The Valuation Models Based on Historical Accounting Data

A Test of Ohlson (1995) Model : A Study in Thailand

ABSTRACT

Finding intrinsic value of firms is important for making decision since there are many techniques to forecast. The Ohlson's model and its developments are interesting in various researches. The linear information dynamics tries to identify the link between current information and future abnormal earnings. Ota (2002)'s model is very interesting because his work is ignore and adjust the information a part from abnormal earnings υ_t by correcting serial correlation in the error term. This paper investigates the validity of the Ohlson's information dynamics (Linear Information Model: LIM) and attempts to improve the Linear Information Model (LIM) by following the functional form of Ota (2002)'s concept for Thailand data.

However, as the data was the time series, the researcher applied the ARIMA process for these autoregressive models. The results presented the Feltham and Ohlson (1995)'s model which increase book value of equity, b_t ,as an explanatory variable show the improvement with the more predictive ability of future stock returns. However, the model that assumes other information as a constant does not show the validity by the explanatory power of contemporaneous stock prices, while the Ohlson (1995) shows the most validity by comparing the explanatory power of contemporaneous stock prices. Finally, among the competitive models based on the predictive ability of future stock returns, as well as the explanatory power of contemporaneous stock prices, the researcher supported the valuation model that follows the Feltham and Ohlson (1995) valuing the firm by book value per share of equity and earning per share altogether but ignore other information. Finally, it should be noted that this study may have limitation for small sample bias according to the maximum likelihood by Autoregressive Integrated Moving Average (ARIMA) process.

I. INTRODUCTION

[Figure I is here]

Market capitalization of the Stock Exchange of Thailand has been increased from 246,674.79 million Baht in September 1988 to 3,192,157.11 million Baht in November 2008; however, the market still fluctuates. Acquisition on intrinsic value or target prices of stocks is important to investors for making decision to buy or not to buy the company's stocks.Consequently, to find the most accurate valuation models of firms and their stocks would be valuable for investors, financial analysts, financial institutions and researchers.

Siengsuwan (2005) showed the results studied in Thailand that although investors make decision based on stock recommendations, it does not guarantee that they will always receive benefits. Furthermore, She refers to Brav and Leheavy (2003) and Srisaruyapong (2004) that target prices are informative to investors. Srisaruyapong (2004) also found that the target prices and stock recommendation are useful information for earning abnormal return. Since the forecasted assumptions are unreliable in the changeable world, the reasercher's motivation is trying to find any models that can reduce any unreliable assumption.

To find the intrinsic values or target prices, the accounting-based valuation models are interesting and important issues in forecasting. According to Anand and Faseruk (2008)' models, these mentioned models can be divided into 2 groups: analyzing historical (trailing) accounting data and forecasted accounting data either pro forma or cash flows.

Anand and Faseruk (2008) also found that the Residual Income Model (RIM) is equal to or at least better than Free Cash Flow (FCF) model. In the same time, Linear Information Model (LIM) is superior to the forward P/E model in capturing the fundamentals.

To begin with, the Residual Income Valuation model (RIV) or Residual Income Model (RIM), named after Edwards-Bell-Ohlson (EBO) as model is based on works by Ohlson (1991 and 1995) and Edwards and Bell (1961) to forecast the firm's value. This model has been developed from the traditional Dividend Discounting Model (DDM) having limits for the non-dividend payment firms.

Residual Income Valuation model (RIV) exploits the main data from balance sheet and income statement by two conditions. The first condition is that the accounting system follows the *clean surplus relation* (CSR) which are the changes in book value resulted from changes on income and dividends. The second condition is the "abnormal earnings" or "residual earning" or "Excess Earning" which is an excess of accounting earnings over the normal earnings available for equity. That is, it is accounting earnings minus a charge for the cost of capital. In the Residual Income Valuation model (RIV), the value of the firm's equity equals the book value of equity plus the present value of expected abnormal earnings in stead of expected dividend in the Dividend Discounting Model (DDM). According to White, Sondhi and Fried (2003), Edwards-Bell-Ohlson (EBO) model, the concepts are similar to the Economic Value Added (EVA) which is interesting topic, focused on the value of equity to value the firm advocated by G.Bennett Stewart III.

Lee (1996) states that both "Economic Value Added" (EVA), which is earning in excess of an expected level of performance tied to capital used and "Edwards-Bell-Ohlson" (EBO) depend on the idea of residual income. Nevertheless, the Residual Income Valuation model (RIV) or Edwards-Bell-Ohlson (EBO) have encountered the same problem similar to Dividend Discounting Model (DDM) which is to estimate infinite variables.

From many researches of accounting techniques used in equity valuation reviewed by the researcher, there are many literature examining accounting values to develop valuation models related to Ohlson (1995) and Feltham and Ohlson (1995). Anand and Faseruk (2008) directly compared accounting-based models with market-based model financially in terms of cash flow. Their results show that the explanatory and predictive power in valuation of accounting numbers are influenced by accrual accounting principles and impact of conservatism on market value of equity perceived by Feltham–Ohlson's Linear Information Model (LIM).

Lo and Lys (2000) discussed this valuation framework of Ohlson (1995) and Feltham and Ohlson (1995) had an impact on accounting research in the 1990s. They found that the model was incorrectly implemented in most studies. In addition, the model with scale-free data does not illustrate better than the ordinary ones. This discovery is similar to Callen (2005) finding that the Feltham–Ohlson model does not show better predictive ability than Ohlson's. In short, the simple

valuation models operate better than the sophisticated models supporting by the conservative accounting theory.

Additionally, there is some problem on variable υ_t that is often unobservable or very difficult to observe contained in empirical testing of the Ohlson (1995). From literatures review of Giner and Iniguez (2006), the researcher has summarized their researches review grouping by the method to handle with troublesome variable into 3 main groups which are: ignored, order backlog and based on analysts' forecasts.

For the analysts' forecast which based on assumption, the result may be unreliable and constrained to find analysts' forecasts data in long period in Thailand. The ignored and adjusted model from Ota (2002) do not sophisticate and rely on the forecast assumption.

Ota (2002), Dechow et al. (1999) emphasized the real achievement of Feltham and Ohlson (1995) and Ohlson (1995) that Linear Information Model (LIM) created a connection between current information and a firm's intrinsic value. Linear Information Model (LIM) is an information dynamics model that explains the time-series behavior of abnormal earnings. Stock valuation based on Linear Information Model (LIM) theoretical framework is estimated by the fundamental accounting variables: earnings and book value. It is also considerable to Improve Linear Information Model (LIM). In his paper, he investigated the validity of the Ohlson (1995) and attempted to improve the Linear Information Model (LIM) focusing on serial correlation in the error terms caused by omitting the necessary variable υ_t from the regression equation. His results found that adjustment for serial correlation improve the Linear Information Model (LIM).

Consequently, the aim of this paper is to investigate the validity of the Ohlson's information dynamics (Linear Information Model: LIM) and to attempt to improve the Linear Information Model (LIM) by the adjustment for serial correlation following Ota (2002) for Thailand data. Whether or not the the Ohlson's information dynamics (Linear Information Model: LIM) characterizes reality with reasonable accuracy is only an empirical matter in Thailand. The benefit of this study is to provide an empirical evidence of new forecast technique for valuation of

company in the Stock Exchange of Thailand and also to inspire a framework for future research by directly connecting accounting variables and intrinsic value.

The researcher uses the data on listed firmed on the Stock Exchange of Thailand (SET) by following the Ota (2002)'s criteria that the researcher will adopt these information for Thailand. The researcher conducted the empirical tests on Linear Information Model (LIM) development and empirical tests of the valuation models using stock market data by following Ota (2002) methodology. However, time series model requires long history data. In this way, it will exclude new listed companies.

According to the key finding in this paper, it suggests that even the Ohlson (1995) shows the more validity by comparing the explanatory power of contemporaneous stock prices, the most reliable model among the competitive models ,based on the predictive ability of future stock returns as well as the explanatory power of contemporaneous stock prices is the Feltham and Ohlson (1995). Therefore, the book value per share of equity and earning per share are beneficial information for investor to value the firm to gain the abnormal return.

This study will be conveyed into 5 sections as follow:

Section 2 provides literatures review on related to Ohlson model

Section 3 illustrates research methodology and data which include the theoretical framework from the Residual income valuation model to Feltham and Ohlson (1995) Linear Information Model (LIM) based on Ota.(2002).

Section 4 provides the main empirical results.

Section 5 demonstrates the conclusion.

II. LITERATURE REVIEWS

As the contribution on this paper is dedicated to find the new forecasting technique for company's valuation in the Stock Exchange of Thailand (SET) based on connecting historical accounting variables, that technique found is using model to reduce uncertainty of assumption to find intrinsic value for making decision. Having been reviewing many research papers, they showed examination on accounting data with decision to focus on Ohlson model. The first group is a review of accounting techniques used in equity valuation to find the main concept of this paper studied. by following the simple one instead of the complicated one. The concept is in according to Ota (2002)'s study.

In the second group, the researcher summarized the development model by Ohlson. For the various accounting information trying to specify troublesome variable υ_t are put in the third group with its implication shows that the result will vary due to the choosing methodology. The success and failure of the studies will be presented in the forth and fifth group to support the concept of the ordinary model as well as comparing the model in the sixth group to show that these conceptual idea is valuable for studying. The seventh group is the study on Ohlson's model in Thailand to show the validity of the model, even though, there are many factors having effect with the results. The last group will show the character of the data that should be tested by autoregressive model first. The examination is categorized and summarized as follow:

The first group is a review of accounting techniques used in equity valuation.

Anand and Faseruk (2008)

They aimed to review various studies that employ accounting-based models in the valuation of equity. They directly compared these accounting-based models with market-based model financially in terms of cash flow and simulations techniques. In market valuation, the results show that explanatory and predictive power of accounting numbers are influenced by accrual accounting principles. The impact of conservatism on market value of equity is perceived by Feltham–Ohlson's Linear Information Model (LIM).

Lo and Lys (2000)

They discussed this valuation framework of Ohlson (1995) and Feltham and Ohlson (1995) that had an impact on accounting research in the 1990s. They found that the model incorrectly implemented in most studies. First, there is a reference on Ohlson (1995) without including the information dynamics that leads to little more than test of Residual Income Valuation model (RIV). Second, they typically used level data which are likely to have biased slope coefficients in analyses. The R^2 are upwardly biased. They also found a lot of evidence that overpowering supports the model suspect. Few studies that test the model with scale-free data find that the model does not perform better results than the ordinary one.

Giner and Iniguez (2006)

They provided an empirical assessment of the Ohlson (1995) and Feltham-Ohlson (1995) models distinguishing between firms with positive and negative abnormal earnings in Spain from 1992 to 1999 by cross-sectional. They found that the Feltham and Ohlson (1995)' model presenting the lowest forecast errors to predict positive abnormal earnings, however, generated the least accurate results in forecasting prices particularly in long horizon due to the negative conservatism coefficient. The results also confirmed that analysts' forecasts of abnormal earnings are more accurate than the forecasts generated by the historical time-series models for horizons up to 4 years. They suggested that the best strategy for the valuation is to utilize the accounting valuation models based on Ohlson (1995) which employs analysts' forecasts and use high persistence parameters for positive abnormal earnings firms and use lower, or even zero, parameters for negative abnormal earnings firms.

Although Anand and Faseruk (2008) showed the success of Feltham–Ohlson's Linear Information Model (LIM), Giner and Iniguez (2006) suggested that the best strategy for the valuation is Ohlson (1995) by analysts' forecasts which similar to Lo and Lys (2000) in the point that the complicated model does not perform better than the ordinary ones and also similar to Ota (2002). Ota (2002) found the results after he developed model based on Feltham–Ohlson's (1995) model that the more validity model still be of Ohlson (1995) which adjusted serial correlation in

error term. The researcher agrees with him for the concept of solving other informative problem by adjusting serial correlation in Ohlson's (1995) due to the unobservable aspect in the changeable situation.

Furthermore, Giner and Iniguez (2006)'s literatures review also reach the researcher's motivation for the idea model which from Ota (2002). Their researches are summarized to review grouping by the method to handle with troublesome variable which could be categorized into 3 main groups which are: ignored, order backlog and based on analysts' forecasts. The background of model development also put in the graph as follow:

[Figure II is here]

This report paper has demonstrated aspects of comparison on the methodology based on Giner and Iniguez (2006)'s Main Characteristics literature review to handle with troublesome variable. The theoretical Myers(1999) models of conservatism fail to order backlog time series of the Residual Income (RI) due to changes in growth rates, accounting procedures and production technologies. Thus, this research supports the idea that the more complex models tend to have noisier estimates of firm value than more simply models. However, the model based on analysts' forecasts by their own assumption may be unreliable in the dynamic world. Accordingly, using the model that ignores troublesome variable υ_t may be better.

The second group, summaries on the development model by Ohlson.

Ohlson (1995)

He developed a model of a firm's market value related to current and future earnings, which are book values, and dividends. When the clean surplus relation applied, with the dividends are paid out of current book value, it does not change the current earning. Firm' value depends on future abnormal earnings. It does not depend on dividend policy like the Dividend Discounting Model (DDM).

Feltham and Ohlson (1995)

They studied models that focus on operating and financial activities. For financial activities, book value equals market value. On the other hand, they could differentiate operating

activities. Presumably, market value is equal to the net present value of expected future dividends. Regarding to clean surplus accounting, it is also equal book value plus the net present value of expected future abnormal earnings. For operating activities, a linear model specifies the dynamics of set of information that comprises of book value and abnormal earnings. The model is developed 3 kinds of analyses, namely, the conclusions rely on the extent that the accounting is conservative as opposed to the unbiased. In addition, either absence or presence of growth in operating activities is significant, if the accounting is conservative.

Ohlson (2001)

His paper implies that for empirical aspects, it should include analyst's forecasts on future earnings as independent variable to forecast the price. He revisited Ohlson 1995 to solve unappreciated point in the literature. Although the Residual Income Valuation model (RIV) is convenient to use, the model's centerpiece is still misled. Another point is that if one supposes that next-period expected earnings are observable, the concept of "other information" in the model can be given concrete empirical content. The researcher opines that Ohlson (1995) forecast firm value based on future abnormal earnings instead of relying on dividend policy like the Dividend Discounting Model (DDM), which has problem for non-dividend payment company, is still valid. Although accounting conservatism which is the additional assumption increased to Feltham and Ohlson (1995), Ota(2002)'s improvement model can capture this assumption. For Ohlson (2001), he did not eliminate the model, but simplified the model without other information.

The third group is the paper **aiming to specify** υ_t **by using various accounting** ***information.***

Myers (1999)

He expressed several differences focusing on the implement on residual income (RI) valuation within the borders of alternative linear information dynamics. His study period was conducted between year 1975to 1996 in USA. The theoretical models of conservatism fail to precisely identify the time series of the Residual Income (RI). His evidence suggests that a simple time-series model of the Residual Income (RI) does not require assumptions that are internally

inconsistent, however this time series is flexible due to changes in growth rates, accounting procedures and production technologies.

Hand and Landsman (1999)

They utilized Ohlson's (1995, 1998) model to construct an empirical assessment of the pricing of dividends in stock prices in USA from 1974 to 1996 by cross-sectional methodology. The result shows that dividends are the element and representative of other information about future abnormal earnings which is reflected in price but is not yet captured by current financial statements.

Barth, Hand and Landsman (1999)

They investigated Ohlson (1999) on the different ability of accrual and cash flow components of earnings to support forecast future abnormal earnings and the components having different valuation implications because of the persistence of the components by applied model to fourteen industries. Their results showed that first, accruals and cash flows are helpful in forecasting future abnormal earnings incremental to abnormal earnings and equity book value. Secondly, accruals and cash flows provide explanatory power for equity market value incremental to equity book value and abnormal earnings. Thirdly, coefficients of accruals and cash flows valuation are consistent with the Ohlson model.

From the researcher's point of view, Myers (1999)'s study on Feltham and Ohlson (1995) fails to identify the time series of RI, Hand and Landsman (1999)'s study on Ohlson's (1995, 1998) by cross-sectional method finds that other information are mainly from dividend. They are similar in the same idea that aims to specify other in formation by different method in similar period. Their results also show the different source of other information. For Barth, Hand and Landsman (1999) also shows the other source of other information which is cash flows. If the researcher tries to specify other information, the result may vary due to the methodology used.

The forth group is the success in study the Ohlson model.

Karathanassisa and Spiliotib (2005)

They examined equity prices by the Ohlson's behavioral theoretical model with panel data. They found that Olhson's approach shows the reliable price valuation models for the emerging Athens Stock Exchange in 1993 to 1998. However, only the abnormal earnings coefficient for the

banking sector was statistically insignificant, because of mergers and acquisitions of Greek banking sector during the 1990s.

Ota (2002)

He investigated the validity of the Ohlson (1995)'s information dynamics (Linear Information Model: LIM) and attempted to improve the Linear Information Model (LIM) in Japan during period of 1964 to 1998 by using time-series method. His results show an improvement of the Linear Information Model (LIM) by the adjustment for serial correlation. His results also found some similarities to those presented in Barth et al. (1999), Dechow et al. (1999), and Hand and Landsman (1998, 1999). The persistence coefficient of abnormal earnings has almost the same value for each of the previous studies and this paper. In addition, the negative coefficient on book value of equity is consistent with previous studies. However, his sample is limited for large firms that they operate for a long time tend to possess land and securities, so the historical costs depress the book value of equity. It also has unsolved issue seen in the selected sample that represents a fair cross-section of Japanese firms. The growth parameter of book value of equity is predicted to be positive that does not support the theory which in line with the US studies.

Gupta, R. (2007)

He utilized differences between computed intrinsic and actual market values by Feltham-Ohlson's framework. Gupta (2007) used Residual Earning (RE) Valuation and Abnormal Earnings Growth (AEG) model which improve Residual Earning (RE) formula that focuses on next-period earnings and their following growth (adjusted for dividends) in accordance with analysts' view. Under the assumption of clean surplus, the valuations derived from the Abnormal Earnings Growth (AEG) model similar to those derived from traditional discounted cash flow models. These valuations were reorienting the valuation focus of equity research firms to traditional accounting variables like book value and net earnings. He forecasted equity values of the 50 largest firms in India including the NSE S&P Nifty Index in 1999 to 2004. He also used price-to-book and price-to-earnings ratios to classify firms as a comparable filter to identifying mispriced stocks. He concluded that the Abnormal Earnings Growth (AEG) model could be used to make superior investment

decisions and outperform the market as well. On the other hand, a considerable input in the Abnormal Earnings Growth (AEG) model is relatively precise for long-term forecasts of annual net earnings.

Although, Karathanassisa and Spiliotib (2005) show the success of Ohlson's approach for the emerging Athens Stock Exchange, the banking sector is not achieved because of mergers and acquisitions of Greek banking sector during the 1990s. For this study, it is exclusive for banking sector due to the different accounting standard with other sector in line with Ota (2002). For Gupta (2007), Abnormal Earnings Growth (AEG) model based on the assumption of clean surplus removes restrictions on dividend policy.

The fifth group is identifying problems in Ohlsons' model.

Morel (2002)

She tested the Ohlson model by using method to mitigate the weakness in previous studies at the firm level. However, her empirical findings suggested that the Ohlson (1995) model has problem in empirical study despite estimating endogenous parameters of the model. The weakness assumption is that an intercept term can adequately capture the 'other information' variable. She also suggested that multi-lagged versions of the Ohlson model hold more promise as an alternative.

Callen (2005)

This paper transforms the undefined ''other information'' variables into predictable variables to tests the Feltham–Ohlson (1995) model suggested by Liu and Ohlson [Liu and Ohlson (2000)] in USA from 1990 to 2001. The evidence found that testing Feltham–Ohlson has principal problems which are the distinction between Net Operating Asset (NOA) and net financial assets as well as between operating earnings and financial earnings.

Choi, O'Hanlon and Pope (2006)

They found a large negative bias in value estimates in USA during 1974 to 1995 when implemented the LIM approach to estimating intrinsic values by DHS (Dechow. Hutton. and Sloan 1999) which based on the unbiased-accounting Ohlson 1995 model, and by Myers 1999 which based on the conservative-accounting Feltham and Ohlson 1995 model. They also measured "Other information" by using analysis forecast-based predictions of residual income. They explained that

bias is that the Linear Information Model (LIM) - based valuation models implementation does not fully appropriate with the assumptions of conservative accounting for the Residual Income (RI) projections.

Similar to the previous studies that try to find other information, there are also problems. For Morel (2002)**,** to use other information in intercept term is not enough; however, the suggestion, multi-lagged versions of Ohlson model, similar to Ota (2002) is alternative. Furthermore, regarding to Callen (2005), the Feltham–Ohlson model does not show better predictive ability than Ohlson although this valuation models are theoretically formulated. This idea is also similar to Lo and Lys (2000)'s concepts that the scale-free data model does not perform better than the ordinary ones. The model not only shares the similarity with Lo and Lys, it also shares the similarity with ideas of Choi, O'Hanlon and Pope (2006) as well in the point that Feltham and Ohlson (1995) model is unsuitable for conservative accounting for the Residual Income (RI) projections.

The sixth group is considering about comparing model.

Dividend Discounting Model (DDM) versus Residual Income Valuation (RIV) model

Pourheydari (2008)

He studied data in Iran from 1996 to 2004 with cross-sectional methodology by comparing the combined value of related dividends and book value versus the combined value of related earnings and book value. As Ohlson (1995) and Feltham and Ohlson (1996) put their valuational theory based on the Residual Income Valuation (RIV) model, the share price can be predict from book value and earnings under certain conditions. Modigliani and Miller (1959) stated that dividends have information content, while earnings reported for any short period are affected by many factors. As Dividend Discounting Model (DDM) and Residual Income Valuation (RIV) model are algebraically equivalent, replacing earnings with dividends in accounting valuation model is viewed as a test of Modigliani and Miller proposition. His result found that dividends have very important role in stock valuation and also have nearly the same explanatory power as earnings. Due to high inflation rate in his country, decision variable should not be relied on only book value which has the smallest relevant value.

Residual Income Model (RIM) and Discount Cash Flow (DCF)

Anand and Faseruk (2008)

According to their comparing Residual Income Model (RIM) and Discount Cash Flow (DCF) methodologies, Residual Income Model (RIM) is more effective method for equity valuation comparing to traditionally following on cash flow model to forecast finite horizon. which refers to Penman and Sougiannis (1998), Francis et al. (2000) and Courteau et al. (2001).However Lundholm and O'Keefe (2001)'s argument is that Residual Income Model (RIM) and Discount Cash Flow (DCF) generate the same estimated value.if there are available for a full set of pro forma statements till horizon which one can recover the book value of operating assets and the two models yield the same result. They referred to Richardson and Tinaikar (2004) that both Penman, and Lundholm and O'Keefe are correct. Penman (1998) is also correct in saying that only Discount Cash Flow (DCF) or Free Cash Flow (FCF) is inadequate. It also needs accounting information to find the missing information related to the operating assets (Richardson and Tinaikar, 2004). Residual Income Model (RIM) avoids determining cash flows for valuation. In addition, it is more advantageous to Discount Cash Flow (DCF) model if there is the ad hoc terminal value.

Edwards-Bell-Ohlson (EBO) versus Discount Cash Flow (DCF) models

White, Sondhi and Fried (2003)

According to their book, in Discount Cash Flow (DCF) models, the assumption is impossible to make reliable forecasts to infinity. It may be important to estimate the terminal value, because it may set up 70% of total value. There is a more manageable problem, as "Discount Cash Flow (DCF) models estimate *firm value* itself, while Edwards-Bell-Ohlson (EBO) model estimates the *differential between firm value and book value*". Discount Cash Flow (DCF) terminal value calculations have the errors expected to be in the shorter horizons of the Edwards-Bell-Ohlson (EBO) model. Free Cash Flow (FCF) tends to be negative when using the model to value growth companies. It may require a longer time horizon of clear annual forecasts until the estimation on the terminal value can be made. On the other hand, the Edwards-Bell-Ohlson (EBO) model based on accrual accounting eliminates the distortion resulted from high capital expenditures. The capital expenditures are allocated by depreciation over time effectively. It matches the generated revenue.

Reducing the forecasting errors' effects, the time horizon needs for the model implementation is correspondingly smaller. The Edwards-Bell-Ohlson (EBO) model's earning measure the wealth creation. It does not represent for another parameter such as cash flows, dividends, or even economic earnings. "As long as the clean surplus relationship is maintained, the model is applicable to any set of accounting rules. By focusing on earnings rather than dividends, *Edwards-Bell-Ohlson (EBO) model defines value in terms of wealth generation rather than wealth distribution.*"

Edwards-Bell-Ohlson (EBO) and Economic Value Added (EVA)

White, Sondhi and Fried (2003)

According to White, Sondhi and Fried (2003), Edwards-Bell-Ohlson (EBO) model is based Ohlson (1991 and 1995) and Edwards and Bell (1961)' works and expanded by Feltham and Ohlson (1995). Edwards-Bell-Ohlson (EBO) model is also conceptually similar to the Economic Value Added (EVA), which focuses on the value of equity to value the firm advocated by G.Bennett Stewart III.

Lee (1996)

According to this paper, both "Economic Value Added" (EVA) which is earning in excess of an expected level of performance tied to capital used and "Edwards-Bell-Ohlson**"** (EBO) model depend on the idea of residual income. "Economic Value Added" (EVA) calculates from shareholders and long term debt holders, on other hand, "Edwards-Bell-Ohlson**"** (EBO) focuses only on equity investors.

Anand and Faseruk (2008)

Refering to their paper, Ohlson's abnormal earnings can compare with the Economic Value Added (EVA) model. Economic Value Added (EVA) is the product of total capital and the difference between the return on assets and the weighted average cost of capital (WACC) for a firm. Thus, Economic Value Added (EVA) is similar to abnormal earnings that can be explained as the difference between earnings and a charge for capital.

The seventh group is the study Ohlson model in Thailand.

Sasiwongpakdee (2008)

Studied the cross sectional stock returns by the model of Chen and Zhang (2007) that explains power of accounting variables for 2002-2006 According to her study, the model built from the model of Zhang (2000) which extending Ohlson (1995) and Feltham and Ohlson (1995;1996) has included endogenous investment decisions. The result shows that cash-flow-related factors is the most explanatory power. Earning yield, capital investment and growth opportunities have ability to explain stock price movement. Changes in profitability, when combined with other factors in the returns model, plays insignificant role as well as changes in discount rates explain about 30 % of the return.

Graham et al. (2002)

Showed the result that book values and earnings have value relevance, However, after Baht depreciation in July 1997, the value relevance declined significantly in study period between first quarter of 1992 and the first quarter of 1998. The volatility of foreign exchange gains and losses may cause directly the change in value relevance.

Sumritpradit (2003)

Studied Feltham and Ohlson (1995) and applied correlation analysis for pooled, yearly, quarterly and industrial cross-sectional regression analysis in 1984 to1999. The results showed that combined value-relevance of earnings and book values are reduced by time. It does not increase by the changing of accounting standard. Whatsoever, price is explained better by earning than by book value. Regarding to limitations, omitted variable which effects accounting profitability and book value to explain stocks' prices such as productivity, Thailand market is also changeable caused by many factors, such as investment in foreign country and politics. These obstructions could be controlled but could not be eliminated completely. Second, the results show heteroskedasticity and the endeavor to solve the econometric problem lead to reduce the forecast ability. However, Ota (2002) showed the results that there is no material problem in his estimated equations (LIM1-7) in the error term.

Ota (2002)

Mentioned, for some firm, the abnormal earnings follow a random-walk process by evaluating LIM1-7 by using AIC. His result found that the mean AIC was not much different between LIM1-4 which implies no improvement of LIM1 by adding a constant term and/or book value of equity. As well as the Ohlson (1995)'s model, it is more appropriate for a multilagged formulation than the single lagged formulation. He also refered to the similar findings reported in Bar-Yosef et al. (1996), Morel (1999), and O'Hanlon (1994, 1995). Bar-Yosef et al. and Morel that test the lag structure of the Ohlson (1995) information dynamics using the FPE and the AICC (Hurvich & Tsai, 1989, 1991), respectively. Their findings also support a multilagged information rather than the single lagged information. Ota (2002) also mentioned to O'Hanlon trying to identify the time-series properties of abnormal earnings using an Autoregressive Integrated Moving Average (ARIMA) process. The study found that all firms' abnormal-earnings series did not follow time-series process.

In conclusion, even there are many techniques for valuing the firms, the accounting technique related to Ohlson and Faltham and Ohlson are inspirational in many researches. Even though, some research is successful, some research is unsuccessful. The concept of the model is equal to or superior in forecasting. From the many literature reviews, the researcher was impressed with Ota (2002)'s concept that tries to use econometric technique for forecasting, instead of trying to increase any variable in the model in according to many researches that suggest the simple model. However, the time series data should be tested by an Autoregressive Integrated Moving Average (ARIMA) process first. As a result, the researcher decided to apply the functional form of Ota (2002) for these autoregressive models.

III. RESEARCH METHODOLOGY AND DATA

Theoretical Framework

In this section, the theoretical development relation between valuation intrinsic value of stocks and accounting data from Dividend Discount Model (DDM) to Ohlson (1995) and Feltham and Ohlson (1995) LIMs are shown follow the work of Ota (2002) as follow:

Residual income valuation model

- According to The ***Dividend Discount Model*** (DDM), dividends are the cash flows that are returned to the shareholder. It defines the value of a firm as the present value of the expected future dividends.

$$V_t = \sum_{i=1}^{\infty} E_t \left[\frac{d_{t+i}}{(1+r)^i} \right], \qquad (1)$$

where V_t = value of a firm at date t;

$E_t \left[d_{t+i} \right]$ = the expected dividends received at date $t + i$;

r = the discount rate that is assumed to be constant.

- The clean surplus concept is that retained earnings are limited to record only periodic earnings (net income) and dividends.

$$b_t = b_{t-1} + x_t - d_t \qquad (2)$$

where b_t = book value of equity at date t;

x_t = earnings for period t;

d_t = dividends paid at date t

‘‘Normal earnings’’of the firm is return on the capital invested at the beginning of the period that is book value of equity at date t-1 multiplied by the cost of capital (interest rate). Then, “abnormal earnings” is defined by earnings for the period t minus ‘‘normal earnings”.

$$x_t^a \equiv x_t - rb_{t-1} \qquad (3)$$

where x_t^a = abnormal earnings for period t.

Eqs. (2) and (3) for simple algebraic can be rewritten as:

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

Using this expression to replace $d_t + i$ in Eq. (1) yields the Residual Income Valuation (RIV),

$$V_t = b_t + \sum_{i=1}^{\infty} E_t \left[\frac{x_{t+i}^a}{(1+r)^i} \right] \qquad (4)$$

The implication of the Residual Income Valuation (RIV) is that a firm's value equals its book value of equity and the present value of anticipated abnormal earnings. A firm's value based on the Residual Income Valuation (RIV) will not be affected by accounting choices is one of the interesting properties of the Residual Income Valuation (RIV).

Linear information model

Feltham and Ohlson (1995) and Ohlson (1995) originally proposed the Linear Information Model (LIM) that is an information dynamics model that describes the time-series behavior of abnormal earnings. Refer to Ota (2002), Dechow et al. (1999) emphasize that the real achievement of Feltham and Ohlson (1995) and Ohlson (1995) is that the Linear Information Model (LIM) creates a link between current information and a firm's intrinsic value.

Ohlson (1995) LIM

The Ohlson (1995) Linear Information Model (LIM) based on assumption of the time-series behavior of abnormal earnings which is similar to the first-order auto-regressive (AR(1)) stochastic process :

$$x_{t+1}^a = \omega_{11} x_t^a + \upsilon_t + \varepsilon_{1t+1} \qquad (5a)$$

$$\upsilon_{t+1} = \gamma \upsilon_t + \varepsilon_{2t+1} \qquad (5b)$$

where x_t^a = abnormal earnings for period t ($x_t^a \equiv x_t - rb_{t-1}$)

υ_t = information other than abnormal earnings;

ω_{11} = persistence parameter of abnormal earnings x_t^a $(0 \le \omega_{11} < 1)$;

γ = persistence parameter of other information υ_t $(0 \le \gamma < 1)$;

$\varepsilon_{1t}, \varepsilon_{2t}$ = error terms

"The Ohlson (1995) Linear Information Model (LIM) assumes that the source of abnormal earnings is monopoly rents[1].

Although monopoly rents may persist for some time, market competition will force returns toward the cost of capital in the long run. Therefore, the persistence parameter ω_{11} is predicted to lie in the range $0 \le \omega_{11} < 1$." Ota (2002)

Combining the Residual Income Valuation (RIV) in Eq. (4) with the Ohlson (1995) Linear Information Model (LIM) in Eqs. (5a) and (5b), the following valuation function was shown as follow:

$$V_t = b_t + \alpha_1 x_t^a + \beta_1 \upsilon_t,$$

Where

$$\alpha_1 = \frac{\omega_{11}}{1 + r - \omega_{11}}$$

$$\beta_1 = \frac{1 + r}{(1 + r - \omega_{11})(1 + r - \gamma)}$$

Feltham and Ohlson (1995) LIM

Feltham and Ohlson (1995), assuming the following four equations with some adjusting for simplicity.

$$x_{t+1}^a = \omega_{11} x_t^a + \omega_{12} b_t + \upsilon_{1t} + \varepsilon_{1t+1} \quad (6a)$$

$$b_{t+1} = \omega_{22} b_t + \upsilon_{2t} + \varepsilon_{2t+1}, \quad (6b)$$

$$\upsilon_{1t+1} = \gamma_1 \upsilon_{1t} + \varepsilon_{3t+1}, \quad (6c)$$

$$\upsilon_{2t+1} = \gamma_2 \upsilon_{2t} + \varepsilon_{4t+1}, \quad (6d)$$

[1]"Monopoly rents generated by the asset will not be offset entirely by accounting for the asset's opportunity cost." (Foss, Nicolai J., Resources, firms, and strategies: a reader in the resource-based perspective, Oxford University Press, United Kingdom, 1997.)

where ω_{11} = persistence parameter of abnormal earnings x_t^a ; $(0 \le \omega_{11} < 1)$;

ω_{12} = conservatism parameter $(0 \le \omega_{12})$;

ω_{22} = growth parameter of book value of equity $(0 \le \omega_{22} < 1+r)$;

$\upsilon_{1t}, \upsilon_{2t}$ = information other than abnormal earnings;

γ_1, γ_2 = persistence parameter of υ_{1t} and υ_{2t} , respectively $(0 \le \gamma_1, \gamma_2 < 1)$;

$\varepsilon_{1t}, \varepsilon_{2t}, \varepsilon_{3t}, \varepsilon_{4t}$ = error terms.

The Feltham and Ohlson (1995) Linear Information Model (LIM) assumes that abnormal earnings are originated from two sources. The first source is monopoly rents. As the market competition is anticipated to force returns toward the cost of capital in the long run, ω_{11} is predicted to lie in the range $0 \le \omega_{11} < 1$. The second source is accounting conservatism that generally lower the valuation of assets below their market value, which generates abnormal earnings. The abnormal earning is defined by multiplying the difference between market value and book value of equity by the cost of capital. Thus, under conservative accounting, ω_{12} is predicted to be $0 \le \omega_{12}$ because a portion of abnormal earning are generated from the conservative valuation of book value rather than monopoly rent.

Combining the Residual Income Valuation (RIV) in Eq. (4) with the Feltham and Ohlson (1995) Linear Information Model (LIM) in Eqs. (6a)–(6d) yields the following valuation function:

$$V_t = b_t + \alpha_1 x_t^a + \alpha_2 b_t + \beta_1 \upsilon_{1t} + \beta_2 \upsilon_{2t},$$

Where

$$\alpha_1 = \frac{\omega_{11}}{1+r-\omega_{11}},\ \alpha_2 = \frac{(1+r)\omega_{12}}{(1+r-\omega_{11})(1+r-\omega_{22})},$$

$$\beta_1 = \frac{1+r}{(1+r-\omega_{11})(1+r-\gamma_1)},\ \beta_2 = \frac{(1+r)\omega_{12}}{(1+r-\omega_{11})(1+r-\omega_{22})(1+r-\gamma_2)}.$$

Therefore, the Feltham and Ohlson (1995) Linear Information Model (LIM) and the Ohlson (1995) Linear Information Model (LIM) grant us the valuation functions of a firm, with two exceptions. First, supplying explicit forecasts of future dividends, and second, making additional assumptions about the calculation of terminal value are not required. This is due to the unreliability of such predictions in a changeable world.

However, this is only an experimental matter in Thailand whether or not the Linear Information Model (LIM) characterizes reality with reasonable accuracy.

Empirical tests on LIM

In this independent study, the researcher would apply the functional form for Linear Information Model (LIM) of Ota (2002) for the data on listed firms on the Stock Exchange of Thailand (SET). In Ota (2002) papers, he estimated LIM1-6 models by using ordinary least squares (OLS). He mentioned that for some firm the abnormal earnings follow a random-walk processed by evaluating LIM1-7 by using AIC which was not much different in mean between LIM1-4. Similary, O'Hanlon found that all firms' abnormal-earnings series did not follow time-series process.

Ota (2002) used generalized least squares (GLS) in his paper instead of the maximum likelihood method (ML) which was commonly used to handle with the serial correlation[2] problem in the error term because maximum likelihood method (ML) has small sample bias when lagged endogenous variables are included in the model. However, the GRID-Search is the optimization method that seems to be costly.

For time series data, it often has autocorrelation, or serial correlation of the disturbance or error that are correlated across periods. The variable is observed sequentially over time. This model is autoregressive models. ARIMA and ARMAX models will be tested for LIM1-7. Thus, the model

[2] "Although it is now a common practice to treat the terms **autocorrelation** and **serial correlation** synonymously, some authors prefer to distinguish the two terms. For example, Tintner defines autocorrelation as "lag correlation of a given series with itself, lagged by a number of time units," whereas he reserves the term serial correlation to "lag correlation between two time series."[3] such as u_1, u_2,…, u_{10} and u_2, u_3, …, u_{11}, where the former is the latter series lagged by one time period, is *autocorrelation*, whereas correlation between time series such as u_1, u_2,…, u_{10} and v_2, v_3, …, v_{11}, where u and v are two different times series, is called *serial correlation*." ([3]Gerhard Tintner, *Econometrics*, John Wiley & Sons, New York, 1965.) (Damodar N. Gujarati, Basic Econometrics, McGraw-Hill, Singapore, 2003.)

for time series will be applied in this research study. However, the maximum likelihood of ARIMA process that follows functional form of Ota (2002) may have small sample bias.

Stationarity of abnormal earnings

Before using the time series data, unit root test was applied to test the stationary of abnormal earning and also test the validity of the Ohlson (1995) model. If abnormal earnings follow a random-walk process, the model is doubtful. Dickey–Fuller (DF) test was performed.

(No Constant or Trend) $\Delta x_t^a = \delta x_{t-1}^a + \varepsilon_t,$

(With Constant) $\Delta x_t^a = \alpha_0 + \delta x_{t-1}^a + \varepsilon_t,$

(With Constant and Trend) $\Delta x_t^a = \alpha_0 + \alpha_1 t + \delta x_{t-1}^a + \varepsilon_t.$

Autocorrelation plot

Changing the data from yearly to quarterly may cause seasonal effects, however it could be detected by plotting the abnormal earning data. If the data has seasonality it will show positive peaks at the seasonal lag and it multiples in autocorrelation (ACF) and partial autocorrelation (PACF). If the abnormal earning data is seasonality, the ARIMA model will be developed to be Seasonal ARIMA (SARIMA). However, the results showed no seasonal effect.

Autoregressive integrated moving average Process

The component of the model ARIMA(p,d,q), autoregressive integrated moving average, are consisted of p which is the number of autoregressive terms, d which is the number of times that the series has to be differed before it becomes stationary, and q that is the number of moving average terms.

[Figure III is here]

LIM1 and LIM2: based on the Ohlson (1995) model

Assumes that the source of abnormal earnings is monopoly rents. This concept mention that the time-series behavior of abnormal earnings which is similar to the first-order auto-regressive (AR(1)) stochastic process.

LIM1 : $x_{t+1}^a = \omega_{11} x_t^a + \varepsilon_{t+1}$

Assumes other information υ_t to be zero as it is unobservable. However, omitting a relevant variable as it is unobservable, the model will be misspecification. According to Ota. (2002), the ARIMA process is (1,d,0)

LIM2 : $x_{t+1}^a = \omega_{10} + \omega_{11} x_t^a + \varepsilon_{t+1}$

Assumes υ_t to be a constant. The ARIMA process is (1,d,0) with constant term is tested.

LIM3 and LIM4: based on the Feltham and Ohlson (1995) model

Assumes that abnormal earnings are originated from two sources. The first source is monopoly rents and the second source is accounting conservatism.

According to Ota (2002),to estimate the Feltham and Ohlson (1995) Linear Information Model (LIM) in Eqs. (6a)–(6d) without any modification is difficult, because it contains unobservable other information υ_{1t} .

LIM3 : $x_{t+1}^a = \omega_{11} x_t^a + \omega_{22} b_t + \varepsilon_{t+1}$

Assumes υ_{1t} to be zero, the ARMAX process (1,d,0) will be applied.

LIM4 : $x_{t+1}^a = \omega_{10} + \omega_{11} x_t^a + \omega_{22} b_t + \varepsilon_{t+1}$

Assumes υ_{1t} to be a constant. the ARMAX process (1,d,0) with constant will be applied.

LIM5 and LIM6: higher-order autoregression of x_t^a

The Ohlson (1995) Linear Information Model (LIM) assumes that abnormal earnings x_t^a is the first-order autoregressive process AR(1). However, in reality, Ota. (2002) suggested that, there is the possibility that the next-period abnormal earnings are affected not only by current-period abnormal earnings but also by past-period abnormal earnings, he examines x_t^a that might follow a higher order autoregressive process AR(p).

LIM5 : $x_{t+1}^a = \omega_{11} x_t^a + \omega_{12} x_{t-1}^a + \varepsilon_{t+1}$

To Examine the second-order autoregressive process of abnormal earnings AR(2), The ARIMA (2,d,0) will be applied and

LIM6 : $x_{t+1}^a = \omega_{11} x_t^a + \omega_{12} x_{t-1}^a + \omega_{13} x_{t-2}^a + \varepsilon_{t+1}$

To examine the third-order autoregressive process of abnormal earnings AR(3). The ARIMA (3,d,0) will be applied and

LIM7: serial correlation in the error terms

LIM7 : $x_{t+1}^{a} = \omega_{11} x_{t}^{a} + u_{t+1}$ and $u_{t+1} = \rho u_{t} + \varepsilon_{t+1}$

LIM7 is a modified version of LIM1 and corrects serially correlated errors by estimating the parameters of LIM7 using a generalized least squares grid-search method (GLS-GRID). However, optimization method by GRID-Search is seem to be costly. In addition, the LIM7 is assumed that υ_t follows a first-order autoregressive process. It could be estimated by autoregressive integrated moving average (ARIMA) process : ARIMA (1,d,1) which plus moving average of the current and past error term.

Data

The sample selection requirements are as follows:

(i) the firms are listed on the Stock Exchange of Thailand (SET),

(ii) the accounting period ends in December,

(iii) banks, securities firms, and insurance firms are excluded,

(iv) a minimum of 15 consecutive years of accounting data is available for each firm included in the sample, and

(v) book value of equity is not negative in any year.

The researcher collected the book value per share of equity data from Datastream that matched the requirements, the samples available are as follow:

[Table I is here]

Due to the data limitation of yearly data, the sample is very small. The researcher, therefore, decided to test quarterly data instead. The researcher collected the data of book value per share (BV) and Earning Per Share (EPS) from SETSMART. The period of study to forecast the parameter of abnormal earning LIM1-LIM7 is from1997 to 2007. Ota (2002) mentions the minimum of data available for each firm are 18 consecutive years of accounting data. In addition, the necessary requirement is requirement (v) because the firms having negative book value of

equity cause negative normal earning. However, Bauman, M. P. (1999) study Feltham and Ohlson [1995] model in USA (1980-1994) which is the minimum of data available is 15 years to study time-series data. Thus, the researcher will choose the firm having positive book value of equity for 15 consecutive years and collect the quarterly data.

The researcher chose to end at 2007 since the researcher had to use the parameter of abnormal earning to test the explanatory power of contemporaneous stock prices to form the portfolio of the selected stocks based on the criteria. The illiquid stock was excluded. There are 47 firms having available data. The price data for forming the portfolio of the year 2008 was collected from SETSMART. The return of the Stock Exchange of Thailand (SET) was collected from www.set.or.th.

The parameters for each of the LIMs for each firm are estimated from the first quarter of 1997 which data are available to quarter ending 2007 and these parameters will use for valuation of the competitive model for each firm.

[Table II is here]

Table II presents descriptive statistics for each variables used in estimating LIM1-7. The mean of abnormal earnings over sample period is -3.08 Baht given an assumed a constant discount rate of 9.0888 %.

Estimating the cost of capital and the computation of abnormal earnings

Ota (2002) estimated the cost of capital by following Abarbanell and Bernard (2000) by using beta Capital Asset Pricing Model (CAPM) which is $r_{ij} = rf_t + \beta_{jt}[0.02]$. He also mentioned that most prior research used a constant at 12% discount rate or an industry risk premium. However, for Thailand, the market risk premium is negative in some years meaning that the investors may not decide to invest. Thus, the researcher would like to reduce the results in this study that it should not vary due to the variety discount rate of Capital Asset Pricing Model (CAPM) for the firms. In this way, the researcher assumed a constant discount rate at 9.0888 % which was calculated from average long-run return from monthly return of Thailand since May 1975 to December 2008. There are some research that used a constant discount rate, such as

Dechow, P., Hutton, A., & Sloan, R. (1999) used 12% long-run historical average, which approximates the long-run average realized return on US equities and the discount rates ranging from 9% to 15% were found in relative rankings of the models in the empirical tests. In Thailand, D.E. Allen, N.J. Morkel-Kingsbury., & W. Piboonthanakiat found that the cumulative adjusted return at the end of the three-year anniversary was 10.02% which analyzed the long-run performance of initial public offerings (IPOs) on the Stock Exchange of Thailand during the study period between 1985 and 1992.

The computation of abnormal earning are as follows (subscript *j*, which denotes a sample firm, will be omitted for case of exposition):

$$x^a_{jt} \equiv x_{jt} - rb_{t-1}$$

Where x_t = earning per share (EPS) for firm *j* for period *t*; r = assume a constant discount rate at 9.0888 % (average long-run return); b_{jt} = book value of equity for firm *j* at date *t*.

Instead of using net income, Ota (2002) and many prior studies in the US used income before extraordinary items net of tax to avoid the unstable estimation of LIM from including extraordinary items which were nonrecurring nature in the calculation. However, excluding extraordinary items from net income violates the clean surplus relation that in line with the theoretical development of the Residual Income Valuation (RIV). For this study, the researcher followed the clean surplus relation to consist with the Residual Income Valuation (RIV) theory by using earning per share (EPS) which is net income/number of share outstanding. In Thailand, Sumritpradit (2003) studied on Feltham and Ohlson (1995) by using earning per share (EPS) as a variable.

Empirical tests of the valuation models using stock market data

In the previous section, the time-series behavior of abnormal earnings was investigated. The competing models are evaluated by comparing their theoretical values to the stock market values in Thailand. To assess the competing models, the researcher followed Ota (2002) that used two criteria based on the two-dimensional framework suggested by Lee, Myers, and Swaminathan (1999).

The first criterion is the models' ability to explain contemporaneous stock prices. If the stock market in Thailand correctly reflects the true value of a firm, the best model will be the model that explains contemporaneous stock prices. This is achieved by regressing actual stock prices on theoretical stock prices based on the competing models. Comparing the Adj. R^2 values gained from the models. Thus, it is presumably that the higher the Adj. R^2, the more explanatory power the model has over contemporaneous stock prices.

The second criterion is the models' capability to predict future stock returns. However, the motivation behind this is the basic idea of fundamental analysis. As the stock market in Japan may not correctly price the intrinsic value of a firm immediately but they will reflect it finally. The researcher would follow Ota (2002). However, due to the limitation of data, Quintile portfolios are formed according to the ratio of the model's theoretical stock price to actual stock price at the end of forth quarter of 2007. These portfolios are maintained for up to 12 months. The top quintile portfolio consists of underpriced firms and the bottom quintile portfolio consists of overpriced firms relative to their theoretical firm values. The strategy is to take a long position in the top quintile portfolio and a short position in the bottom quintile portfolio.

Valuation functions of competitive model

From the results in table IV, section IV is based on the percentage of the model selection criteria minimum AIC or BIC. The three competitive models are LIM1, LIM3 and LIM4.

The valuation function will based on Theoretical Framework in section 3.

V_{L1} model

The V_{L1} model is the valuation model of LIM1 ($x^a_{t+1} = \omega_{11} x^a_t + \varepsilon_{t+1}$). Expected future abnormal earnings are $E_t[x^a_{t+i}] = \omega_{11} x^a_{t+i-1}$. The persistence parameter ω_{11} is the estimated coefficient on x^a_t in LIM1. Other information υ_t is ignored by the assumption of LIM1.

The value of a firm is expressed as

$$V_{L1} = b_t + \sum_{i=1}^{\infty} \frac{\omega_{11} x^a_{t+i-1}}{(1+r)^i}$$

Simplifying this equation yields

$$V_{L1} = b_t + \frac{\omega_{11}}{(1+r-\omega_{11})} x_t^a$$

The condition for convergence is $|\omega_{11}| < 1+r$.

V_{L3} ***model***

The V_{L3} model is the valuation model of LIM3 ($x_{t+1}^a = \omega_{11} x_t^a + \omega_{22} b_t + \varepsilon_{t+1}$). Expected future abnormal earnings are $\sum_{i=1}^{\infty} E_t[x_{t+i}^a] = \omega_{11} x_{t+i-1}^a + \omega_{22} b_{t+i-1}$. The persistence parameter ω_{11} is the estimated coefficient on x_t^a and ω_{22} is the estimated coefficient on b_t in LIM3. Other information υ_t is ignored by the assumption of LIM3.

The value of a firm is expressed as

$$V_{L3} = b_t + \sum_{i=1}^{\infty} \frac{\omega_{11} x_{t+i-1}^a + \omega_{22} b_{t+i-1}}{(1+r)^i}$$

Simplifying this equation yields

$$V_{L3} = b_t + \frac{\omega_{11}}{(1+r-\omega_{11})} x_t^a + \frac{(1+r)\omega_{12}}{(1+r-\omega_{11})(1+r-\omega_{22})} b_t$$

The condition for convergence is $|\omega_{11}| < 1+r$.

V_{L4} **model**

The V_{L4} model is the valuation model of LIM4 ($x_{t+1}^a = \omega_{10} + \omega_{11} x_t^a + \omega_{22} b_t + \varepsilon_{t+1}$).

Expected future abnormal earnings are $\sum_{i=1}^{\infty} E_t[x_{t+i}^a] = \omega_{10} + \omega_{11} x_{t+i-1}^a + \omega_{22} b_{t+i-1}$. The persistence parameter ω_{11} is the estimated coefficient on x_t^a and ω_{22} is the estimated coefficient on b_t in LIM4. LIM4 assumes that other information υ_t is absorbed in a constant term ω_{10} .

The value of a firm is expressed as

$$V_{L4} = b_t + \sum_{i=1}^{\infty} \frac{\omega_{10} + \omega_{11} x_{t+i-1}^a + \omega_{22} b_{t+i-1}}{(1+r)^i}$$

Simplifying this equation yields

$$V_{L4} = b_t + \frac{(1+r)\omega_{10}}{(1+r-\omega_{11})r} + \frac{\omega_{11}}{(1+r-\omega_{11})} x_t^a + \frac{(1+r)\omega_{12}}{(1+r-\omega_{11})(1+r-\omega_{22})} b_t$$

The condition for convergence is $|\omega_{11}| < 1+r$.

[Figure IV is here]

Explanatory power of contemporaneous stock prices

The relative ability of competitive model to explain contemporaneous stock prices is test cross-sectionally by run regression the actual stock price at the end of the forth quarter of 2007 on theoretical stock price. Ota (2002) use actual stock price at the end of May of year *t* and he use the accounting data period ends in March. However, for Thailand data, most accounting period end in December. So I use the accounting period end in December.

The theoretical stock price is computed as

Theoretical stock price = V_{L1}, V_{L3}, V_{L4}

The regression equation :

Actual stock price$_t$ = $\alpha + \beta$ Theoretical stock price$_t$ $+\varepsilon_t$

(*t*= the end of the forth quarter of 2007)

Predictive ability of future stock returns

"First, quintile portfolios are constructed according to the ratio of a model's theoretical stock price to actual stock price. Then, a strategy is set in place where the top quintile portfolio is bought and the bottom quintile portfolio is sold. These portfolios are maintained for a certain period of time and the performance is compared. The top quintile consists of underpriced firms and the bottom quintile consists of overpriced firms relative to their theoretical firm values. The higher the future stock returns, the better the predictive ability of the model." Ota (2002)

$$\text{Portfolio construction criterion} = \frac{\text{Theoretical stock price of } V_{L1},\ V_{L3},\ V_{L4} \text{ in the forthquarter of 2007}}{\text{Actual stock price at the end of the forth quarter of 2007}}$$

V_{L1}/P stands for the trading strategy in section 3 that is based on V_{L1} model in figure 4. The V_{L3}/P and the V_{L4}/P strategies are formed in the same way.

IV. EMPIRICAL RESULT

[Table III is here]

Column (i) of table 3 presents the results that 100% of the sample firms reject the null hypothesis of a unit root at the 10% level when neither constant nor time trend is added as well as adding constant and time trend. However, when the constant are added to the model, 89.4% of the sample firms reject the null of a unit root.

The results of first-differenced abnormal earnings in column (ii) shows that 100% of the sample firms reject the null hypothesis of a unit root at 10% level as well as 5% level. It means that all of the sample firms do not follow the random-walk process. This implies that the Ohlson (1995) model still valid, thus the past movement of abnormal earning can be predicted the future movement of abnormal earning.

[Table IV is here]

Panel A and B of table 4 report the results for LIM1 and LIM2, respectively. As predicted, the persistence coefficients on abnormal earnings, ω_{11} are positive which is 0.4280 and 0.1880. They are similar to the prior research in the US[4] and Ota (2002) which report the positive coefficient of ω_{11}. However, ω_{10} is negative in LIM2 which is different from Ota (2002) of the positive value of 12.9. The percentage of the model selection criteria minimum AIC or BIC are 6.38% and 2.13% respectively.

Panel C and D display the results of LIM3 which has negative coefficients on book value of equity, ω_{22} which is -0.0120. On the other hand, LIM4 has positive coefficients on book value of equity, ω_{22} which is 0.0085. This finding for LIM4 is consistent with conservative accounting practice; however, Ota (2002) reports the coefficient of ω_{22} for LIM3 and LIM4 which is -0.01 and -0.03 similar to the results that reported in prior US research.[5]

[4]The persistence parameter ω_{11} in LIM2 is 0.62 in Dechow et al. (1999), 0.66 in Barth et al. (1999) and 0.67 in Ota (2002).

[5]In this study, the estimate of ω_{22} and its (t statistic) in LIM4 are -0.03 (-1.54). Hand and Landsman (1998) report -0.02 (-2.6), Myers (1999) reports -0.005 (t statistic unknown), Dechow et al. (1999) report -0.09 (-77.64), Hand and Landsman (1999) report -0.006 (-1.4), and Barth et al. (1999) report -0.07 (-7.81).

The sample used in this study is limited to the firms that have been operating for a long time. The negative book value is resulted from the assets that recorded at historical costs and should depress the book value of equity which generates abnormal earnings.

The coefficient on abnormal earnings ω_{11} is positive in both LIM3 and LIM4. The coefficient ω_{10} is a constant in LIM4. From the model, selection criteria indicate that the percentage of the model selection criteria minimum AIC or BIC is 12.77% and 72.34% for LIM3 and LIM4 respectively, which is higher than other LIMs. The increasing the number of explanatory variable in LIM3 and LIM4 is the improvement observed by adding book value of equity, b_t, to LIM1 and LIM2 as an explanatory variable.

Panels E and F of table 4 indicate that the results for LIM5 and LIM6 are similar to LIM1-4 that show the positive coefficient on abnormal earnings, ω_{11}. From the model, selection criteria indicate that the percentage of the model selection criteria minimum AIC or BIC is 2.13% and 0% for LIM5 and LIM6 respectively. The results for LIM6 is in line with Greene (2008) which mentions that researchers have found the ARMA model with relatively small values of p and q have proved quite effective as forecasting models.

[Table V is here]

Comparing the model selection criteria with LIM1,the Ohlson (1995) LIM assumes that abnormal earnings x_t^a is the first-order autoregressive process AR(1). The percentage of minimum AIC or BIC of LIM1 is higher than LIM5 and LIM6. These findings appear to show the validity of the Ohlson (1995) model. However, improvement on model by adding book value of equity in accordance with the Feltham and Ohlson (1995) model seem to be more valid than the Ohlson (1995) model for the sample data in Thailand. Finally, the coefficient on x_t^a, x_{t-1}^a, x_{t-2}^a which is ω_{11}, ω_{12}, ω_{13} are similar to US research that is positive. However, these are different from Ota (2002) for ω_{12} which is negative. He mentioned that ω_{12} may be a negative value when the regression equation omits other information υ_t.

Panel F of table 4 shows the results of LIM7 which improves LIM1 by Ota (2002). He did not try to specify υ_t[6] that could arise from the omission, but correcting serial correlation in the error terms in LIM1. Instead of predict u_{t+1} to the model I plus moving average of the current and past error term or MA (1). The selected criteria shows the percentage of the model selection criteria minimum AIC or BIC 4.26% which is higher than LIM2, 5 and LIM6 that try to improve the model by the Ohlson (1995) model concept.

[Figure V is here]

Figure V presents the results of the explanatory-power test for the three valuation models. The V_{L4} model has the mean Adj. R^2 of -0.021 which is the lowest explanatory power. Hence, it shows that the assumption of LIM4 of other information υ_t as a constant is inappropriate. Comparing the V_{L1} model and V_{L3} model in terms of Adj. R^2, the result appears that V_{L1} has more explanatory power over contemporaneous stock prices than V_{L3} model with the Adj. R^2 of 0.596 and 0.477 for the V_{L1} and V_{L3} models, respectively.

[Figure VI is here]

Figure VI presents the result of predictive ability of future stock returns for the three valuation models based on the V_{L1}/P, V_{L3}/P and V_{L4}/P strategies. It appears that the V_{L4}/P strategy has the superior ability to predict future stock returns followed by the V_{L3}/P strategy and the V_{L1}/P strategy.

Even though, from the model selection criteria based on the percentage of the model selection criteria minimum AIC or BIC, the first model to choose is LIM4. It is unreliable due to the very low mean Adj. R^2 of -0.021. Comparing with the mean Adj. R^2 of LIM3 which is 0.477, it appears that the V_{L3} is more reliable than V_{L4}. Therefore, the suggested valuation model among

[6]Ota (2002) "However, as υ_t does seem to hold the key to the improvement of the LIM, recent research in the US attempts to specify υ_t. Myers (1999) uses order backlog, Hand and Landsman(1998, 1999) use dividends, Barth et al. (1999) use accruals and cash flows, and Dechow et al. (1999) use the absolute value of abnormal earnings, the absolute value of special accounting items, the absolute value of accounting accruals, dividends, an industry-specific variable, and analysts' earnings forecasts as proxies for υ_t. In this paper, LIM1 is adjusted to remove serial correlation from the residuals."

these three competitive models is V_{L3} that follows the the Feltham and Ohlson (1995) without assuming other information. υ_t is a constant in the model and V_{L1} that follows the Ohlson (1995) is still valid according to the higher explanatory power. As investors need the higher return, V_{L3} should be selected. To invest for higher return based on appropriated risk, besides focusing only on the two variables which are book value per share of equity and earning per share, investor should aware of other fundamental analysis of the firms as well as other factors that effects the market. Like Sumritpradit (2003) mentions in his study that Thailand market is also volatile from many factors such as investment in foreign country and politics. The researched information on this paper supports the superiority of LIM3 over LIM1 from the perspective of Thailand stock market under the limitation stated before.

V. CONCLUSION

This study examines the validity of Ohlson (1995) information dynamics model which follows theoretical framework on the developments of the Residual Income Valuation (RIV) and the Linear Information Model (LIM). Also, this research has applied research methodology of Ota (2002) to test the functional form of LIM 1-7. As the models are time series which is autoregressive models, the researcher apply Autoregressive Integrated Moving Average (ARIMA) process instead of Ordinary Least Square (OLS).

In addition, the limitation of yearly data, the researcher tested the models by quarterly data instead. By the empirical tests on model development of the Linear Information Model (LIM) which based on Ohlson (1995) and Feltham and Ohlson (1995) as well as Ota (2002) concept, the development of LIM1, which is LIM7 added moving average term to the model, does not show much improvement by using Thailand's stock market data. The best model among the competitors is LIM4 which assumes that other information υ_t is absorbed in a constant term. It is also consistent with conservative accounting practice.

For the empirical tests of the valuation models of competitive LIMs and test the explanatory power of contemporaneous stock prices, the researcher found that LIM4 assuming other υ_t information as a constant shown the predictive ability of future stock returns above other competitive model. On the other hand, the R^2 and adjust R^2 for LIM4 are very low. The result did not show the explanatory power of contemporaneous stock prices. Furthermore, the maximum likelihood for Autoregressive Integrated Moving Average (ARIMA) method will cause the small sample bias due to the limitation of the data which is available for 47 firms and these firms must be the firms that operate for long period as well as the number of period of the observation.

Moreover, the results for the percentage of the model selection criteria from minimum AIC or BIC in this study do not support the prior study that suggest a multi-lagged information rather than the single lagged information, as the result shows in LIM1, LIM5 and LIM6.Also, for the LIM7 that Ota (2002) tried to correct serial correlation in the error term did not show the

improvement by comparing the percentage of the model selection criteria from minimum AIC or BIC which was not better than LIM1.

According to the results for Thailand data, it indicates that the Feltham and Ohlson (1995) models show predictive ability of future stock returns better than the Ohlson (1995) model. On the other hand, for LIM4 that assume other υ_t information to as a constant by following the Feltham and Ohlson (1995)'s concept does not show the validity by the explanatory power of contemporaneous stock prices, while the Ohlson (1995) show the more validity by comparing the explanatory power of contemporaneous stock prices. The result in this study also implied that assuming other information υ_t as constant is not appropriate.

In conclusion, the researcher supports the V_{L3} as the valuation model following the Feltham and Ohlson (1995) without assuming other information υ_t is a constant in the model based on the predictive ability of future stock returns as well as the explanatory power of contemporaneous stock prices. Therefore, the book value per share of equity and earning per share together are informative for investor to value the firm and make decision. However, V_{L1} that follows the Ohlson (1995) is still valid according to the higher explanatory power. Moreover, the investors who expected higher return based on appropriated risk should be aware of other fundamental analysis of the firms as well as other factors having effects to the market.

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http://proquest.umi.com/pqdweb?index=0&did=9295471&SrchMode=1&sid=4&Fmt=2&VInst=PROD&VType=PQD&RQT=309&VName=PQD&TS=1219042029&clientId=53836

'Abstract (Summary), Ohlson, James A.,1995, Earnings, book values, and dividends in equity valuation'

http://proquest.umi.com/pqdweb?index=8&did=9295464&SrchMode=1&sid=2&Fmt=2&VInst=PROD&VType=PQD&RQT=309&VName=PQD&TS=1219041604&clientId=53836

'Abstract (Summary) Lo, Kin., and Thomas Lys, 2000, The Ohlson model: Contribution to valuation theory, limitations, and empirical applications'

http://proquest.umi.com/pqdweb?index=1&did=59936641&SrchMode=1&sid=6&Fmt=2&VInst=PROD&VType=PQD&RQT=309&VName=PQD&TS=1219043377&clientId=53836

Data source: Market Capitalization, Monthly since Sep-1988 to Nov-2008

http://www.set.or.th/th/market/market_statistics.html

Data source: Book Value per Share and Earning per Share, 1997-2007

http://www.setsmart.com

"Digging Into The Dividend Discount Model"

http://www.investopedia.com/articles/fundamental/04/041404.asp

Table I

Yearly Data Sample

Sample Firms		
Data years of sample firms		
Available data years	No. of firms	%
21 Years	2	2.17%
20 Years	2	2.17%
19 Years	5	5.43%
18 Years	6	6.52%
17 Years	31	33.70%
16 Years	24	26.09%
15 Years	22	23.91%
Total	92	100.00%

Yearly data of book value per share from datastream that match the requirements. The sample selection requirements are as follows: (i) the firms are listed on the Stock Exchange of Thailand (SET), (ii) the accounting period ends in December, (iii) banks, securities firms, and insurance firms are excluded, (iv) a minimum of 15 consecutive years of accounting data is available for each firm included in the sample, and (v) book value of equity is not negative in any year. Due to the data limitation of yearly data, the sample is very small. The researcher, therefore, decided to test quarterly data instead. The researcher collected the data of book value per share (BV) and Earning Per Share (EPS) from SETSMART. After, the illiquid stock was excluded. There are 47 firms having available data.

Table II

Description Statistics on Variables, 2007 (in Baht)

Description	Variable	Mean	Standard deviation	Min	Max
Book value per share of equity	b	42.31	59.34	0.04	639.88
EPS	x	0.76	9.50	-255.14	202.46
Abnormal Earnings	x^a	-3.08	10.74	275.66	195.43

* Each variable has a total of 2,244 firm-quarter observations.

Descriptive statistics for each variables used in estimating LIM1-7. The mean of abnormal earnings over sample period is -3.08 Baht given an assumed a constant discount rate of 9.0888 %.

Table III

Stationarity of Abnormal Earnings Using The DF Test[a]

	(i) x_t [a c]		(ii) Dx_t [a c]	
	Percentage of observations rejected at the		Percentage of observations rejected at the	
Model[b]	10% level	5% level	10% level	5% level
(No Constant or Trend)	100.0	76.6	100.0	100.0
(With Constant)	89.4	89.4	100.0	100.0
(With Constant and Trend)	100.0	93.6	100.0	100.0

[a] A total of 47 firms are used to test the stationarity of their abnormal earnings.

[b] Three types of unit root tests are performed:

[c] (i) x_t [a] tests the stationarity of abnormal earnings.

(ii) Dx_t [a] tests the stationarity of first-differenced abnormal earnings.

Column (i) of table 3 presents the results that 100% of the sample firms reject the null hypothesis of a unit root at the 10% level when neither constant nor time trend is added as well as adding constant and time trend. However, when the constant are added to the model, 89.4% of the sample firms reject the null of a unit root. The results of first-differenced abnormal earnings in column (ii) shows that 100% of the sample firms reject the null hypothesis of a unit root at 10% level as well as 5% level. It means that all of the sample firms do not follow the random-walk process. This implies that the Ohlson (1995) model still valid, thus the past movement of abnormal earning can be predicted the future movement of abnormal earning.

Table IV

Results of LIM1–7 Estimation

(Panel A) LIM1 : $x^a_{t+1} = \omega_{11} x^a_t + \varepsilon_{t+1}$				Arima (1,d,0)
	ω_{11}			Percentage of Minimum AIC or BIC
Mean	0.4280			6.38
(Panel B) LIM2 : $x^a_{t+1} = \omega_{10} + \omega_{11} x^a_t + \varepsilon_{t+1}$				Arima (1,d,0) With Constant
	ω_{10}	ω_{11}		Percentage of Minimum AIC or BIC
Mean	-2.6180	0.1880		2.13
(Panel C) LIM3 : $x^a_{t+1} = \omega_{11} x^a_t + \omega_{22} b_t + \varepsilon_{t+1}$				Armax (1,d,0)
	ω_{11}	ω_{22}		Percentage of Minimum AIC or BIC
Mean	0.3712	-0.0120		12.77
(Panel D) LIM4 : $x^a_{t+1} = \omega_{10} + \omega_{11} x^a_t + \omega_{22} b_t + \varepsilon_{t+1}$				Armax (1,d,0) With Constant
	ω_{10}	ω_{11}	ω_{22}	Percentage of Minimum AIC or BIC
Mean	-2.2296	0.1985	0.0085	72.34
(Panel E) LIM5 : $x^a_{t+1} = \omega_{11} x^a_t + \omega_{12} x^a_{t-1} + \varepsilon_{t+1}$				Arima (2,d,0)
	ω_{11}	ω_{12}		Percentage of Minimum AIC or BIC
Mean	0.3086	0.1711		2.13
(Panel F) LIM6 : $x^a_{t+1} = \omega_{11} x^a_t + \omega_{12} x^a_{t-1} + \omega_{13} x^a_{t-2} + \varepsilon_{t+1}$				Arima (3,d,0)
	ω_{11}	ω_{12}	ω_{13}	Percentage of Minimum AIC or BIC
Mean	0.2546	0.0769	0.2245	0.00
(Panel G) LIM7 : $x^a_{t+1} = \omega_{11} x^a_t + u_{t+1}$ and $u_{t+1} = \rho u_t + \varepsilon_{t+1}$				Arima (1,d,1)
	ω_{11}	MA(1)		Percentage of Minimum AIC or BIC
Mean	0.6609	2.6989		4.26

Panel A and B of table 4 report the results for LIM1 and LIM2, respectively. As predicted, the persistence coefficients on abnormal earnings, ω_{11} are positive which is 0.4280 and 0.1880. However, ω_{10} is negative in LIM2. The percentage of the model selection criteria minimum AIC or BIC are 6.38% and 2.13% respectively. Panel C and D display the results of LIM3 which has negative coefficients on book value of equity, ω_{22} which is -0.0120. On the other hand, LIM4 has positive coefficients on book value of equity, ω_{22} which is 0.0085. This finding for LIM4 is consistent with conservative accounting practice. The coefficient on abnormal earnings ω_{11} is positive in both LIM3 and LIM4. The coefficient ω_{10} is a constant in LIM4. From the model, selection criteria indicate that the percentage of the model selection criteria minimum AIC or BIC is 12.77% and 72.34% for LIM3 and LIM4 respectively. Panels E and F of table 4 indicate that the results for LIM5 and LIM6 are similar to LIM1-4 that show the positive coefficient on abnormal earnings, ω_{11}. From the model, selection criteria indicate that the percentage of the model selection criteria minimum AIC or BIC is 2.13% and 0% for LIM5 and LIM6 respectively.

Panel G of table 4 shows the results of LIM7 which improves LIM1 by Ota (2002). He did not try to specify υ_t [5] that could arise from the omission, but correcting serial correlation in the error terms in LIM1. Instead of predict u_{t+1} to the model, this research plus moving average of the current and past error term or MA (1). The selected criteria shows the percentage of the model selection criteria minimum AIC or BIC 4.26% which is higher than LIM2, 5 and LIM6 that try to improve the model by the Ohlson (1995) model concept.

Table VI

Comparison of LIM5 - 6 with US Results and Ota (2002)

Regression model: $x^a_{t+1} = \omega_{10} + \omega_{11}x^a_t + \omega_{12}x^a_{t-1} + \omega_{13}x^a_{t-2} + \omega_{14}x^a_{t-3} + \varepsilon_{t+1}$

	ω_{10}	ω_{11}	ω_{12}	ω_{13}	ω_{14}
LIM5		0.3182	0.1755		
LIM6		0.2612	0.0791	0.2132	
Hand and Landsman (1998)	n/a	0.55	0.04		
Dechow et.al (1999)	-0.01	0.59	0.07	0.01	0.01
Hand and Landsman (1999)	n/a	0.61	0.14		
Ota (2002) : LIM5		0.90	-0.26		
LIM6		0.90	-0.28	0.04	

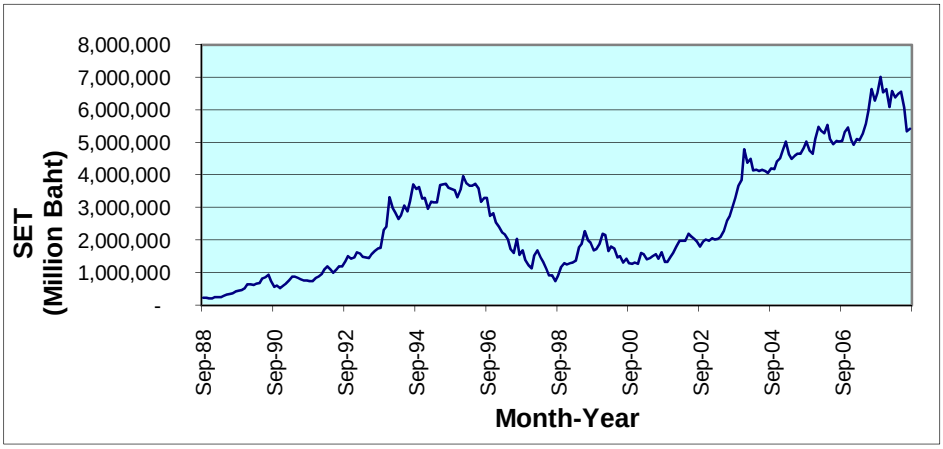
Sources: Ota (2002, p.169)

Comparing the model selection criteria with LIM1,the Ohlson (1995) LIM assumes that abnormal earnings x^a_t is the first-order autoregressive process AR(1). The percentage of minimum AIC or BIC of LIM1 is higher than LIM5 and LIM6. These findings appear to show the validity of the Ohlson (1995) model. However, improvement on model by adding book value of equity in accordance with the Feltham and Ohlson (1995) model seem to be more valid than the Ohlson (1995) model for the sample data in Thailand. Finally, the coefficient on x^a_t, x^a_{t-1}, x^a_{t-2} which is ω_{11}, ω_{12}, ω_{13} are similar to US research that is positive. However, these are different from Ota (2002) for ω_{12} which is negative. He mentioned that ω_{12} may be a negative value when the regression equation omits other information υ_t.

Figure I

Market Capitalization (SET)

Monthly : Since Sep-1988 to Aug 2008

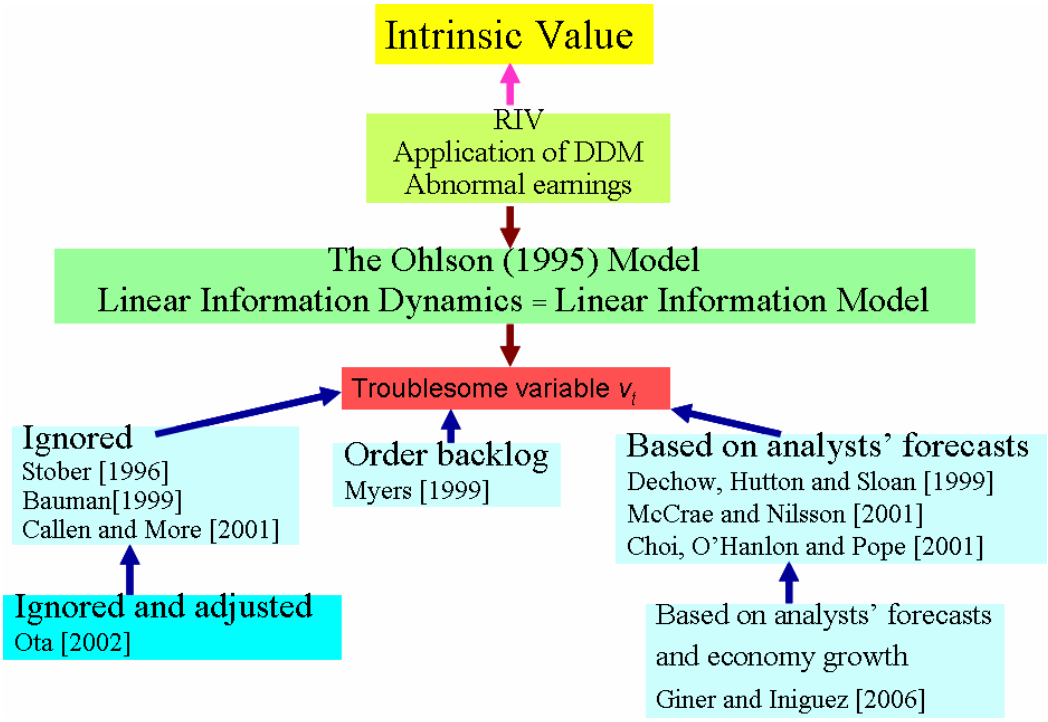


Source : data from www.set.or.th

Market capitalization of the Stock Exchange of Thailand has been increased from 246,674.79 million Baht in September 1988 to 3,192,157.11 million Baht in November 2008; however, the market still fluctuates.

Figure II

A Review of Accounting Techniques Use in Equity Valuation



Summaried from Giner and Iniguez (2006)

Their researches are summarized to review grouping by the method to handle with troublesome variable which could be categorized into 3 main groups which are: ignored, order backlog and based on analysts' forecasts. This report paper has demonstrated aspects of comparison on the methodology based on Giner and Iniguez (2006)'s Main Characteristics literature review to handle with troublesome variable. The theoretical Myers(1999) models of conservatism fail to order backlog time series of the Residual Income (RI) due to changes in growth rates, accounting procedures and production technologies. Thus, this research supports the idea that the more complex models tend to have noisier estimates of firm value than more simply models. However, the model based on analysts' forecasts by their own assumption may be unreliable in the dynamic world. Accordingly, using the model that ignores troublesome variable υ_t may be better.

Figure III

Model Development on LIM

Ota. 2002						Autoregressive Model
LIM	**Model**	υ_t	x_t^a	**Estimated Regression**	**Test Serial Correlation in error term**	**Autoregressive Integrated Moving Average (ARIMA)**
Ohlson (1995) model						
LIM1	$x_{t+1}^a = \omega_{11} x_t^a + \varepsilon_{t+1}$	0	AR(1)	OLS	Durbin's alternative test	Arima (1,d,0)
LIM2	$x_{t+1}^a = \omega_{10} + \omega_{11} x_t^a + \varepsilon_{t+1}$	ω_{10}	AR(1)	OLS	Durbin's alternative test	Arima (1,d,0) With Constant
Feltham and Ohlson (1995)						
LIM3	$x_{t+1}^a = \omega_{11} x_t^a + \omega_{22} b_t + \varepsilon_{t+1}$	0	AR(1)	OLS	Durbin's alternative test	Armax (1,d,0)
LIM4	$x_{t+1}^a = \omega_{10} + \omega_{11} x_t^a + \omega_{22} b_t + \varepsilon_{t+1}$	ω_{10}	AR(1)	OLS	Durbin's alternative test	Armax (1,d,0) With Constant
Higher-order autoregression of x_t^a						
LIM5	$x_{t+1}^a = \omega_{11} x_t^a + \omega_{12} x_{t-1}^a + \varepsilon_{t+1}$	0	AR(2)	OLS	Durbin's alternative test	Arima (2,d,0)
LIM6	$x_{t+1}^a = \omega_{11} x_t^a + \omega_{12} x_{t-1}^a + \omega_{13} x_{t-2}^a + \varepsilon_{t+1}$	0	AR(3)	OLS	Durbin's alternative test	Arima (3,d,0)
Serial correlation in the error terms						
LIM7	$x_{t+1}^a = \omega_{11} x_t^a + u_{t+1}$ and $u_{t+1} = \rho u_t + \varepsilon_{t+1}$	0	AR(1)	GLS-GRID	Durbin's alternative test	Arima (1,d,1)

The component of the model ARIMA(p,d,q), autoregressive integrated moving average, are consisted of p which is the number of autoregressive terms, d which is the number of times that the series has to be differed before it becomes stationary, and q that is the number of moving average terms.

Figure IV

Summary of The LIM1, LIM3, and LIM4 Valuation Models That Are Examined in The Stock Price Test

Valuation Model	**Linear Information model**	**Expected future abnormal earnings x^a_{t+i} at date *t***	**Theoretical firm value at date *t***
	Ohlson (1995)		
V_{L1} (LIM1)	Other information υ_t is ignored. LIM1: $x^a_{t+1} = \omega_{11} x^a_t + \varepsilon_{t+1}$	$E_t[x^a_{t+i}] = \omega_{11} x^a_{t+i-1}$ ARIMA (1,d,0)	$V_{L1} = b_t + \frac{\omega_{11}}{(1+r-\omega_{11})} x^a_t$
	Feltham and Ohlson (1995)		
V_{L3} (LIM3)	Other information υ_t is ignored. LIM3: $x^a_{t+1} = \omega_{11} x^a_t + \omega_{22} b_t + \varepsilon_{t+1}$	$E_t[x^a_{t+i}] = \omega_{11} x^a_{t+i-1} + \omega_{22} b_{t+i-1}$ ARMAX (1,d,0)	$V_{L3} = b_t + \frac{\omega_{11}}{(1+r-\omega_{11})} x^a_t + \frac{(1+r)\omega_{12}}{(1+r-\omega_{11})(1+r-\omega_{22})} b_t$
V_{L4} (LIM4)	Other information υ_t is a constant. LIM4: $x^a_{t+1} = \omega_{10} + \omega_{11} x^a_t + \omega_{22} b_t + \varepsilon_{t+1}$	$E_t[x^a_{t+i}] = \omega_{10} + \omega_{11} x^a_{t+i-1} + \omega_{22} b_{t+i-1}$ ARMAX (1,d,0) with constant	$V_{L4} = b_t + \frac{(1+r)\omega_{10}}{(1+r-\omega_{11})r} + \frac{\omega_{11}}{(1+r-\omega_{11})} x^a_t + \frac{(1+r)\omega_{12}}{(1+r-\omega_{11})(1+r-\omega_{22})} b_t$

Abnormal earnings for firm *j* for period *t*, x^a_{jt}, is computed as

$$x^a_{jt} \equiv x_{jt} - r b_{jt-1}$$

Where x_{jt} = earnings per share (EPS) for firm j for period *t*; b_{jt} = book value of equity for firm j for period *t*; r_{jt} = assume a constant discount rate at 9.0888 %

Expected future abnormal earnings at date *t*, $E_t[x^a_{t+i}](i = 1, 2, 3...)$, and the condition for convergence in computing a theoretical firm value.

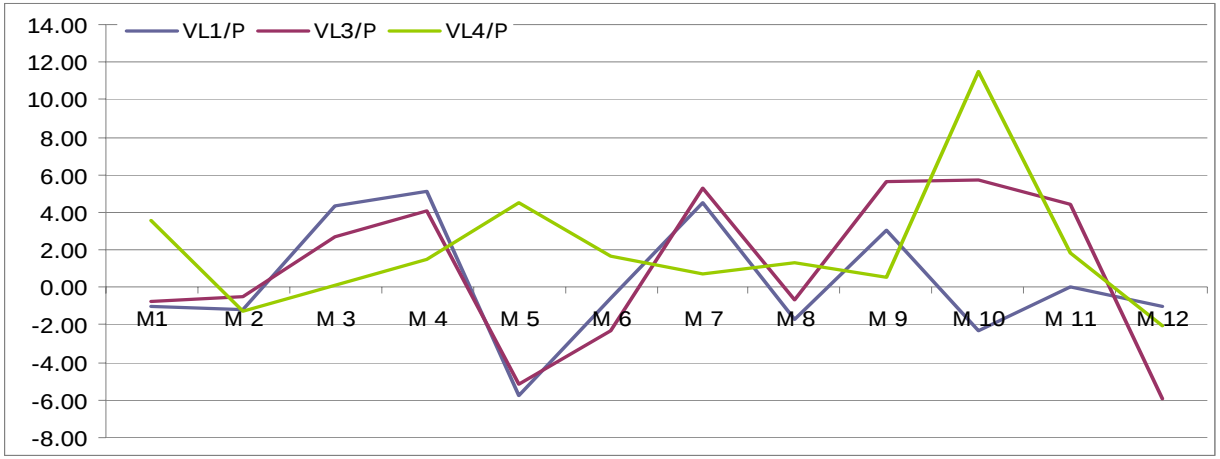
V_{L1} model: $E_t[x^a_{t+i}] = \omega_{11} x^a_{t+i-1}$, ω_{11} is estimated from ARIMA (1,d,0) of LIM1($x^a_{t+1} = \omega_{11} x^a_t + \varepsilon_{t+1}$). The condition for convergence is $|\omega_{11}| < 1 + r$.

V_{L3} model: $E_t[x^a_{t+i}] = \omega_{11} x^a_{t+i-1} + \omega_{22} b_{t+i-1}$, ω_{11}, ω_{22} is estimated from ARMAX(1,d,0) of LIM3 ($x^a_{t+1} = \omega_{11} x^a_t + \omega_{22} b_t + \varepsilon_{t+1}$).The condition for convergence is $|\omega_{11}| < 1 + r$.

V_{L4} model: $E_t[x^a_{t+i}] = \omega_{10} + \omega_{11} x^a_{t+i-1} + \omega_{22} b_{t+i-1}$, ω_{10}, ω_{11}, ω_{22} is estimated from ARMAX(1,d,0) with constant of LIM4 ($x^a_{t+1} = \omega_{10} + \omega_{11} x^a_t + \omega_{22} b_t + \varepsilon_{t+1}$).The condition for convergence is $|\omega_{11}| < 1 + r$.

Figure V

The Explanatory Power over Contemporaneous Stock Prices



Return	M1	M 2	M 3	M 4	M 5	M 6	M 7	M 8	M 9	M 10	M 11	M 12	Average	R2	Adj. R^2
VL1/P	-0.98%	-1.21	4.35%	5.08%	-5.77%	-0.60%	4.50%	-1.73%	3.04%	-2.26%	0.01%	-1.02%	0.28%	0.596	0.587
VL3/P	-0.76%	-0.51	2.70%	4.09%	-5.14%	-2.28%	5.32%	-0.63%	5.63%	5.72%	4.44%	-5.91%	1.06%	0.477	0.466
VL4/P	3.59%	-1.31	0.11%	1.47%	4.49%	1.69%	0.68%	1.29%	0.58%	11.52%	1.82%	-2.01%	1.99%	0.001	-0.021

Future stock returns of the V_{L1}/P , V_{L3}/P and V_{L4}/P strategy which follow Ota (2002)'s study. This figure depicts the mean of the each month returns for 2008 produced by the V_{L1}/P , V_{L3}/P and V_{L4}/P strategy. The figure also presents the Adj. R^2 of V_{L1}, V_{L3}, and V_{L4}. Actual stock prices at the end of forth quarter of 2007 are regressed cross-sectionally on theoretical stock prices of the model for forth quarter of 2007. The sample consists of 47 firms. For the results of the explanatory-power test for the three valuation models, the V_{L4} model has the mean Adj. R^2 of -0.021 which is the lowest explanatory power. Hence, it shows that the assumption of LIM4 of other information υ_t as a constant is inappropriate. Comparing the V_{L1} model and V_{L3} model in terms of Adj. R^2, the result appears that V_{L1} has more explanatory power over contemporaneous stock prices than V_{L3} model with the Adj. R^2 of 0.596 and 0.477 for the V_{L1} and V_{L3} models, respectively.

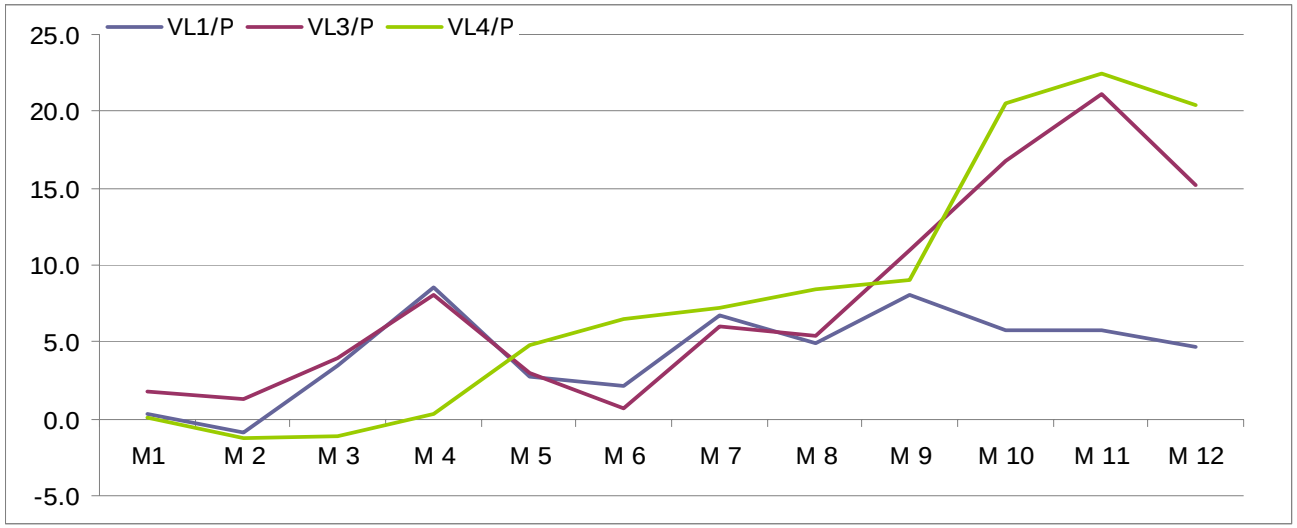
$$\text{Portfolio construction criterion} = \frac{\text{Theoretical stock price of } V_{L1},\ V_{L3},\ V_{L4} \text{ in the forthquarter of 2007}}{\text{Actual stock price at the end of the forth quarter of 2007}}$$

Theoretical stock price = V_{L1}, V_{L3}, V_{L4}

$$\text{Actual stock price}_t = \alpha + \beta\ \text{Theoretical stock price}_t + \varepsilon_t$$ (t= the end of the forth quarter of 2007)

Figure VI

The Cumulative Returns for 2008



Return	M1	M 2	M 3	M 4	M 5	M 6	M 7	M 8	M 9	M 10	M 11	M 12
VL1/P	0.3%	-0.9%	3.5%	8.6%	2.8%	2.2%	6.7%	5.0%	8.0%	5.7%	5.7%	4.7%
VL3/P	1.8%	1.3%	4.0%	8.1%	2.9%	0.7%	6.0%	5.4%	11.0%	16.7%	21.2%	15.2%
VL4/P	0.1%	-1.2%	-1.1%	0.3%	4.8%	6.5%	7.2%	8.5%	9.1%	20.6%	22.4%	20.4%

Future stock returns of the V_{L1}/P , V_{L3}/P and V_{L4}/P strategy which follow Ota (2002). Quintile portfolios are formed according to the ratio of the model's theoretical stock price to actual stock price at the end of forth quarter of 2007. The top quintile portfolio consists of underpriced firms and the bottom quintile portfolio consists of overpriced firms relative to their theoretical firm values. The strategy is to take a long position in the top quintile portfolio and a short position in the bottom quintile portfolio. These portfolios are maintained for up to 12 months. This figure depicts the cumulative returns for 2008 produced by the V_{L1}/P , V_{L3}/P and V_{L4}/P strategy. The sample consists of 47 firms. the result of predictive ability of future stock returns for the three valuation models based on the V_{L1}/P, V_{L3}/P and V_{L4}/P strategies. It appears that the V_{L4}/P strategy has the superior ability to predict future stock returns followed by the V_{L3}/P strategy and the V_{L1}/P strategy.

$$\text{Portfolio construction criterion} = \frac{\text{Theoretical stock price of } V_{L1},\ V_{L3},\ V_{L4} \text{ in the forthquarter of 2007}}{\text{Actual stock price at the end of the forth quarter of 2007}}$$

APPENDIX

Analysis of Related Literatures : Main Characteristics

Based on Giner and Iniguez(2006). 'An empirical assessment of the Feltham-Ohlson models considering the sign of abnormal earnings'

Group	Name of Article	Issue of Study	Similarity	Differences
1. Group by Model based on main characteristics ***Feltham and Ohlson [1995]***	1. Stober, T. L. (1996). 'Do prices behave as if accounting book values are conservative? Cross-sectional tests of the Feltham-Ohlson (1995) valuation model'. Working paper. University of Notre Dame.	*Model:* Feltham and Ohlson [1995], *Sample:* USA (1964-1993), *Link:* Predictive, *Other information:* Ignored, *Methodology:* Time-series and cross sectional	***Model:* Feltham and Ohlson [1995]** *Sample:* USA *Link:* Predictive *Other information:* Ignored *Methodology:* Time-series	*Methodology:* cross sectional
	2. Bauman, M. P. (1999). 'An empirical investigation of conservatism in book value measurement'. *Managerial Finance, 25* (12):42-54.	*Model:* Feltham and Ohlson [1995], *Sample:* USA (1980-1994), *Link:* Predictive, *Other information:* Ignored, *Methodology:* Time-series	***Model:* Feltham and Ohlson [1995]** *Sample:* USA *Link:* Predictive *Other information:* Ignored *Methodology:* Time-series	
	3. Myers, J. N. (1999). 'Implementing residual income valuation with linear information dynamics. *The Accounting Review,74 {1):1-28.*	*Model:* Feltham and Ohlson [1995], *Sample:* USA (1975-1996), *Link:* Predictive and valuation, *Other information:* Order backlog, *Methodology:* Time-series	***Model:* Feltham and Ohlson [1995]** *Sample:* USA *Link:* Predictive *Methodology:* Time-series	*Other information:* Order backlog
2. Group by Model based on main characteristics ***Ohlson [1995]***	1. Dechow, P. M., Hutton, A. P. and Sloan, R. G. (1999). 'An empirical assessment of the residual income valuation model'. *Journal of Accounting and Economics,* 26:1-34.	*Model:* Ohlson [1995], *Sample:* USA (1976-1995), *Link:* Predictive and valuation, *Other information:* Based on analysts' forecasts, *Methodology:* Cross-sectional	***Model:* Ohlson [1995]** *Sample:* USA *Link:* Predictive and valuation *Other information:* Based on analysts' forecasts *Methodology:* Cross-sectional	
	2. McCrae, M. and Nitsson, H. (2001). 'The explanatory and predictive power of different specifications of the Ohison *{\995)* valuation models'. *The European Accounting Review,* 10 (2):315-34I	*Model:* Ohlson [1995], *Sample:* Sweden (1987-1997), *Link:* Predictive and valuation, *Other information:* Based on analysts' forecasts, *Methodology:* Cross-sectional	***Model:* Ohlson [1995]** *Link:* Predictive and valuation *Other information:* Based on analysts' forecasts *Methodology:* Cross-sectional	*Sample:* Sweden

Group	Name of Article	Issue of Study	Similarity	Differences
2. Group by Model based on main characteristics ***Ohlson [1995***	3. Choi, Y., O'Hanlon, J. and Pope, P. F. (2001). 'Linear information models in residual income-based valuation: a development of the Dechow, Hutton and Sloan empirical approach'. Working paper, Lancaster University.	*Model:* Ohlson [1995], *Sample:* USA (1976-1995), *Link:* Predictive and valuation, *Other information:* Based on analysts' forecasts, *Methodology:* Cross-sectional	***Model:* Ohlson [1995]** *Sample:* USA *Link:* Predictive and valuation *Other information:* Based on analysts' forecasts *Methodology:* Cross-sectional	
	4. Callen, J. L. and Morel, M. (2001). 'Linear accounting valuation when abnonnal eamings are AR(2)'. *Review of Quantitative Finance and Accounting*, 16:191-203	*Model:* Ohlson [1995], *Sample:* USA (1969-1996), *Link:* Predictive and valuation, *Other information:* Ignored, *Methodology:* Time-series	***Model:* Ohlson [1995]** *Sample:* USA *Link:* Predictive and valuation	*Other information:* Ignored *Methodology:* Time-series
Main paper	5. Ota, K. (2002). 'A test ofthe Ohison (1995) model: empirical evidence from Japan'. *The International Journal of Accounting*, 37 (2): 157-182.	*Model:* Ohlson [1995], *Sample:* Japan (1964-1998), *Link:* Predictive and valuation, *Other information:* Ignored but adjusted, *Methodology:* Time-series	***Model:* Ohlson [1995]** *Link:* Predictive and valuation	*Sample:* Japan *Other information:* Ignored but adjusted *Methodology:* Time-series
3. Group by Model based on main characteristics ***Ohlson [1995]*** ***Feltham and Ohlson [1995]***	1. Begona Giner and Raul Iniguez(2006). 'An empirical assessment of the Feltham-Ohlson models considering the sign of abnormal earnings' *Accounling anil Business Research*, Vol. 36. No. 3. pp. 169-190. 2006	*Model:* Ohlson [1995] Feltham and Ohlson [1995], *Sample:* Spain (1992-1999), *Link:* Predictive and valuation, *Other information:* Based on analysts' forecasts and economy growth, *Methodology:* Cross-sectional		

Literature reviews: coefficients of the OFO models

Source: Giner and Iniguez(2006). 'An empirical assessment of the Feltham-Ohlson models considering the sign of abnormal earnings'

ω_{11}: persistence parameter of abnormal earnings; ω_{12} : conservatism parameter; ω_{22} : growth parameter of book value of equity parameter; γ_1: persistence of the first 'other information' variable; γ_2: persistence of the second 'other information' variable.

STUDY	ω_{11}	ω_{12}	ω_{22}	γ_1	γ_2
Theoretical interval in the OFO models Stober [1996]	$0 \le \omega_{11} \le 1$ 0.395	$\omega_{12} > 0$ Between -0.014 and -0.025	$0 \le \omega_{22} \le 1+r$ Between 0.94 and 0.95	$0 \le \gamma_1 \le 1$ -	$0 \le \gamma_2 \le 1$ -
Bauman [1999]	0.223	-0.052	0.911	-	-
Myers [1999]	0.039	-0.005	1.061	0.998	-
Dechow. Hutton and Sloan [1999]	Between 0.47* and 0.62*	-0.09*	-	0.32*	-
McCrae and Nilsson [2001]	0.523*	-	-	0.436*	-
Choi, O'Hanlon and Pope [2001]	Between 0.58* and 0.61*	-	Between 1 and 1.06	Between 0.59 and 0.60	-
Callen and Morel [2001]	0.462*	-	-	-	-
Ota [2002]	Between 0.52* and 0.73*	-0.03	-	-	-
Giner and Iniguez [2006]	Between 0.55* and 0.84*	Between -0.091* and 0.003	Between 1.014* and 1.026*	Between 0.34* and 0.42*	Between 0.38* and 0.90*

(-) means that the parameter is ignored
* Significant at 5% (Stober [1996], Bauman [1999] and Myers [1999] do not indicate the significance)