sum_{\tau=1}^4 a_{\tau} E_t[EPS_{i,t+\tau} - rBV_{i,t+\tau-1}] + e_{it}$$

The interest rate, r , used is 6.57%. The t -statistics are based on White's (1980) heteroscedastic consistent standard errors. Observations with negative book values were eliminated. *** means significant at the 1% level. Outliers deleted were defined as the top and bottom 0.5% of cases for earnings per share, price and book value per share as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).

From the table, the EBO models based on forecasted earnings seem to be doing well with an explanatory power of 56%. However, the R^2 reported here is far less than the R^2 of 68% reported by Bernard, whose study used U.S. data covering the 1978-1993 period.

Apart from the book value variable, the only other significant variable is abnormal earnings for one-year-ahead (i.e. $\tau=1$), and its regression coefficient is consistent with what was expected. In the Bernard's study, however, three variables (book value, abnormal earnings for $\tau=1$ and $\tau=4$) were significant at the 5% level.

In the second column of Table 18, the results of a model that includes an additional variable (i.e. abnormal earnings variable for $\tau=3$) are presented. Except for a 1% increase in R^2 from 56% to 57%, the inclusion of the abnormal earnings variable for $\tau=3$ has not resulted in any marked improvement in the model. Only the book value variable and the one-year-ahead abnormal earnings variable ($\tau=1$) again emerged as the significant variables.

To determine if the EBO models based on forecasted earnings are sensitive to the level of interest rate used, the models were re-estimated using a different interest rate rather than the average 90-day Treasury bill rate of 6.6% – in 1992 – used in the above analysis. The results of the re-estimated equations are reported in Appendix F. It is clear from the appendix that the re-estimated regressions are essentially the same irrespective of the interest rate used. The explanatory power of the two regression equations estimated are essentially the same, and only the book value and one-year-ahead abnormal earnings variables are again significantly different from zero.

Compared to the full EBO model suggested by Rees (which has an adjusted R^2 of 62%), the Bernard's model is lagging in explanatory power. The reason why the models are compared on their explanatory power is because they both have the same dependent variable.

In conclusion, it is worth noting that the poor performance of the EBO models based on forecasted earnings (as compared to those based on historical financial information) might be due to error in the computation of abnormal earnings. It is possible that the ex post realized earnings diverge considerably from their ex ante expectations. Future research should consider using analysts' forecasts. The use of analysts' forecasts

can potentially lead to more observations for multiple years rather than a single year.

Also, analysts' forecasts may be a better proxy for the ex ante earnings expectations of market participants than ex post realized earnings.

5.2 EVC Models

Descriptive statistics for the variables used in the economic profit models are reported in Table 19. As can be seen from the table, the average company on the TSE trades at around 1.8 times of its adjusted book value of capital. This multiple is similar to market to book multiples in the U.S. (e.g. O'Byrne, 1996, reported a market-to-book multiple of 1.79). Also, whilst the average company listed on the TSE earns a return on capital of about 9%, its weighted average cost of capital (WACC) is 11%, and it generates an economic profit of negative 2%. In the U.S., O'Byrne (1996) reports that the average company earns a 10% rate of return and an economic profit that is indistinguishable from zero. While U.S. firms seem to break even on EVC, Canadian companies, on average, earn a negative EVC – they destroy value.

Table 19: Descriptive Statistics for EVC models

Variable	Mean	Median	Standard Deviation
Sample size = 1706			
Market Value/Capital	1.786	1.299	1.516
(EVC/c)/Capital	-0.179	-0.214	1.109
(NOPAT/c)/Capital	0.821	0.786	1.109
(FCF/c)/Capital	-0.926	-0.212	2.665
WACC	0.107	0.107	0.018
EVC/Capital	-0.020	-0.023	0.122
NOPAT/Capital	0.088	0.081	0.122
FCF/Capital	-0.101	-0.021	0.290

Due to the controversy surrounding the value of EVC models vis-à-vis models based on NOPAT, this study reports results for both EVC and NOPAT models. To facilitate the comparison of the NOPAT and EVC models, the same adjustments have been made to the variables in the models. Reported in Table 20 are results of some ‘basic’ models where market value-to-capital is modeled to be functionally dependent on capitalized EVC, NOPAT, and free cash flows (FCF) to the firm, all deflated by book capital.

Table 20: Results of basic EVC, NOPAT and FCF Models

	EVC Model	NOPAT Model	FCF Model
Intercept	1.855	1.466	1.649
<i>t</i> -statistic	49.28***	24.23***	44.43***
(EVC/c)/Capital	0.389	-	-
<i>t</i> -statistic	6.18***	-	-
(NOPAT/c)/Capital	-	0.389	-
<i>t</i> -statistic	-	6.18***	-
(FCF/c)/Capital	-	-	-0.148
<i>t</i> -statistic	-	-	-7.81***
R ²	0.0811	0.0811	0.0675
Adj. R ²	0.0805	0.0805	0.067
Cases	1706	1706	1706

The estimated equation for the economic profit model is:

$$MV/Capital = a_0 + a_1((EVC_{it}/c_{it})/Capital) + e_{it}$$

The comparative models have been run by substituting NOPAT and FCF for EVC. The *t*-statistics are based on White's (1980) heteroscedastic consistent standard errors. *** means significant at the 1% level. Outliers deleted were defined as the top and bottom 0.5% of cases for EVC, MV/Cap, NOPAT and FCF as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).

A review of Table 20 shows that the results of the ‘basic’ NOPAT model are essentially the same as the results of the basic EVC model. The R²s and coefficients of these two models are about the same. However, the FCF model does have a negative coefficient on FCF (which is contrary to the positive coefficient that was expected), and has an R² that is slightly lesser than the R²s for the NOPAT and EVC models. The results

reported here are, in part, consistent with O'Byrne's (1996)²⁴, where similar R^2 s were reported for NOPAT and EVC models.

O'Byrne (1996) suggested an extended economic profit model to account for the fact that the market puts different multiples on positive and negative economic profits as well as different capital multiples for companies of different sizes. The extended model was tested in this study and the results are reported in Table 21. To facilitate comparison, additional models where the same adjustments are made to NOPAT and FCF are also reported in Table 21.

²⁴ Because the NOPAT model was not forced through the origin in this study, the results here are only compared to O'Byrne's initial results where the NOPAT model was estimated with an intercept.

Table 21: Market Value as Explained by EVC, NOPAT and FCF

	EVC Model	NOPAT Model	FCF Model
Intercept	4.245	3.849	4.455
<i>t</i> -statistic	17.09***	14.66***	16.58***
(EVC [*] /c)/Capital	0.943	-	-
<i>t</i> -statistic	9.20***	-	-
VIF	1.16	-	-
(EVC [*] /c)/Capital	-0.113	-	-
<i>t</i> -statistic	-1.93**	-	-
VIF	1.11	-	-
ln(Capital)	-0.234	-0.234	-0.252
<i>t</i> -statistic	-12.62***	-12.38***	-12.52***
VIF	1.10	1.11	1.12
(NOPAT [*] /c)/Capital	-	0.702	-
<i>t</i> -statistic	-	10.40***	-
VIF	-	1.14	-
(NOPAT [*] /c)/Capital	-	-0.410	-
<i>t</i> -statistic	-	-4.43***	-
VIF	-	1.13	-
(FCF [*] /c)/Capital	-	-	0.208
<i>t</i> -statistic	-	-	3.44***
VIF	-	-	1.12
(FCF [*] /c)/Capital	-	-	-0.173
<i>t</i> -statistic	-	-	-8.49***
VIF	-	-	1.22
R ²	0.2964	0.2906	0.2078
Adj. R ²	0.2952	0.2893	0.2064
Cases	1706	1706	1706

The equation estimated is:

$$MV/Capital = b_0 + b_1 \ln Capital + b_2((EVC^*_{it}/c_{it})/Capital) + b_3((EVC^*_{it}/c_{it})/Capital) + e_{it}$$

This time, the comparative models run involved substituting NOPAT^{*} and NOPAT^{*} for EVC^{*} and EVC^{*} as well as FCF^{*} and FCF^{*} for EVC^{*} and EVC^{*}. The *t*-statistics are based on White's (1980) heteroscedastic consistent standard errors. *** means significant at the 1% level; ** means significant at the 5% level. Outliers deleted were defined as the top and bottom 0.5% of cases for EVC, MV/Cap, NOPAT and FCF as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).

From the table, both the EVC and NOPAT models have approximately the same explanatory power. The extended EVC model has an R² and adjusted R² of 30%, which means that 30% of the variation in market value-to-capital is accounted for by variation in the set of predictors in this model. On the other hand, the NOPAT model has an R² and

adjusted R^2 of 29%, which is similar to the EVC's explanatory power of 30%. The findings here are consistent with those reported by Biddle et al. (1997). They reported similar R^2 s for a NOPAT model and an EVC model. The FCF model, however, has an explanatory power that is lower than the explanatory power of both the NOPAT and EVC models. The FCF model has an R^2 and adjusted R^2 of 21%. On the basis of explanatory power, it can be concluded that the FCF model is quite inferior to both the NOPAT model and EVC model. In other words, the levels of economic profit and NOPAT better explain current market value than levels of FCF.

The regression coefficients for the variables in the three models have signs that are significantly different from zero and are in accordance with expectations – except the EVC⁻ coefficient. Based on O'Byrne's (1996) study using U.S. data, it was expected that the EVC⁻ coefficient would be positive but lower than the EVC⁺ coefficient. But it turns out that the EVC⁻ coefficient in this study is negative (with a border-line significance because its two-tail p-value is 5%). Despite the fact that a positive relation between EVC⁻ and market value-to-capital (based on O'Byrne's results) had been hypothesized, the negative coefficient does not mean that the results are counter-intuitive. The negative coefficient could imply that Canadian investors are more intolerant of companies that destroy value – a result consistent with Jog and Hoffstatter's (1999) findings that Canadian capital markets are increasingly becoming intolerant of firms that destroy value.

The coefficients on NOPAT⁺, EVC⁺ and FCF⁺ are all positive, suggesting a positive association between these variables and market value. The coefficient on the natural log of capital is negative in all three models, thus, attesting to the fact that

multiples on capital decrease with company size. This is in line with the economic reasoning that the scale advantages enjoyed by companies tend to slow down – and may even diminish – as companies get bigger. Also, the NOPAT⁻, EVC⁻ and FCF⁻ coefficients are all negative – implying a negative relation between these variables and market value.

The evidence presented this far shows that the NOPAT model and EVC model are essentially the same. The coefficients on NOPAT⁺ and EVC⁺ over the years were obtained to determine if there is any difference between models based on NOPAT and economic profit. Figure 2 is a plot of the coefficients over the five years of this study.

Figure 2: Market's Pricing of NOPAT⁺ and EVC⁺ compared

As can be seen from Figure 2, the EVC⁺ coefficient is higher than the NOPAT⁺ coefficient in every year. This implies that the market puts a higher pricing multiple on economic profits than on NOPAT. However, this interpretation should not be taken on face value since a five-year window may not provide a long enough period to discern any trend.

From the above analysis, one can infer that the EVC and NOPAT models are fairly robust.

5.3 Price-to-Earnings Models

Provided in Table 22 are descriptive statistics for the variables used in the P/E regressions.

Table 22: Descriptive Statistics for the P/E Model

Variable	Mean	Median	Standard Deviation
Sample size = 689			
P/E	29.659	16.703	69.645
Beta	0.948	0.937	0.195
Earnings Growth Rate	0.217	0.112	0.573
Dividend Payout	0.375	0.158	1.494

The P/E ratio for the average sample firm is 30. Even though there is no suggested threshold for assessing the reasonableness of a P/E ratio, the ratio of 30 appears to be on the high side. The average firm in the P/E sample has a beta of about 0.95, earnings growth rate of 22% and dividend payout ratio of about 38%.

Results of the P/E regressions are reported in Table 23. The results are presented for the pooled sample as well as the yearly regressions. The reason for providing the yearly regression estimates is because the yearly R^2 s and estimates do not appear to be stable from year to year. However, because the yearly estimates for the other models tested were stable over time, and similar to the pooled regression results, the results of the yearly estimates for the other models were not reported.

Table 23: Tests of Price/Earnings Model

	Intercept	Beta	Earnings Growth Rate	Payout	R ²	Adj. R ²	Cases
Pool Sample	2.413	16.140	-4.147	34.273	0.5463	0.5443	689
<i>t-stat</i>	2.98***	1.22	-0.79	2.71***			
<i>VIF</i>		1.00	1.01	1.02			
1992	11.838	6.051	-0.219	39.845	0.7764	0.7694	100
<i>t-stat</i>	0.31	0.19	-0.01	18.33***			
<i>VIF</i>		1.01	1.14	1.15			
1993	30.642	-2.724	-9.278	17.161	0.0945	0.0727	129
<i>t-stat</i>	2.04**	-0.18	-1.29	1.11			
<i>VIF</i>		1.04	1.12	1.11			
1994	18.096	-0.400	0.573	7.200	0.1232	0.1038	140
<i>t-stat</i>	3.44***	-0.08	0.30	4.72***			
<i>VIF</i>		1.02	1.00	1.02			
1995	11.479	16.404	-16.016	12.225	0.0664	0.0473	151
<i>t-stat</i>	0.79	1.03	-1.63	2.48**			
<i>VIF</i>		1.01	1.02	1.02			
1996	12.491	18.448	-10.933	-6.458	0.0428	0.0254	169
<i>t-stat</i>	1.28	1.44	-2.28**	-1.03			
<i>VIF</i>		1.05	1.04	1.08			

The estimated equation is:

$$P/E = a_0 + a_1 \text{Beta}_{it} + a_2 \text{Growth}_{it} + a_3 \text{Payout}_{it} + e_{it}$$

The t-statistics are based on White's (1980) heteroscedastic consistent standard errors. Observations with negative earnings per share were excluded in the computation of the P/E ratio. *** means significant at the 1% level; ** means significant at the 5% level. Outliers deleted were defined as the top and bottom 0.5% of cases for earnings per share, price and book value per share as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).

Due to the fact that the earnings growth rate variable was computed using the geometric average growth rate in earnings over the past five years, sample sizes were reduced. Consequently, the P/E, P/S, and P/B models have comparatively smaller sample sizes.

From Table 23, the P/E model appears to have a satisfactory explanatory power (with an R² of 55%) but results in only one significant variable – ordinary dividend payout ratio. All other coefficients are not significantly different from zero.

It also appears that the yearly regressions have coefficients that are not stable over time. However, they are mostly not significantly different from zero. There is therefore no cause for alarm since the coefficients are not significant anyway. However, the use of the five-year average growth rate in earnings reduced the yearly samples. It is therefore possible that the results are being impacted by the small yearly sample sizes.

5.4 Price-to-Book Models

The price-to-book (P/B) model's descriptive statistics are reported in Table 24. The average firm in the P/B sample trades at a P/B multiple of 1.9 and has a beta of about 0.96. It is also evident from the table that the average firm has grown its earnings by 22%, achieved a return of 7% on equity and paid about 17% of its earnings as dividends to ordinary shareholders.

Table 24: Descriptive Statistics for the P/B Model

Variable	Mean	Median	Standard Deviation
Sample size = 774			
Price-to-book	1.884	1.562	1.144
Beta	0.958	0.948	0.199
Average Earnings growth	0.220	0.111	0.599
Return on Equity	0.066	0.089	0.254
Dividend Payout Ratio	0.165	0.118	3.452

Reported in Table 25 are the results of the P/B regressions. The first column of the table shows results of the model as suggested by Damodaran (1994).

Table 25: Tests of Basic and Extended Price/Book Models

	Basic P/B	Extended P/B
Intercept	1.932	1.323
<i>t-stat</i>	9.93***	6.97***
Beta	-0.108	-0.022
<i>t-stat</i>	-0.54	-0.12
VIF	1.02	1.02
Earnings Growth Rate	0.209	0.074
<i>t-stat</i>	2.19**	0.87
VIF	1.00	1.03
ROE	0.131	-
<i>t-stat</i>	0.52	-
VIF	1.01	-
ROE ⁺	-	5.150
<i>t-stat</i>	-	8.68***
VIF	-	1.07
ROE ⁻	-	-0.990
<i>t-stat</i>	-	-3.22***
VIF	-	1.06
Payout	0.007	0.003
<i>t-stat</i>	1.19	1.05
VIF	1.01	1.01
R ²	0.0138	0.1764
Adj. R ²	0.0087	0.1711
Cases	774	774

The first equation estimated is:

$$P/B = a_0 + a_1 \text{Beta}_{it} + a_2 \text{Growth}_{it} + a_3 \text{ROE}_{it} + a_4 \text{Payout}_{it} + e_{it}$$

The second estimated equation is:

$$P/B = a_0 + a_1 \text{Beta}_{it} + a_2 \text{Growth}_{it} + a_3 \text{ROE}^+_{it} + a_4 \text{ROE}^-_{it} + a_5 \text{Payout}_{it} + e_{it}$$

The t-statistics are based on White's (1980) heteroscedastic consistent standard errors. Cases with negative book values were eliminated. *** means significant at the 1% level; ** means significant at the 5% level. Outliers deleted were defined as the top and bottom 0.5% of cases for earnings per share, price and book value per share as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).

In addition to having a low explanatory power (R^2 of 1%), many of the variables in the price-to-book model are not significantly different from zero. The only significant variable is the growth rate in earnings.

The model was refined in this study by partitioning the return on equity (ROE) variable into ROE⁺ and ROE⁻. When ROE was segregated into ROE⁺ and ROE⁻, the

model's explanatory power increased to 18%, with both ROE^+ and ROE^- emerging as the significant variables while earnings growth rate becomes insignificant this time. As well, the coefficients on ROE^+ and ROE^- conform to what one will expect.

In conclusion, it is obvious that the P/B model has performed quite poorly. This is surprising since Damodaran (1994) reported fairly good R^2 s (ranging from 84% to 88.5% between 1987 to 1991) for the P/B model using U.S. data.

5.5 Price-to-Sales Models

Descriptive statistics for the variables used in the price-to-sales model are provided in Table 26.

Table 26: Descriptive Statistics for the P/S Model

Variable	Mean	Median	Standard Deviation
Sample size = 774			
Price-to sales	1.443	0.729	2.336
Beta	0.958	0.948	0.198
Average Earnings growth	0.217	0.111	0.599
Dividend Payout Ratio	0.165	0.118	3.452
Net Margin	0.038	0.040	0.245

The average price-to-sales ratio of the P/S sample is about 1.4 while the average beta is about 0.96, which is slightly lower than the theoretical market beta of 1. This implies that the sample in this study has a lower risk than the typical market portfolio. Given that the sample selection criteria excludes such high-risk firms like resource firms, an average beta lower than 1 can be expected. In addition, the average earnings growth rate is calculated as a five-year geometric average. It is therefore likely that most of the

risky firms could not make the five-year cut. The average growth rate in earnings is 22%. The dividend payout ratio is 17% on average. Also, the net profit as a percentage of sales is about 4%.

The results of the basic empirical price-to-sales stock-pricing model suggested by Damodaran (1996) are presented in the first column of Table 27.

Table 27: Tests of Basic and Extended Price/Sales Models

	Basic P/S	Extended P/S
Intercept	2.211	0.581
<i>t-stat</i>	7.21***	2.14***
Beta	-0.717	-0.121
<i>t-stat</i>	-2.29**	-0.49
VIF	1.01	1.02
Earnings Growth Rate	0.398	0.054
<i>t-stat</i>	2.66***	0.71
VIF	1.00	1.02
Margin	-4.367	-
<i>t-stat</i>	-2.54**	-
VIF	1.00	-
Margin [~]	-	12.707
<i>t-stat</i>	-	8.43***
VIF	-	1.04
Margin [~]	-	-6.886
<i>t-stat</i>	-	-3.81***
VIF	-	1.01
Payout	-0.005	-0.007
<i>t-stat</i>	-0.77	-1.34
VIF	1.01	1.01
R ²	0.2197	0.583
Adj. R ²	0.2157	0.5802
Cases	774	774

The first equation estimated is:

$$P/S = a_0 + a_1 \text{Beta}_{it} + a_2 \text{Growth}_{it} + a_3 \text{Margin}_{it} + a_4 \text{Payout}_{it} + e_{it}$$

The second estimated equation is:

$$P/S = a_0 + a_1 \text{Beta}_{it} + a_2 \text{Growth}_{it} + a_3 \text{Margin}^{\sim}_{it} + a_4 \text{Margin}^{\sim}_{it} + a_5 \text{Payout}_{it} + e_{it}$$

The t-statistics are based on White's (1980) heteroscedastic consistent standard errors. *** means significant at the 1% level; ** means significant at the 5% level. Outliers deleted were defined as the top and bottom 0.5% of cases for earnings per share, price and book value per share as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).

The basic price-to-sales (P/S) model seems to have a satisfactory explanatory power of 22%. The coefficients on beta, earnings growth rate and net profit as a percentage of sales (margin) are all significantly different from zero. While the coefficients on beta and earnings growth rate are in accordance with expectations and consistent with findings in the U.S. (Damodaran, 1996), the net margin coefficient, which turns out to be negative, is not in line with expectations. A priori, it was expected that the

margin coefficient would be positive since higher profitability should, *ceteris paribus*, translate into higher stock prices.

To determine if there is a plausible reason behind the negative coefficient on net margin, the basic model was extended by decomposing the margin variable into margin^+ (defined to equal margin if margin is positive and zero otherwise) and margin^- (defined to equal margin if margin is negative and zero otherwise). As can be seen in the second column of Table 27, the redefinition of margin into margin^+ and margin^- has resulted in a significant improvement in the explanatory power of the model. The extended P/S model now has an R^2 of 58%, indicating that 58% of the variation in the P/S ratio can be explained by variation in the set of independent variables. This is a fairly good R^2 , even though it is still lower than the 77% R^2 reported by Damodaran (1996) for the P/B model using 1995 U.S. data. Also, the coefficient on margin^+ is significantly positive and in line with expectations while the margin^- coefficient is significantly negative – as expected. It can thus be concluded that lumping profitable and loss making firms together may not be the best in every situation since the market may be putting different pricing multiples on profit-making and loss-making firms. However, the significance of the coefficients on earnings growth rate and beta fade away when margin is decomposed into margin^+ and margin^- .

The P/S models seem to be doing well.

5.6 Court Accepted Formulas

Table 28 contains descriptive statistics for the variables used in the estimation of the two Court Accepted stock pricing formulas. From the table, the average stock price is about \$9 while the average book value is about \$6. Again, apart from the zero median value for the $DV/(DVYLD_{industry})$ variable, all the other medians are close to the means. Given that the median for dividends per share has already been reported to be zero, it is not surprising that the $DV/(DVYLD_{industry})$ variable has a zero median since dividend per share is expressed over industry dividend yield.

Table 28: Descriptive Statistics for Court Accepted Formulas

Variable	Mean	Median	Standard Deviation
Sample Size = 2079			
Price	9.016	7.125	7.032
$(EPS)*(P/E_{industry})$	6.768	5.059	15.604
$DV/(DVYLD_{industry})$	5.862	0.000	16.944
$(BV)*(BVM_{industry})$	9.998	7.044	9.230
Book Value	5.624	4.015	5.154

In Table 29, the results of the empirical tests of the two court accepted stock pricing models based on the Bader (column 1) and Central Trust (column 2) cases are provided.

Table 29: Tests of Court Accepted Formulas

	Bader	Central Trust
Intercept	3.457	3.302
<i>t-stat</i>	23.93***	23.36***
(EPS)*(P/E _{industry})	0.106	0.100
<i>t-stat</i>	11.01***	11.06***
<i>VIF</i>	1.16	1.17
DV/(DVYLD _{industry})	0.027	0.026
<i>t-stat</i>	2.56***	2.78***
<i>VIF</i>	1.18	1.17
BV	0.834	-
<i>t-stat</i>	25.28***	-
<i>VIF</i>	1.31	-
(BV)*(BVM _{industry})	-	0.488
<i>t-stat</i>	-	26.84***
<i>VIF</i>	-	1.29
R2	0.5738	0.6053
Adj. R2	0.5732	0.6048
Cases	2079	2079

The equations estimated are:

$$P = a_0 + a_1(\text{EPS}_{it})(\text{PE}_{\text{industry}}) + a_2(\text{DV}_{it}/\text{DVYLD}_{\text{industry}}) + a_3\text{BV}_{it} + e_{it}$$

$$P = a_0 + a_1(\text{EPS}_{it})(\text{PE}_{\text{industry}}) + a_2(\text{DV}_{it}/\text{DVYLD}_{\text{industry}}) + a_3(\text{BV}_{it})(\text{BVM}_{\text{industry}}) + e_{it}$$

The t-statistics are based on White's (1980) heteroscedastic consistent standard errors. Observations with negative earnings per share were excluded in the computation of the P/E ratio. *** means significant at the 1% level. Outliers deleted were defined as the top and bottom 0.5% of cases for earnings per share, price and book value per share as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).

An examination of Table 29 shows that the independent variables in the court accepted model based on the Bader case do quite well in explaining stock price (the dependent variable), with an explanatory power of about 57%. All the regression coefficients are significantly different from zero. Also, the coefficients, except the DV/(DVYLD_{industry}) coefficient, are in accordance with what were hypothesized. There was no ex ante certainty of what the sign of the coefficient on DV/(DVYLD_{industry}) will be. It however turns out to be significantly positively related to price.

Compared to the Bader case, the Central Trust formula does even better because it has a higher explanatory power. Its R² is 61% and adjusted R² is 60%. The coefficients

are significant, and are in accordance with ex ante expectations. Again, theory does not conclusively suggest the expected sign of the $DV/(DVYLD_{industry})$ coefficient. It turns out to have a significant positive association with price.

It has been suggested in the literature that models with the same dependent variable can be ranked on the basis of R^2 (Wilcox, 1984). Between the two court accepted formulas, one can therefore conclude that the Central Trust formula is slightly superior. And comparing the Central Trust formula to the full EBO model, one can say that the full EBO model has a slight advantage over court accepted formulas since the full EBO model's adjusted R^2 (of 62%) is slightly higher.

To determine if the courts could have done better if economic profit or economic value created (EVC) had been used rather than EPS, the court accepted models were rerun, this time using EVC per share and industry price to EVC per share. Just like the industry price-earnings ratio, the industry price-EVC ratio was computed only for industries that had a positive average EVC per share. The results of this analysis are reported in Table 30.

Table 30: Tests of Court Accepted Formulas using EVC

	Bader	Central Trust
Intercept	4.387	4.588
<i>t-stat</i>	7.67***	7.83***
<i>VIF</i>		
(EVC)*(Ind. P to EVC)	0.006	0.006
<i>t-stat</i>	2.85***	2.64***
<i>VIF</i>	1.08	1.08
DV/(DVYLD _{industry})	0.223	0.239
<i>t-stat</i>	5.58***	5.70***
<i>VIF</i>	1.16	1.14
BV	0.615	-
<i>t-stat</i>	6.06***	-
<i>VIF</i>	1.25	-
(BV)*(BVM)	-	0.314
<i>t-stat</i>	-	5.54***
<i>VIF</i>	-	1.23
R ²	0.6443	0.6173
Adj. R ²	0.6401	0.6127
Cases	255	255

The equations estimated are:

$$P = a_0 + a_1(EVC_{it})(PEVC_{industry}) + a_2(DV_{it}/DVYLD_{industry}) + a_3BV_{it} + e_{it} \text{ (Bader case)}$$

$$P = a_0 + a_1(EVC_{it})(PEVC_{industry}) + a_2(DV_{it}/DVYLD_{industry}) + a_3(BV_{it})(BVM_{industry}) + e_{it} \text{ (Central Trust case)}$$

The t-statistics are based on White's (1980) heteroscedastic consistent standard errors. Cases with negative industry EVC per share were excluded. *** means significant at the 1% level. Outliers deleted were defined as the top and bottom 0.5% of cases for EVC, price and book value per share as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).

From the results in Table 30, it appears that if the court accepted formulas were based on economic profit, the explanatory power of the models would have been generally higher. The Bader case would have had an explanatory power of 64% if EVC had been used instead of the 57% explanatory power. However, if EVC had been used in the Central Trust case, the model would have had an explanatory power of 62% as compared to the 61%. The results reported here are quite encouraging, and potentially indicate that the EVC theory could be strengthened and solidified if stock pricing models based on EVC are refined around industry relative ratios.

5.7 Variable Importance

To determine the relative contribution of the various variables to the different models tested in this study, the Thomas et al.'s (1996) extension of the Pratt's (1987) measure was used.

A graph of the importance of book value per share and earnings per share over the five-year period of the study is presented in Figure 3. It is apparent from the graph that book value per share contributes more to the basic EBO model than earnings per share. The minimum contribution of book value to the basic model over the five-year period is 63% (in 1996) and its maximum contribution of 78% occurred in 1992.

The results reported here are consistent with Collins et al.'s (1997) results that show the value-relevance of book value to be higher than the value-relevance of earnings in recent times. Because of the availability of forty years of data, Collins et al. were able to discern that the value-relevance of 'bottom line' earnings had declined, and has been replaced by increased value-relevance of book value. The use of only five years of data in this study makes it impossible to do a trend analysis along the lines reported by Collins et al. What is most revealing is that this study has been able to arrive at some of the same conclusions as those reported in Collins et al. (1997) even though a different methodology was employed, which is much simpler than the methodology used by Collins et al.

Figure 3: Variable importance

Due to the multicollinearity between total capital and total debt, a negative importance is assigned to debt in the full EBO model. However, the joint importance of total capital and total debt (the variables in a collinear relationship) is about 61%. Retained earnings accounts for 16% of importance while investments accounts for 12% and ordinary dividends has importance of about 11%.

The results of the variable importance calculations for the EVC model are presented in Table 31. Comparative results are also presented for the NOPAT as well as FCF models.

Table 31: Variable importance for EVC, NOPAT and FCF models

Variable	$\tilde{\beta}_j$	$\tilde{\rho}_j$	d_j	VIF
EVC model				
(EVC ⁺ /c)/Capital	0.407	0.461	63%	1.16
(EVC ⁻ /c)/Capital	-0.056	0.019	0%	1.11
ln(Capital)	-0.283	-0.387	37%	1.10
$R^2 = 0.2964$				
NOPAT model				
(NOPAT ⁺ /c)/Capital	0.400	0.421	58%	1.14
(NOPAT ⁻ /c)/Capital	-0.139	-0.092	4%	1.13
ln(Capital)	-0.283	-0.387	38%	1.11
$R^2 = 0.2906$				
FCF model				
(FCF ⁺ /c)/Capital	0.114	0.0495	3%	1.12
(FCF ⁻ /c)/Capital	-0.263	-0.3187	40%	1.22
ln(Capital)	-0.305	-0.3871	57%	1.12
$R^2 = 0.2078$				

Table of variable importance for the extended EVC, NOPAT and FCF models. d_j is the percent importance, $\tilde{\rho}_j$ is the simple correlation between the predictor variable and the response variable (MV/Capital) and $\tilde{\beta}_j$ is the standardized regression coefficient.

For the EVC model, the important variables are EVC⁺ and log of Capital. The EVC⁻ variable contributes essentially nothing to the regression model. For the NOPAT model, all three predictors make some contribution to the regression. The combined contribution of NOPAT (i.e. NOPAT⁺ plus NOPAT⁻) is 62%, which is similar to the combined importance of 63% for EVC⁺ and EVC⁻. For the FCF model, log of capital is the dominant contributor to the regression. What is interesting is that while NOPAT⁺ and EVC⁺ accounted for the highest importance in their respective models, the FCF⁺ accounted for the least importance in the FCF model.

5.8 Sensitivity Analyses

Sensitivity analyses were conducted to determine if alternative assumptions and conditions may alter the conclusions arrived at in this study. Specifically, the sensitivity analyses covered redefinition of earnings per share, reduced sample size, only dividend-paying stocks and deflation by book value.

The results of the redefinition of EPS and reduced sample are reported in Appendix G. The first column of the appendix presents sensitivity analysis results for the basic EBO model where EPS is alternatively defined as earnings to common stockholders after discontinued operations and unusual items. From the appendix, the results are essentially the same as those reported earlier. The second column of the appendix reports results for the basic EBO model where a random sample of 60% of the cases was taken for analysis. The main objective was to determine if results are sensitive to the sample size. As can again be seen from the appendix, the results are essentially the same as, and comparable to, the results of the basic EBO model based on the full sample. The import of this is that it is reasonable to compare results of Canadian studies (with relatively smaller samples) to U.S. studies where the sample sizes are very large.

The sensitivity of the full EBO model was tested using only dividend-paying cases and not the whole sample. The results, which are presented in Appendix H, are essentially the same as those reported for the whole sample, i.e., dividends are significantly important in explaining stock prices. Also, the explanatory power of the full EBO model (for the dividend-paying sample) has increased. The R^2 , which is 62% for the whole sample has increased by 2% to 64% for the dividend-paying sample.

To also determine if the results of this study are driven by firm size, the variables in the basic EBO model were deflated by book value, and the equation re-estimated with the deflated variables. The results are presented in Appendix I. As can be seen from the appendix, this re-estimated model's explanatory power of 56% is similar to the 57% R^2 for the basic EBO model. Also, the variables are all significantly different from zero and have regression coefficients that are in line with expectations. Therefore, it can be concluded that the results of this study are not driven by firm size.

5.9 Robustness of Models

The robustness check results, ranked by the models' performances on Stein's formula, are presented in Table 32.

Table 32: Models' Cross Validation Results

Model	R2	Adj. R2	Stein's Formula	Stein's Rank
EVC Bader	0.6443	0.6401	0.6343	1
Full EBO	0.6227	0.6218	0.6206	2
EVC Central Trust	0.6173	0.6127	0.6065	3
Central Trust	0.6053	0.6048	0.6040	4
Extended P/S	0.5830	0.5802	0.5770	5
Bader	0.5738	0.5732	0.5724	6
Basic EBO	0.5718	0.5714	0.5708	7
Bernard 1	0.5647	0.5582	0.5501	8
Bernard 2	0.5666	0.5585	0.5487	9
P/E	0.5463	0.5443	0.5417	10
Extended EVC	0.2964	0.2952	0.2935	11
Extended NOPAT	0.2906	0.2893	0.2877	12
Basic P/S	0.2197	0.2157	0.2105	13
Extended FCF	0.2078	0.2064	0.2045	14
Extended P/B	0.1764	0.1711	0.1646	15
Basic EVC	0.0811	0.0805	0.0795	16
Basic NOPAT	0.0811	0.0805	0.0795	17
Basic FCF	0.0675	0.0670	0.0659	18
Basic P/B	0.0138	0.0087	0.0022	19

When it comes to the question of using the estimated regressions for predicting other samples from the same population, the obvious choice is the Bader court accepted formula based on EVC because it has the highest cross validation power. From the above table, the Bader Court Accepted formula based on EVC has 63% cross validity predictive power. Given that this same model has the highest explanatory power recorded so far, there is the need for theoretical work on EVC models to be refocused around industry price-to-EVC relatives.

Following closely in second position is the full EBO model, which has a cross validity predictive power of 62%. In third position is the Central Trust court accepted formula that utilizes EVC instead of earnings. The basic P/B model is the model with the least cross validation power.

Chapter Six: Conclusion

The use of fundamental variables to explain stock prices has received a great deal of discussion and theoretical support. While there is some empirical evidence on stock price levels valuation based on U.S. and U.K. data, there is a complete absence of evidence on levels models using Canadian data. To fill this void, this study had, as its principal objective, the intention to empirically determine the role that fundamental variables play in explaining security prices in Canada. To achieve this, a number of stock price level models that link fundamental variables to stock prices were tested using a sample of TSE listed firms over the 1992-1996 period. Another objective in this study was to determine the relative importance of explanatory variables in the different models.

The study found high explanatory power for EBO stock price level models, EVC models, the P/E model, P/S models and stock pricing models based on two court accepted formulas.²⁵ As well, the major variables in most of the models were significantly related to prices in Canadian stock markets. The high explanatory power, together with the significance of most of the predictor variables indicates that fundamental variables play a substantial role in stock pricing in Canada.

In addition, the study examined whether or not Canadian investors consider dividends and debt as signals of value. The results unearthed from this study show that both the levels of dividends and debt do matter for investors of TSE listed companies, at least over the five-year period of this study. In particular, the dividend signal is very strong for firms with “low” market capitalization compared to those with “medium”

²⁵ The R^2 s reported for these models generally range from over 20% to over 60%.

market capitalization and also very strong for companies with “medium” market capitalization compared to those with “high” market capitalization. These findings imply that the dividend signal is very potent in the presence of information asymmetry – since information asymmetry is perceived to be inversely related to firm size. Further, the dividend signal is materially valuable for highly profitable firms and firms experiencing losses than for firms with moderate profitability – implying that while dividends are a costly but credible signal used by the management of firms experiencing losses to communicate future profitability, the management of highly profitable companies use dividends to signal to the market that they do not waste free cash flows. Furthermore, the dividend signal is very strong for companies with low growth opportunities and insignificant for firms with high growth prospects. In connection with the debt signal, the study’s results show that debt signals positive value for firms with low debt-to-equity ratios. For firms with medium and high debt-to-equity ratios, however, the debt signal is materially negatively priced by the stock market.

An experimentation with alternative court accepted formulas that use the product of EVC per share and industry price-to-EVC per share turned out to produce the best model with very high explanatory power and the highest cross validation power. While these results are very encouraging, it is hoped that they will signal the need to develop better EVC models along industry price-to-EVC relatives.

In relation to the objective of determining the relative contribution of the independent variables in the different models, the results were also very interesting and consistent with results documented in the U.S. In the basic EBO model, it was discovered that book value contributed more to the explanatory power of the model than earnings –

findings consistent with what was reported by Collins et al. in their study of U.S. firms.

In the EVC models, EVC^+ and log of capital account for the great part of importance while in the NOPAT model, all the variables – $NOPAT^+$, $NOPAT^-$ and log of capital contribute to importance of the estimated equations.

Chapter Seven: Benefits, Limitations and Suggestions for Future Research

7.1 Benefits

There are a number of benefits emanating from this study. The following are the main benefits of the study:

1. This study adds to the substantial body of literature on equity valuation. By providing evidence on some of the theorized stock pricing models, the study has added to the extensive literature, already in existence, on valuation and has added to the available knowledge pool, evidence that will help in further understanding security pricing.
2. The study also provides evidence on two important financial policy issues: dividend policy and capital structure. Since it was found that both dividends and debt matter, and the fact that they matter more for firms with specific characteristics (market capitalization, profitability and growth opportunities) than others, the study will help managers to understand the implications of some of their policies on share prices – depending on the particular situation facing the company. This understanding will invariably help corporate managers in strategizing and adopting value-creating policies.
3. Each of the models tested in this study has variables that are functionally related to stock prices. While most of the variables in the different models were significantly priced in Canadian equity markets, some of them were statistically unimportant in those models. The study has therefore provided insights on the factors or variables that are key when it comes to the pricing of risk capital.

4. The results of this study may be very helpful to investors in identifying stocks whose pricing deviate significantly from the norm. This identification can go a long way to induce appropriate portfolio decisions. For instance, the study found that the market puts positive multiples on EVC⁺. If a particular company earns a positive economic profit and yet the market puts a low multiple on the company's stock, this may suggest that the stock's price deviates from the norm, and if an investor takes a long position in the stock at its current price, there may be some potential for an upward gain in the near future.
5. Last but not the least, the study provides Canadian evidence on stock pricing models, independent of U.S. and U.K. evidence. With the obvious absence of empirical evidence on price level models based on Canadian data, this study has indeed filled an apparent gap. Also, the individual idiosyncratic features of the Canadian, U.S. and U.K. capital markets (e.g. differences in operational and legal environments) notwithstanding, the similarity among this study's findings and those reported in the U.S. and U.K. shows that price level models have importance that cuts across the frontiers of national boundaries.

7.2 Limitations

The major limitation of the study relates to survivorship bias. Because every edition of the Stock Guide database excludes firms that have been delisted due to mergers and acquisitions, bankruptcies or leveraged buy-outs, a survivorship bias is introduced which may impact on the generalizability of the results. The exclusion of some industries (an offshoot of the sample selection criteria) may also restrict the generalizability of the

results of this study. Additionally, since only publicly traded TSE companies have been used in this study, generalization of the results may be affected.

The various models in this study largely depend on accounting numbers reported in financial statements and subsequently included in the Stock Guide database. However, accounting information may be vulnerable to managerial misrepresentations or other biases (such as conservatism) arising from the accounting system. The fact that external auditors independently verify the fairness of accounting information provides comfort for the use of accounting information. In connection with biases resulting from conservatism, Ohlson's (1995) theory shows that the decrease in book value caused by conservative accounting is exactly offset by an increase in future ROEs, so that computed firm value is unaffected.

Furthermore, the cross-sectional regression models impose constant parameter values across firms, but there are powerful arguments that response coefficients may be likely impacted by such factors as growth and risk.

Finally, the likelihood that the significance of the major variables in the different models tested was due to chance cannot be eliminated. Thus, it is possible that certain significant variables in the different models are linked to stock prices by chance, and not because there is an underlying relationship between the variables and stock prices. Even though the sensitivity of the sub-sampling criteria used in this study was tested and results were essentially the same, it is also possible that the results were obtained by chance, and different results would have been obtained if alternative sub-sampling criteria were used.

7.3 Suggestions for Future Research

The findings of this study combined with some of the study's limitations provide important possibilities for future research. Firstly, given that a greater explanatory power was achieved when court accepted formulas were defined to be based on economic profit and not earnings per share, there appears to be a need for theoreticians to look at the possibility of developing EVC-based stock pricing models around industry relatives.

Secondly, the scope of future research can be broadened to include firms listed on other Canadian Stock Exchanges as well as firms in some of the industries that were excluded. The scope of future research should also be broadened to include other sub-sampling criteria for testing the value relevance of dividends and debt.

Thirdly, future research should use analysts' forecasts of earnings to proxy for market participants' ex ante expectations since the use of ex post realized earnings in this study does not appear to suitably proxy for ex ante earnings expectations.

Finally, future research should be directed at analyzing the debt signal based on an interaction between return on equity and debt equity ratios. Since there is the possibility that highly profitable firms may also take on moderate debt on average, it will be interesting to see how the market values debt for highly profitable firms with low D/E ratios and those with high D/E ratios.

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Appendix A – Definitions of Variables

Variable	Label	Definition
Price	P	Price per share at the end of the company's financial year.
Earnings	E or ORDEPS	EPS. Following Collins et al. (1997) and Hand and Landsman (1999), EPS is defined as income to ordinary shareholders before extraordinary items, discontinued operations and tax adjusted unusual items divided by the average number of shares.
Dividends	DV	Dividends per share. Ordinary Dividends divided by the weighted-average number of shares.
Retained earnings	RE	EPS less ordinary dividends per share.
Investments	IV	Capital expenditures plus investments and acquisitions divided by the weighted-average number of shares.
Book value	BV	Total equity less both preferred equity and element of convertible debt divided by the number of shares at the balance sheet date.
Total debt	TD or TOTDBTP	Total Debt, including short-term and long-term debt, long-term liabilities and non-ordinary equity divided by the number of shares at the balance sheet date.
Total capital	[TD + BV] or TOTCAP	Sum of ordinary equity and total debt.
NOPAT	NOPAT	Net operating profits after taxes.
Economic Profit or Economic Value Created	EV or EVC	NOPAT less capital charge (i.e. WACC*Capital).
Positive EVC	EV ⁺ or EVC ⁺	Equals EVC if EVC is positive and zero otherwise.
Negative EVC	EV ⁻ or EVC ⁻	Equals EVC if EVC is negative and zero otherwise.
Return on equity	ROE	EPS divided by book value of equity.
Positive ROE	ROE ⁺	Equals ROE if ROE is positive and zero otherwise.
Negative ROE	ROE ⁻	Equals ROE if ROE is negative and zero otherwise.
Net (profit) margin	Margin	Earnings divided by sales.
Positive net (profit) margin	Margin ⁺	Equals margin if margin is positive and zero otherwise.
Negative net (profit) margin	Margin ⁻	Equals margin if margin is negative and zero otherwise.
Beta	Beta	A company's stock beta, which is based on the standard Vasicek method.
Earnings growth rate	Earnings growth	Geometric average growth rate in earnings over the previous five years.
Price-to-sales	P/S	Price divided by sales per share.
Price-to-book	P/B	Price divided by book value of equity per share.
Price-to-earnings	P/E	Price divided by EPS.
Payout Ratio	Payout	Dividends divided by earnings.
Dividend Yield	DVYLD	Dividends per share divided by price.
Free Cash Flow to Equity	FCFE	Net Income + Depreciation - Capital spending - Changes in working capital - Principal repayments ÷ New debt issues.
Free Cash Flow to Firm	FCF	FCFE + [Interest expense * (1 - tax rate)] + Principal repayments - New debt issues + Preferred dividends.

Appendix B – Ridge Regression

In the presence of multicollinearity, the technique of OLS (which is mostly based on the Gauss-Markov procedure for estimating the unknown β) is no longer the best procedure because the $X'X$ matrix deviates considerably from a unit matrix and does not have a uniform eigenvalue spectrum. Hoerl and Kennard (1970) demonstrated that when this happens, the estimates of β in $Y = X\beta + \varepsilon$, based on the criterion of minimum residual sum of squares can have a high probability of being far removed from β . In such instances, an estimation approach (known as ridge regression) whereby instability is reduced at the expense of introducing a small amount of bias into the regression coefficient estimates has been shown to be a useful procedure for circumventing the many difficulties that ordinary least squares estimates are subject to. The biased parameter estimates (resulting from ridge regression) have smaller mean squared errors than the unbiased estimates obtainable through ordinary least squares.

The major problem in ridge regression is the choice of the ridge constant k (which is added to each eigenvalue of the $X'X$ matrix). Hoerl and Kennard (1970) proposed a general formulation (generalized ridge regression) and showed that the optimal values for the k_i will be $k_i = \sigma^2/\alpha_i^2$. Hocking et al. (1976) lend support to the generalized ridge regression technique when, in their survey of biased estimators, they noted that the generalized ridge estimator is potentially superior.

The severity of the multicollinearity between total capital and total debt (in the EBO model suggested by Rees) led to the implementation of the ridge regression technique.

Appendix C – Reclassification of Stock Guide industry Groups

Condensed Group Name	Condensed Group #	Stock Guide Group #
Oil & Gas	3	16, 18 and 21
Paper & Forest Products	4	26
Consumer Products	5	32, 34, 36, 37, 39 and 43
Industrial Products	6	27, 31, 50, 52, 54, 55, 56, 60, 61, 62, 63, 70 and 71
Real Estates	7	85
Transportation & Environmental Services	8	75
Pipelines	9	23
Communications & Media	10	80, 81 and 83
Merchandising	11	41, 42, 44, 45, 46, 47 and 57

Appendix D – Normal Probability Plot of Standardized Residuals

Appendix E – Tests of Free Cash Flows to Equity

Cash Flow Model	
Intercept	3.284
<i>t-stat</i>	21.14***
FCFE	-0.039
<i>t-stat</i>	-0.68
BV	1.050
<i>t-stat</i>	34.38***
R ²	0.5407
Adj. R ²	0.5403
Cases	2078

The estimated model is:

$$P_{it} = a_0 + a_1 FCFE_{it} + a_2 BV_{it} + e_{it}$$

The t-statistics are based on White's heteroscedastic consistent standard errors. *** means significant at the 1% level. Outliers deleted were defined as the top and bottom 0.5% of cases for FCFE, price and book value per share as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).

Appendix F – Tests of EBO Models based on Forecasted Earnings

	Model 1	Model 2
Intercept	2.817	2.815
<i>t-stat</i>	7.87***	7.91***
Book Value	0.992	0.998
<i>t-stat</i>	13.20***	13.46***
<i>VIF</i>	1.35	1.36
Abnormal Earnings, $\tau=1$	2.016	2.016
<i>t-stat</i>	3.41***	3.37***
<i>VIF</i>	1.73	1.73
Abnormal Earnings, $\tau=2$	0.172	-0.016
<i>t-stat</i>	0.26	-0.03
<i>VIF</i>	1.73	2.02
Abnormal Earnings, $\tau=3$	-	0.415
<i>t-stat</i>	-	0.97
<i>VIF</i>	-	1.74
Abnormal Earnings, $\tau=4$	0.140	-0.014
<i>t-stat</i>	0.29	-0.03
<i>VIF</i>	1.30	1.46
R^2	0.5631	0.5649
Adj. R^2	0.5566	0.5568
Cases	275	275

The model estimated is:

$$P_{it} = a_0 + a_1 BV_{it} + \sum_{\tau=1}^4 a_{\tau+1} E_t[EPS_{t,\tau} - rBV_{t,\tau-1}] + e_{it}$$

The interest rate, r , used is 10.8% (based on 1992 average medium term debt rate). The t -statistics are based on White's (1980) heteroscedastic consistent standard errors. *** means significant at the 1% level. Outliers deleted were defined as the top and bottom 0.5% of cases for earnings per share, price and book value per share as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).

Appendix G – Redefined Earnings and Reduced Sample Results

Alternative Definition of EPS		Reduced Sample
Constant	3.532	3.498
<i>t</i> -statistic	22.22***	17.77***
BV	0.939	0.792
<i>t</i> -statistic	6.93***	18.72***
E	1.017	2.574
<i>t</i> -statistic	28.17***	10.25***
R ²	0.5381	0.5641
Adj. R ²	0.5377	0.5634
Cases	2090	1279

The estimated model is:

$$P_{it} = a_0 + a_1 E_{it} + a_2 BV_{it} + e_{it}$$

The *t*-statistics are based on White's heteroscedastic consistent standard errors. *** means significant at the 1% level. Outliers deleted were defined as the top and bottom 0.5% of cases for earnings per share, price and book value per share as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).

Appendix H – Tests of Full EBO model for only Dividend-Paying Stocks

	Full EBO Model
Intercept	3.592
<i>t-stat</i>	11.69***
DV	4.227
<i>t-stat</i>	8.12***
RE	3.234
<i>t-stat</i>	9.52***
IV	0.353
<i>t-stat</i>	4.9***
BV+TD	0.706
<i>t-stat</i>	16.74***
TD	-0.756
<i>t-stat</i>	-15.16***
R ²	0.6384
Adj. R ²	0.6359
Cases	746
$b_1 - b_2 = 0$	6.31
<i>p-value</i>	[0.01]
$b_3 - b_4 = 0$	262.66
<i>p-value</i>	[0.00]

The model estimated is:

$$P_{it} = b_0 + b_1 DV_{it} + b_2 RE_{it} + b_3 (BV_{it} + TD_{it}) - b_4 TD_{it} + b_5 IV_{it} + e_{it}$$

The *t*-statistics are based on White's (1980) heteroscedastic consistent standard errors. The tests of the equality of beta coefficients are Chi-square tests using asymptotic standard errors of parameter estimates, which are also based on White's heteroscedastic consistent covariance matrices. *** means significant at the 1% level. Outliers deleted were defined as the top and bottom 0.5% of cases for earnings per share, price and book value per share as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).

Appendix I – Results of Basic EBO Model Deflated by Book Value

	Basic EBO Model
Intercept	1.262
<i>t</i> -statistic	19.35***
1/BV	1.978
<i>t</i> -statistic	14.68***
E/BV	0.698
<i>t</i> -statistic	4.05***
R ²	0.5571
Adj. R ²	0.5567
Cases	2056

The estimated model is:

$$(P_{it}/BV) = a_0 + a_1 (1/BV)_{it} + a_2 (E/BV)_{it} + e_{it}$$

The *t*-statistics are based on White's heteroscedastic consistent standard errors. Cases with negative book value per share were excluded. *** means significant at the 1% level. Outliers deleted were defined as the top and bottom 0.5% of cases for earnings per share, price and book value per share as well as cases with yearly studentized residuals greater than 4 (in absolute value terms).