SENIOR RESEARCH

Topic: Stock return predictability with financial ratios: A panel data analysis in the Stock Exchange of Thailand (SET)

Name: Norraset Meesuwan

ID: 5545871629

Advisor: San Sampattavanija, Ph.D.

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Abstract

This research is carried out to study whether the financial ratios can predict the expected future stock returns of selected listed companies in the stock exchange of Thailand (SET) during the period of 2006-2014 (quarterly data from financial statement). Fundamental valuation ratios including earnings yield (EY), dividend yield (DY), and book-to-market ratios (BM) are selected as the predictor variables. In addition, other accounting variables including leverage (DE), net profit margin (NPM), return on asset (ROA), and asset turnover (AT) are included as the predictor variables as well. This study employs the panel data analysis by applying the fixed-effects model to estimate the predictive regressions. Based on the univariate regression models, DY, EY, and BM individually and positively play a significant role in explaining the stock returns but there's no significance form the accounting ratios after controlling for the risk differences by beta. The explanatory power of BM is the highest. Results from one-way multivariate fixed firm effects suggest that after adding more variables into the models, only the fundamental valuation ratios are statistically significant and NPM turns out to be positively correlated to the expected stock returns. The predictive power increases considerably when including the two-way fixed firm and time effects models for estimations. On contrary with the CAPM, beta has no relationship with expected stock returns in all models. Furthermore, the combination of fundamental valuation ratios will enhance the return predictability. The portfolio stimulations are also constructed to check for the robustness of indicators. Book-to-market ratio and combinations of financial ratios provide the strong evidence of predictive power in Thai market.

CONTENT

1. Introduction

There has been an argument whether the stock market can be predictable or not for such a long time. Kendall (1953) observes that stock prices seem to wander randomly overtime and test whether the past prices can be used to predict the future prices. However, according to the efficient market hypothesis (EMH), one cannot exploit both the historical and publicly available information to gain profits if a stock market is semi-strong form efficient. Specifically, if the stock market is efficient, no profitable trading strategy can be formed based on published financial statement. Since then, many researchers examine the validity of this hypothesis and expand by including other predictive variables. Financial variables that are generally tested to predict stock returns are the fundamental valuation indicators such as dividend yield, book-to-market ratio, earning yield etc. In addition, accounting ratios that indicate the performances of a company in various aspects have also been used to test the predictability of stock returns. The results of many studies are mixed across the countries and time periods. In Thailand, Tantipanichakul and Supattarakul (2010) suggest that investors can use publicly available, historical accounting information to choose stocks and earn abnormal returns because they agree that Thai stock markets are not semi-strong form efficient.

Literally, financial ratios allow shareholders to compare different information in a meaningful way in order to make investment decisions Singh and Schmidgall (2002). It becomes a crucial area to be researched as ratios are normally utilized for financial performance evaluation intuitively without considering their theoretical and statistical properties.

Since there is relatively much less work on investigating this predictability of stock returns with financial ratios in Thai market, this research will give a clearer picture of these

works. In this study, we will explore the relationship between 2 main groups of financial ratios and the expected stock returns. Firstly, the fundamental valuation ratios include earnings yield (EY), dividend yield (DY), and book-to-market ratio (BM) which were selected by Lewellen (2004). Secondly, we will examine additional the accounting ratios that are divided into 4 performance indicators. Leverage, efficiency, profitability, and activity ratio are measured by total debt to equity (DE), return on asset (ROA), net profit margin (NPM), and asset turnover (AT) ratio respectively. Moreover, we will focus on the predictive power of each financial ratio as measured by the adjusted R^2 form the regressions and expected stock returns with the panel data analysis based on the study of Pandey (2001).In addition, the investment strategies based on the results of regression analysis are investigated. 8 portfolios with maximum-Sharpe ratio and equal-weighted portfolios are constructed during 20014Q1-2015Q3 which links the robustness of results in the regression analysis part and the real evidence in Thai market.

The findings of this study can be, to some extent, useful for investors. The investors can allocate their portfolios based on the significances of specific ratios in order to receive desirable or higher returns.

2. Literature reviews

Forty years ago, Fama (1970) observed that the stock returns were unpredictable because of the efficiency in the market. However, many research studies examined the predictability of stock returns based on various predictors. Consequently, the understanding of predictability is more debatable. There are lots of studies investigating the relationship between the financial ratios and stock returns in diverse aspects. We will categorize literature reviews of financial ratios into 2 parts; fundamental valuation ratios and accounting ratios.

2.1 Fundamental valuation ratios

Rozeff (1982) may be the first one who studied the predictive power of dividend yield and concludes that there exists a positive relationship between the dividend yields and expected stock returns because dividend yield acts as a measure of the ex-ante risk premium. When the environment is perceived to be so risky, investors demand a high premium for holding a stock. Campbell and Shiller (1988) indicate that dividend yield has the ability to confine with expected returns and dividend yield growth thus dividend yield is considered to be a good predictor of stock returns. Fama and French (1988) find that the power of dividend yield measured by R^2 increases with the return horizon. Kothari and Shanken (1997) find that in the US market, dividend yield and book to market ratios have dependable proof for expected real returns over a period of 1926-1961 and there lies a track of time series variation. In contrast, Goetzmann and Jorion (1993) use the bootstrap methodology and stimulations to examine the ability of dividend yields to predict stock returns. The results suggest that there is no strong statistical evidence indicating that dividend yields can be used to forecast stock returns.

Basu (1975) finds that high earning yield, which is the inverse of price-earnings ratio; stocks perform better than low earning yield stock regardless of higher level of systematic risk. Fama and French (1988) confirm the predictability of dividend yield to forecast stock returns and also find that earnings yield has less predictive power than dividend yield. In contrary, Lamont (1998) argues that aggregate earnings are negatively correlated with expected returns and concludes that earnings yield fails to forecast aggregate stock returns.

Rosenbrg, Reid and Lanstein (1985) point out that book-to-market ratio is the crucial predictor of stock returns and the positive relationship exists. Chen, Hamao and Lakonishok (1991) find the similar results in the Japanese market. Pontiff and Schall (1998) also investigate return predictability of aggregate book-to-market ratio in the US market; the result shows the predictive power of the book-to-market ratio.

Lewellen (2004) studies the predictability of valuation ratios such as dividend yield, earnings yield and book-to-market ratios in NYSE and found some strong evidence that dividend yield predicts stock returns within the period of 1946-2000 but other two predictors seem to have limited predictive power. Kheradyar, Ibrahim, and Mat Nor (2011) find the significance of earning yields, dividend yield, and book-to-market ratio to predict the stock returns in Malaysian market and indicates that book-to-market ratio exhibits the highest predictive power. In addition, they claim that the combination of these ratios increase the predictive power.

Fama and French (1992) find the systematical risk or beta is no longer able to predict the stock returns suggesting that stocks with large betas have relatively low expected returns, but find that book-to-market ratio bears the highest explanatory power on the cross-section of returns in the US market. Lakonishok and Shapiro (1984) also find no relationship between beta and returns. Daniel and Titman (1997) establish that the cross-sectional stock returns

could be explained by the firm characteristic such as dividend yield, earnings yield, and book-to-market ratio and show that the market beta has no explanatory power for stock returns. Tudor (2008) also suggests that, according to two-way fixed effects model, book-to-market ratio and earnings yield have a strong positive impact on stock returns but the beta lacks the explanatory power in all regressions on the Romanian stock market for the period of 2002-2008.

In Thailand, Chairakwattana and Nathaphan (2014) examine the predictability power of future stock returns by employing Bayesian Model Averaging (BMA) during 2001-2011. Their results show that book-to-market, default risk premium and inflation rate are useful predictors of future stock returns, especially in favor of large-cap stocks. Hjalmarsson (2010) studies the predicting global stock returns and he finds that earnings yield has no predictive power of stock returns in case of Thailand.

2.2 Accounting ratios

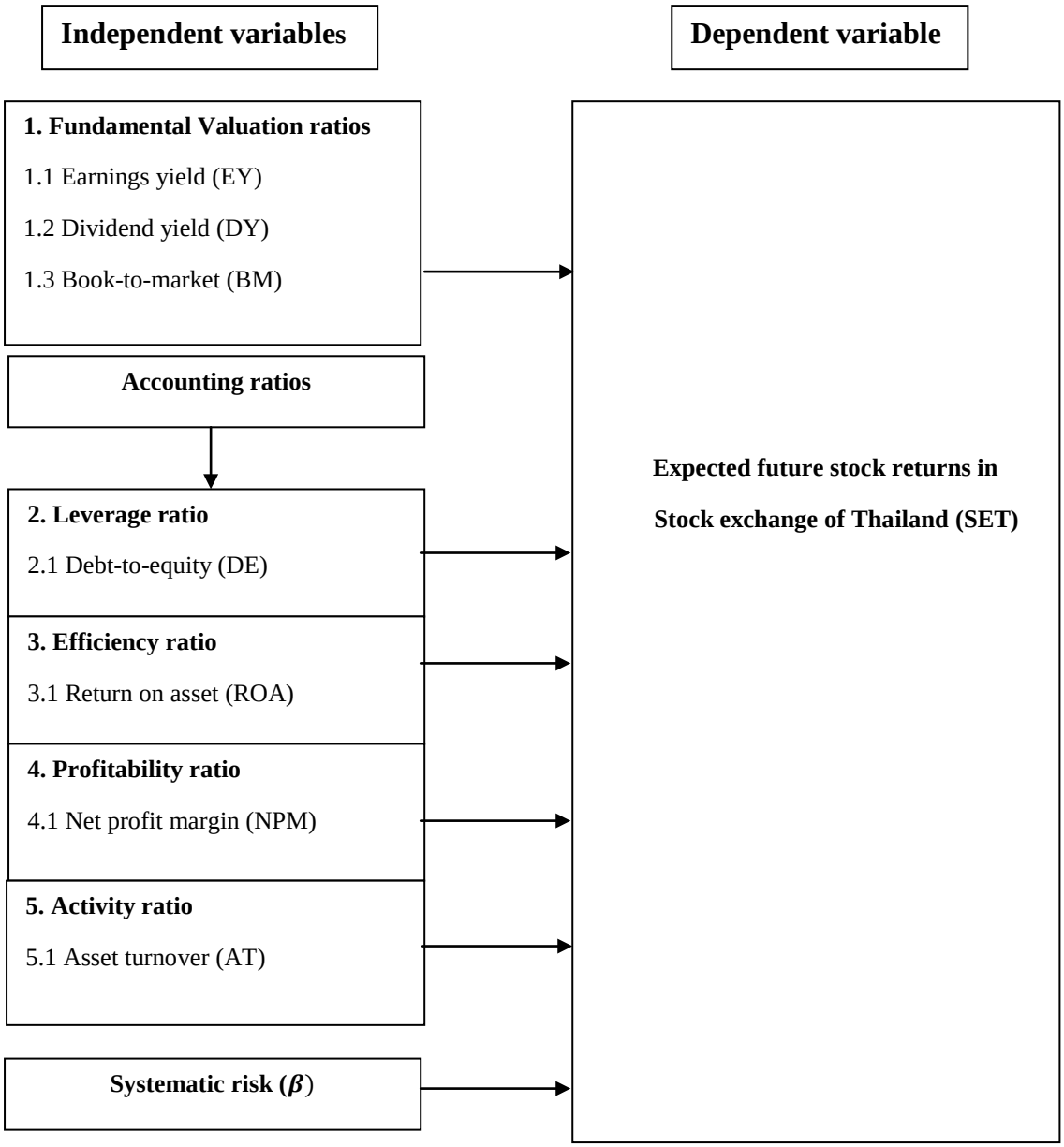
Bhandari (1988) points out the contradiction of the CAPM model and suggests that the expected stock return is positively related to the level of leverage as measured by total debt to equity ratio given the firm's beta. Barbee, Mukherji, and Reines (1996) support Bhandari's proposition in a study of returns on the US stock market during a period from 1979 to 1991. On the contrary, Fama and French (1992) use the book values of assets to the book value of equity as a proxy of firm's leverage. They reveal that stocks of the firms with higher book leverage earn lower returns.

Alexis, Patra and Poshakwale (2010) study the predictability of various accounting variables using panel data analysis in Greek stock market and the results suggest that leverage ratio is negatively and asset turnover is positively related to return. Whereas, return on asset and net profit margin have no impact. In contrary, Muhammad (2014) investigates that return

on asset as well as pay-out ratio can explain stock returns in the Australian market. Martini, Mulyonoc and Rahfiani (2009) study the relationship of accounting variables in Indonesian market in terms of profitability, liquidity, leverage and turnover. The results show that net profit margin and asset turnover are significantly related to both cumulative market adjusted and abnormal returns. Er and Vuran (2012) examine the factors affecting stock returns in Turkey market during the period of 2003-2007 with the technique of dynamic panel approach. They find that both the activity and profitability ratios can be used to explain the stock returns.

In the context of Thai market, Petcharabul and Romprasert (2014) investigate the relationship between financial ratios and stock returns in technology industry of SET by applying panel data analysis. Their findings reveal that price earnings ratio and return on equity are positively related to stock returns whereas current ratio, inventory turnover, and leverage ratio show no relationship.

3. Conceptual Framework



4. Data and Methodology

4.1 Data description

In this study, I select 70 listed companies in The Stock Exchange of Thailand (SET) and this study comprises a period of 9 years starting from January 2006 to December 2014.All the data and variables are in form of quarterly data since most of the financial statements are normally announced quarterly. Hence, there are in total 2,520 observations from N=70 and T =36. The filtering process of companies includes five criteria. First, the company must be listed on the SET main board before 1 January 2006. Second, the stocks of companies must not be suspended for more than 12 months at any period of study. Third, the stocks of companies must not be delisted during the period of study. Fourth, the data of all variables for all companies must be available in Bloomberg terminal program. Fifth, dividend yield of companies must not be zero for more than 12 months at any time period. And, all of the financial data are obtained from Bloomberg terminal software which is one of the most effective sources. The lists of companies in this study are provided in the appendix.

4.2 Variables of study

1. Stock returns (R)

Stock return is a quarterly return calculated by changes in closing prices between two consecutive quarters. The stock price will be adjusted for dividends when calculating the stock return according to the following formula,

$$R_{it} = ln\left(\frac{p_t}{p_{t-1}}\right) + \frac{D_{it}}{p_{t-1}}$$

R_{it} means the returns of stock i in quarter *t*; p_{it} is the closing price of stock i in the end of quarter t; p_{it-1} is the closing price of stock i in the end of quarter t-1, D_{it} is the cash dividend of stock i paid in quarter t. It's noted that the return calculated using the logarithmic form.

2. Market beta (β)

The systematic risk normally uses parameter beta(β), which describes the relationship between variation in stock returns and variation in the return of whole financial market. A zero beta means that return of an asset has independently changed from the market returns. A positive beta indicates that stock return changes with the financial market as a whole whereas a negative beta indicates a negative relationship. Normally, each stock beta is calculated individually from CAPM or a market model. In addition, the systematic risk may change over time and will thus generate a long series of beta values for each stock. I; on the other hand, get each quarterly beta for each stock form Bloomberg terminal software which performs the standard estimation period of 2 years to get total 36 betas for each firm.

3. Dividend yield (DY)

Dividend yield indicates the dividend paid by the company in return of the investment of the investor; where dividend is distributed to the shareholder of the company. Based on Fama and French (1988), the formula count dividend yield is derived from constant growth model as follows.

$$DY_t = \frac{Dividend\ per\ share_t}{Price\ per\ share_{t-1}}$$

4. Earning yield (EY)

The earning yield or earning to price ratio is the reversal of P/E or price to earnings ratio. The calculation is as follows.

$$EY_t = \frac{Earning\ per\ share_t}{Market\ value_t}$$

Current earning can be a measurement for the future earnings. It's argued that 'high-risk stocks with high expected returns will have low price relative to earning Fama and French (1992). Negative or zero earning when the company's performance generates loss will not be included in the study and it will be set as zero.

5. Book-to-market ratio (BM)

The book to market ratio refers to book value of a company on the balance sheet, which is the total equity, divided by the current market value or trading price. This ratio is the reciprocal of P/BV ratio. This ratio used by practitioners and academia to analyze whether a stock price is undervalued or overvalued. If this ratio gets higher, it means that stock price seems to be undervalued and expected returns will increase. The formula is shown below.

$$BM_t = \frac{Book\ value\ per\ share_t}{Market\ value\ per\ share_t}$$

6. Leverage (DE)

In terms of financial leverage for each company, the ratio of debt to equity ratio is selected. Debt to equity ratio represents the relative debt to shareholder equity. According to Bhandari (1988), a natural proxy for the risk of common equity of a firm is that's firm's debt to equity ratio. An increase in this ratio increases the risk of its common equity. It's calculated as shown below.

$$DE_t = \frac{Total\ Debt_t}{Total\ equity_t}$$

7. Return on asset (ROA)

Return on asset is regarded as one mesurement of efficiency in terms of management of an asset providing how effcient managment is at using its asset to generate earnings. Similarly, this ratio can be helpful indicator in comparing a company's performance with its competitors. Hence, this ratio should positively affect stock returns. The calculation is shown below.

$$ROA_t = \frac{Net\ income_t}{Total\ asset_t}$$

8. Net profit margin (NPM)

In terms of profitability ratio, net profit margin represents the ability of the firms to generate additional income as compared to the increase in sales. An increase in this ratio means the firm is more profitable. As a result, the stock prices should be increasing accordingly. The formula of this ratio is calculated below

$$NPM_t = \frac{Net\ income_t}{Sales_t}$$

9. Asset turnover (AT)

Asset turnover is an indicator of the efficiency of firm in managing its operation process. It measures a company's ability to generate sales from its assets by comparing net sales with total assets. Therefore, a higher ratio is always more favorable. Higher ratios mean the company uses its assets efficiently. Consequently, an increase in this ratio should positively have an impact on stock returns. The calculation of this ratio is provided below

$$AT_t = \frac{Sales_t}{Total\ assets_t}$$

Descriptive statistics of variables

Table 1: Descriptive statistics

Variables	Notation	Mean	SD	Min	Max	Observation
Return	**R**	7.73037	17.73	-71.016585	93.92531	2,520
Beta	**β**	1.00134	0.9	-4.2976	4.2026	2,520
Earning yield	**EY**	8.399056	6.04	1.02864	58.03494	2,520
Dividend yield	**DY**	4.894343	2.98	0	24.2775	2,520
Book-to-market	**BM**	56.43819	44.64	3.308793	470.3669	2,520
Leverage	**DE**	68.13297	66.62	0	639.1072	2,504
Return on asset	**ROA**	9.018479	6.65	-6.5858	53.0813	2,510
Net profit margin	**NPM**	12.827	22.01	-193.1215	479.4177	2,517
Asset turnover	**AT**	0.939887	0.79	0.0452	4.2026	2,510

(See graphs of mean of variables in the appendix)

4.3 Research Hypothesis

Our main questions are to find the relationship between selected financial ratios in terms of fundamental valuation ratios and accounting ratios and expected stock returns in SET during 2006-2014. According to the previous related literature reviews, we expect to have the sign of predictor variables accordingly. Hence, these hypotheses are imposed.

Main Hypothesis 1: The relationship between the fundamental valuation ratios of listed companies in SET during 2006-2014 and expected future stock returns.

Secondary hypotheses 1:

1.1 There exists the positive relationship between earnings yield (EY) and its ability to predict expected future stock returns.

1.2 There exists the positive relationship between dividend yield (DY) and its ability to predict expected future stock returns.

1.3 There exists the positive relationship between book-to-market (BM) ratio and its ability to predict expected future stock returns.

Main Hypothesis 2: The relationship between the accounting ratios of listed companies in SET during 2006-2014 and expected future stock returns.

Secondary hypotheses 2

2.1 There exists the positive relationship between leverage ratio (DE) and its ability to predict expected future stock returns.

2.2 There exists the positive relationship between return on asset (ROA) and its ability to predict expected future stock returns.

2.3 There exists the positive relationship between net profit margin (NPM) and its ability to predict expected future stock returns.

2.4 There exists the positive relationship between asset turnover (AT) and its ability to predict expected future stock returns.

4.4 Methodology

In order to determine the relationship between stock returns and predictor variables, we have employed predictive regression using panel data (pooled time series cross-section) analysis. By pooling the data, the econometric issues encountered in the time series case can, to some extent, be dealt with more easily. Intuitively, persistent regressors can cause no problems when they are exogenous. When pooling the data, independent cross-sectional information dilutes the endogeneity effects, and thus potentially alleviates the bias effects seen in the time-series case Hjalmarsson (2006). Moreover, pooling data into panel provides more advantages. It provides more observations, more variability, less collinearity among variables, more degree of freedom and more efficiency Baltagi (1995, 3-6).

My panel predictive regression is the modified models of Pandey (2001). In order to see whether which model is suitable for panel data analysis, we compute the Hausman test. The null hypothesis of this test suggests that the random-effects model is more appropriate than the fixed-effects model. Further, most of the test results reject the null hypothesis that

random-effects model is appropriate as compared to the fixed-effects model. As a result, our presentation and analyses of results are based on the fixed-effects model.

We estimate 4 different models based on 2 main specifications. The first one is the univariate regression and multivariate regression. The other one is the types of fixed-effects model which include only the fixed firm effect model and both fixed firm and time effects model. All explanatory variables are EY, DY, BM, DE, ROA, NPM, AT. And, BETA is used to control for individual risk differences of each stock in every model. In addition, one-period lag (t-1) of independent variables is used in the predictive regressions.

Model 1: Univariate with fixed firm effect model

$$R_{i,t} = \alpha_i + \delta_1 \beta_{i,t-1} + \delta_2 X_{i,t-1} + \varepsilon_{i,t}$$

Model 2: Univariate with fixed firm and time effect model

$$R_{i,t} = \alpha_i + \delta_1 \beta_{i,t-1} + \delta_2 X_{i,t-1} + \gamma_t + \varepsilon_{i,t}$$

Model 3: Multivariate with fixed firm effect model

$$R_{i,t} = \alpha_i + \delta_1 \beta_{i,t-1} + \sum_{n=1}^{N} \delta_{n+1} X_{ni,t-1} + \varepsilon_{i,t}$$

Model 4: Multivariate with fixed firm and time effect model

$$R_{i,t} = \alpha_i + \delta_1 \beta_{i,t-1} + \sum_{n=1}^{N} \delta_{n+1} X_{ni,t-1} + \gamma_t + \varepsilon_{i,t}$$

For model 1 and 2: $R_{i,t}$ = Expected returns of i^{th} firm in period t

α_i = Individual effect of i^{th} firm

$X_{i,t-1}$ = Factor of financial ratios of i^{th} firm in period t-1

$\beta_{i,t-1}$ = Systematic risk of i^{th} firm in period t-1

γ_t = Period effect of all firms

δ_n = Estimated coefficients

$\varepsilon_{i,t}$ = Unsystematic error from the predicted $R_{i,t}$ terms

i=1, 2,…, 70 and t=1, 2,…, 36

For model 3 and 4: $R_{i,t}$ = Expected returns of i^{th} firm in period t

α_i = Individual effect of i^{th} firm

$\beta_{i,t-1}$ = Systematic risk of i^{th} firm in period t-1

$X_{ni,t-1}$ = Factor of n^{th} financial ratio of i^{th} firm in period t-1, n=1,2,….,N

γ_t = Period effect of all firms

δ_n = Estimated coefficienst

$\varepsilon_{i,t}$ = Unsystematic error from the predicted $R_{i,t}$ terms

i=1, 2,…,70 t=1, 2,…,36 and N= number of predictor variables

However, the persistence of heteroskedasticity may lead to the inefficiency of the estimators. Therefore, we apply the White-period cluster standard error Arellano (1987) to each model to correct for this problem because it is robust against heteroskedasticity along the cross-section dimension for a fixed period and autocorrelation along the time dimension for a fixed cross-section when the cross-section dimension is higher than the time dimension.

5. Empirical results and analysis

5.1 Unit root tests

Table 2: Unit root tests based on ADF and LLC

Variables	Individual unit root test ADF	Common unit root test LLC
Return	938.569***	-33.4464***
Beta	314.181***	-3.16696***
Earning yield	313.933***	-7.82281***
Dividend yield	309.676***	-9.95223***
Book-to-market	241.626***	-7.63135***
Leverage	507.187***	-16.1903***
Return on asset	270.443***	2.31568*
Net profit margin	1012.39***	-28.7476***
Asset turnover	127.048**	-2.61580**
*Note: ***,** and * indicate rejections of null hypothesis at 1,5 and 10 level of significance respectively*		

Firstly, the unit root test is computed to see whether the variable is stationary or not. Based on various panel unit root tests, augmented dickey fully (ADF) test and Levin, Lin and Chu (LLC) test are selected to test for individual and common unit root test respectively. Both of the tests evaluate the null hypothesis of a unit root. The results from table 2 show that all of the variables exhibit no statistical evidence of presence of a unit root. Therefore, all variables are stationary at level and the regression will not be spurious.

5.2 Regression analysis

To better understand the empirical validity of the models described in the previous section and the effect of financial ratios and stock returns, we first examine the correlations between stock returns and each of the predictor variables. The correlations are described by using the univariate regression. Later, the multivariate regressions are employed to see the incremental explanatory power of the various factors. In addition, the systematic risk or beta is included to each variable to control for the risk difference of each firm in different periods.

It is more appropriate in the panel data analysis to allow for firm-specific stock return differences as stock returns vary considerably across firms. As a result, we employ the panel data fixed-effect models. They control for the underlying time-invariant heterogeneity among firms. In addition, we use data over nine-year period encompassing various economic conditions. Consequently, we also employ the two-way fixed firm and time effect models to account for time effects given the firm effects.

Univariate analysis

According to the estimations of the first model, the univariate regression of stock returns and each of the predictor variables-DY, EY, BM, DE, ROA, NPM and AT. Table 3 provides the results of the fixed-effect model. From the individual regression, the fundamental valuation ratios including DY, EY, and BM are all individually and statistically significant to explain the expected stock returns. All of them have a positive relationship with stock returns. Hence, high dividend-yield, earning-yield and book-to-market ratio stocks seem to earn higher returns than low dividend-yield, earning-yield and book-to-market ratio stocks. In contrast, the accounting variable ratios including DE, NPM, ROA, and AT are all statistically insignificant which means that those ratios are not able to predict returns. In terms of the predictive power measured by the adjusted R^2, DY, EY and BM contribute 3.8%,

3.5% and 5.2% respectively. Therefore, book-to-market ratio has the highest predictive power to explain stock returns followed by dividend yield and earning yield. Moreover, the beta is not significant when it is concluded in each explanatory variable. So, it seems that the systematic risk or beta is no longer able to predict stock returns, which is consistent to the findings of Fama and French (1992).

Table3: Univariate one-way fixed effects model (Model 1)

Predictor variables	**Beta coefficient**	**Predictor variable Coefficient**	**Adjusted R^2**
DY_{t-1}	0.339 (0.517)	**1.638***** (0.198)	**0.038**
EY_{t-1}	0.218 (0.519)	**0.761***** (0.119)	**0.035**
BM_{t-1}	0.611 (0.573)	**0.147***** (0.014)	**0.052**
DE_{t-1}	-0.208 (0.576)	-0.004 (0.008)	-0.007
NPM_{t-1}	-0.192 (0.581)	0.019 (0.016)	0.006
ROA_{t-1}	-0.133 (0.529)	0.133 (0.095)	-0.005
AT_{t-1}	-0.143 (0.546)	-0.815 (1.591)	-0.006

*Note: 1. *******, ****** and ***** indicate significance at 1%, 5% and 10% respectively.*
2. White-period standard error is reported in the parenthesis.

During the period of 2006-2014, Thai stock market and firms passed through different economic conditions. As a result, the underlying relationship between expected stock returns and the explanatory variables may show difference and we apply two-way fixed firm and time effect univariate regression to control for different periods. Table 4 gives the results of model 2. The results disclose that values of adjusted R^2 increase considerably to all of predictor variables and only fundamental valuation ratio variables are still individually and significantly correlated with stock returns but their coefficients reduce as period effect is taken in, given the firm effect. Whereas, in the same line with one-way fixed effect model, accounting ratio variables along with beta remain insignificant. And, book-to-market ratio has the highest predictive power.

Table 4: Univariate two-way fixed effects model (Model 2)

Predictor variables	**Beta coefficient**	**Predictor variable Coefficient**	**Adjusted R^2**
DY_{t-1}	0.201 (0.455)	**1.477***** (0.166)	**0.323**
EY_{t-1}	0.343 (0.519)	**0.756***** (0.154)	**0.312**
BM_{t-1}	0.462 (0.485)	**0.128***** (0.016)	**0.356**
DE_{t-1}	0.173 (0.479)	-0.003 (0.009)	0.015
NPM_{t-1}	0.182 (0.454)	0.052 (0.017)	0.216
ROA_{t-1}	0.251 (0.463)	0.162 (0.094)	0.059
AT_{t-1}	0.259 (0.474)	0.523 (1.499)	0.012

*Note: 1. *******, ****** and ***** indicate significance at 1%, 5% and 10% respectively.*
2. White-period standard error is reported in the parenthesis.

Multivariate analysis

To see the predictive ability of various variables when they are considered together, multivariate regressions are employed. Table 5 summarizes the results of model 3. We begin by investigating various regressions with fixed firm effect model. In addition, we add one more predictor variable in each regression to estimate whether those variables are significant or not. All of the fundamental valuation ratios are all statistically significant in all cases but the coefficients are lower compared to its individual regression. All of the estimated coefficients have the positive signs indicating the positive relationship between fundamental ratios and stock returns. However, among accounting ratios, NPM turns out to be positively significant. The positive relationship indicates that the higher net profit margin firms earn higher returns than the lower ones. In terms of predictive power, the results show that when the DY, EY and BM are in the same regression controlled by beta, the adjusted R^2 has the highest value at 7.1% which is higher than any regressions in model 1. It's notable that beta remains insignificant in all regressions.

Table 5: Multivariate one-way fixed effects model (Model 3)

	(1)	(2)	(3)	(4)	(5)	(6)
$Beta_{t-1}$	0.452 (0.505)	0.699 (0.531)	0.726 (0.541)	0.742 (0.535)	0.803 (0.553)	0.801 (0.549)
DY_{t-1}	**1.171***** (0.234)	**0.621***** (0.254)	**0.626**** (0.255)	**0.646**** (0.259)	**0.641**** (0.266)	**0.648**** (0.262)
EY_{t-1}	**0.466***** (0.145)	**0.315***** (0.144)	**0.316**** (0.143)	**0.288**** (0.145)	**0.332**** (0.154)	**0.333**** (0.155)
BM_{t-1}	-	**0.096***** (0.018)	**0.096***** (0.018)	**0.01***** (0.018)	**0.093***** (0.018)	**0.093***** (0.018)
DE_{t-1}	-	-	0.009 (0.013)	0.009 (0.014)	0.008 (0.013)	0.007 (0.014)
NPM_{t-1}	-	-	-	**0.032*** (0.016)	**0.036*** (0.016)	**0.035*** (0.017)
ROA_{t-1}	-	-	-	-	0.109 (0.107)	0.088 (0.122)
AT_{t-1}	-	-	-	-	-	0.925 (2.156)
Adj.R^2	0.062	**0.071**	0.061	0.064	0.064	0.061

*Note: 1. *****, **** and ***** indicate significance at 1%, 5%, and 10% respectively.*
2. White-period standard error is reported in the parenthesis.

Similar to model 2, we take the period effect into the consideration given the firm effect in accordance with model 4. Table 6 provides the results of this model. All the regressions estimated in the model 4 are consistent with the model 3. All the fundamental valuation ratios are positively significant. On the other hand, among accounting ratios, NPM turns out to be positively significant like in the case of the model 3. Compared to the model 3, predictive power in all regressions is increasing dramatically when the period effect is taken into the consideration. Moreover, the combination of fundamental valuation ratios still contributes to the highest adjusted R^2 at 47.2% which is similar to the studies of Kheradyar, Ibrahim, and Mat Nor (2011). Like other models, beta is not able to explain stock returns.

According to the results of 4 models, we have to accept the main hypothesis 1 that all of the fundamental valuation ratios have a relationship with expected future stock returns in SET during 2006-2014. We have to reject the main hypothesis 2 and conclude that accounting ratios seem to have no relationship with returns except in case of net profit margin that appears to have a little impact as other variables are included in the regression (Model 3 and 4). Furthermore, the coefficient of DY has the highest value indicating that an increase in

dividend yield generates the highest increase in expected stock returns among the predictor variables. On the other hand, in terms of predictive power measured by the adjusted R^2, book-to-market ratio is the most important factor to predict stock returns in SET, as considered by univariate regression (Model 1 and 2), which is similar to the findings of Fama and French (1992), Kothari and Shanken (1997) and Pontiff and Schall (1998).

Table 6: Multivariate two-way fixed effects model (Model 4)

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
$Beta_{t-1}$	0.412 (0.431)	0.501 (0.443)	0.543 (0.455)	0.563 (0.454)	0.618 (0.473)	0.62 (0.472)
DY_{t-1}	**0.993***** (0.171)	**0.749***** (0.182)	**0.752***** (0.183)	**0.757***** (0.184)	**0.767***** (0.185)	**0.765***** (0.183)
EY_{t-1}	**0.616***** (0.156)	**0.527***** (0.161)	**0.527***** (0.159)	**0.501**** (0.161)	**0.508**** (0.173)	**0.509**** (0.172)
BM_{t-1}	-	**0.079***** (0.015)	**0.079***** (0.015)	**0.082***** (0.015)	**0.081***** (0.016)	**0.082***** (0.016)
DE_{t-1}	-	-	0.008 (0.009)	0.008 (0.009)	0.008 (0.011)	0.009 (0.008)
NPM_{t-1}	-	-	-	**0.035*** (0.016)	**0.036*** (0.017)	**0.036*** (0.018)
ROA_{t-1}	-	-	-	-	0.015 (0.121)	0.024 (0.142)
AT_{t-1}	-	-	-	-	-	0.427 (2.554)
Adj.R^2	0.457	**0.472**	0.454	0.456	0.454	0.452

*Note: 1. *******, ****** and ***** indicate significance at 1%, 5%, and 10% respectively.*
2. White-period standard error is reported in the parenthesis.

5.3 Investment Strategies

Next, we create the investment strategies based on the previous regression results. Fundamental valuations ratios seem to play an important role in predicting the stock returns. As a consequence, the portfolios are constructed based on these ratios. Firstly, 70 selected stocks used in this study are ranked based on the average value of EY, DY, and BM from the highest to the lowest. Secondly, 6 portfolios are constructed where each portfolio comprises of 5 stocks. Stocks that are included in each portfolio are selected in accordance with 5 stocks with the highest and lowest average values of EY, DY, and BM. In addition, as the predictive power of financial ratios is enhanced when they are considered together, 2 mixed portfolios

consisting of 6 stocks, whose stock components compose of the 2 highest and lowest average values of EY, DY and BM for high-mixed and low-mixed respectively, are constructed. Therefore, 8 portfolios are constructed as follows.

Table 7: Lists of Portfolios

Portfolio 1: HEY	Highest average earnings yield portfolio
Portfolio 2: LEY	Lowest average earnings yield portfolio
Portfolio 3: HDY	Highest average dividends yield portfolio
Portfolio 4: LDY	Lowest average dividends yield portfolio
Portfolio 5: HBM	Highest average book-to-market ratio portfolio
Portfolio 6: LBM	Lowest average book-to-market ratio portfolio
Portfolio 7: HM	Highest average of earnings yield, dividends yield, and book-to-market ratio combination portfolio
Portfolio 8: LM	Lowest average of earnings yield, dividends yield, and book-to-market ratio combination portfolio

Thirdly, the portfolios are categorized into 2 types; the maximum risk-adjusted or Sharpe ratio and equal-weighted portfolios. We begin by conducting the weight of each stock in each portfolio to maximize the Sharpe ratio. Generally, the greater the value of the Sharpe ratio, the more attractive the risk-adjusted return. The period of portfolios' weight construction includes *2006Q1 to 2013Q4*. Next, after we get the maximum weights in each portfolio, they are kept constant and used to calculate the portfolios' Sharpe ratio during *2014Q1 to 2015Q3*. And, the equal-weighted portfolios are also calculated for the Sharpe ratio during this period. In addition, we annualize the quarterly Sharpe ratio to get the annual Sharpe ratio as

compared to the yearly investment horizon indicators. The further details of stock selection for each portfolio and Sharpe ratios are provided in the appendix.

Table8: Annualized Returns, Volatility and Sharpe ratio of Portfolios during 2014Q1-2015Q3

Portfolio	Return (%)		Volatility(SD)		Sharpe ratio	
	Max Sharpe	Equal Weighted	Max Sharpe	Equal Weighted	Max Sharpe	Equal weighted
1.HEY	26.908	24.318	28.521	14.661	0.943	1.659
2.LEY	10.503	27.204	15.603	11.917	0.673	2.283
3.HDY	14.215	19.597	29.535	48.202	0.481	0.407
4.LDY	24.930	33.333	27.644	22.332	0.902	1.493
5.HBM	10.277	22.960	16.052	13.061	0.640	1.758
6.LBM	1.4034	14.095	11.174	13.918	0.126	1.013
7.HM	14.893	26.651	15.214	14.741	0.979	1.808
8.LM	2.534	10.952	12.259	17.954	0.207	0.610
Market Benchmark	6.599859		14.27816		0.46223456	

The results displayed via Table 8 (see the separate graphs in the appendix) show the performances of 8 portfolios in terms of return, volatility, and Sharpe ratio. Similar to our previous regression analysis, after controlling for the risk difference of firms by beta, the risk-adjusted return shows the effective of portfolios. During the period of 2014 to 3rd quarter of 2015, the performances of highest average of fundamental valuation ratio oriented portfolio mostly outperform the lowest ones. However, in case of DY, the results reveal the failure of these ratios to gain higher returns because HDY's Sharpe ratios are lower than LDY's in both portfolios. Essentially, BM consistently contributes the highest predictive power as shown by the portfolio stimulation. The discrepancy of returns and Sharpe ratio between LBM and HBM portfolio is notably huge. They reveal the higher book-to-market portfolio is strongly outperforming the lower ones. To compare with the market performance, SETTRI or total set return index is employed as to calculate the Sharpe ratio for the market benchmark. The majority of portfolios earns higher Sharpe ratio than the market. However, LBM portfolio

with maximum-Sharpe ratio earns lower Sharpe ratio than the market as well as HDY with equal-weighted portfolio. Additionally, the combination of financial ratios enhance the predictive power as the highest mixed (HM) portfolio mostly provides higher returns than lowest mixed (LM) portfolio and other single-ratio oriented portfolio in either max-Sharpe ratio or equal-weighted portfolios including the market benchmark as well. From the construction of portfolios, it's notable that equal-weighted portfolios in overall are outperforming the maximum-Sharpe ratio portfolios. Hence, maximum-Sharpe ratio strategy may be invalid for Thai market as compared with equal-weighted one. To some extent, investors can rely on these financial ratios as guidance for gaining higher or desirable expected returns, where book-to-market ratios and combination of financial ratios seem to be the robust indicators.

6. Conclusions and Implications

This research studies the predictive power of financial ratios which consists of 2 groups and stock returns. Firstly, fundamental valuation ratios include dividend yield, earnings yield and book-to-market ratio. Secondly, the accounting ratios based on various indicators including the leverage measured by debt to equity ratio, the profitability measured by net profit margin, the efficiency ratio measured by return on asset ratio and the activity ratio measured by asset turnover ratios.

Based on panel data analysis, we select 70 firms in SET during 2006 to 2014 using quarterly basis that results in total of 2,520 observations. One-way and two-way with univariate and multivariate fixed-effect regressions are employed. The systematic risk or beta is included in every regression to control for the risk differences among firms.

Overall results suggest that the fundamental valuation ratios seem, to some extent, have positively predictive power, regarding to the low adjusted R^2 in all models. Whereas, in the case of accounting ratios, only net profit margin seems to positively correlate with stock returns as the period effect is taken in the regressions. Book-to-market ratio is the dominant factor to predict stock returns due to its highest predictive power. Furthermore, the combination of fundamental valuation ratios enhances stock return predictability. Hence, the financial ratios seem to play unique and complementary roles on stock return predictability. Correspondingly, the empirical evidences from portfolio stimulations indicate the robustness of book-to-market ratios and combination of fundamental valuation ratios to achieve higher the risk-adjusted return or Sharpe ratio, while dividend yield and earning yield portfolios encounter weak results.

Nonetheless, these studies encounter some limitations. Firstly, the stocks used are limited, only70 companies in SET. In addition, the time period covered in this study is rather short. This research would provide better results if a longer period of time could be tested. Secondly, the financial ratios used in this study are limited to easily accessed basic ratios. The use of other ratios might yield different results. Thirdly, the portfolio stimulations are based on the static of average financial ratios which may not be suitable because the time varying of financial ratio could produce more desirable results.

Thus, recommendations for further studies are as follows. Firstly, an increase in the number of studied stocks as much as possible will provide a clearer picture of results, and more sophisticated financial ratios can be used to further test the conclusion observed in this study. Such ratios may not be easily obtained and commonly used compared to the ones in this study, but may yield better returns. Secondly, the time interval to adjust portfolios can be added. Since the robustness of study will be enhanced if the portfolio are adjusted accordingly with the lag of predictor variables such as monthly, quarterly, semi-annually and annually adjustments. And, it can be further studied to see which holding periods lead to better portfolio performance.

In conclusion, in spite of the limitations, the empirical results found in this study imply that the Thai stock market is not efficient. Investors that are interested in investing in SET can, to some extent, adopt the stock-selecting approach for their effective investments by using such basic screening rules in this study.

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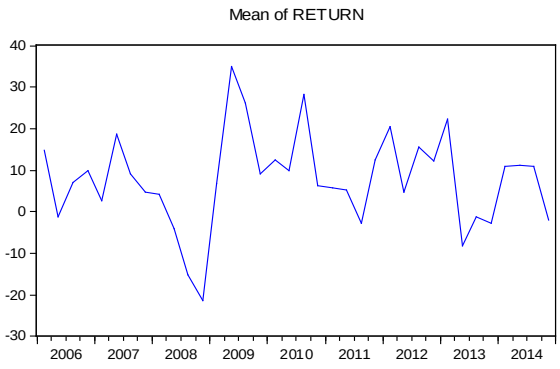
Appendix

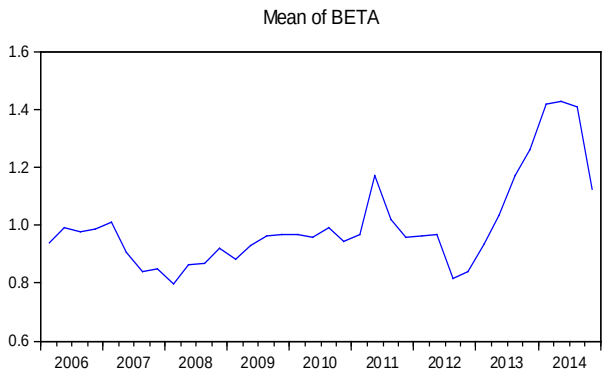
Appendix 1: Selected companies in SET used in this study

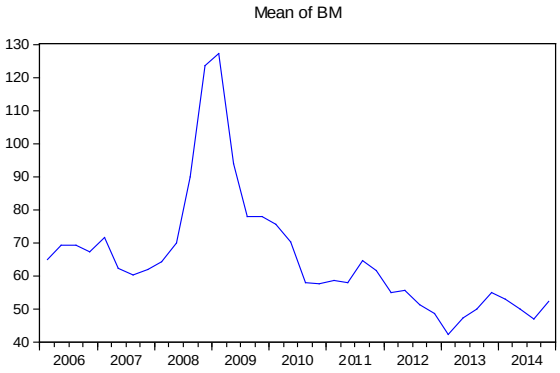
No	Stock Name	Stock long name
1	ADVANC	ADVANCED INFO SERVICE PUBLIC COMPANY LIMITED
2	AIT	ADVANCED INFORMATION TECHNOLOGY PUBLIC CO.,LTD.
3	AMARIN	AMARIN PRINTING AND PUBLISHING PUBLIC COMPANY LIMITED
4	AMATA	AMATA CORPORATION PUBLIC COMPANY LIMITED
5	AOT	AIRPORTS OF THAILAND PUBLIC COMPANY LIMITED
6	AP	AP (THAILAND) PUBLIC COMPANY LIMITED
7	ASP	ASIA PLUS GROUP HOLDINGS PUBLIC COMPANY LIMITED
8	AYUD	SRI AYUDHYA CAPITAL PUBLIC COMPANY LIMITED
9	BANPU	BANPU PUBLIC COMPANY LIMITED
10	BAY	BANK OF AYUDHYA PUBLIC COMPANY LIMITED
11	BBL	BANGKOK BANK PUBLIC COMPANY LIMITED
12	BCP	THE BANGCHAK PETROLEUM PUBLIC COMPANY LIMITED
13	BCH	BANGKOK CHAIN HOSPITAL PUBLIC COMPANY LIMITED
14	BDMS	BANGKOK DUSIT MEDICAL SERVICES PUBLIC COMPANY LIMITED
15	BEC	BEC WORLD PUBLIC COMPANY LIMITED
16	BECL	BANGKOK EXPRESSWAY PUBLIC COMPANY LIMITED
17	BH	BUMRUNGRAD HOSPITAL PUBLIC COMPANY LIMITED
18	BIGC	BIG C SUPERCENTER PUBLIC COMPANY LIMITED
19	BKI	BANGKOK INSURANCE PUBLIC COMPANY LIMITED
20	CENTEL	CENTRAL PLAZA HOTEL PUBLIC COMPANY LIMITED
21	CK	CH. KARNCHANG PUBLIC COMPANY LIMITED
22	CPALL	CP ALL PUBLIC COMPANY LIMITED
23	CPF	CHAROEN POKPHAND FOODS PUBLIC COMPANY LIMITED
24	CPN	CENTRAL PATTANA PUBLIC COMPANY LIMITED
25	DELTA	DELTA ELECTRONICS (THAILAND) PUBLIC COMPANY LIMITED
26	EGCO	ELECTRICITY GENERATING PUBLIC COMPANY LIMITED
27	GLOW	GLOW ENERGY PUBLIC COMPANY LIMITED
28	HANA	HANA MICROELECTRONICS PUBLIC COMPANY LIMITED
29	HEMRAJ	HEMARAJ LAND AND DEVELOPMENT PUBLIC COMPANY LIMITED
30	HMPRO	HOME PRODUCT CENTER PUBLIC COMPANY LIMITED
31	INTUCH	INTOUCH HOLDINGS PUBLIC COMPANY LIMITED
32	KBANK	KASIKORNBANK PUBLIC COMPANY LIMITED
33	KGI	KGI SECURITIES (THAILAND) PUBLIC COMPANY LIMITED
34	KTB	KRUNG THAI BANK PUBLIC COMPANY LIMITED
35	LANNA	THE LANNA RESOURCES PUBLIC COMPANY LIMITED
36	LH	LAND AND HOUSES PUBLIC COMPANY LIMITED
37	LPN	L.P.N. DEVELOPMENT PUBLIC COMPANY LIMITED
38	MAJOR	MAJOR CINEPLEX GROUP PUBLIC COMPANY LIMITED

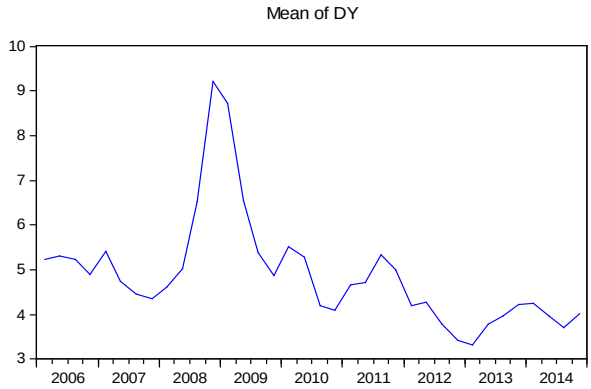
39	MAKRO	SIAM MAKRO PUBLIC COMPANY LIMITED
40	MBK	MBK PUBLIC COMPANY LIMITED
41	MBKET	MAYBANK KIM ENG SECURITIES (THAILAND) PUBLIC COMPANY LIMITED
42	MCOT	MCOT PUBLIC COMPANY LIMITED
43	MINT	MINOR INTERNATIONAL PUBLIC COMPANY LIMITED
44	MODERN	MODERNFORM GROUP PUBLIC COMPANY LIMITED
45	NOBLE	NOBLE DEVELOPMENT PUBLIC COMPANY LIMITED
46	OISHI	OISHI GROUP PUBLIC COMPANY LIMITED
47	PAP	PACIFIC PIPE PUBLIC COMPANY LIMITED
48	PS	PRUKSA REAL ESTATE PUBLIC COMPANY LIMITED
49	PTT	PTT PUBLIC COMPANY LIMITED
50	PTTEP	PTT EXPLORATION AND PRODUCTION PUBLIC COMPANY LIMITED
51	QH	QUALITY HOUSES PUBLIC COMPANY LIMITED
52	RATCH	RATCHABURI ELECTRICITY GENERATING HOLDING PUBLIC CO.,LTD.
53	SAMART	SAMART CORPORATION PUBLIC COMPANY LIMITED
54	SC	SC ASSET CORPORATION PUBLIC COMPANY LIMITED
55	SCB	THE SIAM COMMERCIAL BANK PUBLIC COMPANY LIMITED
56	SCC	THE SIAM CEMENT PUBLIC COMPANY LIMITED
57	SIRI	SANSIRI PUBLIC COMPANY LIMITED
58	SNP	S & P SYNDICATE PUBLIC COMPANY LIMITED
59	SPALI	SUPALAI PUBLIC COMPANY LIMITED
60	SPC	SAHA PATHANAPIBUL PUBLIC COMPANY LIMITED
61	STA	SRI TRANG AGRO-INDUSTRY PUBLIC COMPANY LIMITED
62	STANLY	THAI STANLEY ELECTRIC PUBLIC COMPANY LIMITED
63	TCCC	THAI CENTRAL CHEMICAL PUBLIC COMPANY LIMITED
64	TICON	TICON INDUSTRIAL CONNECTION PUBLIC COMPANY LIMITED
65	TOP	THAI OIL PUBLIC COMPANY LIMITED
66	TPA	THAI POLY ACRYLIC PUBLIC COMPANY LIMITED
67	TPC	THAI PLASTIC AND CHEMICALS PUBLIC COMPANY LIMITED
68	TU	THAI UNION GROUP PUBLIC COMPANY LIMITED
69	TVO	THAI VEGETABLE OIL PUBLIC COMPANY LIMITED
70	UP	UNION PLASTIC PUBLIC COMPANY LIMITED

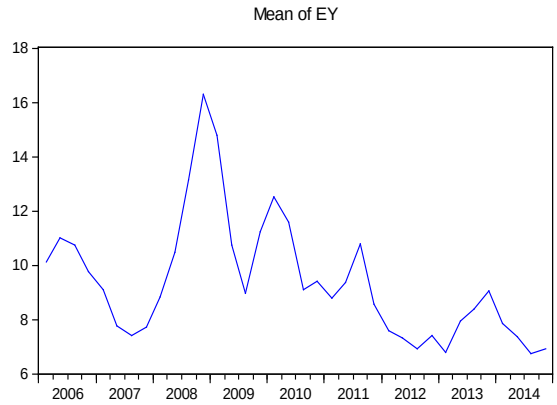
Appendix 2: Graphs of Mean variables over time

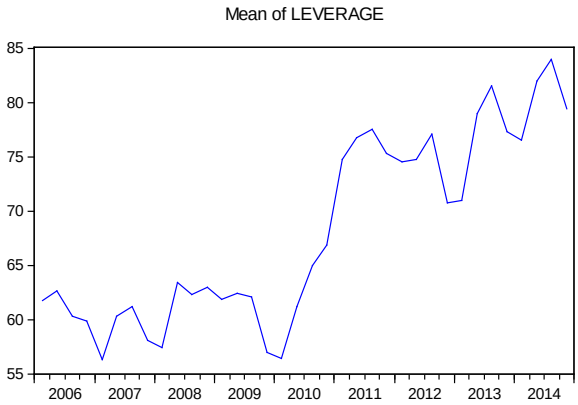


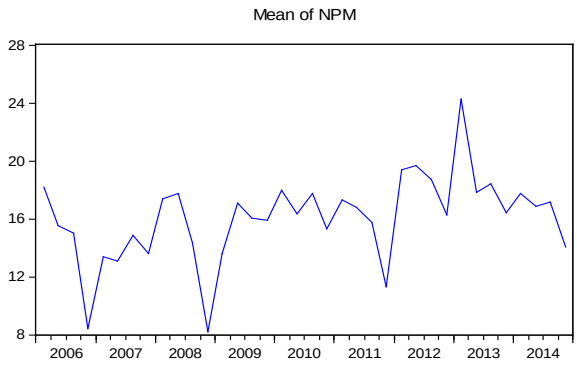


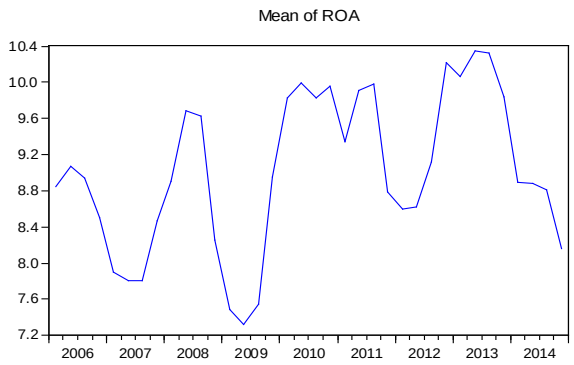


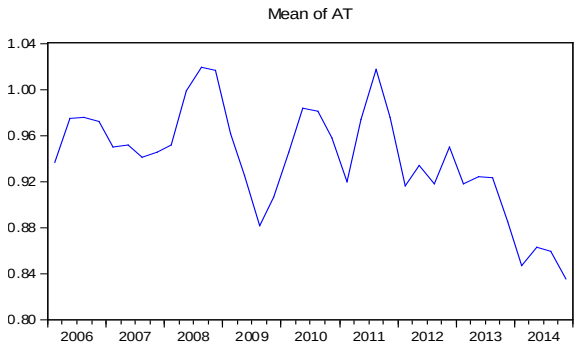












Appendix3: Sharpe ratio

Sharpe ratio

Sharpe ratio is a ratio developed by Sharpe (1994) that is used in analyzing the risk-adjusted returns. This makes it possible to compare returns on investment to make sure that the excess return is not due to increased risk. The higher Sharpe ratio indicates the higher investment efficiency. The value can be obtained as follows:

$$Sharpe\ Ratio = \frac{r_p - r_f}{\sigma_p}$$

r_p = portfolio's expected rate of return

r_f = rate of return on a risk-free asset (based on a10-year government bond in this case)

σ_p = standard deviation of the portfolio's rates of return

Appendix 4: Portfolios' selection

Portfolio1: HEY (High earning yield)

Stock	Max-Sharpe portfolio weight	Equal-weighted portfolio weight	Average EY
SPALI	0.220	0.2	18.910
STA	0.000	0.2	17.969
AIT	0.407	0.2	19.072
TCCC	0.373	0.2	14.203
SIRI	0.000	0.2	17.506

Portfolio 2: LEY (Low earning yield)

Stock	Max-Sharpe portfolio weight	Equal-weighted portfolio weight	Average EY
MINT	0.000	0.2	4.002
CPN	0.000	0.2	4.023
BDMS	0.248	0.2	4.154
BEC	0.685	0.2	4.833
BH	0.067	0.2	4.934

Portfolio 3: HDY (High dividend yield)

Stock	Max-Sharpe portfolio weight	Equal-weighted portfolio weight	Average DY
TCCC	0.121	0.2	9.150
MODERN	0.133	0.2	7.723
AIT	0.000	0.2	8.252
PAP	0.098	0.2	8.962
UP	0.648	0.2	9.779

Portfolio 4: LDY (Low dividend yield)

Stock	Max-Sharpe portfolio weight	Equal-weighted portfolio weight	Average DY
MINT	0.000	0.2	2.227
KBANK	0.000	0.2	1.572
BAY	0.000	0.2	1.141
BH	1.000	0.2	2.255
CK	0.000	0.2	2.491

Portfolio 5: HBM (High book-to-market ratio)

Stock	Max-Sharpe portfolio weight	Equal-weighted portfolio weight	Average BM
UP	1.000	0.2	105.285
KGI	0.000	0.2	125.959
PAP	0.000	0.2	126.879
STA	0.000	0.2	134.493
SIRI	0.000	0.2	140.102

Portfolio 6: LBM (Low book-to-market ratio)

Stock	Max-Sharpe portfolio weight	Equal-weighted portfolio weight	Average BM
BEC	0.566	0.2	11.451
OISHI	0.195	0.2	26.180
CPN	0.000	0.2	26.636
MINT	0.000	0.2	28.517
BDMS	0.239	0.2	28.582

Portfolio 7: HM (High mixed)

Stock	Max-Sharpe portfolio weight	Equal-weighted portfolio weight	TYPE
SPALI	0.081	0.167	HEY
AIT	0.014	0.167	HEY
TCCC	0.172	0.167	HDY
UP	0.733	0.167	HDY
KGI	0.000	0.167	HBM
STA	0.000	0.167	HBM

Portfolio 8: LM (Low mixed)

Stock	Max-Sharpe portfolio weight	Equal-weighted portfolio weight	TYPE
MINT	0.000	0.167	LEY
CPN	0.165	0.167	LEY
KBANK	0.000	0.167	LDY
BAY	0.000	0.167	LDY
BEC	0.585	0.167	LBM
OISHI	0.260	0.167	LBM

Appendix 5: Annualized Return, Volatility and Sharpe ratio of Portfolios and Market