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Can fundamental value predict stock returns? An empirical assessment of the Feltham -Ohlson model

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CAN FUNDAMENTAL VALUE PREDICT STOCK RETURNS? AN EMPIRICAL ASSESSMENT OF THE FELTHAM-OHLSON MODEL

by

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ABSTRACT

In valuation research, two modeling approaches that have become prominent are those based on the Residual Income Model (RIM) and those based on the Feltham-Ohlson framework. Ohlson (1995) develops a valuation model which links a firm's fundamental value to the book value of equity, earnings and other relevant information. Feltham and Ohlson (1995) extend the Ohlson (1995) model to incorporate growth and conservative accounting.

This study provides an evaluation of the Feltham-Ohlson (1995) model assuming market inefficiency. Analyst forecast data are obtained from the international I/B/E/S files. Financial information and share prices are obtained from the Compustat Database. Canadian T-bill rates and exchange rates are obtained from the International Financial Statistics database. All variables are scaled by the market value of equity at fiscal year end to mitigate for heteroscedasticity. Financial firms are excluded. Following Myers (1999), the discount rate is measured as the sum of the Canadian T-bill rate and the firm's industry risk premium. Panel data methodology with lagged values is used to determine the parameters of the linear dynamics equations.

Net operating assets are found to have a negative relationship with abnormal earnings. For the firms in the sample, net operating assets are diminishing over the time period 1990-1998. Managers are selling off assets or they are not making investments sufficient to offset the effects of depreciation.

For every year from 1989 to 1998, four portfolios are formed based on the V/P ratio where V is the predicted value of the firm based on the Feltham-Ohlson (1995) model and P is the market value at fiscal year end. There is a statistically significant difference in the one year returns on low (V/P) portfolios and high (V/P) portfolios. Noise traders acting on pseudo signals continue to invest in overvalued stocks. Professional arbitrageurs are unable to restore equilibrium because of their limited wealth and time horizons.

The differences in the equally weighted 36 month return for the low (V/P) and the high (V/P) portfolios are not statistically significant, indicating that investors become less optimistic about overvalued stocks within 36 months.

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CHAPTER I

INTRODUCTION

Kothari (2001) identifies two roles for fundamental analysis: "The principal motivation for fundamental analysis research and its use in practice is to identify mispriced securities for investment purposes. However, even in an efficient market there is an important role for fundamental analysis. It aids our understanding of the determinants of value, which facilitates investment decisions and valuation of non-publicly traded securities. Regardless of the motivation, fundamental analysis seeks to determine firms' intrinsic values".

Copeland and Weston (1992) list the concept of intrinsic value as one of four hypotheses which attempt to explain the investor's decision making process:

(1) The naïve hypothesis: asset prices are completely arbitrary and unrelated either to the future cash flows of the asset or to the probabilities of the payouts.

(2) The speculative equilibrium hypothesis: all investors base their decisions entirely on their anticipation of other individuals' behavior without any necessary relationship to the actual payoffs that the assets are expected to provide.

(3) The intrinsic value hypothesis: prices will be determined by each individual's estimate of the payoffs of an asset without consideration of its resale value to other individuals.

(4) The rational expectations hypothesis: prices are formed on the basis of the expected future payouts of the assets, including their resale value to third parties.

Lee (1999) makes the following points about the equity valuation process:

(1) It is prospective, producing an estimate of the present value of expected payoffs to shareholders. Better valuation models will produce better estimates.

(2) The valuation task is interdisciplinary, involving skills in accounting, finance, economics, marketing and corporate strategy.

(3) The parameters of the valuation model are determined using additional information from outside the firm, including industry wide performance benchmarks, macroeconomic variables such as expected inflation and interest rates, as well as information on competitive trends in a firm's input and output markets.

The present value of expected dividends model (PVED) defines share price as the present value of expected future dividends discounted at their risk-adjusted rate of return. This model is generally attributed to Williams (1938). By assuming that the discount rate, r, is constant through time, that dividends are expected to grow at a constant rate g and that the growth rate of dividends is less than the discount rate, Gordon (1962) transforms the PVED model into a model known as the Gordon Growth Model.

Campbell (2000) notes two empirical difficulties related to the use of expected dividends:

(1) Many companies pay cash to shareholders partly by repurchasing shares on the open market. Repurchases affect dividends per share because they reduce the number of shares.

(2) Many companies seem to be postponing the payment of dividends until much later in their life cycle. Lee (1996) states that more than 25% of the firms listed on the New York Stock Exchange do not pay any dividends at all.

In response to these practical difficulties, the discounted cash flow (DCF) model and the residual income model (RIM) were developed. By assuming that changes in book value of shareholders equity equals net income available to common stockholders minus common stock dividends (the clean surplus relation), Edwards and Bell (1961) were able to transform the present value of expected dividends model into one in which expected dividends are replaced by expected abnormal earnings. The model was popularized by Peasnell (1982) and Ohlson (1995) and is known as the Edwards-Bell-Ohlson (EBO) model or the residual income model (RIM). Lo and Lys (2000) note that availability of analyst forecasts since the 1980s and the easy access to computational resources allowed researchers to implement the EBO model.

Most specifications of the DCF model require estimates of free cash flow, which is the cash flow available for distribution to both debt and equity holders. The DCF model estimates the value of the sum of the debt and equity of the firm. Consequently, the appropriate discount rate is the weighted average cost of capital. The market value of the firm's debt must be subtracted from the total value of the firm to obtain the value of the equity. A shortcoming of the DCF model is the need to subtract long term capital investment from operating cash flows to compute free cash flow. In the case of growing firms, this causes negative free cash flows for many years. In contrast, under the accrual accounting system used by the RIM, depreciation and amortization allocate this investment cost over time, matching it against the revenue it generates. Penman and

Sougiannis (1998) show that the RIM's use of accrual accounting allows for more reasonable valuations than the DCF model from forecasted payoffs over relatively short horizons.

Lee (1996) discusses the similarities between the EBO model and the concept of EVA (Economic Value Added). Both EVA and the EBO model use the idea of residual income, defined as earnings in excess of an expected level of performance. In both models, the expected level of performance is based on the capital employed at the beginning of the period and the cost of that capital. In the case of EVA, Lee (1996) notes that some companies use an average of total assets at the beginning and end of the period as the definition of the capital base and the cost of capital is the weighted average cost of capital. For the EBO model, the capital is that supplied by equity investors and the cost of this capital is the required return on equity. When these definitions are used, EVA shows that a firm or division is creating wealth for its investors only if its ROA exceeds the weighted average cost of capital. Similarly, the EBO model shows that a firm is creating wealth for its shareholders only if it earns a return on equity (ROE) in excess of the cost of equity capital.

Ohlson (1995) develops a valuation model which links a firm's fundamental value to the book value of equity, earnings and other relevant information. The model is an extension of the dividend discount model and assumes unbiased accounting, clean surplus, linear information dynamics and the Modigliani and Miller (1958, 1961) propositions. The other information in the Ohlson (1995) model represents information which has been released to the public and has affected stock prices but is not yet reflected in the financial statements. Feltham and Ohlson (1995) extend the model to incorporate growth and conservative accounting.

The Ohlson (1995) model imposes a time-series structure on the abnormal earnings process that affects value. The linear information dynamics in the model specifies an autoregressive time-series decay in the current period's abnormal earnings and allows information other than abnormal earnings to affect stock prices. The economic intuition for the autoregressive process in abnormal earnings is that competition will sooner or later diminish above-normal returns or firms experiencing below normal rates of return will eventually exit.

The Ohlson (1995) and the Feltham-Ohlson (1995) model have become prominent in capital markets research. Bernard (1995) writes "The Ohlson (1995) and Feltham and Ohlson (1995) studies stand among the most important developments in capital markets research in the last several years. The studies provide a foundation for redefining the appropriate objective of research on the relation between financial statement data and firm value."

Lo and Lys (2000) state "to date (May 12, 1999) we found an average of nine annual citations in the Social Sciences Citation Index for Ohlson (1995). If this citation rate continues, Ohlson's work is not just influential but will become a classic."

Lo and Lys (2000) propose future enhancements to the Ohlson (1995) model: "The model has been developed in the context of perfect capital markets, and so is not meant to be entirely descriptive of the real world. Just as our colleagues in finance have taken away the MM assumptions one by one, we can do the same with the Ohlson model.

The model could be enhanced to incorporate the effects of taxes, bankruptcy costs, agency costs, asymmetric information and so on."

Kothari (2001) comments on how valuation models should be tested: "All valuation models make unrealistic assumptions. This feature is common to most theoretical models, like the Ohlson (1995) model that imposes a particular structure on the abnormal earnings process and other information. It is fruitless to criticize one or more of these models on the basis of the realism of the assumptions. Assuming efficient capital markets, one objective of a valuation model is to explain observed share prices. Alternatively in an inefficient capital market, a good model of intrinsic or fundamental value should predictably generate positive or negative abnormal returns. Therefore in the spirit of positive science, it is worthwhile examining which of these models best explains share prices and/or which has the most predictive power with respect to future returns."

Addressing the concept of market efficiency, Lee (2001) states "market prices are buffeted by a continuous flow of information, or rumors and innuendos disguised as information. Individuals reacting to these signals, or pseudo-signals, cannot fully calibrate the extent to which their own signal is already reflected in price. Prices move as they trade on the basis of their imperfect informational endowments. Eventually through trial and error, the aggregation process is completed and prices adjust to fully reveal the impact of a particular signal. But by that time, many new signals have arrived, causing new turbulence. As a result, the ocean is in a constant state of restlessness. The market is in a continuous state of adjustment. In this analogy, market efficiency is a journey not a destination." Lee (2001) considers market efficiency to be the outcome of the interactions between noise traders and professional arbitrageurs. According to Lee (2001) professional arbitrage requires the use of valuation models and careful monitoring of market information. In contrast, a noise trader acts on a signal that ultimately proves to have no information concerning value. Professional arbitrageurs trade on the basis of fundamental information, subject to risk aversion and wealth constraints.

Lee (2001) notes that the unpredictability of returns does not guarantee market efficiency. This unpredictability could be the result of the activity of noise traders who are influenced by "fads" and "fashions" causing stock prices to diverge dramatically from fundamental values. Lee (2001) considers valuation research to be beneficial because it could lead to improved valuation models, which would improve the effectiveness of the professional arbitrageurs, resulting in an enhancement in the efficiency of financial markets.

Statement of the Problem

Empirical tests of the Feltham and Ohlson (1995) and the Ohlson (1995) models have failed to validate these models. However these results could be driven by the implementation choices made by the researchers. The empirical tests take one of two basic forms: if the empirical test assumes efficient markets then the estimate of fundamental value of a share of stock predicted by the model is compared with the current price of the stock. On the other hand if the empirical test assumes inefficient markets, then the ability of the model to predict future stock returns is evaluated. Dechow et al. (1999) test the Ohlson (1995) model assuming market inefficiency and compute the difference in returns between a portfolio of stocks formed on the basis of high fundamental value to price and a portfolio formed on the basis of low fundamental value to price. They find that this difference is statistically insignificant, indicating that their implementation of the Ohlson (1995) model was unable to predict future returns. These results could be a consequence of their implementation choices which include a twelve month forecasting horizon, a fixed cost of equity capital rate of 12% and an assumption that firms are homogeneous with respect to characteristics that might affect the parameters of the forecasting equation. Dechow et al. (1999) suggest that future research should test a more general model such as the Feltham-Ohlson (1995) model which incorporates growth in operating assets and accounting conservatism.

Ohlson and Feltham (1995) update the model to take into account conservative accounting and growth in operating assets. Myers (1999) tests the Feltham-Ohlson (1995) model assuming market efficiency. Consequently current market price becomes the benchmark of fundamental value. Myers (1999) uses order backlog as the proxy for the unobservable information which is an arbitrary choice. In contrast, Ohlson and Liu (2000) show that by taking expectations of one of the linear dynamics equations, the unobservable information can be extracted from analysts' earnings forecasts. Myers (1999) attempts to take into account firm specific differences by performing time series regressions on a firm by firm basis and then sorting the parameters of the equations into percentiles. For the purpose of taking firm specific differences into account, panel data methodology would be more appropriate. Myers (1999) alters the Feltham-Ohlson (1995) model so that he does not take into account the unobservable information that affects the growth in net operating assets.

This dissertation addresses the following issues:

(1) Does the implementation of the Feltham-Ohlson (1995) model as suggested by Ohlson and Liu (2000) confirm the validity of the model as measured by its ability to predict returns?

(2) Do the parameters produced by the model fall within the bounds required by the theoretical predictions?

(3) Does the model perform better over longer horizons than over shorter horizons?

(4) Is the performance of the model caused by the identification of some new risk factor or is it due to the correlation with existing risk factors?

(5) Is the panel data testing approach superior to the pooled time series cross-sectional approach?

(6) Do the fixed effects, time effects or time and fixed effects panel data approaches provide equivalent results?

(7) How would the results be affected if the assumption of market efficiency was changed to an assumption of market inefficiency?

Purpose of the Study

The purpose of this study is to test the empirical validity of the Feltham-Ohlson (1995) model using an implementation methodology more closely matched to the theoretical model than that used by previous researchers. An empirical test of the model requires several critical implementation decisions, such as the choice of the econometric technique, the method for assessing the validity of the model and the method for measuring unobservable information. Ohlson and Liu (2000) provide useful guidelines for performing empirical tests of the model.

Ohlson and Liu (2000) show that the unobservable information can be extracted from analysts' earnings forecasts through taking expectations of the linear dynamics equations. Consequently, this unobservable information need not be omitted from tests of the model nor does the choice of a measure of unobservable information have to be made on an arbitrary basis. In this study, the unobservable information is extracted from I/B/E/S analysts' earnings forecasts.

An empirical test of the Feltham-Ohlson (1995) model requires the estimation of the parameters of the linear dynamics equations and then using these parameters to estimate the valuation function. The use of panel data methodology in this study to estimate the coefficients of the linear dynamics equations could potentially lead to an improvement over pooled time series cross-sectional regressions because it accounts for differences in firms and differences that depend on the time period.

Since I am assuming that markets need not be efficient, then according to Kothari (2001), return predictability becomes an appropriate method of assessing the validity of the Feltham-Ohlson (1995) model. If stocks are inappropriately valued, then at some point in the future the stock price will adjust toward the fundamental value of the stock. The Feltham-Ohlson (1995) model makes no prediction as to when this correction will occur. Hence it would be appropriate to test its predictive ability over a variety of time periods.

Clearly any predictive power of the Feltham-Ohlson (1995) model could be the result of correlation with other factors such as beta, the price-earnings ratio, price to book value of equity or an unknown risk factor. For the first three factors, some insight could be obtained by examining the characteristics of the portfolios formed by sorting firms on the basis of fundamental value to market value. If the difference in the beta, price-earnings ratio or price to book value of equity of these portfolios is not statistically significant, then the results are not driven by these characteristics. Due to the lack of data availability in Compustat I only test the price-earnings factor.

Hypotheses

H1: A portfolio that has a high V/P ratio indicates that the stocks in the portfolio are undervalued and would consequently produce high returns. Conversely, a portfolio that has a low V/P ratio indicates that the stocks in the portfolio are overvalued and would produce low returns. Therefore we would expect that if stocks were sorted into quartile portfolios based on the V/P ratio, the average difference in returns between the highest and lowest quartile portfolio would be statistically significant. We can then assert that there is a statistically significant difference between the returns on a portfolio formed on the basis of a low V/P ratio and a portfolio formed on the basis of a high V/P ratio. This is a measure of the predictive power of the Feltham-Ohlson (1995) model.

H2: If there is correlation between the P/E ratio and the V/P ratio, the predictive power of the V/P ratio could be the result of the P/E ratio. If the highest V/P quartile portfolio has an average P/E ratio that is not statistically different from the P/E ratio of the lowest V/P quartile portfolio, the difference in the returns of these portfolios could not be a consequence of the differences in the P/E ratio.

H3: The pooled time series cross sectional approach treats all firms as homogenous and does not take into account effects that are a consequence of certain time periods. The fixed effects panel data approach takes cross sectional differences of firms into account. The time effects panel data approach takes differences that are specific to a time period into account. The time and fixed effects panel data approach takes both cross sectional differences in firms and differences across time into account. Hence the panel data approach should produce results that have a greater degree of statistical significance than the pooled cross sectional time series approach.

H4: Feltham and Ohlson (1995) place the following restrictions on the parameters of the linear dynamics equations:

(1) $| \gamma_1 | < 1$, $| \gamma_2 | < 1$

(2) $0 \leq \omega_{11} < 1$

(3) $1 \leq \omega_{22} < R_e$

(4) $\omega_{12} \geq 0$

Therefore the results should show that the parameters associated with the linear information dynamics are within the theoretical bounds predicted by Feltham and Ohlson (1995).

Scope and Limitations of the Study

Because of data limitation, the analysis is confined to Canadian firms. Analyst forecast data are obtained from the international I/B/E/S files. Financial information is obtained from the Compustat Database. Following DeChow et al. (1999), all variables are scaled by the market value of equity to mitigate for heteroscedasticity. Canadian T-bill rates and exchange rates are obtained from the IFS database. A proxy for the risk premium for each Canadian industry is obtained from the Fama and French (1997) study using U.S. data.

Financial firms are excluded because these firms have a low level of operating assets and are subject to additional regulatory requirements that could affect the relation between their accounting numbers and stock market values. Firms with negative equity for any year are excluded. Firms are required to have consecutive years of data available on both the I/B/E/S files and the Compustat Database to be included. Return data were available in Compustat up to 2001. Since three years of return data were required, this restricted the last year of the sample to 1998. These restrictions limited the sample period to 1989-1998. Firms are not excluded if they had fiscal year ends other than December or if they changed their fiscal year ends during the sample period.

The one year ahead I/B/E/S forecast (F1) and the two year ahead I/B/E/S forecast (F2) are taken from May of the year subsequent to the end of the fiscal year. This is done to allow for delays in the reporting of the financial statements. If the company has not made its financial statements public by May, the analysts' forecasts in May refer to the previous fiscal year. In this case, the two year ahead forecast is used in place of the one year ahead forecast and the three year ahead forecast is used in place of the two year ahead forecast. If the analysts' forecasts are not available for May but are available for a preceding month subsequent to the fiscal year end, then they are taken from the preceding month. If these procedures were unsuccessful, the forecasts are treated as missing observations.

When Canadian companies report earnings in U.S. dollars, analysts provide forecasts in U.S. dollars. Using exchange rates from International Financial Statistics, these forecasts are converted to Canadian dollars. I/B/E/S analysts' forecasts are sometimes made on a fully diluted basis. In this case it would be appropriate to use the fully diluted EPS from Compustat. However, Compustat does not always provide this information, but it does consistently provide undiluted EPS information. In order to maintain consistency, undiluted EPS information is always used. No adjustments are made for outliers and transactions costs are not taken into account.

The Ohlson (1995) model and the Feltham-Ohlson (1995) model are developed with the assumption of risk neutrality so that the discount rate equals the risk free rate. However, following Myers (1999), the discount rate used in this research is the sum of the industry specific risk premium derived by Fama and French (1997) and the annualized Canadian T-bill rate. A possible limitation is that the risk premiums derived by Fama and French (1997) could be specific to the U.S. during the time period when they were estimated (7/63 – 12/94).

Following the suggestion by Ohlson and Liu (2000), the one year ahead forecast of net operating assets is determined as current net operating assets times the expected growth in net operating assets. Ohlson and Liu (2000) suggest using a five year forecast of growth to estimate the growth in operating assets. Since the long term forecast is not always available, the growth rate implicit in the one year and two year forecast is used. In a few cases the one year forecast was zero. To avoid division by zero when computing the growth rate, this was treated as a missing observation.

Organizational Plan

Chapter II contains a two part literature review concerning:

1) Studies testing the validity of models that are modifications of the Residual Income Model

2) Studies testing the validity of models that add linear information dynamics to the Residual Income Model such as the Ohlson (1995) model and the Feltham-Ohlson (1995) model.

Chapter III describes the Feltham-Ohlson (1995) model and the methodology to be applied.

Chapter IV contains a description of the results.

Chapter V contains an analysis of the findings as well as the conclusions.

CHAPTER II

LITERATURE REVIEW

Studies Based on the Residual Income Model (RIM)

The purpose of the study by Frankel and Lee (1998) is to examine the effectiveness of a residual income model in predicting cross sectional stock returns in the U.S. The model is implemented using I/B/E/S consensus analysts' earnings forecasts and is truncated after three periods. They demonstrate the superiority of this model in predicting stock returns over other predictors of stock returns such as market beta, firm size and book value of equity to market value of equity.

The residual income valuation model is derived from the present value of expected future dividends (PVED) model. The assumptions of this (PVED) model are homogeneous beliefs and unchanging interest rates.

$$V_t = \sum_{\tau=1}^{\infty} R^{-\tau} E_t \left[\tilde{d}_{t+\tau} \right] \quad (1)$$

Where

V_t is the estimated value of the stock price at time t

r_e is the one period cost of equity capital

$R = 1 + r_e$

d_t is common dividends

E_t [.] is the expectation operator based on information available at time t

To derive the residual income model from PVED, two additional assumptions are made:

(1) Clean surplus

$$b_t = b_{t-1} + x_t - d_t \tag{2}$$

where b_t is equity book value (total common equity) at the end of period t

b_{t-1} is equity book value at the end of period t-1

x_t is accounting earnings or net income available to common shareholders for period t

(2) The regularity condition, which is that the book value of equity grows at a rate less than R.

This implies that

$$\frac{E_t\left[\tilde{b}_{t+\tau}\right]}{R^{\tau}} \rightarrow 0 \text{ as } \tau \rightarrow \infty \tag{3}$$

Residual income or abnormal earnings is given by

$$x_t^a = x_t - r_e\, b_{t-1} \tag{4}$$

$$x_t = x_t^a + r_e\, b_{t-1}$$

$$x_t = x_t^a + (R-1)\, b_{t-1} \tag{5}$$

From (2)

$$d_t = b_{t-1} - b_t + x_t \tag{6}$$

Substituting (5) in (6) gives

$$d_t = b_{t-1} - b_t + x_t^a + (R-1)\, b_{t-1}$$

$$d_t = - b_t + x_t^a + Rb_{t-1}$$

$$d_t = x_t^a + R\, b_{t-1} - b_t \tag{7}$$

substituting (7) in (1) gives

$$V_t = \sum_{\tau=1}^{\infty} R^{-\tau} E_t[\tilde{d}_{t+\tau}] = \sum_{\tau=1}^{\infty} R^{-\tau} E_t[\tilde{x}^a_{t+\tau}] + \sum_{\tau=1}^{\infty} R^{-\tau+1} E_t[\tilde{b}_{t-1+\tau}] - \sum_{\tau=1}^{\infty} R^{-\tau} E_t[\tilde{b}_{t+\tau}] \quad (8)$$

Corresponding terms in the last two expressions of (8) cancel leaving the first and last terms. From (3), the last term can be ignored.

$$V_t = \sum_{\tau=1}^{\infty} R^{-\tau} E_t[\tilde{x}^a_{t+\tau}] + b_t \quad (9)$$

Substituting (4) in (9) gives

$$V_t = b_t + \sum_{\tau=1}^{\infty} \frac{E_t[\tilde{x}_{t+\tau} - (r_e \; b_{t+\tau-1})]}{(1+r_e)^{\tau}}$$

$$V_t = b_t + \sum_{\tau=1}^{\infty} \frac{E_t[(ROE_{t+\tau} - r_e) \; b_{t+\tau-1}]}{(1+r_e)^{\tau}} \quad (10)$$

where

b_t = book value of equity at time t

E_t [.] = expectation based on information available at time t

r_e = cost of equity capital

$ROE_{t+\tau}$ = the after tax return on book value of equity for period $t + \tau$

Equation (10) shows that firm value can be partitioned into two components – an accounting measure of the capital invested (b_t) and a measure of the present value of all future residual income. The term in square brackets represents the abnormal earnings in each future period. If a firm always earns income at a rate exactly equal to its cost of equity capital then this term is zero and $V_t = b_t$. However firms whose expected ROEs are higher (lower) than r_e have firm values greater (lesser) than the book value of equity.

Equation (10) expresses firm value in terms of an infinite series but for practical purposes a finite forecast period must be specified. This requires a "terminal value" estimate – an estimate of the value of the firm based on the residual income earned after the finite forecasting period.

Frankel and Lee (1998) implement equation (10) using a three period valuation model:

$$V_t = b_t + \frac{(FROE_{t+1} - r_e)}{(1+r_e)} b_t + \frac{(FROE_{t+2} - r_e)}{(1+r_e)^2} b_{t+1} + \frac{(FROE_{t+3} - r_e)}{(1+r_e)^2 r_e} b_{t+2}$$

b_t is defined as the book value of equity (i.e. total shareholders equity)

r_e = the cost of equity

$FROE_{t+i}$ = forecasted ROE for year $t + i$

For the cost of equity capital, Frankel and Lee (1998) use a three factor industry based discount rate derived by Fama and French (1997).

The sample used by Frankel and Lee (1998) consists of domestic nonfinancial companies appearing in the NYSE, AMEX or NASDAQ, which are present in the CRSP and Compustat databases. Also, firms are required to have a one-year ahead and two-year ahead EPS forecast from I/B/E/S. This constrains the sample period to the years 1975-1993 because I/B/E/S began operations in 1975. To ensure that accounting variables are known before returns are computed, they require a minimum gap of six months between the fiscal year end and the portfolio formation date. The sample is constrained to have fiscal year ends between June and December inclusively. Based on accounting data in the calendar year t-1 and the I/B/E/S consensus forecast in May of year t, portfolios are formed in June 30 of year t.

The first test determines the predictive power of the V/P ratio (fundamental value to price) compared to other variables that are believed to predict returns. These variables are size (market value of equity) and book value of equity/price. For each variable of interest, quintile portfolios are formed based on the ranking of the stock with respect to the chosen variable. The characteristics of the portfolios and the differences in returns between the highest and lowest ranking portfolios are examined.

Every year all sample firms are sorted into quintiles based on market value of equity (ME), book value of equity/Price (B/P), and V/Price. The market value of shareholder's equity is based on the stock price as of June 30 of year t. Firm size quintiles are formed in two ways. In the first method, the portfolio boundaries are based on the June 30 prices of all NYSE firms. In the second method, the portfolio boundaries are based on the June 30 prices for the firms selected to form the sample. This is done because the sample is biased towards large firms. This bias occurs because firms in the sample were chosen so that both the one and two year ahead forecast was available. Consequently the chosen firms are likely to be large firms since it is more probable that analysts would follow larger firms. This results in two sets of five portfolios sorted by size, a set of five portfolios sorted by book value of equity/price and a set of five portfolios sorted by V/ P. This creates a total of 20 portfolios, grouped into 4 sets of quintiles. For each portfolio, Frankel and Lee (1998) report the average B/P, ME, and V/P values as well as the average post ranking market betas and average buy and hold returns over the next 12, 24 and 36 months. The market beta is estimated using an equally weighted market index and each firm's monthly returns over the next 36 months. They compute the difference in means between the top (Q5) and bottom (Q1) quintiles. The statistical significance of this difference is assessed using a Monte Carlo simulation technique.

Frankel and Lee (1998) implement the Monte Carlo simulation technique by forming empirical reference distributions. Each year firms are randomly assigned to quintile portfolios (without replacement). This procedure generates five random quintile portfolios each year with the same number of observations as the actual quintile portfolios. They repeat the process until they have obtained 1000 sets of quintile portfolios for each year. They then compute the mean returns for the Q5-Q1 portfolio. The p-values calculated from the simulated empirical distribution of mean Q5-Q1 returns are used to determine the statistical significance of the Q5-Q1 returns of the portfolios sorted by market value of equity (ME), book value of equity/price, and V/P.

First, they examine the size effect. The results show that there is a small firm effect when the distribution of quintiles is based on a partitioning of all NYSE firms. Over 12, 24 and 36 month periods following portfolio formation, small firms generally outperform large firms. However because they require that firms be followed by analysts, larger firms dominate the sample. Over 80% of their firms are larger than the median NYSE firm. When the distribution of quintiles is based on a partitioning of firms in the sample, large firms outperform small firms over 24 and 36 month holding periods. In this case, because large firms dominate the sample, the size differences are not as pronounced as in the previous partitioning method.

They find that there is a B/P effect. The lowest B/P firms earn an average of 13.7%, 25.1% and 40.7% over the next 12, 24 and 36 months. The highest B/P firms earn an average of 18.6%, 33.3% and 55.8% over the next 12, 24 and 36 months. The differences between the Q5 and Q1 portfolios are all significant at the 1% level. They also find that the low B/P firms have higher betas than high B/P firms. This suggests that the B/P effect is not due to differences in market risk.

The lowest V/P firms earn an average of 13.8%, 21.7% and 33.1% over the next 12, 24 and 36 months. The highest V/P firms earn an average of 16.9%, 36.9% and 63.7% over the next 12, 24 and 36 months. The 12 month prediction results for V/P are slightly weaker than the results for B/P. The Q5-Q1 values for the 12, 24 and 36 month periods are all statistically significant at the 1% level. The low V/P firms have higher betas and lower B/P values than the high V/P firms. This suggests that the V/P effect could not be due to differences in market risk, but could be influenced by differences in B/P.

The next issue to be resolved is how much of the explanatory power of V/P for long term returns is due to its correlation with firm size and B/P. To address this question, they use a two dimensional sorting procedure. Firms are assigned to one of 25 portfolios based on their V/P and size ranking. Horizontally, portfolios are ranked by the V/P ratio and vertically, portfolios are ranked by size. Then the average returns to a 36 month buy and hold strategy are computed. The procedure is repeated with sorting variables V/P and B/P.

The results indicate that V/P has strong predictive power in all five size quintiles. The difference in the Q5-Q1 returns (based on the V/P ranking) of the portfolios for each size category range from 27% to 38.8%. These differences are statistically significant at the 1% level in each of the five size quintiles. Similarly V/P has strong predictive power in four of the B/P quintiles. In this case the difference in the Q5-Q1 returns range from

15% to 46.9%. These differences are statistically significant at the 1% level in quintiles Q1, Q2, Q4 and Q5 and significant at the 10% level in quintile Q3. Overall the results suggest that in longer time horizons, the predictive power of V/P for future returns is not explained by either B/P or firm size.

Frankel and Lee (1998) conclude that V/P is a reliable predictor of cross sectional returns, particularly over longer horizons. This ability to predict returns is not attributable to B/P, firm size or beta.

Lee, Myers and Swaminathan (1999) evaluate a residual income model based measure of fundamental value using the following criteria:

(1) Better fundamental value estimates yield V/P ratios that have a lower standard deviation and a faster rate of mean reversion.

(2) Better fundamental value estimates yield V/P ratios that have greater predictive power for future returns.

Lee et al. (1999) explain that their motivation for choosing predictive power as the test of a model of fundamental value is a consequence of a model that relates the price of a stock to its fundamental value. In this model, P_t is the price at time t, V_t^* the fundamental value at time t, and V_t an empirical estimate of fundamental value. The log of P_t measures the log of V_t^* with error ε_t and the log of V_t measures the log of V_t^* with error ω_t.

$$\log (P_t) = \log (V_t^*) + \varepsilon_t$$

$$\log (V_t) = \log (V_t^*) + \omega_t$$

$$\log (V_t / P_t) = \omega_t - \varepsilon_t$$

If price measures fundamental value perfectly, then $\varepsilon_t = 0$ for all t, and any mean reversion in V/P is due entirely to ω_t. In this case, unless ω_t is a proxy for time varying expected real returns, V/P should have no predictive power for subsequent real returns. If however, V/P measures mispricing then it would have predictive power for subsequent real returns.

The residual income model Lee et al. (1999) use is derived from (10) which expresses firm value in terms of an infinite series but for practical purposes, an explicit forecast period must be specified. This requires a "terminal value" estimate – an estimate of the value of the firm based on the residual income earned after the explicit forecasting period. A two-stage approach is used to estimate the fundamental value:

(1) forecast earnings explicitly for the next three years

(2) forecast earnings beyond year 3 implicitly by linearly fading the period t + 3 ROE to the industry target ROE. To compute an industry target ROE, Lee et al. (1999) group all stocks into the same 48 industry classifications as Fama and French (1997). The industry target ROE is the median of past ROEs from all firms in the same industry. The median industry ROE is reached at period t + T. By using a "fade rate" Lee et al. (1999) attempt to capture the gradual decline of abnormal ROE over time caused by competition.

(3) The terminal value beyond period T is estimated by taking the period T residual income as a perpetuity. This procedure is based on the assumption that the book value of equity does not change. This assumption implies that there is no growth in retained earnings and no further issuance of equity capital. It also implies that all the earnings are paid out as dividends.

The following finite horizon estimate is computed for each firm:

$$V_t = b_t + \frac{(FROE_{t+1} - r_e)}{(1+r_e)} b_t + \frac{(FROE_{t+2} - r_e)}{(1+r_e)^2} b_{t+1} + TV \quad (11)$$

where

b_t = book value of equity (i.e. total shareholders equity)

r_e = the cost of equity

Depending on the choice of the risk free rate, Lee et al. (1999) generate two classes of cost of equity estimates:

(1) r_e (TB) = monthly annualized one-month T-bill rate + average market risk premium relative to returns on the one month T-bills ($R_m - R_{tb1}$)

(2) r_e (LT) = monthly annualized long term Treasury bond rate + average market risk premium relative to returns on long term treasury bonds ($R_m - R_{Ltb}$) where R_m is the average return on the NYSE/AMEX market portfolio

As implemented by Lee et al. (1999) for each month t beginning in April 1963, the average excess return (excess return is the market return in excess of the one month T-bill return or long term Treasury bond return) on the NYSE/AMEX market portfolio from January 1945 to month t-1 is computed and used as an estimate of the market risk premium for month t.

$FROE_{t+i}$ = forecasted ROE for year t + i

For the first three years, this variable is computed as

$FEPS_{t+i} / b_{t+i-1}$

where $FEPS_{t+i}$ is the mean forecasted EPS for year t + i and b_{t+i-1} is the book value of equity per share for year t + i – 1. Beyond the third year, FROE is forecasted using a linear fade rate to the industry median ROE. The I/B/E/S analysts supply a one year ahead and a two year ahead EPS forecast as well as an estimate of the long term growth rate. The long-term growth rate is used to compute a three year ahead earnings forecast. as follows:

$FEPS_{t+3} = FEPS_{t+2} (1 + Ltg)$

In the above equation, when Ltg is not available, the composite growth rate implicit in $FEPS_{t+1}$ and $FEPS_{t+2}$ is used to forecast $FEPS_{t+3}$. The forecasted book value of equity is computed as follows:

$b_{t+i} = b_{t+i-1} + FEPS_{t+i} - FDPS_{t+i}$

where $FDPS_{t+i}$ is the forecasted dividend per share for period t + i estimated using the current dividend payout ratio (k) as follows:

$FDPS_{t+i} = FEPS_{t+i} * k$

Lee et al. (1999) estimate k by dividing actual dividends from the last fiscal year by earnings over the same time period. Share repurchases are excluded due to the practical problems associated with determining the likelihood of their recurrence in future periods. If firms experience negative earnings, they divide the dividends paid by (0.06 * total assets) to derive an estimate of the payout ratio. This is because the long run return on total assets in the United States is approximately 6%. Hence they use 6% of total assets as a proxy for normal earnings levels when current earnings are negative. TV is the terminal value, which is estimated using one of three possible forecast horizons:

$$T = 3, \quad TV = \frac{(FROE_{t+3} - re)}{(1 + re)^2 re} b_{t+2}$$

$$T=12, \quad TV = \sum_{i=3}^{11} \frac{(FROE_{t+i} - re)}{(1+re)^{i} re} b_{t+i-1}$$

$$+ \frac{(FROE_{t+12} - re)}{(1+re)^{11} re} b_{t+11}$$

$$T=18, \quad TV = \sum_{i=3}^{17} \frac{(FROE_{t+i} - re)}{(1+re)^{i} re} b_{t+i-1}$$

$$+ \frac{(FROE_{t+18} - re)}{(1+re)^{17} re} b_{t+17}$$

T = number of years being forecasted.

Several variations of the Dow Jones value to price (V/P) ratio are evaluated where V is the fundamental value determined by a particular model and P is the end of month Dow Jones portfolio value. These include:

VP3 (TB) which uses the three period model computed using the short term interest rate

VP3 (LT) which uses the three period model computed using the long term interest rate

VP12 (TB) which uses the 12 period model computed using the short term rate

VP12 (LT) which uses the 12 period model computed using the long term rate

They also evaluate several other measures of fundamental value:

DJDP defined as dividends paid by the stocks in the Dow Jones portfolio in the most recent fiscal year divided by end-of-month Dow Jones portfolio value.

DJEP defined as the earnings of the stocks in the Dow Jones portfolio from the most recent fiscal year divided by end-of-month Dow Jones portfolio value.

DJBM defined as latest available book value of equity of the Dow Jones portfolio divided by the end-of-month Dow Jones portfolio value.

Their sample consists of all firms that have been members of the DJIA at least once on the last day of any month between May 1963 and June 1996. Financial data on these firms are collected from the merged 1995 COMPUSTAT annual industrial file. ROE data prior to the availability of COMPUSTAT are hand collected from Moody's Stock Guide. Stock price and returns are collected from the 1995 Center for Research in Securities Prices (CRSP) files.

To assess the predictive power of these measures of fundamental value, univariate regressions are run using VP3 (LT), VP3 (TB), VP12 (LT), VP12 (TB), DJDP, DJEP and DJBM.

$$\sum_{k=1}^{K} \frac{DJ_{t+k}}{K} = a + b\,(VP3\ (LT))_t + \varepsilon_{t+k,t}$$

$$\sum_{k=1}^{K} \frac{DJ_{t+k}}{K} = a + b\,(VP3\ (TB))_t + \varepsilon_{t+k,t}$$

$$\sum_{k=1}^{K} \frac{DJ_{t+k}}{K} = a + b\,(VP12\ (LT))_t + \varepsilon_{t+k,t}$$

$$\sum_{k=1}^{K} \frac{DJ_{t+k}}{K} = a + b\,(VP12\ (TB))_t + \varepsilon_{t+k,t}$$

$$\sum_{k=1}^{K} \frac{DJ_{t+k}}{K} = a + b\,(DJDP)_t + \varepsilon_{t+k,t}$$

$$\sum_{k=1}^{K} \frac{DJ_{t+k}}{K} = a + b(DJEP)_t + \varepsilon_{t+k,t}$$

$$\sum_{k=1}^{K} \frac{DJ_{t+k}}{K} = a + b(DJBM)_t + \varepsilon_{t+k,t}$$

DJ is the monthly real return on the Dow Jones Industrial Average which is defined as the difference between the continuously compounded real return per month on the DJIA and the monthly continuously compounded inflation rate.

K represents the time horizon and takes on the values 1, 4, 6, 9, 12, and 18 months. For instance if K = 3, then every month the returns for the following three month period are computed and divided by 3. This gives the average return per month.

The results show that the VP3 (LT) ratio has significant predictive power for Dow returns. The Z-statistics for the coefficient of VP3 (LT) are significant at the 5% level at all horizons. The R^2 range from 1.6% to 13.6%. The slope coefficients are all positive indicating that high V/P predicts high stock returns. Similar results hold for VP12 (LT). Replacing the long-term rate with the short term rate strengthens the predictive power of V/P. The Z-statistics for the coefficient of VP3 (TB) are significant at the 1% level for all horizons. The R^2 are also higher and range from 3.1% to 20.5%. Similar results hold for VP12 (TB).

In contrast they find that DJDP, DJEP and DJBM have little predictive power for the Dow returns. The Z statistics are small, ranging from 0.517 to 0.902 and the R^2 are low, ranging from 0.25 to 1.32. Next, they run multivariate regressions with all four measures of fundamental value. The reason for doing this is to determine whether the predictive power of V/P is due to its correlation with DJDP, DJEP and DJBM.

$$\sum_{k=1}^{K} \frac{DJ_{t+k}}{K} = a + bDJDP_t + cDJEP_t + dDJBM_t + eVP3\,(LT)_t + \varepsilon_{t+k,t}$$

$$\sum_{k=1}^{K} \frac{DJ_{t+k}}{K} = a + bDJDP_t + cDJEP_t + dDJBM_t + eVP3\,(TB)_t + \varepsilon_{t+k,t}$$

Lee et al. (1999) find that only V/P consistently predicts future Dow Jones returns because the Z-statistics corresponding to VP3(LT) and VP3(TB) are significant at the 1% or 5% level for all horizons, whereas the Z-statistics corresponding to DJDP, DJEP and DJBM are not significant.

In the next series of tests, Lee et al. (1999) examine the forecasting power of V/P, controlling for business cycle-related variation in conditional expected returns. Fama and French (1989) find evidence that the default spread, Def, and the term spread, Term, predict future stock returns. They interpret these two variables as ex ante measures of default and term risk related to the business cycle. The default spread is a measure of the ex ante default risk premium in the economy and is measured as the difference between the end-of-month yield (annualized) on a market portfolio of corporate bonds and end-of-month yield (annualized) on a portfolio of AAA bonds. Term is defined as the annualized end of month term spread. The term spread is a measure of the ex ante term risk premium in the economy and is measured as the difference between the end of month yield (annualized) on a portfolio of AAA bonds and the end-of-month yield on the one month T-bill. Because Lee et al. (1999) find that TB1 (the annualized end of month yield on the one month Treasury bill) is correlated with V/P, it is included in the business cycle tests.

$$\sum_{k=1}^{K} \frac{DJ_{t+k}}{K} = a + bDef_t + cTerm_t + dTB1_t + eVP3\ (LT)_t + \varepsilon_{t+k,t}$$

$$\sum_{k=1}^{K} \frac{DJ_{t+k}}{K} = a + bDef_t + cTerm_t + dTB1_t + eVP3\ (TB1)_t + \varepsilon_{t+k,t}$$

Lee et al. (1999) find that TB1 is a significant predictor at the 10% level. Neither Def or Term has much incremental power after controlling for V/P. The Z-statistic corresponding to V/P is significant at the 1% level for 1 to 12 month horizons and at the 5% level for the 18 month horizon. This indicates that V/P still has predictive power after controlling for TB1, Def and Term.

The autocorrelation in the 36 month return is 0.12 for VP3 (TB) and 0.3 for VP3(LT). This suggests that there may be mean reversion in stock prices at long horizons. To ensure that the results are not driven by this effect, Lee et al. (1999) perform regressions with the 36 month lagged market return.

$$\sum_{k=1}^{K} \frac{DJ_{t+k}}{K} = a + bVP3\ (LT)_t + c \sum_{\lambda=1}^{36} \frac{DJ_{t+1-\lambda}}{36} + \varepsilon_{t+k,\,t}$$

$$\sum_{k=1}^{K} \frac{DJ_{t+k}}{K} = a + bVP3\ (TB)_t + c \sum_{\lambda=1}^{36} \frac{DJ_{t+1-\lambda}}{36} + \varepsilon_{t+k,t}$$

$\sum_{\lambda=1}^{36} \frac{DJ_{t+1-\lambda}}{36}$ is the average of the monthly returns from the past 36 months.

The results show that both VP3 (TB) and VP3 (LT) continue to predict returns even after controlling for past returns. Replacing 36 month lagged returns with 12 month or 24 month lagged returns yields similar results. Using 12 period rather than 3 period versions of V/P also does not affect these findings.

In conclusion, Lee et al. (1999) show that in the 1963-1996 period, traditional value benchmarks such as B/P, E/P and D/P have little predictive power for overall returns in the United States. They develop a measure of V/P that outperforms these value benchmarks in terms of both tracking ability and predictive power. This predictability is not due to mean reversion nor is it due to known term structure related variables or other traditional price to value indicators. Lee et al. (1999) conclude that the results indicate that either V/P captures mispricing or a new dimension of time varying risk that has not yet been identified.

Ritter and Warr (2002) explain the bull market beginning in 1982 as being partly due to a correction of undervalued stock prices. They note that during the period from August 1982 to December 1999 the compound real total return on the Dow Jones Industrial Average was 15% per year, far in excess of the increase in earnings or book value of equity. Explanations provided by the academic literature include improved earnings growth prospects and a decrease in the equity risk premium (the arithmetic mean of the difference in the annual rate of return from stocks minus the annual rate of return on Treasury bills). Ritter and Warr (2002) suggest that inflation induced valuation errors led to an undervaluation of stocks prior to 1982 and that the rise in stock prices was partly due to a correction of this undervaluation.

Ritter and Warr (2002) modify the model of fundamental value used by Lee, Myers and Swaminathan (1999) to adjust for inflation induced valuation errors and test whether this model can predict real returns on the Dow Jones Industrial Average over a 12 month horizon.

Ritter and Warr (2002) hypothesize that investors commit two errors in valuing equities: they capitalize real cash flows at nominal rates (the capitalization rate error) and they fail to recognize the capital gain that accrues to the equity holders of firms with fixed dollar liabilities in the presence of inflation (the debt capital gain error).

Inflation has different effects on nominal debt instruments depending on whether it is expected or unexpected. In the case of unexpected inflation there is a wealth transfer from the bondholders to the equity holders of levered firms because unexpected inflation is not priced into the nominal interest rate of the bond. In the second case where inflation is fully expected, there is also a wealth transfer from bondholders to equity holders as inflation decreases the real value of the bondholders' asset. However bondholders are compensated for this because the expected inflation was priced into the nominal interest rate of the bond. Ritter and Warr (2002) focus on the second of these two effects.

As an example of the debt capital gain error, consider a zero real growth firm that pays out all earnings as dividends and has accounting depreciation that exactly equals the economic depreciation of assets (this assumes that there is no inflation). At time zero, the firm has debt per share of D_0 with a real interest rate of r, operating income per share of ox_0 and an income tax rate of T. In a world of no inflation, the expected EPS at time one is

$EPS_1 = (1\text{-}T)\ [ox_1 - rD_0]$

The value of the firm V (the value of the assets per share) is the sum of the value of the equity S and debt D. At t=0

$V_0 = S_0 + D_0$

The debt to equity ratio at time 0 is D_0 / S_0

To avoid the problem of wealth transfers between debt and equity holders due to inflation surprises, Ritter and Warr (2002) assume that debt is repayable on demand. Consequently, at the onset of steady inflation p, the old debt is replaced by new debt with the same face value but an interest rate of R where $R = r + p$ (ignoring the cross product term). The EPS, at time one, of the levered firm in the presence of inflation is

$EPS_1 = (1\text{-}T)\ [ox_1 - RD_0] = (1 - T)\ [ox_1 - rD_0 - p\ D_0]$

This shows that the onset of inflation has reduced expected EPS by $(1\text{-}T)pD_0$. This reduction in EPS will lower the value of the firm. Assuming that inflation is neutral, the basic earning power of the firm remains unchanged in real terms so the level of operating income will increase with inflation.

$ox_1 = ox_0\,(1 + p)$

Consequently the firm's assets must also increase at the rate of inflation to support this increase in operating income. Since this is a zero real growth firm, at time t=1, retained earnings has changed from zero to $-pD_0$ because of the additional interest expense. At time t=1, prior to any new debt issue but after nominal interest and dividends have been paid, the value of the assets (the value of the firm) has grown by the inflation rate less the inflationary component of the nominal interest expense.

$$V_1 = V_0(1 + p) - pD_0 = (S_0 + D_0)(1 + p) - pD_0$$

$$= S_0\,(1+p) + D_0$$

S_0 is the value of equity at time 0.

The debt to equity ratio at time 1 is $D_0 / S_0\,(1+p)$

To maintain the previous debt to equity ratio, the firm must issue incremental debt in the amount of pD_0. This is a measure of the capital gain that equity holders receive because of the reduction in the real value of the firm's debt. It offsets the higher interest payment demanded by the bondholders to compensate them for the depreciation in real terms of the firm's debt. The higher interest payment will reduce the EPS and consequently lower the value of the firm. Consequently to correct for the debt capital gain error, the expected inflation rate times the market value of debt per share, pD, should be added to the forecasted earnings per share.

Because of inflation which has occurred in the past, a firm's historical depreciation expense will understate the true replacement cost and therefore, will lead to overstated accounting income. To overcome this, the depreciation adjustment, DA, which is the difference between the inflation adjusted depreciation expense and actual depreciation expense must be subtracted from reported earnings.

Inflation, through its effect on depreciation will also lead to book value of equity being understated. This is because the purchasing power of the invested capital was greater before the impact of inflation. Since the book value of equity is part of the capital base on which the required return is computed, this will lead to overstatement of EVA (Economic Value Added) following a period of inflation. EVA is defined as

EVA = EBIT (1-T) – After tax cost of capital * (Operating Capital)

Operating capital = [current assets – current liabilities that do not charge interest] + net plant and equipment

To correct for this, replacement book value of equity should be used instead of book value of equity. The three period model used by Lee et al. (1999), is adjusted for these inflation effects to provide the following measure of fundamental value.

$$V_t = ReB_t + \frac{\frac{FEPS_{t+1}}{1+p_t} + p_t D_t - DA_t - rReB_t}{1+r}$$

$$+ \frac{\frac{FEPS_{t+2}}{(1+p_{t+1})(1+p_t)} + \frac{p_{t+1}D_{t+1}}{(1+p_t)} - DA_t - \frac{rReB_{t+1}}{(1+p_t)}}{(1+r)^2}$$

$$+ \frac{\frac{FEPS_{t+3}}{(1+p_{t+2})(1+p_{t+1})(1+p_t)} + \frac{p_{t+2}D_{t+2}}{(1+p_{t+1})(1+p_t)} - DA_t - \frac{rReB_{t+2}}{(1+p_{t+1})(1+p_t)}}{(1+r)^2(r-g)}$$

g is the terminal growth rate

$p_t D_t$ is the debt capital gain

DA_t is the depreciation adjustment

ReB_t is the replacement cost book value of equity

p_t is the expected inflation rate

$FEPS_{t+i}$ is the earnings per share forecast for the period ending t+i

r is the real cost of equity

The following regressions are performed:

$DJIA_{t+12} = \beta_0 + \beta_1 (Vnom/P)_t + \varepsilon_t$

$DJIA_{t+12} = \beta_0 + \beta_1 (Vreal/P)_t + \varepsilon_t$

$DJIA_{t+12} = \beta_0 + \beta_1 p_t + \varepsilon_t$

$DJIA_{t+12} = \beta_0 + \beta_1 (Vreal/P)_t + \beta_2 p_t + \varepsilon_t$

$DJIA_{t+12}$ is the continuously compounded real percentage return on the Dow Jones Industrial Average (cum dividend) computed over the next 12 months.

P is the market value of the stocks in the DJIA

Vnom is the fundamental value of the stocks in the Dow Jones Industrial Average without any inflation adjustments.

Vreal is the fundamental value of the stocks in the Dow Jones Industrial Average with inflation adjustments.

p_t is the forecasted rate of change of the GDP deflator over the next 12 months expressed as a percentage (a measure of expected inflation), which is obtained from the Survey of Professional Forecasters.

In the first regression, the coefficient on Vnom/P is significant and the adjusted R^2 is 11.2%. In the second regression, the coefficient on Vreal/P is not significant and the adjusted R^2 is 0.004%. In the third regression, the coefficient on p is negative and significant and the adjusted R^2 is 11.2%. In the fourth regression, the coefficients on both Vreal/P and p are significant and the adjusted R^2 is 27.1%

The two-variable regression with both Vreal/P and expected inflation gives dramatically improved predictive power than when either variable is used by itself. The t-statistic on Vreal/P changes from -0.53 to 2.91 when it changes from being used alone to being used together with expected inflation. The t-statistic on expected inflation changes from -2.33 to -4.94 when it changes from being used alone to being used together with Vreal/P. The variable Vreal/P captures changes in real returns on the DJIA associated with time varying real rates of interest, expected earnings growth, and distortions in accounting income associated with inflation. Consequently these cannot be used to explain the strong association between expected real returns and expected inflation.

Ritter and Warr (2002) claim that the most plausible explanation for the significant negative coefficient of expected inflation is disintermediation: investors who are confused about nominal versus real returns pull money out of equities when nominal interest rates are high. This flow of funds exerts continued downward pressure on stock prices, resulting in negative real returns on equities when nominal interest rates are high. The variable Vreal/P has the opposite effect: when Vreal/P is high, returns are expected to be high as stock prices revert toward fundamental value. Therefore the omission of expected inflation from the regression equation causes a weakening of the association between expected real returns and Vreal/P because of omitted variable bias.

Ritter and Warr (2002) conclude that their value/price measure has a strong ability to predict real returns on the Dow when combined with expected inflation.

Studies Based on the Ohlson Models

Dechow, Hutton and Sloan (1999) provide an empirical assessment of the Ohlson (1995) model which assumes unbiased accounting. Unbiased accounting implies that equity market value will converge to equity book value.

From (9)

$$V_t = \sum_{\tau=1}^{\infty} R^{-\tau} E_t[\tilde{x}^a_{t+\tau}] + b_t$$

Ohlson (1995) adds the following equations referred to as linear information dynamics:

$$\tilde{x}^a_{t+1} = \omega x^a_t + v_t + \tilde{\varepsilon}_{1,t+1} \qquad (12)$$

$$\tilde{v}_{t+1} = \gamma v_t + \tilde{\varepsilon}_{2,t+1} \qquad (13)$$

b_t is defined as the book value of the firm's equity at date t

x_t is defined as the earnings for the period (t-1,t)

x^a_{t+1} is defined as abnormal earnings, computed as $x_t - r_e b_t$

v_t is defined as the unobservable information which provides a measure of the value relevant events that are not yet reflected in the financial statements.

Ohlson (1995) places the following restrictions on the parameters to these equations:

(a) $0 \leq \omega < 1$

(b) $0 \leq \gamma < 1$

The motivation for restriction (a) is based on the economic reasoning that abnormal profits dissipate due to competition. When $\omega = 0$, the firm is in a no-growth state. When $0 < \omega < 1$, a firm's return on equity (ROE) shifts over time towards the firm's cost of equity capital, r_e, as the abnormal profits grow smaller.

The model also assumes that v is unrelated to current earnings and dividends, The two disturbance terms in (12) and (13) are assumed to be mean zero and serially uncorrelated, though they may be contemporaneously cross-related. The variances of the disturbance terms may be heteroskedastic. The model contributes two new ideas. The first one is information that is observed by the market before it affects reported earnings (the unobservable information). This is captured by the term v_t that is observed in period t but does not affect earnings until t+1. The second idea is that abnormal earnings may converge to zero over time because of the assumption that both ω and γ are less than one. This in turn implies that both book value of equity and market value of equity will converge. Combining equations 9, 12 and 13 yields the following equation:

$$V_t = b_t + \alpha_1 x_t^a + \alpha_2 v_t$$

where

$$\alpha_1 = \frac{\omega}{R - \omega}$$

$$\alpha_2 = \frac{R}{(R - \omega)(R - \gamma)} > 0$$

Dechow et al. (1999) implement the following version of the Ohlson (1995) linear information dynamics:

$$\tilde{x}_{t+1}^a = \omega_0 + \omega_1 x_t^a + v_t + \tilde{\varepsilon}_{1,t+1} \quad (14)$$

$$\tilde{v}_{t+1} = \gamma_0 + \gamma_1 v_t + \tilde{\varepsilon}_{2,t+1} \quad (15)$$

Historical accounting data are obtained from the COMPUSTAT files. The empirical analysis uses annual financial statement data from 1976 to 1995. Stock return data are obtained from the CRSP daily files. All the empirical tests use cum dividend stock returns and buy-and-hold returns. Analyst forecast data are obtained from the I/B/E/S files. The empirical analysis is conducted on per-share data. All the tests use earnings measured before extraordinary items which violates the clean surplus assumption. However, from a practical perspective, extraordinary items are nonrecurring. Consequently the inclusion of the extraordinary items would not be likely to improve the prediction of abnormal earnings.

DeChow et al. (1999) use a constant discount rate of $r_e = 12\%$, since this approximates the long-run average realized return on US equities. The parameter ω_1 is estimated separately for each fiscal year. This is done by first estimating x_t^a for each firm.

$$x_t^a = x_t - r_e\, b_{t-1}$$

Next, the unobservable information variable is removed and ω_1 is estimated using all historically available data from 1950 through the forecast year in a pooled time series cross-sectional regression. This is re-estimated each year.

$$\tilde{x}_{i,\,t+1}^a = \omega_0 + \omega_1 x_{i,t}^a + \tilde{\varepsilon}_{i,t+1}$$

All variables are scaled by the market value of equity at the end of the calendar year t to control for heteroskedasticity and the 1% most extreme observations are winsorised so that they do not have an undue influence on the regressions.

Tests using additional lags of abnormal earnings are performed to examine whether the first order autoregressive process is sufficient. Inclusion of three additional lags of abnormal earnings has a trivial impact. Only the second lag is statistically significant but the coefficient magnitude is only 0.07 versus 0.59 on the first lag. Thus the first order autoregressive process appears to provide a reasonable approximation.

DeChow et al. (1999) measure the period t conditional expectation of period t+1 earnings using the consensus analyst forecast of period t+1 earnings.

$E_t[x^a_{t+1}] = f^a_t = f_t - r_e b_t$

f_t denotes the I/B/E/S consensus forecast of earnings for year t+1 measured in the first month following the announcement of earnings for year t

from (12)

$v_t = E_t[x^a_{t+1}] - \omega\ x^a_t$

The other information v_t can then be obtained as follows:

$v_t = f^a_t - \omega x^a_t$

This gives the series of v_t.

Next, DeChow et al. (1999) estimate γ_1 using the same procedure that they used to estimate ω_1

$$\tilde{v}_{i,t+1} = \gamma_0 + \gamma_1 v_{i,t} + \tilde{\varepsilon}_{i,t+1}$$

After estimating the parameters they compute the fundamental value

$$V_t = b_t + \alpha_1 x^a_t + \alpha_2 v_t$$

where

$$\alpha_1 = \frac{\omega_1}{R - \omega_1}$$

$$\alpha_2 = \frac{R}{(R - \omega_1)(R - \gamma_1)} > 0$$

DeChow et al. (1999) find that $\omega_1 = 0.62$ and $\gamma 1 = 0.32$. These values are within the bounds predicted by Ohlson (1995). Once fundamental value has been computed, portfolios can be formed. Each year, observations are ranked and assigned in equal numbers to deciles based on the ratio of fundamental value (V) to observed market value of equity (P).

Decile portfolios are formed using the ranked ratios. Lower deciles consist of stocks that are overpriced relative to fundamental value and are therefore expected to experience lower future stock returns. Higher deciles consist of stocks that are underpriced relative to fundamental value and are expected to experience higher stock returns. Equally weighted buy and hold stock returns are then computed for each decile portfolio over the subsequent 12 months beginning three months after the end of the fiscal year from which the historical forecast data are obtained.

DeChow et al. (1999) report the mean of the 20 years of annual portfolio returns. T-statistics are based on the time series standard errors of the 20 annual portfolio returns. The hedge portfolio return, which is the difference between the return for portfolio 10 and the return for portfolio 1, determines the predictive ability of each model with respect to future returns. They report the results for models that include the unobservable information, as well as models that do not include this information. They find that the hedge portfolio returns for models that include the unobservable information are lower than the returns for models that do not include this information. The hedge portfolio return for the model that includes the unobservable information is 6.2% with a t-statistic of 1.34. The hedge portfolio return for the model ignoring the unobservable information is 9.4% with a t-statistic of 2.39. DeChow et al. (1999) explain this by hypothesizing that analysts' earnings estimates are biased and investors use this information to determine fundamental value, causing lower future returns. When analysts' earnings forecasts are omitted, fundamental value is more accurately determined since the biased information is not used, causing higher future returns.

Dechow et al. (1999) conclude that the empirical support for the Ohlson (1995) model is ambiguous and suggest that improved results might be obtained with the Feltham-Ohlson (1995) model which incorporates growth in operating assets and accounting conservatism.

Myers (1999) performs an empirical assessment of various versions of the Ohlson model including the Ohlson (1995) and Feltham Ohlson (1995) model. Because Myers assumes market efficiency, he evaluates these models by determining how well the estimate of fundamental value matches the current price.

The initial sample consists of all nonfinancial firms with the necessary data on the 1997 Compustat annual data file. To be included, common equity, earnings before extraordinary items, market price and the number of common shares outstanding are required to be available for at least 15 of the 22 years between 1975 and 1996 inclusive. Firm-years with negative equity values are omitted. For tests involving the order backlog, the additional requirement of at least 5 years of nonzero order backlog is imposed. Myers (1999) estimates the cost of equity as follows:

$r_e(j,m) = r_f(m) + r_{prem}(j)$

where

$r_e(j,m)$ = the estimated cost of equity for firm j in month m

$r_f(m)$ = the annualized one month T-bill rate at fiscal year-end

$r_{prem}(j)$ = the risk premium for firm j

The risk premium is the firm's industry risk premium as estimated by Fama and French (1997). Myers (1999) reports that analysis conducted with constant discount rates of 9%, 10% and 11% do not have materially different results.

Feltham and Ohlson (1995) assume the following linear information dynamics:

$$o\tilde{x}^a_{t+1} = \omega_{11}\, ox^a_t + \omega_{12}\, oa_t + v_{1t} + \tilde{\varepsilon}_{1,t+1} \quad (16)$$

$$o\tilde{a}_{t+1} = \omega_{22}\, oa_t + v_{2t} + \tilde{\varepsilon}_{2,t+1} \quad (17)$$

$$\tilde{v}_{1t+1} = \gamma_1 v_{1t} + \tilde{\varepsilon}_{3,t+1} \quad (18)$$

$$\tilde{v}_{2t+1} = \gamma_2 v_{2t} + \tilde{\varepsilon}_{4,t+1} \quad (19)$$

Myers (1999) makes the following changes to the Feltham-Ohlson (1995) model:

(1) Although Feltham and Ohlson (1995) use abnormal operating income in equation (16), Myers (1999) uses abnormal net income because abnormal net income and abnormal operating income are equal under the assumptions of the model that the interest rate associated with both marketable securities and debt is the risk free rate. The risk free rate is further assumed to be time invariant. Consequently net financial assets (defined as marketable securities minus debt) only earn the normal return.

(2) Myers (1999) uses book value of equity in place of net operating assets because he finds it difficult to separate out the net financial assets from book value of equity.

(3) Myers (1999) uses order backlog as the nonaccounting variable. The motivation for substituting order backlog as the additional variable is that order backlog should indicate increased residual income in the following period. Temporary shortages of inventory, capacity or labor may cause backlogs. This should depress current residual income and as the shortages ease, residual income should grow. Alternatively, order backlogs may be

due to increased demand. In this case, current residual income would be normal, but future residual income should grow as orders are filled.

(4) Myers (1999) adds an intercept to the first equation because residual income may not be zero on average if order backlog is not a proxy for the unobservable variable.

(5) Myers does not take into account the unobservable information that affects the growth in net operating assets.

The model used by Myers (1999) then becomes

$$RI_{t+1} = \omega_{10} + \omega_{11} RI_t + \omega_{12} b_t + \omega_{13} bklog_t + \varepsilon_{1t+1}$$

$$b_{t+1} = \omega_{22} b_t + \varepsilon_{2t+1}$$

$$bklog_{t+1} = \omega_{33} bklog_t + \varepsilon_{3\,t+1}$$

RI is residual income which is calculated as earnings before extraordinary items minus the cost of equity times book value of equity. Earnings before extraordinary items does not correspond perfectly with the theory because it violates the clean surplus assumption. Other violations of clean surplus that could affect the information dynamics are prior period adjustments, changes in accounting policies and the consolidation of partially owned subsidiaries.

b_t is the accounting book value of equity

bklog is order backlog

Each equation is estimated separately on a firm by firm basis. Each firm's coefficients from the RI and bklog equations are estimated using an ordinary least squares (OLS) time-series regression. Myers (1999) does not use pooled time series cross sectional regression, because of firm specific differences such as economic pressures, production technology and accounting policies.

Myers (1999) assumes that book value of equity is expected to grow on average for most firms. Consequently he does not estimate the second equation by OLS because of nonstationarity. Instead, Myers (1999) estimates the growth rate of equity for each firm as the median ratio of year t+1 book value of equity to year t book value of equity.

After determining the parameters for each firm, Myers (1999) then analyzes the cross sectional distribution of these parameters. Myers (1999) reports the 20th, 40th, 50th, 60th and 80th percentile ranking of the parameters ω_{10}, ω_{11}, ω_{12}, ω_{13}, ω_{22}, ω_{33}. For a specific firm, the ω's may appear in different percentiles.

Myers (1999) finds that the median value of the ω_i parameters are within the theoretical bounds except for ω_{12} and ω_{13}. The value of ω_{12} is negative at the 20th, 40th, 50th and 60th percentiles. A negative value of ω_{12} implies aggressive accounting, contrary to the assumptions made by Feltham and Ohlson (1995).

The median value of ω_{13} is zero which implies that order backlog does not cause an increase in RI in the following year, contrary to the assumptions concerning the effect of order backlog on earnings made by Myers (1999). The values of these ω_i parameters at the 50th percentile are used to determine the coefficients of the Value equation, V_t

$$V_t = \alpha_0 + \alpha_1 RI_t + (1+ \alpha_3) b_t + \alpha_3 bklog_t \qquad (20)$$

where

$$\alpha_0 = \frac{\omega_{11}}{R - \omega_{11}}$$

$$\alpha_1 = \frac{\omega_{11}}{R - \omega_{11}}$$

$$\alpha_2 = \frac{\omega_{12} R}{(R - \omega_{11})(R - \omega_{22})}$$

$$\alpha_3 = \frac{R(\omega_{12} + R\omega_{13} - \omega_{13}\omega_{23})}{(R - \omega_{11})(R - \omega_{22})(R - \omega_{33})}$$

The α's constructed in this fashion are referred to as the equilibrium price coefficients. The fundamental value constructed in this fashion is a way of representing the fundamental value of the "typical" firm. This fundamental value is used in the following cross sectional regressions.

$P_i = \alpha + \beta_1 V_i + \varepsilon_i$

$P_i = \alpha + \beta_1 RI_i + \varepsilon_i$

$P_i = \alpha + \beta_1 b_i + \varepsilon_i$

$P_i = \alpha + \beta_1 bklog_i + \varepsilon_i$

$P_i = \alpha + \beta_1 RI_i + \beta_2 b_i + \beta_3 bklog_i + \varepsilon_i$

where P_i is the price of the firm in 1996

For the regression of price on fundamental value, the significance of the intercept and slope coefficients are tested against their respective theoretical values of zero and one and are found to be significantly different from these values. The parameters obtained by the remaining regressions are compared against the equilibrium price coefficients (the implied values) from equation (20). (These were obtained by substituting the median values of the ω's into equation (20) to obtain the α's). These parameters should not be significantly different if price and fundamental value are expected to be equal as Myers (1999) suggests. For example in the last regression, β_1 is compared to α_1, β_2 is compared to $(1+ \alpha3)$ and β_3 is compared to α_3. For the first four equations, the parameters obtained by the regression are significantly different from their implied values. For the last equation, the parameter on book value of equity is significantly different from the implied value.

A second approach to computing the fundamental value of the typical firm was conducted. V was computed for all firms using the firm specific ω's and then the V/P ratios were sorted into percentiles. The value of V/P at the 50th percentile was chosen as representing that of the typical firm. The value of V/P at the 50th percentile was expected to be 1 (because of the assumption made by Myers (1999) of market efficiency) but in fact it was found to be 0.648.

Myers (1999) finds that his implementation of the Feltham-Ohlson (1995) model provides an estimate of fundamental value that is significantly different from the current price. The closeness of the match between fundamental value and price is his criterion of the validity of a model of fundamental value because of his assumption of market efficiency. He attributes these results to insufficient observations and to nonstationarity in the time series processes of accounting information.

CHAPTER III

MODELS AND METHODOLOGY

Models

Ohlson 1995 Model

Ohlson (1995) uses accounting relations to modify the PVED model so that the fundamental value of a firm is determined by its current and future earnings, book value of equity and cost of equity capital. However the model in this form (eq 10) is an infinite series. Ohlson (1995) then adds the linear dynamics equations, which model assumptions such as persistence in abnormal earnings and that future abnormal earnings are affected by events which have not yet been recorded in the financial statements. The valuation function then yields a linear solution.

Feltham-Ohlson 1995 Model

Feltham and Ohlson (1995) generalize the Ohlson (1995) model to accommodate the existence of both financial and operating activities. Under their assumption of perfect markets, the book and market values of financial assets and liabilities coincide. In contrast, the accounting for operating assets is different because these assets are typically not individually traded in perfect markets. The use of accounting conventions for accruals generally leads to differences between a firm's market and book value of equity. Accrual accounting attempts to recognize changes in financial statement items in the period in which the transactions and events occur rather than the period in which cash changes hands. Differences between book and market value of equity could occur if investments are expensed immediately (such as investments in research and development) or are amortized more quickly than their drop in value. The United States, Germany and the Netherlands are the only major accounting systems that require immediate expensing of research and development costs. Most countries permit or require capitalization of research and/or development costs. Also, accounting procedures do not recognize today the expected net present value of future investment projects.

Modigliani and Miller (1961) show that the value of the firm is unaffected by dividend policy assuming that there are no personal taxes, agency costs or information asymmetry. This framework is used by Feltham and Ohlson (1995) so that the valuation of operating activities does not depend on the extent to which the firm distributes financial assets as dividends. Modigliani and Miller (1958, 1963) show that under a set of assumptions the market value of any firm is independent of its capital structure. Feltham and Ohlson (1995) use this result when they assume that the firm's equity value equals the value of its net operating assets plus the value of its net financial assets. The difference between marketable securities and debt (bonds payable) at time t is referred to as net financial assets. Feltham and Ohlson (1995) assume that the risk-free interest rate is time independent and applies to both marketable securities and debt. The book value of the firm's equity at time t is the sum of net financial assets and net operating assets:

$$b_t = fa_t + oa_t \qquad (21)$$

where oa_t is defined as operating assets, net of operating liabilities at date t. Operating assets (liabilities) consist of all asset (liability) accounts that do not generate interest. This includes cash held for operating purposes, accounts receivable, inventory, prepaid expenses, property, plant and equipment net of depreciation, and operating liabilities such as accounts payable and accrued wages.

fa_t is defined as financial assets net of financial obligations at date t

b_t is defined as the book value of the firm's equity at date t

The period (t-1, t) earnings are

$$x_t = i_t + ox_t \tag{22}$$

x_t is defined as the earnings for the period (t-1, t)

i_t is defined as interest revenues, net of interest expenses, for period (t-1, t)

ox_t is defined as operating earnings for period (t-1, t). Operating earnings consist of all non-interest items (sales, cost of goods sold, selling and administration expenses, and gains and losses on the disposal of operating assets)

Operating earnings minus an interest charge for the use of operating assets defines abnormal operating earnings

$$ox_t^a = ox_t - (R_F - 1)oa_{t-1}$$

where R_F denotes one plus the risk-free interest rate.

The clean surplus relation (CSR) is assumed to hold, i.e. all changes in book value of equity are reported as either income or dividends.

$$b_t = b_{t-1} + x_t - d_t \tag{23}$$

d_t is defined as dividends, net of capital contributions, at date t

The net interest relation (NIR) is assumed for net financial assets, fa_t

$$i_t = (R_F - 1)\, fa_{t-1} \tag{24}$$

Financial activities begin period (t-1, t) with net financial assets fa_{t-1}. Interest i_t is earned on fa_{t-1} during the period, dividends d_t are paid at the end of the period, and cash from operating activities c_t are received at the end of the period. The net result is an ending stock of net financial assets fa_t. The financial assets relation (FAR) among these accounting variables is:

$$fa_t = fa_{t-1} + i_t - [dt - c_t] \quad (25)$$

c_t = cash flows realized from operating activities, net of investments in those activities as of date t

$c_t < 0$ represents net capital expenditures in operating assets

Since the firm's activities are either financial or operating, CSR and FAR imply the following operating asset relation (OAR)

$$oa_t = oa_{t-1} + ox_t - c_t \quad (26)$$

This is derived as follows:

Substituting (21) in CSR gives

$$fa_t + oa_t = b_{t-1} + x_t - d_t$$

$$oa_t = b_{t-1} + x_t - d_t - fa_t \quad (27)$$

Substituting (22) in (27) gives

$$oa_t = b_{t-1} + i_t + ox_t - d_t - fa_t \quad (28)$$

Substituting (25) in (28) gives

$$oa_t = b_{t-1} + i_t + ox_t - d_t - (fa_{t-1} + i_t - d_t + c_t)$$

$$oa_t = (b_{t-1} - fa_{t-1}) + ox_t - c_t \quad (29)$$

Substituting (21) in (29) gives

$$oa_t = oa_{t-1} + ox_t - c_t$$

Operating activities begin period (t-1, t) with net operating assets oa_{t-1}, generate operating income ox_t during the period, transfer cash flows c_t to the financial assets at the end of the period and end the period with net operating assets oa_t. The cash flows from operations represent the dividends paid by the operating activities, but these cash flows can be transformed into financial assets and need not be immediately distributed to the equity holders. From accounting relations CSR, NIR, FAR and OAR and valuation relation PVED, Feltham and Ohlson (1995) show that the firm's equity value can be represented equivalently as

$$(a)\ V_t = fa_t + \sum_{\tau=1}^{\infty} R^{-\tau} E_t[\tilde{c}_{t+\tau}] \qquad (30)$$

$$(b)\ V_t = b_t + \sum_{\tau=1}^{\infty} R^{-\tau} E_t[\tilde{x}^a_{t+\tau}] \qquad (31)$$

$$(c)\ V_t = b_t + \sum_{\tau=1}^{\infty} R^{-\tau} E_t[o\tilde{x}^a_{t+\tau}] \qquad (32)$$

Feltham and Ohlson (1995) then assume the following linear information dynamics (LIM):

$$o\tilde{x}^a_{t+1} = \omega_{11}\, ox^a_t + \omega_{12}\, oa_t + v_{1t} + \tilde{\varepsilon}_{1,t+1} \qquad (33)$$

$$o\tilde{a}_{t+1} = \omega_{22}\, oa_t + v_{2t} + \tilde{\varepsilon}_{2,t+1} \qquad (34)$$

$$\tilde{v}_{1t+1} = \gamma_1 v_{1t} + \tilde{\varepsilon}_{3,t+1} \qquad (35)$$

$$\tilde{v}_{2t+1} = \gamma_2 v_{2t} + \tilde{\varepsilon}_{4,t+1} \qquad (36)$$

and the ε terms are zero-mean random error terms.

The linear information dynamics model three key characteristics: the persistence in abnormal operating earnings ω_{11}, the growth in net operating assets ω_{22} and the conservatism in reporting net operating assets ω_{12}. Feltham and Ohlson (1995) place the following restrictions on the parameters of the linear dynamics equations:

(1) $|\gamma_1| < 1$, $|\gamma_2| < 1$

(2) $0 \leq \omega_{11} < 1$

(3) $1 \leq \omega_{22} < R_F$

(4) $\omega_{12} \geq 0$

Condition (1) implies that the random events influencing other information have no long run effect on future other information.

The lower bound in condition (2) eliminates oscillation in abnormal operating earnings and the upper bound implies that abnormal operating earnings have a decreasing impact on future abnormal operating earnings.

Condition (3) restricts the long run growth in operating assets. The lower bound rules out liquidation of the firm's assets in the long run and the upper bound is necessary for absolute convergence in the present value calculations of expected abnormal operating earnings and expected cash flows.

Condition (4) eliminates aggressive accounting where the market value of net operating assets is lower than the book value of net operating assets. Conservative accounting implies that $\omega_{12} > 0$ and unbiased accounting implies that $\omega_{12} = 0$.

Feltham and Ohlson (1995) combine equations (30) – (36) to show that the valuation function can be expressed as

$$V_t = bv_t + \alpha_1 ox_t^a + \alpha_2 \, oa_t + \beta \upsilon_t$$

(37)

where

$$\alpha_1 = \frac{\omega_{11}}{R_F - \omega_{11}}$$

$$\alpha_2 = \frac{\omega_{12} R_F}{(R_F - \omega_{22})(R_F - \omega_{11})}$$

$$\beta = (\beta_1, \beta_2) = \left[\frac{R_F}{(R_F - \omega_{11})(R_F - \gamma_1)}, \frac{\alpha_2}{(R_F - \gamma_2)} \right]$$

$$\upsilon_t = [v_{1t}, v_{2t}]$$

Methodology

Every year, from 1990 to 1998, portfolios are chosen in June based on the computed ratio of fundamental value to market value at fiscal year end. This ratio was determined from the Feltham-Ohlson (1995) equations through a three stage process. Panel data methodology is used to estimate the equations in the first two stages. Coefficients computed in the regressions of stage one are used in the regressions in stage two, and the coefficients computed in stage one and two are used to compute the ratio of fundamental value to market value in stage three. Separate results are computed for the fixed effects, time effects and fixed and time effects panel data models.

Stage One

Since the financial assets are expected to earn the market rate of return, they do not contribute to abnormal earnings. Hence, the determination of abnormal earnings gives the same result as the determination of abnormal operating earnings. Consequently as in

Myers (1999), abnormal operating earnings are replaced with abnormal earnings. Applying this reasoning to equations (33) and (34) results in equations (38) and (39). The following equations are estimated using panel data regressions:

$$\tilde{x}^a_{t+1} = \omega_{11}\, x^a_t + \omega_{12}\, oa_t + \tilde{\varepsilon}_{1,t+1} \quad (38)$$

$$o\tilde{a}_{t+1} = \omega_{22}\, oa_t + \tilde{\varepsilon}_{2,t+1} \quad (39)$$

x_t is earnings before extraordinary items

oa is defined as net operating assets which is the sum of property, plant and equipment (net) plus total current assets which represent cash and other assets expected to be realized in cash within one year, less total current liabilities which are liabilities due within one year.

Abnormal earnings are defined as

$$x^a_t = x_t - r_e b_t$$

b_t is book value of equity and is the sum of par value, capital surplus (amounts of directly contributed equity capital in excess of the par value) and accumulated retained earnings.

r_e is the cost of equity capital and is measured as the sum of the annualized t-bill rate and the firm's industry risk premium. The industry risk premium is a three factor industry based discount rate derived by Fama and French (1997). In the three factor model, a security's expected return depends on the expected market return and the expected returns on two portfolios meant to mimic additional risk factors. The mimicking portfolios are SMB (small minus big) which is the difference between the returns on a portfolio of small stocks and a portfolio of big stocks, and HML (high minus low), the difference between the returns on a portfolio of high book to market value of equity stocks and a portfolio of low book to market value of equity stocks. The expected return equation of the three factor model is

$$E[R_i] - r_f = b_i (E[R_M] - r_f) + s_i E[SMB] + h_i E[HML]$$

where b_i, s_i and h_i are the slopes determined in the following regression

$$R_i - r_f = b_i [R_M - r_f] + s_i SMB + h_i HML + \varepsilon_i$$

This regression uses all firms in an industry, whereas SMB and HML are based on firms in all industries. The expected values of R_M, SMB and HML are determined from their average values for the time period 1963-1994. Fama and French (1997) report the risk premium ($R_i - r_f$) for a variety of industries. This is an industry average for the time period 1963 – 1994 and the sample consists of monthly data on stocks from the NYSE, AMEX and NASDAQ. Estimation of equations 37 and 38 provided the values of ω_{11}, ω_{12} and ω_{22}.

Stage Two

The coefficients ω_{11}, ω_{12} and ω_{22} determined in step one were used to extract the unobservable information in stage two. The expected abnormal earnings in the next period is the analysts' forecasts of abnormal earnings. This is obtained from the consensus analysts' forecasts of earnings minus the cost of equity capital times the book value of equity.

$$E_t [x^a_{t+1}] = f^a_t = f_t - r_e b_t$$

Substituting earnings for operating earnings in equations (33) and (34) and taking expectations we get

$$E[\tilde{x}^a_{t+1}] - \omega_{11} x^a_t - \omega_{12}\, oa_t = v_{1t} \tag{40}$$

$$E[\tilde{oa}_{t+1}] - \omega_{22}\, oa_t = v_{2t} \tag{41}$$

Following the suggestion by Ohlson and Liu (2000), the one year ahead forecast of net operating assets, $E[o\tilde{a}_{t+1}]$ is determined as current net operating assets times the expected growth in net operating assets. Ohlson and Liu (2000) suggest using a five year forecast of growth to estimate the growth in operating assets. Since the long term forecast is not always available the growth rate implicit in the one year and two year forecast is used. In a few cases the F1 forecast was zero. To avoid division by zero this is treated as a missing observation. Having obtained v_{1t} and v_{2t}, panel data regressions are used to estimate the parameters of the remaining linear dynamics equations:

$$\tilde{v}_{1,t+1} = \gamma_1 v_{1t} + \tilde{\varepsilon}_{3,t+1}$$
$$\tilde{v}_{2,t+1} = \gamma_2 v_{2t} + \tilde{\varepsilon}_{4,t+1}$$

This provided the values of γ_1 and γ_2. At this point, all the required parameters needed to calculate the fundamental value were determined.

<u>Stage Three</u>

V_t is computed from eq (37):

$$V_t = b_t + \alpha_1 x_t^a + \alpha_2 \, oa_t + \beta v_t \qquad (42)$$

where

$$v_t = (v_{1t}, v_{2t})$$

$$\alpha_1 = \frac{\omega_{11}}{R - \omega_{11}}$$

$$\alpha_2 = \frac{\omega_{12} R}{(R - \omega_{22})(R - \omega_{11})}$$

$$\beta = (\beta_1, \beta_2) = \left[\frac{R}{(R - \omega_{11})(R - \gamma_1)}, \frac{\alpha_2}{(R - \gamma_2)}\right]$$

$$R = 1 + r_e$$

The results from phase three provides an estimate of the fundamental value of all companies for a particular year. The ratio of fundamental value to market value (taken from the fiscal year end of the firm), V/P is computed and used to rank companies into four portfolios. Equally weighted and value weighted buy and hold returns for each portfolio are computed over the subsequent 12 and 36 months. The mean of the nine years of annual portfolio returns is obtained for each portfolio. The statistical significance of the difference in the return between portfolio one (low V/P) and portfolio four (High V/P) is then computed. For each portfolio, the P/E values were obtained from Compustat to determine whether the results were influenced by this factor.

CHAPTER IV

RESULTS

Table 1 and Table 2 show the fixed effects panel data regression results of the linear information dynamics equations (eq (38) – eq (41)). The fixed effects regression technique takes firm specific differences into account. This is in contrast to the pooled time series cross-sectional regression used by DeChow, Hutton and Sloan (1999) which assumes that all firms are homogeneous. For each year from 1990 to 1998, the regressions are performed using data from all previous years as well as the current year. This results in nine sets of regression coefficients.

Table 1. Fixed Effects Regression Coefficients 1990-1994

	1990	1991	1992	1993	1994
w_{11}	-0.13738	-0.03251	0.02699	-0.08381	-0.03643
t value	-1.38500	-0.44100	0.32500	-1.12300	-0.60300
P value	0.16800	0.65990	0.74530	0.26230	0.54670
w_{12}	-0.00715	-0.02118	-0.01685	-0.01718	-0.06332
t value	-0.65900	-2.17300	-1.31500	-1.42400	-1.12500
P value	0.51110	0.03080	0.18950	0.15540	0.26140
Adj R^2	0.28040	0.43981	0.40153	0.39162	0.01208
w_{22}	0.02517	0.06428	0.09261	-0.00137	0.05361
t value	0.55200	1.96100	2.21500	-0.03100	1.26200
P value	0.58150	0.05110	0.02750	0.97540	0.20770
Adj R^2	0.83373	0.87523	0.70499	0.68237	0.62212
γ_1	-0.11182	-0.04724	0.00708	-0.15484	0.01383
t value	-1.64700	-0.96400	0.14300	-2.90300	0.26800
P value	0.10160	0.33620	0.88660	0.00390	0.78850
Adj R^2	0.62855	0.71457	0.56214	0.49465	0.35178
γ_2	-0.91260	-0.50226	-0.28311	-0.20026	-0.14453
t value	-23.33300	-7.15300	-4.31100	-3.45300	-2.78500
P value	0.00000	0.00000	0.00000	0.00060	0.00560
Adj R^2	0.88173	0.27057	0.09909	0.02391	0.02243

Table 2. Fixed Effects Regression Coefficients 1995-1998

	1995	1996	1997	1998
w_{11}	-0.20148	-0.17618	-0.15988	-0.14153
t value	-3.82700	-3.58900	-3.47400	-3.30800
P value	0.00010	0.00030	0.00050	0.00090
w_{12}	-0.08710	-0.08735	-0.09645	-0.08669
t value	-1.78500	-1.92000	-2.29000	-2.49300
P value	0.07420	0.05490	0.02200	0.01270
Adj R^2	0.04036	0.03110	0.02556	0.02250
w_{22}	0.07564	0.11371	0.15573	0.16709
t value	1.92700	3.03300	4.34300	5.04000
P value	0.05400	0.00240	0.00000	0.00000
Adj R^2	0.63571	0.63435	0.62433	0.60513
γ_1	-0.15208	-0.10480	-0.07541	0.18854
t value	-3.29000	-2.44700	-1.89200	5.24900
P value	0.00100	0.01440	0.05840	0.00000
Adj R^2	0.11234	0.13134	0.18562	0.42811
γ_2	-0.11522	-0.09728	-0.08181	-0.06952
t value	-2.44600	-2.21100	-1.98400	-1.77800
P value	0.01440	0.02700	0.04730	0.07540
Adj R^2	0.01637	0.01732	0.01631	0.01395

Table 3 and Table 4 show the time effects panel data regression results of the linear information dynamics equations (eq (38) – eq (41)). The time effects regression technique takes into account differences that are related to a specific time period. For each year from 1990 to 1998, the regressions are performed using data from all previous years as well as the current year. This results in nine sets of regression coefficients.

Table 3. Time Effects Regression Coefficients 1990-1994

	1990	1991	1992	1993	1994
w_{11}	0.06535	0.29028	0.25610	0.35657	-0.04242
t value	0.75500	4.16700	3.41000	5.74800	-0.81800
P value	0.45140	0.00000	0.00070	0.00000	0.41400
w_{12}	-0.01669	-0.02249	-0.01843	-0.02047	-0.09486
t value	-1.77600	-2.71700	-1.76300	-2.38900	-2.60800
P value	0.07770	0.00710	0.07890	0.01740	0.00940
Adj R^2	0.02987	0.17122	0.12913	0.22604	0.00587
w_{22}	0.40100	0.60696	0.53961	0.66299	0.62327
t value	5.33300	11.39700	11.04900	17.10400	16.86400
P value	0.00000	0.00000	0.00000	0.00000	0.00000
Adj R^2	0.15931	0.36418	0.28922	0.44456	0.39283
γ_1	0.30179	0.39161	0.39076	0.33513	0.53038
t value	3.84000	6.24700	7.17700	6.65500	13.05600
P value	0.00020	0.00000	0.00000	0.00000	0.00000
Adj R^2	0.08549	0.15141	0.15114	0.14132	0.28643
γ_2	-0.00953	-0.00020	0.05017	-0.01512	0.03410
t value	-0.11500	-0.00300	0.85200	-0.28700	0.70900
P value	0.90850	0.99770	0.39480	0.77410	0.47870
Adj R^2	-0.00926	-0.00702	-0.00508	-0.00207	-0.00060

Table 4. Time Effects Regression Coefficients 1995-1998

	1995	1996	1997	1998
w_{11}	-0.02850	-0.02659	-0.02329	-0.02079
t value	-0.59800	-0.59900	-0.55900	-0.52900
P value	0.54980	0.54910	0.57610	0.59690
w_{12}	-0.08602	-0.08209	-0.07767	-0.07197
t value	-2.67200	-2.81700	-2.90200	-3.07500
P value	0.00750	0.00480	0.00370	0.00210
Adj R^2	0.00749	0.00840	0.00842	0.00872
w_{22}	0.65746	0.67857	0.68829	0.65839
t value	19.94900	22.58200	24.60700	23.90600
P value	0.00000	0.00000	0.00000	0.00000
Adj R^2	0.43614	0.46540	0.47955	0.43824
γ_1	0.53837	0.56350	0.56918	0.55353
t value	14.43600	16.51000	17.80500	18.05100
P value	0.00000	0.00000	0.00000	0.00000
Adj R^2	0.31308	0.34538	0.35347	0.34026
γ_2	0.03458	0.04071	0.04275	0.04616
t value	0.77700	0.97600	1.08800	1.23800
P value	0.43740	0.32910	0.27650	0.21570
Adj R^2	-0.00080	-0.00055	-0.00061	0.00031

Table 5 and Table 6 show the time and fixed effects panel data regression results of the linear information dynamics equations (eq (38) – eq(41)). The time and fixed effects regression technique takes into account firm specific differences as well as time specific differences. For each year from 1990 to 1998, the regressions are performed using data from all previous years as well as the current year. This results in nine sets of regression coefficients.

Table 5. Time and Fixed Effects Regression Coefficients 1990-1994

	1990	1991	1992	1993	1994
w_{11}	-0.11619	-0.01055	0.02658	-0.08482	-0.04193
t value	-1.18100	-0.14400	0.32400	-1.15200	-0.68300
P value	0.23960	0.88550	0.74650	0.24990	0.49480
w_{12}	-0.00916	-0.01997	-0.01910	-0.01735	-0.07987
t value	-0.85300	-2.08000	-1.50800	-1.44900	-1.37000
P value	0.39530	0.03860	0.13260	0.14820	0.17150
Adj R^2	0.29164	0.45595	0.41610	0.41128	0.00525
w_{22}	0.04824	0.07319	0.10830	0.00972	0.06029
t value	1.13400	2.32400	2.62700	0.22200	1.42600
P value	0.25860	0.02100	0.00910	0.82480	0.15460
Adj R^2	0.85623	0.88580	0.71809	0.70556	0.64164
γ_1	-0.09278	-0.04700	0.00490	-0.16324	-0.01083
t value	-1.38800	-0.96800	0.09800	-3.06000	-0.21700
P value	0.16730	0.33400	0.92180	0.00240	0.82830
Adj R^2	0.64349	0.72249	0.55905	0.52134	0.46334
γ_2	-0.91189	-0.50204	-0.28387	-0.19562	-0.14535
t value	-23.0810	-7.10200	-4.29300	-3.34600	-2.78200
P value	0.00000	0.00000	0.00000	0.00090	0.00560
Adj R^2	0.87873	0.26395	0.08987	0.01847	0.01967

Table 6. Time and Fixed Effects Regression Coefficients 1995-1998

	1995	1996	1997	1998
w_{11}	-0.20463	-0.17952	-0.16285	-0.14391
t value	-3.83700	-3.61300	-3.49700	-3.32900
P value	0.00010	0.00030	0.00050	0.00090
w_{12}	-0.09969	-0.09797	-0.10549	-0.09426
t value	-1.98100	-2.08200	-2.41800	-3.32900
P value	0.04760	0.03730	0.01560	0.00090
Adj R^2	0.03574	0.02788	0.02300	0.02002
w_{22}	0.08058	0.11553	0.15407	0.17339
t value	2.06100	3.09000	4.30000	5.24100
P value	0.03930	0.00200	0.00000	0.00000
Adj R^2	0.65440	0.65498	0.64563	0.62465
γ_1	-0.15444	-0.11719	-0.09115	-0.05450
t value	-3.33900	-2.73700	-2.28900	-1.44200
P value	0.00080	0.00620	0.02210	0.14940
Adj R^2	0.13782	0.16867	0.22883	0.22201
γ_2	-0.11886	-0.10158	-0.08328	-0.06904
t value	-2.50800	-2.29400	-2.00600	-1.75400
P value	0.01210	0.02180	0.04490	0.07940
Adj R^2	0.01407	0.01512	0.01313	0.01140

Feltham and Ohlson (1995) placed restrictions on the parameters of the following linear dynamics equations used in their valuation model:

$$o\tilde{x}^a_{t+1} = \omega_{11}\, ox^a_t + \omega_{12}\, oa_t + v_{1t} + \tilde{\varepsilon}_{1,t+1}$$

$$o\tilde{a}_{t+1} = \omega_{22}\, oa_t + v_{2t} + \tilde{\varepsilon}_{2,t+1}$$

$$\tilde{v}_{1t+1} = \gamma_1 v_{1t} + \tilde{\varepsilon}_{3,t+1}$$

$$\tilde{v}_{2t+1} = \gamma_2 v_{2t} + \tilde{\varepsilon}_{4,t+1}$$

These restrictions were:

(1) $0 \leq \omega_{11} < 1$

The purpose of the lower bound in condition (1) was to eliminate oscillating persistence in abnormal earnings and the purpose of the upper bound was to ensure that the impact on earnings decays geometrically with time. For the fixed effects regressions, ω_{11} is negative for eight of the nine years and is statistically significant in the years 1995-1998. For the time effects regressions, ω_{11} is negative in the years 1994-1998 but is not statistically significant in these years. For the time and fixed effects regressions, ω_{11} is negative for eight of the nine years and is significant at the 1% level for years 1995 – 1998. The results indicate that positive abnormal earnings alternate with negative abnormal earnings and vice versa. This violates the theoretical assumptions of the model. However the results indicate that the absolute value of ω_{11} is less than one which confirms the theoretical prediction of the diminishing impact of abnormal earnings.

(2) $\omega_{12} \geq 0$

The purpose of this condition was to eliminate aggressive accounting (book values of assets are greater than their market values). Conservative accounting implies that $\omega_{12} > 0$ and unbiased accounting implies that $\omega_{12} = 0$. The results in all regressions show that ω_{12} is consistently negative, contrary to the predictions. For the fixed effects regressions, ω_{12} is negative for all years and is significant at least at the 10% level for years 1995 – 1998. For the time effects regressions, ω_{12} is negative for all years and is significant at least at the 10% level for all years. For the fixed and time effects regressions, ω_{12} is negative for all years and is at least at the 10% level for years 1991 and 1995 – 1998. This would indicate that accounting is aggressive, i.e. that assets are overvalued.

(3) $1 \leq \omega_{22} < R_e$

The purpose of condition (3) was to restrict the long run growth in operating assets. The lower bound prevents the liquidation of the firm's assets in the long run and the upper bound is necessary for convergence in the present value calculations of expected abnormal operating earnings and expected cash flows.

Table 7. Average Cost of Equity Capital

Year	r_e
1998	11.1516
1997	11.1616
1996	9.69158
1995	10.6416
1994	13.3216
1993	11.9716
1992	11.2716
1991	13.0216
1990	15.1616

For the fixed effects regressions, ω_{22} is negative for 1993 and less than 1 for the other years. It is significant at least at the 10% level for years 1991, 1992 and 1995 – 1998. For the time effects regression, ω_{22} is positive and less than 1 for all years. It is significant at the 1% level for all years. For the time and fixed effects regressions, ω_{22} is positive and less than 1 for all years. It is significant at the 10% level for years 1991, 1992, 1995-1998. The results indicate that the asset base is shrinking: firms are selling off assets or they are not making sufficient investments in assets to mitigate the effects of depreciation.

(4) $|\gamma_1| < 1$, $|\gamma_2| < 1$

The purpose of condition (4) was to ensure that the random events influencing other information have no long run effect on future other information. This condition holds for the fixed effects, time effects and time and fixed effects regressions for all years. For the fixed effects regressions, γ_1 is significant at least at the 10% level for years 1990, 1993, and 1995-1998. For the time effects regressions, γ_1 is significant at the 1% level for all years. For the fixed and time effects regressions, γ_1 is significant at the 2% level for years 1993 and 1995-1997. Similarly, for the fixed effects regressions, γ_2 is significant at least at the 10% level for all years. For the time effects regressions, γ_2 is not significant for any year. For the fixed and time effects regressions, γ_2 is significant at least at the 10% level for all years.

The fixed effects parameters from Tables 1 and 2 were applied to equation (42) to determine the fundamental value V. The V Ratio for each firm was formed by dividing the fundamental value by the market value at fiscal year end. Myers (1999) uses market value at fiscal year end in his computations, whereas DeChow et al. (1999) use market value at the end of the calendar year. Firms were ranked into four portfolios based on the V Ratio and the average V Ratio was computed for each portfolio. Table 8 shows the average V ratio for each portfolio.

Table 8. V Ratio Fixed Effects

	P1	P2	P3	P4
1990	0.42129	0.65263	0.90092	1.47723
1991	0.37505	0.58696	0.76128	1.23092
1992	0.39131	0.62251	0.76177	1.67224
1993	0.30505	0.49787	0.64350	1.00898
1994	0.32475	0.55870	0.66742	1.22677
1995	0.29171	0.53613	0.65916	1.21074
1996	0.28921	0.45254	0.59794	1.08171
1997	0.26178	0.42706	0.57710	1.04835
1998	0.28616	0.49600	0.70743	1.27545

The time effects parameters from Tables 3 and 4 were applied to equation (42) to determine the fundamental value V. The V Ratio for each firm was formed by dividing the fundamental value by the market value at fiscal year end. Firms were ranked into 4 portfolios based on the V Ratio and the average V Ratio was computed for each portfolio. Table 9 shows the average V ratio for each portfolio.

Table 9. V Ratio Time Effects

	P1	P2	P3	P4
1990	0.38100	0.61233	0.83450	1.34655
1991	0.30919	0.51802	0.64837	1.06947
1992	0.37593	0.59849	0.73486	1.63103
1993	0.30487	0.47106	0.59081	1.03505
1994	0.28195	0.47011	0.57057	0.88621
1995	0.22613	0.45194	0.59126	1.36799
1996	0.24023	0.42886	0.55999	1.34433
1997	0.22832	0.39825	0.51136	1.06938
1998	0.25107	0.42732	0.61458	1.15044

The time and fixed effects parameters from Tables 5 and 6 were applied to equation (42) to determine the fundamental value V. The V Ratio for each firm was formed by dividing the fundamental value by the market value at fiscal year end. Firms were ranked into 4 portfolios based on the V Ratio and the average V Ratio was computed for each portfolio. Table 10 shows the average V ratio for each portfolio.

Table 10. V Ratio Time and Fixed Effects

	P1	P2	P3	P4
1990	0.41959	0.64922	0.89712	1.46913
1991	0.37515	0.58754	0.76052	1.22790
1992	0.38955	0.61796	0.75866	1.67358
1993	0.30477	0.49744	0.64226	1.00915
1994	0.31600	0.53759	0.64726	1.15031
1995	0.30284	0.55602	0.67978	1.23188
1996	0.27764	0.43948	0.58583	1.08150
1997	0.25490	0.41856	0.56508	1.04192
1998	0.27873	0.45670	0.68533	1.24984

For each firm in the portfolios shown in Table 8, the one year total returns were obtained from Compustat and the equally weighted portfolio returns were computed as the arithmetic average of the one year total returns of the stocks in the portfolio. The results are shown in Table 11.

Table 11. One Year Returns Fixed Effects Equally Weighted

	P1	P2	P3	P4
1990	7.95621	7.07700	20.90147	1.64083
1991	21.95032	1.16732	2.52894	-14.23906
1992	69.79532	36.50984	39.66889	-0.26878
1993	15.68753	8.14247	-2.08878	23.10833
1994	38.35295	15.55279	18.06689	9.22978
1995	32.17174	7.70647	4.69817	-2.47244
1996	29.94783	27.22806	36.15983	38.49647
1997	20.91658	28.75600	3.96356	-13.62706
1998	-7.13639	-8.15189	4.03656	-6.31384
Avg	25.51579	13.77645	14.21506	3.950471

For each firm in the portfolios shown in Table 8, the one year total returns were obtained from Compustat and the value weighted portfolio returns were computed as the arithmetic average of the one year total returns of the stocks in the portfolio weighted by their market value at fiscal year end. The results are shown in Table 12.

Table 12. One Year Returns Fixed Effects Value Weighted

	P1	P2	P3	P4
1990	-11.04801	4.46955	11.77639	-0.96767
1991	1.72242	-2.28751	-7.93564	-5.66243
1992	92.07614	16.00606	16.04174	1.69285
1993	11.44362	10.62826	2.81830	9.53723
1994	21.14042	22.69312	30.28729	13.31858
1995	18.97260	14.31569	5.42881	3.47476
1996	24.49431	25.80638	30.60127	51.18224
1997	31.57365	22.58847	-2.03540	-20.40874
1998	3.17322	0.93323	-1.36414	-10.66230
Avg	21.50537	12.794806	9.51318	4.6116147

For each firm in the portfolios shown in Table 9, the one year total returns were obtained from Compustat and the equally weighted portfolio returns were computed as the arithmetic average of the one year total returns of the stocks in the portfolio. The results are shown in Table 13.

Table 13. One Year Returns Time Effects Equally Weighted

	P1	P2	P3	P4
1990	0.56121	14.47200	17.15142	5.59922
1991	12.69417	8.11233	7.60039	-13.23900
1992	76.51194	46.11394	28.41961	1.92772
1993	8.41083	14.85689	-0.40094	25.74994
1994	41.13872	11.43478	23.94544	12.01679
1995	25.74111	13.01889	2.01806	7.92783
1996	23.94556	36.46283	27.10406	45.16671
1997	13.00126	25.53258	15.62944	-13.53539
1998	-3.19450	-7.07911	2.65567	-9.84217
Avg	22.09003	18.102793	13.79146	6.8635176

For each firm in the portfolios shown in Table 9, the one year total returns were obtained from Compustat and the value weighted portfolio returns were computed as the arithmetic average of the one year total returns of the stocks in the portfolio weighted by the market value at fiscal year end. The results are shown in Table 14.

Table 14. One Year Returns Time Effects Value Weighted

	P1	P2	P3	P4
1990	-12.15996	5.37867	10.55077	0.74016
1991	4.52137	-4.49292	-5.82118	-10.53450
1992	81.37179	24.79368	9.90995	-0.23222
1993	9.76997	9.67507	-1.62123	17.41904
1994	23.40342	18.50266	28.29509	10.80100
1995	15.56832	14.78093	8.12466	19.41442
1996	18.36478	30.24994	34.86769	39.13390
1997	30.34643	14.09626	5.98861	-4.79886
1998	9.07101	-3.91165	-1.84045	-12.82438
Avg	20.02857	12.119182	9.828212	6.5687288

For each firm in the portfolios shown in Table 10, the one year total returns were obtained from Compustat and the equally weighted portfolio returns were computed as the arithmetic average of the one year total returns of the stocks in the portfolio. The results are shown in Table 15.

Table 15. One Year Returns Time and Fixed Effects Equally Weighted

	P1	P2	P3	P4
1990	6.41847	8.61474	20.90147	1.64083
1991	21.95032	1.16732	2.52894	-14.23906
1992	70.90379	35.40137	39.66889	-0.26878
1993	15.68753	8.14247	-2.08878	23.10833
1994	38.35295	16.66400	16.89394	9.22978
1995	33.66063	8.80700	1.96489	-2.47244
1996	32.23228	24.94361	36.15983	38.49647
1997	20.91658	28.75600	5.51189	-15.17539
1998	-8.29822	-7.47361	5.14489	-6.83317
Avg	25.75826	13.891433	14.07622	3.7207316

For each firm in the portfolios shown in Table 10, the one year total returns were obtained from Compustat and the value weighted portfolio returns were computed as the arithmetic average of the one year total returns of the stocks in the portfolio weighted by the market value at fiscal year end. The results are shown in Table 16.

Table 16. One Year Returns Time and Fixed Effects Value Weighted

	P1	P2	P3	P4
1990	-11.59490	4.77346	11.77639	-0.96767
1991	1.72242	-2.28751	-7.93564	-5.66243
1992	83.63313	14.71571	16.04174	1.69285
1993	11.44362	10.62826	2.81830	9.53723
1994	21.14042	22.61176	30.71126	13.31858
1995	19.12021	14.77168	5.75572	3.47476
1996	25.08764	25.43242	30.60127	51.18224
1997	31.57365	22.58847	-3.93420	-20.42552
1998	4.51270	0.22925	-1.74014	-11.83945
Avg	20.73765	12.607056	9.343856	4.4789552

For each firm in the portfolios shown in Table 8, the three year total returns were obtained from Compustat and the equally weighted portfolio returns were computed as the arithmetic average of the three year total returns of the stocks in the portfolio. The results are shown in Table 17.

Table 17. Three Year Returns Fixed Effects Equally Weighted

	P1	P2	P3	P4
1990	11.29242	9.73595	19.69721	2.74333
1991	21.26153	4.47674	11.10044	4.57756
1992	23.20479	14.99137	11.76494	12.34367
1993	20.23321	5.11284	2.54544	13.29456
1994	23.12811	17.88042	16.89150	13.83150
1995	15.17747	15.05205	15.73550	13.55800
1996	-0.91556	14.70667	8.91578	9.27142
1997	0.58753	6.48241	-5.42106	-12.42200
1998	-5.14717	-0.13761	4.40769	-7.88747
Avg	12.09137	9.811204	9.515272	5.4789517

For each firm in the portfolios shown in Table 8, the three year total returns were obtained from Compustat and the value weighted portfolio returns were computed as the arithmetic average of the three year total returns of the stocks in the portfolio weighted by their market value at fiscal year end. The results are shown in Table 18.

Table 18. Three Year Returns Fixed Effects Value Weighted

	P1	P2	P3	P4
1990	-0.05083	3.20403	7.29737	-1.46160
1991	4.26902	1.97109	2.67340	4.92249
1992	31.15437	7.00795	9.42408	13.70629
1993	10.55796	9.17115	11.55470	13.75388
1994	7.35523	21.37792	20.90248	21.73622
1995	8.38449	16.32136	13.44977	19.00055
1996	1.98819	11.08379	10.11767	10.43711
1997	10.17307	3.09680	-12.26905	-23.61715
1998	5.40508	7.06533	8.46282	-24.68080
Avg	8.80406	8.9221579	7.957029	3.7552203

For each firm in the portfolios shown in Table 9, the three year total returns were obtained from Compustat and the equally weighted portfolio returns were computed as the arithmetic average of the three year total returns of the stocks in the portfolio. The results are shown in Table 19.

Table 19. Three Year Returns Time Effects Equally Weighted

	P1	P2	P3	P4
1990	5.69858	15.32979	19.45268	3.00144
1991	16.28061	9.59850	11.75322	5.04005
1992	25.47622	14.59678	10.73811	12.73717
1993	15.29117	10.28311	6.54356	13.45106
1994	25.49006	15.19844	20.49694	13.96584
1995	8.44650	16.91539	17.26567	19.44589
1996	-0.13228	12.38033	8.07017	13.29600
1997	-1.02779	8.48218	-5.20194	-12.81256
1998	-2.96888	-3.51156	5.78924	-6.94707
Avg	10.28380	11.030329	10.54529	6.7975368

For each firm in the portfolios shown in Table 9, the three year total returns were obtained from Compustat and the value weighted portfolio returns were computed as the arithmetic average of the three year total returns of the stocks in the portfolio weighted by the market value at fiscal year end. The results are shown in Table 20.

Table 20. Three Year Returns Time Effects Value Weighted

	P1	P2	P3	P4
1990	-0.99142	3.87861	6.90135	-0.73385
1991	6.30498	2.12301	1.88247	3.86939
1992	28.58083	10.77975	7.22912	14.30456
1993	8.83015	8.64208	10.37989	15.89088
1994	11.53609	18.47304	21.96108	16.94342
1995	1.17687	15.08399	19.06843	24.09660
1996	1.36000	10.58100	10.93934	16.84713
1997	9.47093	5.34653	-9.87375	-22.80014
1998	10.72520	0.35948	9.56620	-21.71365
Avg	8.55485	8.3630552	8.67268	5.1893701

For each firm in the portfolios shown in Table 10, the three year total returns were obtained from Compustat and the equally weighted portfolio returns were computed as the arithmetic average of the three year total returns of the stocks in the portfolio. The results are shown in Table 21.

Table 21. Three Year Returns Time and Fixed Effects Equally Weighted

	P1	P2	P3	P4
1990	8.65863	12.36974	19.69721	2.74333
1991	21.26153	4.47674	11.10044	4.57756
1992	24.38147	13.81468	11.76494	12.34367
1993	20.95063	4.71342	2.71295	13.29456
1994	23.12811	19.52579	15.15472	13.83150
1995	15.33826	18.11889	12.32856	13.55800
1996	2.86339	10.92772	8.91578	9.27142
1997	0.58753	6.48241	-4.31882	-13.46300
1998	-8.54853	3.13241	3.79056	-5.85300
Avg	12.06900	10.395757	9.01626	5.5893369

For each firm in the portfolios shown in Table 10, the three year total returns were obtained from Compustat and the value weighted portfolio returns were computed as the arithmetic average of the three year total returns of the stocks in the portfolio weighted by the market value at fiscal year end. The results are shown in Table 22.

Table 22. Three Year Returns Time and Fixed Effects Value Weighted

	P1	P2	P3	P4
1990	-0.50799	3.49443	7.29737	-1.46160
1991	4.26902	1.97109	2.67340	4.92249
1992	29.84076	5.82528	9.42408	13.70629
1993	10.80477	9.03009	11.54228	13.75388
1994	7.35523	21.73388	20.48044	21.73622
1995	8.05402	16.45803	13.88345	19.00055
1996	2.96760	10.52194	10.11767	10.43711
1997	10.17307	3.09680	-12.52992	-25.93710
1998	5.23947	6.88903	8.46491	-20.57701
Avg	8.68844	8.7800631	7.928187	3.9534248

For each firm in the portfolios shown in Table 8, the P/E ratio was obtained from Compustat and the portfolio P/E ratio was computed as the arithmetic average of the P/E ratios of the stocks in the portfolio. The results are shown in Table 23.

Table 23. P/E Ratio Fixed Effects

	P1	P2	P3	P4
1990	57.79260	36.42271	21.70900	9.39642
1991	19.57350	25.17182	54.08855	19.01291
1992	21.70738	29.98710	129.93691	79.16443
1993	33.73836	24.65145	29.72300	33.26670
1994	30.42177	24.12431	21.63950	35.15983
1995	25.66919	16.23900	19.95179	13.42707
1996	54.90529	14.16164	17.04063	55.89713
1997	23.37771	23.46744	36.96815	29.78631
1998	28.07173	23.78546	19.88300	14.43450
Avg	32.80639	24.223437	38.99339	32.171699

For each firm in the portfolios shown in Table 9, the P/E ratio was obtained from Compustat and the portfolio P/E ratio was computed as the arithmetic average of the P/E ratios of the stocks in the portfolio. The results are shown in Table 24.

Table 24. P/E Ratio Time Effects

	P1	P2	P3	P4
1990	60.21986	35.58193	23.06450	8.67523
1991	26.72642	21.66365	56.30790	17.90342
1992	22.48473	31.01700	139.93530	64.18356
1993	40.83931	16.03691	29.72882	34.37144
1994	31.75825	21.34320	24.51900	31.21943
1995	27.27614	16.92346	19.32365	13.78675
1996	52.60947	19.19131	29.71538	44.69085
1997	24.54608	23.42694	38.47007	25.90071
1998	28.67836	24.71900	18.45785	14.07600
Avg	35.01540	23.3226	42.16916	28.311932

For each firm in the portfolios shown in Table 10, the P/E ratio was obtained from Compustat and the portfolio P/E ratio was computed as the arithmetic average of the P/E ratios of the stocks in the portfolio. The results are shown in Table 25.

Table 25. P/E Ratio Time and Fixed Effects

	P1	P2	P3	P4
1990	58.04627	36.15093	21.70900	9.39642
1991	19.57350	25.17182	54.08855	19.01291
1992	21.55354	30.18710	129.93691	79.16443
1993	33.73836	24.65145	29.72300	33.26670
1994	30.42177	19.44900	27.71740	35.15983
1995	25.79738	17.60412	18.14764	13.42707
1996	33.18124	47.73518	17.04063	55.89713
1997	23.37771	23.46744	40.94008	25.81438
1998	28.57269	22.61800	21.13531	11.60222
Avg	30.47360	27.448338	40.04872	31.415677

The statistical significance of the difference between the average return for portfolio 1 and portfolio 4 is determined using the test on the difference between two means where the variances of the two parent populations are unknown but assumed equal (Harnett and Murphy (1985)).

The t-test statistic is

$$t_{n1+n2-2} = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\left(\frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}\right)\left(\frac{n_1+n_2}{n_1 n_2}\right)}}$$

n1 is the size of the first sample, n2 is the size of the second sample. In both cases, the sample size is the number of years. The sample variance is computed from the sample values. The degrees of freedom are (n1 + n2 – 2). The hypothesis being tested is H_0: $\mu_1 = \mu_2$ versus H_a: $\mu_1 \neq \mu_2$. The results are shown in Table 26.

Table 26. Test of Differences in Portfolio Returns

			t-value	p-value
One year returns	Fixed Effects	Equally weighted	2.344404	0.032291
		Value Weighted	1.415191	0.176181
	Time Effects	Equally weighted	1.464893	0.162323
		Value Weighted	1.306259	0.209932
	Time and Fixed Effects	Equally weighted	2.330249	0.033207
		Value Weighted	1.441128	0.168833
Three Year Returns	Fixed Effects	Equally weighted	1.333804	0.200945
		Value Weighted	0.775782	0.449194
	Time Effects	Equally weighted	0.681591	0.505244
		Value Weighted	0.522152	0.608719
	Time and Fixed Effects	Equally weighted	1.276825	0.219885
		Value Weighted	0.745275	0.466913
P/E Ratio	Fixed Effects		0.07118	0.944137
	Time Effects		0.906378	0.378184
	Time and Fixed Effects		-0.10944	0.914216

The results indicate that there is a statistically significant difference between portfolio 1 (low V/P) and portfolio 4 (high V/P) for the equally weighted one year returns using fixed effects and time and fixed effects regressions. However the average returns for the low V/P (overvalued) portfolio are higher than the average returns for the high V/P (undervalued) portfolio, contrary to the predictions of the Feltham-Ohlson (1995) model.

All the regressions indicate that the difference in the P/E ratio for the low (V/P) portfolio compared to the high (V/P) portfolio is not statistically significant. This implies that the results are not driven by differences in P/E values.

CHAPTER V

ANALYSIS AND CONCLUSIONS

Analysis

In their test of the Ohlson (1995) model, DeChow et al. (1999) find that ω_{11} is positive and less than 1. Myers (1999) has similar results with the Feltham-Ohlson (1995) model but finds that for 20% of the firms in his study, ω_{11} is negative, with an absolute value less than 1. This contrasts with the results of this study in which ω_{11} is negative, with an absolute value less than 1 for most of the time period of the sample data. These results are significant for the fixed effects and time and fixed effects regressions in the years 1995-1998. This indicates that positive abnormal earnings alternate with negative abnormal earnings, and that abnormal earnings has a diminishing impact on future abnormal earnings.

Myers (1999) finds that ω_{12} is negative for 80% of the firms in his sample. This agrees with the results found in this study where ω_{12} is negative for all regressions and significant for 1995-1998 in the fixed effects and time and fixed effects regressions. This indicates that operating assets have a negative relationship with abnormal earnings. For 80% of the firms in his sample Myers (1999) finds that ω_{22} is greater than one. However, he uses all net assets. In contrast, I use net operating assets and find that ω_{22} is positive but less than one. This indicates that net operating assets are diminishing over the time period 1990-1998. A possible explanation is that managers are selling off assets or that they are not making investments sufficient to offset the effects of depreciation.

Myers (1999) finds that γ_1 is greater than one for 40% of the firms in his sample. The theoretical model limits the absolute value of this parameter to be less than one, to model the diminishing impact of the unobservable information on future unobservable information. However Myers (1999) uses order backlog as a proxy for the unobservable information whereas DeChow et al. (1999) and this study extract this information from analysts' earnings forecasts. DeChow et al. (1999) find that γ_1 is within the theoretical bounds. Neither DeChow et al. (1999) nor Myers (1999) test γ_2 because it is not included in their models. I find that both γ_1 and γ_2 are within the theoretical bounds of the model. This condition holds for the fixed effects, time effects and time and fixed effects regressions for all years. This implies that the other (unobservable) information has a diminishing impact on future other information, as the Feltham-Ohlson (1995) model predicts.

In contrast to DeChow et al. (1999), I find a statistically significant difference in the equally weighted one year returns for portfolios formed using fixed effects regressions and time and fixed effects regressions. The results in this study indicate that during the time period 1990-1998, overvalued portfolios outperformed undervalued portfolios in the short run contrary to the predictions of the Feltham-Ohlson (1995) model. DeChow et al. (1999) did not compute the 36 month return. The differences in the equally weighted 36 month return for the low (V/P) and the high (V/P) portfolios are not statistically significant, indicating that investors become less optimistic about overvalued stocks within 36 months.

The differences in the 12 and 36 month value weighted return for the low (V/P) and the high (V/P) portfolios are not statistically significant. This contrasts with the results for the equally weighted 12 month returns, indicating that small firms are driving the differences in the one year returns.

Finally, there is no statistically significant difference in the P/E ratios of portfolios formed using fixed effects, time effects and time and fixed effects regressions. This variable was not controlled for in Myers (1999) and DeChow et al. (1999). The lack of statistically significant differences indicate that the results are not a consequence of differences in the P/E ratios.

Conclusions

This study contributes to the literature by providing the first assessment of the Feltham-Ohlson (1995) model assuming market inefficiency. A key feature of the implementation is the use of panel data methodology to take into account firm specific differences and differences that are due to specific time periods. Net operating assets are found to have a negative influence on abnormal earnings. A possible explanation for this is that managers are investing in projects that are not providing the required return on equity causing assets to be overvalued. Operating assets are diminishing over the time period of the study. A possible explanation is that managers are selling off assets or that they are not making investments sufficient to offset the effects of depreciation.

There is a statistically significant difference in the one year total returns on portfolios formed on the basis of the V/P ratios and that this difference becomes insignificant after 36 months. However, the low (V/P) portfolios have higher returns than the high (V/P) portfolios, which is contrary to the predictions of the Feltham-Ohlson

(1995) model. A possible explanation for these findings is that noise traders acting on pseudo signals continue to invest in overvalued stocks. Professional arbitrageurs are unable to restore equilibrium because of their limited wealth and time horizons. The differences in the equally weighted 36 month return for the low (V/P) and the high (V/P) portfolios are not statistically significant, indicating that investors become less optimistic about overvalued stocks within 36 months. The differences in the 12 and 36 month value weighted return for the low (V/P) and the high (V/P) portfolios are not statistically significant, indicating that small firms are driving the differences in the one year returns. A possible explanation for this is that the small firms have less analyst coverage than larger firms, increasing the possibility of overvaluation.

Finally, the difference in the P/E ratios of portfolios formed using fixed effects, time effects and time and fixed effects regressions is not statistically significant, indicating that the results are not a consequence of differences in the P/E ratios.

Taken as a whole these results indicate that small Canadian stocks were overvalued during the time period 1990-1998. The results confirm that the Feltham-Ohlson (1995) model is a valuable resource for investors and could potentially enhance the efficiency of the financial markets. Future research should attempt to determine the impact of bias in analysts' earnings forecasts and correct for it. Also the impact of international differences in accounting rules should be considered. Finally, data spanning longer time periods and including more firms could improve the significance of the results.

APPENDIX A

TABLES

Table 27. Variables From Databases Used in Limdep Programs

Variable in Limdep Program	Compustat or IBES Mnemonic	Var. in Eq.	Interpretation	Source	Units
CE	CEQ	b_t	Common Equity This item includes 1.Common stock outstanding 2. Capital surplus 3. Retained Earnings 4. Treasury stock adjustments for both common and non-redeemable preferred stock	Compustat	Millions of dollars
CSO	CSHPRI		Common Shares for Basic EPS	Compustat	Millions
NOA	NOA	oa_t	Net Operating Assets The sum of Property, plant and equipment(net) plus total current assets less total current liabilities	Compustat	Millions of dollars
NI	IB	x_t	Income before Extraordinary Items This item represents the income of a company after all expenses, including special items, income taxes and minority interest – but before provisions for common and/or preferred dividends. This item does not reflect discontinued operations (appearing below taxes) or extraordinary items.	Compustat	Millions of dollars

Table 27. (Continued) Variables From Databases Used in Limdep Programs

MV	MKVALF		Market Value at Fiscal Year End	Compustat	Millions of dollars
RP			Industry Risk Premium	Fama (1997)	percent
TB			Annual Canadian Tbill Rate	IFS database	percent
F1	FY1		IBES one yr ahead forecast	IBES, IFS	cents per share
F2	FY2		IBES two yr ahead forecast	IBES, IFS	cents per share

Table 28. Other Variables from Compustat Database

Variable in Limdep Program	Compustat or IBES Mnemonic	Interpretation	Source	Units
Not used	PEM	Price to Earnings ratio monthly Foe each month the month-end close price is divided by the appropriate 12-months Moving Earnings Per Share. If Earnings per share is less than or equal to zero, a "Not Meaningful" data code is returned	Compustat	Decimal

Table 29. Computed Variables

Variable in Limdep Program	Var in Eq	Interpretation	Source
I		Index of companies	Based on number of companies
T		Time index	Based on the number of years of data
RE	r_e	Cost of Equity Capital	RP + TB
ANI	x_t^a	Abnormal Net Income	NI-(RE*CE/100)
DANI		Deflated Abnormal Net Income	ANI/MV
LGANI		Lagged Abnormal Net Income	ANI[-1]
LGNOA		Lagged Net Operating Assets	NOA[-1]
LGMV		Lagged Market Value	MV[-1]
DLGANI		Deflated Lagged Abnormal Net Income	LGANI/LGMV
DLGNOA		Deflated Lagged Net Operating Assets	LGNOA/LGMV
DNOA		Deflated Net Operating Assets	NOA/MV
AFNI		One year ahead forecast of abnormal earnings	(F1*CSO/100) – (RE*CE/100)
DAFNI		Deflated AFNI	AFNI/MV
G		Growth rate in Net Operating Assets	(F2-F1)/F1 If F1 is 0 it is replaced by 1
FNOA		One year ahead forecast of Net Operating Assets	NOA*G
DFNOA		Deflated forecasted Net Operating Assets	FNOA/MV
DV1		Deflated V1	DAFNI – w11*DANI – w12*DNOA
DV2		Deflated V2	DFNOA – w22*DNOA
DCE		Deflated CE	CE/MV
R			1 + RE

Table 30. Industry Risk Premiums

Industry	Short name	Risk Premium (Ri – Rf)
Aircraft	Aero	7.54
Agriculture	Agric	6.51
Automobiles and Trucks	Autos	9.39
Banking	Banks	8.08
Alcoholic Beverages	Beer	2.99
Construction Materials	BldMt	6.4
Printing and Publishing	Books	6.96
Shipping Containers	Boxes	5.77
Business Services	BusSv	6.51
Chemicals	Chems	6.58
Electronic Equipment	Chips	6.01
Apparel	Clths	8.85
Construction	Cnstr	6.42
Coal	Coal	5.97
Computers	Comps	2.49
Pharmaceutical products	Drugs	0.09
Electrical Equipment	ElcEq	5.98
Petroleum and Natural Gas	Enrgy	4.93
Fabricated Products	FabPr	9.69
Trading	Fin	6.72
Food Products	Food	4.09
Entertainment	Fun	8.43
Precious Metals	Gold	5.35
Defense	Guns	6.25
Healthcare	Hlth	6.14
Consumer Goods	Hshld	3.19
Insurance	Insur	5.72
Measuring and Control Equipment	LabEq	5.8
Machinery	Mach	6.46
Restaurants, Hotel, Motel	Meals	6.81
Medical Equipment	Medeq	2.64
Nonmetallic Mining	Mines	7.65
Miscellaneous	Misc	9.56
Business Supplies	Paper	7.78
Personal Services	PerSv	7.26
Real Estate	RlEst	11.16

Table 30 (Continued) Industry Risk Premiums

Industry	Short name	Risk Premium (Ri – Rf)
Retail	Rtail	5.88
Rubber and Plastic Products	Rubbr	7.78
Shipbuilding. Railroad Equip	Ships	8.63
Tobacco Products	Smoke	5.56
Candy and Soda	Soda	8.46
Steel Works	Steel	9.61
Telecommunications	Telcm	5.17
Recreational Products	Toys	10.01
Transportation	Trans	7.39
Textiles	Txtls	9.18
Utilities	Util	5.41
Wholesale	Whlsl	7.52

Table 31. Companies Used in Statistical Tests

Fiscal Yr end	Compustat Ticker	IBES Ticker	Company Name	SIC	Industry Short Name
Dec	A	A1	ABITIBI CONSOLIDATED INC	2621	Paper
Dec	AGE	AGE2	AGNICO EAGLE MINES LTD	1040	Gold
Jul	AGR	AGR1	AGRA INDS LTD	8711	Bussv
Dec	AC.A	AC5	AIR CANADA -CL A	4512	Trans
Dec	AEC	AEC1	ALBERTA ENERGY CO LTD	1311	Enrgy
Dec	AL	AL	ALCAN INC	3350	Steel
Sep	AXL	AXL1	ANDERSON EXPLORATION LTD	1311	Enrgy
Mar/Dec	ACO.X	ACO1	ATCO LTD -CL I	4932	Util
Sep/Dec	AUR	AUR1	AUR RESOURCES INC	1000	Mines
Jul/Dec	CBE	CBE1	CABRE EXPLORATION LTD	1311	Enrgy
Mar	CAE	CAE1	CAE INC	3690	Elceq
Dec	CNQ	CNQ1	CANADIAN NATURAL RESOURCES	1311	Enrgy
Dec	CP	CP1	CANADIAN PACIFIC RAILWAY	9997	Misc
Aug	SAT	SAT1	CANADIAN SATELLITE COMMUNICATIONS	4899	Telcm
Dec	CTR.A	CTR1	CANADIAN TIRE CORP	5531	Rtail
Dec	CU	CU1	CANADIAN UTILITIES	4932	Util
Dec	CAM.A	CAM1	CANAM MANAC GROUP INC -CL A	3440	Bldmt
Dec	CFP	CRP1	CANFOR CORP	2421	Bldmt
Mar	CAO.A	CAO1	CARA OPERATIONS LTD -CL A	5812	Meals
Dec	CCL.B	CCQ2	CCL INDUSTRIES -CL B	2844	Hshld
Aug	CHM.B	CHM1	CHUM LTD -CL B	4832	Telcm
Dec	CRW	CRW1	CINRAM INTERNATIONAL INC	3652	Toys
Aug/Feb	CSN	CSN1	COGNOS INC	7372	Bussv
Sep	CGC	CGC1	CONSUMERS PACKAGING INC	3221	Boxes
Aug/Feb	CDL.A	CDL1	CORBY (H.) DISTILLERY -CL A	2080	Beer
Dec	CEI	CEI1	CO-STEEL	3312	Steel
Dec	DRL	DRL1	DERLAN INDUSTRIES LTD	3728	Aero
Dec	DFS	DFS1	DOFASCO INC	3312	Steel
Dec	DOM.B	DOM1	DOMAN INDUSTRIES -CL B	2421	Bldmt
Dec	DTC	DTC1	DOMTAR INC	2621	Paper
Dec	DHC.A	DHC1	DONOHUE INC -CL A	2621	Paper
Dec	DUP.A	DUP1	DUPONT CANADA -CL A	2820	Chems
Jan	DLX	DLX1	DYLEX LTD	5651	Rtail
Dec	ECO	ECO	ECHO BAY MINES LTD	1040	Gold
Dec	FTS	NFL1	FORTIS INC	4911	Util
Dec	FPL	FPI1	FPI LTD	2092	Food

Table 31. (Continued) Companies Used in Statistical Tests

Fiscal Yr end	Compustat Ticker	IBES Ticker	Company Name	SIC	Industry Short Name
Mar	FN	FN1	FRANCO-NEVADA MINING CORP	6795	Fin
Apr	GAC	GAC1	GEAC COMPUTER CORP LTD	7373	Comps
Jun/Dec	GLG	GLG1	GLAMIS GOLD LTD	1040	Gold
Oct	GRT.A	GRT1	GRT.A	2750	Bussv
Jan	HBC	HBC1	HUDSONS BAY CO	5311	Rtail
Dec	IMO	IMO1	IMPERIAL OIL LTD	2911	Enrgy
Dec	N	N	INCO LTD	3330	Steel
Dec	IFP.A	WHN1	INTL FOREST PRODUCTS -CL A	2421	Bldmt
Dec	IPS	ISP1	IPSCO INC	3312	Steel
Dec	IVA.A	IVA2	IVACO INC -CL A	3312	Steel
Aug	LDM	LDM1	LAIDLAW INC	4100	Trans
Jun/Dec	LNR	LNR2	LINAMAR CORP	3714	Autos
Dec	L	L1	LOBLAW COS LTD	5411	Rtail
Mar	MOL.A	MOL1	MOLSON INC -CL A	2082	Beer
Dec	MCL	MCL	MOORE CORP LTD	2761	Paper
Dec	PNG.A	PNG1	PACIFIC NORTHERN GAS	4923	Util
Dec	PDG	PDL1	PLACER DOME INC	1040	Gold
Dec	POT	POT1	POTASH CORP SASK INC	2870	Chems
Dec	PDI	PDI1	PREMDOR INC	2430	Bldmt
Jan	RET.A	RET2	REITMANS (CANADA) -CL A	5621	Rtail
Mar	ROC	ROC1	ROTHMANS INC	2111	Smoke
Dec	SMT	SMT1	SAMUEL MANU-TECH INC	3490	Bldmt
Dec	SCC	SSR2	SEARS CANADA INC	5311	Rtail
Dec	SHC	SHC1	SHELL CANADA LTD -CL A	2911	Enrgy
Mar/Dec	SSI	SSI1	SLATER STEEL INC	3312	Steel
Dec	SFF	SFF1	SLOCAN FOREST PRODS LTD	2421	Bldmt
Dec	SPZ	SPZ1	SPAR AEROSPACE LTD	3663	Chips
Dec	ST.A	ST1	ST LAWRENCE CEM GRP -CL A	3241	Bldmt
Dec	STE.A	STE1	STELCO INC -CL A	3312	Steel
Sep/Dec	TEK.B	TEK2	TECK CORP -CL B	1040	Gold
Sep	TBC	TBC3	TEMBEC INC -CL A	2611	Paper
Dec	TS.B	TS1	TORSTAR CORP -CL B	2711	Books
Dec	TRP	TRP1	TRANSCANADA PIPELINES LTD	4922	Util
Dec	TMA	TMA1	TRIMAC CORP	4213	Trans
Dec	ULP	ULP1	ULSTER PETROLEUM LTD	1311	Enrgy
Dec	WFT	WFT1	WEST FRASER TIMBER CO	2421	Bldmt
Dec	W	WTC1	WESTCOAST ENERGY INC	4923	Util
Dec	WN	WN1	WESTON (GEORGE) LTD	5411	Rtail
August	WIC.B	WCW	WIC WESTERN INTL COMM -CL B	4833	Telcm
Dec	WPK	WPK1	WINPAK LTD	3560	Mach

Table 32. Canadian Tbill Rates and Exchange Rates

Yr	Canadian Tbill rates	Exchange rate: Canadian dollar per US dollar
1985	9.43	1.37
1986	8.97	1.39
1987	8.15	1.33
1988	9.48	1.23
1989	12.05	1.18
1990	12.81	1.17
1991	8.73	1.15
1992	6.59	1.21
1993	4.84	1.29
1994	5.54	1.37
1995	6.89	1.37
1996	4.21	1.36
1997	3.26	1.38
1998	4.73	1.48
1999	4.72	1.49
2000	5.49	1.49
2001	3.77	1.55

APPENDIX B

I/B/E/S DATABASE LAYOUT AND DESCRIPTION

Table 33. File 1 Summary Statistics

Field	Length	Type	Start Position
I/B/E/S Ticker	6	X	1
I/B/E/S Statistical Period (YYMM)	4	N	7
Forecast Period End Date (YYMM)	4	N	11
Forecast Period Indicator	1	X	15
Number of Estimates	2	N	16
Number Up	2	N	18
Number Down	2	N	20
Median Estimate	6.#	N	22
Mean Estimate	6.#	N	28
Standard Deviation	6.#	N	34
High Estimate	6.#	N	40
Low Estimate	6.#	N	46
Decimal Location	1	N	52

Field Description for File 1

(1) Forecast Period Indicator

0 – Long Term Growth
1 – FY1
2 – FY2
3 – FY3
4 – FY4
5 – FY5
6 – Qtr1
7 – Qtr2
8 – Qtr3
9 – Qtr4
A – Semi 1
B – Semi 2
C – Semi 3
D – Semi 4

(2) Decimal Location is the number of digits to the right of the decimal point for fields in monetary units. For the United States and Canada it will always be 2.

(3) The Data Format is as follows:

There are two types of data: (shown in the type column of the layout)

X – Character data
N – Numeric data, right justified, integers or decimal fractions, fixed format

Decimal numbers are shown in the form mm.nn, where mm is the total field size excluding the decimal point and nn is the number of digits to the right of the decimal point.
A "#" for nn indicates that the number of digits to the right of the decimal point may vary. The number of digits to the right of the decimal point is stored in the Decimal Location Field.
Numbers less than 1.0 are filled with spaces to the left of the decimal point.
values are prefixed with a minus sign
Decimal numbers that are not available are indicated by a minus sign followed by 9's to fill the field. For example "-99999" would be used for a 6 byte field.
Date values that are not available or not meaningful are indicated by a "0"

(4) Number Down

This is the number of estimates that have been lowered (from the value as of the last monthly run) since the last monthly cycle. New estimates and multiple estimate changes are not counted in this sum. For example, if since the last monthly cycle, an analyst lowers his/her estimate from 1.8 (the value as of the last monthly run) to 1.7 and then revises that estimate from 1.7 to 1.75, it is counted as one estimate lowered, because only the estimate as of the last monthly run is used in the calculation.

(5) Number Up

This is the number of estimates that have been increased (from the value as of the last monthly run) since the last rolling 4-week monthly cycle. New estimates and multiple estimate changes are not counted in this sum. For example, if since the last monthly cycle, an analyst raises his/her estimate from 2.3 to 2.5 and then revises that estimate from 2.5 to 2.4 it is counted as one estimate raised because only the estimate as of the last monthly run is used in the calculation.

(6) I/B/E/S Statistical Period

There are several ways to refer to the I/B/E/S monthly cycle dates, all of which refer to the same date. The most frequent definitions of the I/B/E/S run date are:

1. The Thursday that falls between the 14th and 20th of each month
2. The Thursday before the third Friday of the month
3. The Thursday of the week in which options expire

The rationale for this mid month date dates back to earlier days when most brokerage research was released by US mail on the first of the month. The two week lead time was necessary to process print and ship the data to clients.

(7) High Estimate

The greatest value in a set of estimates for a company, for the fiscal period indicated.

(8) Low Estimate

The smallest value in a set of estimates for a company for the fiscal period indicated.

(9) I/B/E/S Ticker

The I/B/E/S ticker is an I/B/E/S identifier that is unique and permanent. In the event of a company name change or ticker change, the I/B/E/S ticker remains the same. In the case of an acquisition or merger of two companies, the I/B/E/S ticker for the dominant entity prevails for future reporting. This allows for historical continuity.

(10) Forecast period end date

This is the future date corresponding to the forecast being made. For example if the statistical period is May 1984 and the fiscal year end is September 1984, then FY1 corresponds to Sept 1984 and FY2 corresponds to Sept 1985

(11) Long Term Growth Forecast (LTG)

Long Term Growth Forecasts are received directly from contributing analysts, they are not calculated by I/B/E/S. While different analysts apply different methodologies, the Long Term Growth Forecast generally represents an expected annual increase in operating earnings over the company's next full business cycle. In general, these forecasts refer to a period of between three to five years. Due to the variance in methodologies for Long Term Growth calculations, I/B/E/S recommends and uses as its default display the median value for Long Term Growth Forecast as opposed to the mean value. The median value is less affected by outlier forecasts.
This value appears as a percentage with 2 decimal places.

(12) Standard Deviation

The statistical measure of dispersion of estimates for the fiscal period indicated. The standard deviation is the average variance from the mean expressed in local currency.

Table 34. File 3 Company Identification

Field	Length	Type	Start Position
I/B/E/S Ticker	6	X	1
Cusip	8	X	7
Official Ticker Symbol or Home Market Code	6	X	15
Company Name	16	X	21
Dilution Factor	5.3	N	37
Primary/Diluted Indicator (P/D)	1	X	42
Canadian Currency or Parent/Consolidated Flag	1	X	43
Capital International Flag	1	X	44
Uniform Actuals Indicator	1	X	45
Sector/Industry/Group Code	6	N	46
Start Date (YYMM)	4	N	52

Field Description for File 3

Canadian Currency or Parent/Consolidated Flag

The flag has different usages in the US and International file. Its purpose for US/Canadian companies is to mark the companies whose currency is Canadian. On the international side, the flag deals solely with Japanese companies as a means to differentiate between companies reporting on a parent or consolidated basis.
C = Canadian dollar
Blank = US dollar

APPENDIX C

LIMDEP PROGRAMS

Stage One Program

```
/*==========================================================================

OHLSON EQUATION 1

ANI(t+1) = (w11) * ANI(t) + (w12) * NOA(t) + e
ANI : Abnormal Net Income
NI : Net Income
NOA : Net Operating Assets
MV : Market Value
RP : Industry risk premium
TB : annual Canadian Tbill rate
CE : Common Equity
RE : Return on Equity
w11 , w12 : slopes
NF = number of companies
TF = number of time periods
KF = number of regressors not including the constant term

*/==========================================================================
Read ; File = d:\dissertation\results2\data7.xls ;  Format =  XLS ; Names $
?
? Data Setup
?
Reject ; T > 15 $
Reject ; T < 6 $
Skip
Create ; RE = RP + TB $
Create ; ANI = NI - (RE * CE/100)  $
Create ; DANI = ANI/MV    $
Create ; LGANI = ANI[-1] ; LGNOA = NOA[-1] ; LGMV = MV[-1] $
Create ; DLGANI = LGANI/LGMV ; DLGNOA = LGNOA/LGMV ; DNOA =
NOA/MV $
Create ; DNOA = NOA/MV $
Calculate ; NF = 76 $
Calculate ; TF = 10 $
Calculate ; KF = 2 $

?----------------------------------------------------------------
? Pooled Cross Sectional  Regression
?----------------------------------------------------------------
```

```
Namelist ; X = DLGANI, DLGNOA $
Regress ; Lhs = DANI ; Rhs = X ; Res = e $
Calc    ; list ; eer = sumsqdev ; ssqrd $

?--------------------------------------------------------------------
? Group Means Regression
?--------------------------------------------------------------------
Regress ; Lhs = DANI ; Rhs = X ; Str=I ; Panel ; Means $
Calc    ; list ; ssqrd $

?--------------------------------------------------------------------
? Firm Effects, and test for firm effects
? F(n-1,nT-n-K)
?--------------------------------------------------------------------

Regress ; Lhs = DANI ; Rhs = X ; Str=I ; Panel
        ; Fixed Effects ; Output = 2 $
Calculate ; DF1 = NF - 1 $
Calculate ; DF2 = NF*TF - NF - KF $
Calc    ; eeu = sumsqdev
        ; list ; ssqrd
                ; F = ((eer - eeu)/DF1)/(eeu/DF2)
                ; Ftb(.95,DF1,DF2) $

?--------------------------------------------------------------------
? Time Effects
? F(T-1,nT-T-K)
?--------------------------------------------------------------------
Regress ; Lhs = DANI ; Rhs = X ; Str=T ; Panel
        ; Fixed Effects ; Output = 2 $
Calculate ; DF1 = TF - 1 $
Calculate ; DF2 = NF*TF - TF - KF $
Calc    ; eeu = sumsqdev
        ; list ; ssqrd
                ; F = ((eer - eeu)/DF1)/(eeu/DF2)
                ; Ftb(.95,DF1,DF2) $

?--------------------------------------------------------------------
? Firm and Time Effects
? F(n+T-1,nT-T-n-K)
?--------------------------------------------------------------------
Regress ; Lhs = DANI ; Rhs = X ; Str=I ; Period = T
        ; Panel ; Fixed Effects ; Output = 2 $
Calculate ; DF1 = NF + TF - 1 $
Calculate ; DF2 = NF*TF - NF- TF - KF $
Calc    ; eeu = sumsqdev
```

```
        ; list ; ssqrd
              ; F = ((eer - eeu)/DF1)/(eeu/DF2)
              ; Ftb(.95,DF1,DF2) $

/*=====================================================================

OHLSON EQUATION 2
NOA(t+1) =  (w22) * NOA(t) + e
w22 : slope

*/=====================================================================
?-------------------------------------------------------------------
? Pooled Cross Sectional Regression
?-------------------------------------------------------------------
Calculate ; KF = 1 $
Namelist ; X =  DLGNOA $

Regress ; Lhs = DNOA ; Rhs = X ; Res = e $
Calc    ; list ; eer = sumsqdev ; ssqrd $

?-------------------------------------------------------------------
? Group Means Regression
?-------------------------------------------------------------------
Regress ; Lhs = DNOA ; Rhs = X ; Str=I ; Panel ; Means $
Calc    ; list ; ssqrd $

?-------------------------------------------------------------------
? Firm Effects, and test for firm effects
?-------------------------------------------------------------------
Regress ; Lhs = DNOA ; Rhs = X ; Str=I ; Panel
        ; Fixed Effects ; Output = 2 $

Calculate ; DF1 = NF - 1 $
Calculate ; DF2 = NF*TF - NF - KF $
Calc    ; eeu = sumsqdev
        ; list ; ssqrd
              ; F = ((eer - eeu)/DF1)/(eeu/DF2)
              ; Ftb(.95,DF1,DF2) $
?-------------------------------------------------------------------
? Time Effects
?-------------------------------------------------------------------
Regress ; Lhs = DNOA ; Rhs = X ; Str=T ; Panel
        ; Fixed Effects ; Output = 2 $
Calculate ; DF1 = TF - 1 $
Calculate ; DF2 = NF*TF - TF - KF $
Calc    ; eeu = sumsqdev
```

```
        ; list ; ssqrd
              ; F = ((eer - eeu)/DF1)/(eeu/DF2)
              ; Ftb(.95,DF1,DF2) $

?-------------------------------------------------------------------
? Firm and Time Effects
?-------------------------------------------------------------------
Regress ; Lhs = DNOA ; Rhs = X ; Str=I ; Period = T
        ; Panel ; Fixed Effects ; Output = 2 $
Calculate ; DF1 = NF + TF - 1 $
Calculate ; DF2 = NF*TF - NF- TF - KF $
Calc    ; eeu = sumsqdev
        ; list ; ssqrd
              ; F = ((eer - eeu)/DF1)/(eeu/DF2)
              ; Ftb(.95,DF1,DF2) $
```

Stage Two Program

```
/*==========================================================================

OHLSON EQUATION 3

V1 = AFNI(t)  - (w11) * ANI(t) - (w12) * NOA (t)

v1( t+1) =  (y1)* v1(t) + e
w11, w12,  : slopes from the regression of Ohlson equation 1
y1 : slope
CSO : Common shares outstanding
NI : Net Income
CE : Common Equity
RE : Return on Equity
RP : Industry risk premium
TB : Annual Canadian Tbill rate
G = Growth rate in Net Operating Assets
NOA : Net Operating Assets
MV : Market Value
F1 : I/B/E/S consensus analyst 1 year forecast of EPS
F2 : I/B/E/S consensus analyst 2 year forecast of EPS
NF = number of companies
TF = number of time periods
KF = number of regressors not including the constant term

*/==========================================================================
Read ; File = d:\dissertation\results2\data7.xls ;  Format =  XLS ; Names $
?
```

```
? Data Setup
?
Reject ; T > 15 $
Reject ; T < 6 $
Skip
Calculate ; w11 = -.02180232890   $
Calculate ; w12 = -.06917244454   $
Calculate ; w22 = .1670942553     $
Create ; RE = RP + TB $
Create ; ANI = NI - (RE * CE/100)  $
Create ; DANI = ANI/MV    $
Create ; AFNI = (F1*CSO/100) - (RE*CE/100)   $
Create ; DAFNI = AFNI/MV $
Create ; G = (F2-F1)/F1 $
Create ; FNOA = NOA * (1+G) $
Create ; DNOA = NOA/MV ; DFNOA = FNOA/MV $
Create ; DV1 = DAFNI - w11 * DANI - w12 * DNOA  $
Create ; LGV1 = DV1[-1]   $
Create ; DV2 = DFNOA - w22* DNOA  $
Create ;  LGV2 = DV2[-1]  $
Calculate ; NF = 76 $
Calculate ; TF = 10 $
Calculate ; KF = 1 $
?
? Initial Least Squares Regression
?
Regress ; Lhs = DV1 ; Rhs = LGV1 ; Res = e $
Calc    ; list ; eer = sumsqdev ; ssqrd$

Namelist ; X =  LGV1 $

Regress ; Lhs = DV1 ; Rhs = X $
Calc    ; list ; eer = sumsqdev ; ssqrd $

?------------------------------------------------------------------
? Group Means Regression
?------------------------------------------------------------------
Regress ; Lhs = DV1 ; Rhs = X ; Str=I ; Panel ; Means $
Calc     ; list ; ssqrd $
?------------------------------------------------------------------
? Firm Effects, and test for firm effects
? F(n-1,nT-n-K)
?
?------------------------------------------------------------------
Regress ; Lhs = DV1 ; Rhs = X ; Str=I ; Panel
       ; Fixed Effects ; Output = 2 $
```

```
Calculate ; DF1 = NF - 1 $
Calculate ; DF2 = NF*TF - NF - KF $
Calc    ; eeu = sumsqdev
        ; list ; ssqrd
               ; F = ((eer - eeu)/DF1)/(eeu/DF2)
               ; Ftb(.95,DF1,DF2) $

?----------------------------------------------------------------------
? Time Effects
?----------------------------------------------------------------------
Regress ; Lhs = DV1 ; Rhs = X ; Str=T ; Panel
        ; Fixed Effects ; Output = 2 $

Calculate ; DF1 = TF - 1 $
Calculate ; DF2 = NF*TF - TF - KF $
Calc    ; eeu = sumsqdev
        ; list ; ssqrd
               ; F = ((eer - eeu)/DF1)/(eeu/DF2)
               ; Ftb(.95,DF1,DF2) $

?----------------------------------------------------------------------
? Firm and Time Effects
?----------------------------------------------------------------------
Regress ; Lhs = DV1 ; Rhs = X ; Str=I ; Period = T
        ; Panel ; Fixed Effects ; Output = 2 $
Calculate ; DF1 = NF + TF - 1 $
Calculate ; DF2 = NF*TF - NF- TF - KF $
Calc    ; eeu = sumsqdev
        ; list ; ssqrd
               ; F = ((eer - eeu)/DF1)/(eeu/DF2)

               ; Ftb(.95,DF1,DF2) $
/*==========================================================================

OHLSON EQUATION 4
v2 = FNOA(t)  - (w22) *  NOA (t)
v2( t+1) =  (y2) * v2(t) + e
FNOA : Forecast of Net Operating Assets
w22 : slope from Ohlson equation 2
y2 : slope
*/==========================================================================
?
? Initial Least Squares Regression
?
Regress ; Lhs = DV2 ; Rhs = LGV2 ; Res = e $
Calc    ; list ; eer = sumsqdev ; ssqrd$
```

```
Namelist ; X =  LGV2 $
Regress ; Lhs = DV2 ; Rhs = X $
Calc    ; list ; eer = sumsqdev ; ssqrd $
?------------------------------------------------------------------
? Group Means Regression
?------------------------------------------------------------------
Regress ; Lhs = DV2 ; Rhs = X ; Str=I ; Panel ; Means $
Calc    ; list ; ssqrd $
?------------------------------------------------------------------
? Firm Effects, and test for firm effects
?------------------------------------------------------------------
Regress ; Lhs = DV2 ; Rhs = X ; Str=I ; Panel
        ; Fixed Effects ; Output = 2 $
Calculate ; DF1 = NF - 1 $
Calculate ; DF2 = NF*TF - NF - KF $
Calc    ; eeu = sumsqdev
        ; list ; ssqrd
               ; F = ((eer - eeu)/DF1)/(eeu/DF2)
               ; Ftb(.95,DF1,DF2) $
?------------------------------------------------------------------
? Time Effects
?------------------------------------------------------------------
Regress ; Lhs = DV2 ; Rhs = X ; Str=T ; Panel
        ; Fixed Effects ; Output = 2 $
Calculate ; DF1 = TF - 1 $
Calculate ; DF2 = NF*TF - TF - KF $
Calc    ; eeu = sumsqdev
        ; list ; ssqrd
               ; F = ((eer - eeu)/DF1)/(eeu/DF2)
               ; Ftb(.95,DF1,DF2) $

?------------------------------------------------------------------
? Firm and Time Effects
?------------------------------------------------------------------
Regress ; Lhs = DV2 ; Rhs = X ; Str=I ; Period = T
        ; Panel ; Fixed Effects ; Output = 2 $
Calculate ; DF1 = NF + TF - 1 $
Calculate ; DF2 = NF*TF - NF- TF - KF $
Calc    ; eeu = sumsqdev
        ; list ; ssqrd
               ; F = ((eer - eeu)/DF1)/(eeu/DF2)
               ; Ftb(.95,DF1,DF2) $
```

Stage Three Program

```
/*=====================================================================

Computation of fundamental value divided by market value

V(t) = CE(t) + A1*ANI(t) + A2*NOA(t) + B1*V1 +B2*V2

A1 = w11/(R-w11)
A2 = w12*R/((R-w22)*(R-w11))
B1 = R/((R-w11)*(R-GM1))
B2 = R/(R-GM2)

w11, w12   : slopes from the regression of Ohlson equation 1
GM1, GM2 : slopes from the regression involving the
unobservable variables
v1, v2 : the unobservable variables
CSO : Common shares outstanding
NI : Net Income
CE : Common Equity
RE : Return on Equity
RP : Industry risk premium
TB : Annual Canadian Tbill rate
G = Growth rate in Net Operating Assets
NOA : Net Operating Assets
MV : Market Value
F1 : I/B/E/S consensus analyst 1 year forecast of EPS
F2 : I/B/E/S consensus analyst 2 year forecast of EPS

*/=====================================================================
Read ; File = d:\dissertation\results2\data7.xls ;  Format =  XLS ; Names $
?
? Data Setup
?
Reject ; T > 15 $
Reject ; T < 6 $
Skip
Calculate ; w11 = -.02180232890   $
Calculate ; w12 = -.06917244454   $
Calculate ; w22 = .1670942553     $
Calculate ; GM1 = .1885434257      $
Calculate ; GM2 =  -.06951940086   $
 Create ; RE = RP + TB $
Create ; ANI = NI - (RE * CE/100)  $
Create ; DCE = CE/MV $
```

```
Create ; DANI = ANI/MV    $
Create ; AFNI = (F1*CSO/100) - (RE*CE/100)   $
Create ; DAFNI = AFNI/MV $
Create ; G = (F2-F1)/F1 $
Create ; FNOA = NOA * (1+G) $
Create ; DNOA = NOA/MV ; DFNOA = FNOA/MV $
Create ; DV1 = DAFNI - w11 * DANI - w12 * DNOA  $
Create ; DV2 = DFNOA - w22* DNOA  $
Create ; R = 1 + RE/100 $
Create ; A1 = w11/(R- w11) $
Create ; A2 = (w12*R)/((R-w22)*(R-w11)) $
Create ; B1 = R/((R-w11)*(R-GM1)) $
Create ; B2 = A2/(R-GM2) $
Create ; DV = DCE + A1*DANI + A2*DNOA + B1*DV1 + B2*DV2 $
```

APPENDIX D

PANEL DATA METHODOLOGY

Benefits of Panel Data

Baltagi (1995) lists the following benefits of using panel data:

1) Controlling for individual heterogeneity.

2) Panel data give more informative data, more variability, less collinearity among the variables, more degrees of freedom and more efficiency.

3) Panel data are better able to study the dynamics of adjustment.

4) Panel data are better able to identify and measure effects that are not detectable in pure cross sections or pure time series data.

5) Panel data models allow us to construct and test more complicated behavioral models than purely cross section or time series data.

6) Panel data are usually gathered on micro units, like individuals, firms and households. Many variables can be more accurately measured at the micro level and biases resulting from aggregation over firms or individuals are eliminated.

Fixed Effects

The regression model takes the following form:

$$y_{it} = \alpha_{it} + \boldsymbol{\beta}' \mathbf{x}_{it} + \varepsilon_{it}$$

The individual effect is α_i which is taken to be constant over time t and specific to the individual cross sectional unit i.

$$E[\varepsilon_{it}] = 0$$

$$E[\varepsilon^2{}_{it}] = \sigma^2{}_{\varepsilon}$$

Random Effects

The regression model takes the following form:

$$y_{it} = \alpha + \boldsymbol{\beta}' \mathbf{x}_{it} + u_i + \varepsilon_{it}$$

$E[\varepsilon_{it}] = E[u_i] = 0$

$E[\varepsilon^2_{it}] = \sigma^2_\varepsilon$

$E[u^2_{it}] = \sigma^2_u$

The component u_i is the random disturbance characterizing the ith observation and is constant through time.

Fixed Time Effects

The regression model takes the following form:

$y_{it} = \alpha_i + \gamma_t + \boldsymbol{\beta}' \mathbf{x}_{it} + u_i + \varepsilon_{it}$

$E[\varepsilon_{it}] = 0$

$E[\varepsilon^2_{it}] = \sigma^2_\varepsilon$

The component γ_t is a time effect which is common to all observations at time t

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