The over-valuated Stock Exchange of Thailand (SET) index and Monetary Policy Implementation

NUTTHANUN JAROENJITUKUL

PRESENTED TO

DR. BENJARONG SUWANKIRI AND DR. PIMNARA HIRANKASI

IN FULFILLMENT OF THE REQUIREMENTS

FOR THE COURSE EE439 SEMINAR IN MONETARY AND FINANCIAL ECONOMICS

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Abstract:

Can the over-valuation of Stock Exchange of Thailand (SET) index be detected? To extract the fundamental price of the Stock Exchange of Thailand (SET) index, we have used the Earning per share approach and other mathematic calculations. By employing the Generalized Autoregressive Conditionally Heteroscedastic (GARCH) process, we found that today's over-valuation of the Stock Exchange of Thailand (SET) index is close to its size in 1996. The impact of the size of over-valuated Stock Exchange of Thailand (SET) index, value of portfolio investment and real effective exchange rate (REER) may be explained by policy rate, using the Vector Autoregression (VAR) model.

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Over-valuated Stock Exchange of Thailand (SET) index and Monetary Policy Implementation

1. Introduction

The stock market plays an important role in mobilizing resources and diverting them in productive channels. In this way, it facilitates and promotes the process of economics growth in the country, especially in emerging market economies that have a limited saving. It links companies to investors and offer savers the chance to make a higher return from their money. However, any investment in the stock market involves an element of risk. In figure 1, it is shown that during December 2012 to March 2013, the Stock Exchange of Thailand (SET) index had both risen dramatically since December 2012 and dropped remarkably on March 2013. According to John Burr Williams (1938), he said the rising of stock price should come from its fundamental value of its underlying business. However, in reality, in most cases, expectation and speculation come to play a role in stock price determination. Investors no longer look at only the fundamental value of business, but speculate a resale price. It can be suspected that the increase in SET index indeed was not driven by only its fundamental value but also speculation in which embedded. Looking at a volume part in figure 1, it also supports this belief. After interviews from top five security companies in Thailand, Finansia Syrus security, Kasikorn securities, SCB securities, Bualuang securities, and TISCO securities, they said with one voice that recently, a number of new accounts have been requested to open. Therefore, the expected result is that the rising in SET index during December 2012 to March 2013 was not only driven by its fundamental value but also the speculation influence, mainly from new investors who invest their money because they see the way to increase their return from the stock market.

Figure 1: Stock Exchange of Thailand (SET) index and its Volume

Source: Trade Economics

Hence, this leads to the first objective of this paper which is to identify and measure the proxy of the over-valued size of the Stock Exchange of Thailand index.

The author hopes that it may be useful to both investors and government agencies as the urgent warning of asset price bubble. Meaning, this measurement may warn us when the over-valued size of SET index exceeds its fundamental value. To detect the fundamental value from the SET index, dividend discount model is employed.

After getting the proxy of over-valuated size of SET index, this paper also attempts to test the power of monetary tools like interest rate and its effect on the Thai economy. This paper includes another three variables which is policy rate, real effective exchange rate, and value of portfolio investment in the model. Hence this leads into the second and third objectives which are to see the relationship among these four variables by using vector autoregressive model (VAR) and to suggest the monetary policy implementation to Bank of Thailand.

The author hopes that readers will benefit from this knowledge and perceive more understanding about the asset over-pricing and monetary policy implementation. The author believes that by tracking the current situation which Thailand is facing nowadays not only yields an advantage to scholars in the academic world as a case study but also to the general person who desires to understand this phenomenon and apply this into his/her business strategies.

1.1. Objectives of the study

To identify and measure the proxy of asset over-pricing level

To see the relationship among four variables, policy rate, value of portfolio investment, real effective exchange rate and proxy of over-valued size.

To suggest the monetary policy implementation

2. Source of Data

The paper employs monthly data of earnings per share of SET index, provided in the Stock Exchange of Thailand website. For the interest rate, policy rate is employed, and for real effective exchange rates, they come from International Monetary Fund (IMF) data. For the portfolio investment, this paper uses the data from Bank of Thailand (BoT), which mainly obtained data through International Transaction Reporting System (ITRS). The range of all data is from May 2000 to October 2012 due to the fact that policy rates were first used by Bank of Thailand on May 2000 and last on October 2012.

3. Review of Literature

The literature reviewed here mainly consists of studies in asset price behavior during the boom economy period.

The first work to be reviewed here is the work of Ito and Iwaisako (1995). They paid attention to the linkage of the stock market and effects of monetary policy. They found that the monetary policy, interest policy, apparently did affect asset prices. However, according to study of Glindro and Delloro (2010), they argued that the increase of stock price during

bubble period was unable to be explained fully by the movement of interest rate, but the overly optimistic expectations on the part of investors and then turned speculative.

In addition, the studied Gurkaynak (2005) also supported the usefulness detect the fundamental part of asset price instead of using its actual price. He employed the various econometric tests of asset price bubbles. Despite recent advance, there is no single method of fundamental calculation that is widely satisfied. Yet, the next study of Taboga (2011), he proposed his paper by employing earning per share ratio to be an effective gauge of under/over-valuation of a corporation's stock. It suggested that the model would have been able to provide early warning signs of mis-valuation in real time.

Therefore, it is also interesting to determine the forecasting power of the earning per share ratio in Thailand, as well as, its supporting explanations behind the scene.

4. Theoretical Framework and Methodology

4.1 The definition of asset price over-valuation

Before, we go any further with methodology; it is necessary to understand the definition of asset price over-valuation. There are many definitions of asset price bubble provided by many literatures, but only few of them talk about asset price over-valuation. As such this paper employs the terms of asset price bubble's definition to explain the definition of asset price overvaluation. These two definitions seem to be similar; the difference is just a matter of size and damage's consequence.

Stiglitz (1990) said; "if the reason that the price is high today is only because investors believe that the selling price will be higher tomorrow, when "fundamental" factor do not seem to justify such a price, then a bubble exists".

Garbe (2000) relates the bubble to deviation from "fundamentals" and states that "the definition of bubble is that part of asset price movement that is unexplainable based on what we call fundamentals".

Siegel (2003) suggests that they are not necessarily a bubble since expectations of cash flows many years in the future may deviate prices from their fundamental values in the short term. One must wait a sufficient period of time to see how the future plays out before anyone can identify a bubble, particularly during an upswing.

Therefore, to simplify the proxy of over-valued size definition is when the asset price increase is higher than the fundamental value of that asset, particularly in long term relationship.

$$b_t = \frac{P_t - P_t^f}{P_t}$$

where b_t is proxy of overvaluation, P_t is stock price at time t and P_t^f is the fundamental of that asset.

4.2 Detect the proxy of asset price over-valuation

Following the definition of over-valued size, the main concern in measuring the size of overvaluation is to find out the fundamental price of the asset. In this paper, only the fundamental price of SET index is employed. Even though there are many studies that try to measure the fundamental price of stock, from the hardest like state space, to the simplest like dividend discount model, there is no single method of fundamental calculation that is widely satisfied.

One of the most widely used economic and financial theories to explain equity price is "dividend discounted model". The model is based on a simple condition which links the time-series of real stock prices to the time-series of real dividend payments, given the expected rate of return is constant.

Step1: Dividend Discounted Model

Studied by Shiller (1981), the present value of stock equates to the present discounted value of expected future dividend payments.

$$P_t = \sum_{i=1}^{\infty} \left(\frac{1}{1+r}\right)^i E_t(d_{t+i})$$

where P_t is present value of asset price, d_{t+i} is the expected future dividend payment and r is the interest rate.

However, in the real world this equation might not hold, claimed by Hodrick (1994). He said that the model should not include only a discounted model but also introduces the error term, so-called bubble or over-valued size in this case, B_t.

$$\begin{aligned} P_t &= \sum_{i=1}^{\infty} \left(\frac{1}{1+r}\right)^i E_t(d_{t+i}) + B_t \\ \textit{such that } E_t(B_{t+1}) &= (1+r)B_t \end{aligned}$$

Gurkaynak (2005) introduced his paper named Econometric Test of Asset Price Bubbles. He claimed that when investors determine the asset price, they take into account two components which are a "market fundamental" part, which is the discounted value of expected future dividends, and the expected future price of stock itself.

$$E_t(P_{t+i-1}) = \frac{1}{1+r} E_t(P_{t+i} + d_{t+i}).$$

Therefore, the price of an asset today is the sum of the net present value of expected future dividend and expected future resale price.

When combining these two approaches together we get the following equation.

$$P_t = \sum_{i=1}^{\infty} \left(\frac{1}{1+r}\right)^i E_t(d_{t+i}) + \lim_{i\to\infty} \left(\frac{1}{1+r}\right)^i P_{t+i.} + B_t$$

Gurkaynak stated that if there is a positive bubble and it is positive in terms of expected future resale price, this cannot be an equilibrium price in long term as all agents will want to sell the asset infinite time until the price falls to the fundamental level.

$$\lim_{i\to\infty} \left(\frac{1}{1+r}\right)^i P_{t+i.}$$ should be equal to zero

In conclusion, the in final equation for econometrics is

$$P_t = \sum_{i=1}^{\infty} \left(\frac{1}{1+r}\right)^i E_t(d_{t+i}) + B_t$$

Step2: Use earnings per share instead of dividend.

According to the dividend discount model, dividend is the function of present value of price, excluding error term (B_t)

$$P_t = \sum_{i=1}^{\infty} \left(\frac{1}{1+r}\right)^i E_t(d_{t+i}).$$

Simple equation: $P_t = \beta\,(d_{t+i})$ when $\sum_{i=1}^{\infty}\left(\frac{1}{1+r}\right)^i = \beta$

According to the dividend discount model, the value of dividend today is the function of expected future dividend, plus intercept and some value of error term.

$$d_{t+1} = \mu + d_t + \epsilon_{t+1}$$

Therefore,

$$P_t = \beta(\mu + d_t + \epsilon_{t+1})$$

Hence, writing in simple equation form: $P_t = k(d_t)$

where μ is the intercept in dividends, d_t is the dividends at time t, and ϵ_t is the a normal random variable with conditional mean zero and constant variance. Furthermore this paper assume that at period-t dividends are known when P_t is set, the present-value stock price is directly proportional to dividends, like what states in simple equation form. This set of assumptions therefore provides possible motivation for the measure of fundamental price.

However, for empirical sakes, this study decides to use earnings per share (EPS_t) instead of dividend payments per share (D_t). There are three reasons to support this change…

1) In reality, not every company in the Stock Exchange of Thailand pay dividend to investors. Some corporations, for example, may decide to defer dividend payments to shareholders, in order to use company income to expand their investment projects. Some companies may announce paying dividend payment to retain confidentiality from investors, even though their companies might make a loss during that period. Hence, using dividend might not be an appropriate variable to reflex the fundamental value of companies.
2) Today's investors normally tend to look at price per earnings ratio in making decisions to purchase stocks, instead of looking at the dividend yield.
3) Earnings per share (EPS) are calculated from the bottom line of firm to number of shares. Therefore, it gives a more accurate sense about the fundamental value of the firm. Furthermore, it is still consistent with the dividend theory because dividend is derived from dividend payout ratio from the firm's bottom line.

Owing to the above reasons, this study will use monthly data series of stock price (P_t) and earnings per share (EPS_t) in the empirical works. We assume that dividend payment (d_t), which is derived from dividend payout ratio, is a linear function of reported EPS_t represented by the following equation

$$d_t = \alpha_1 + \alpha_2 (EPS_t) + €_t$$

Combine equation:

$$P_t = k(\alpha_1 + \alpha_2 (EPS_t) + €_t)$$

$$P_t = k\alpha_1 + k\alpha_2 (EPS_t) + k€_t$$

Thus,

$$P_t = ¥ + ¶ (EPSt) + £$$

Where, $k\alpha_1 = ¥$, $k\alpha_2 = ¶$, and $k€_t = £$

In addition, this paper also includes dummy variables to capture structural change and to make sure our model is clean. Three periods of dummy variables are included which are d1 (2003:06-2012:10), d2 (2008:05-2008:12) and d3 (2009:10-2012:12). The reason of using these dummies is the following.

Firstly, during 2003, there is structural change from 2003:06 to 2012:12. This paper expects that this phenomenon happened due to both external and domestic factors expecting the Thai economy to boom, especially from the tourism section which has significantly increase compared to the quarter before. During the first half the year, uncertainties regarding the US- Iraqi War and the outbreak of SARS affected confidence to some extent, resulting in the postponement of some investment projects as well as the reduction in tourism-related income. However, with the concerns fading away in the third quarter, the Thai economy rebounded robustly, confirming its strong economic fundamentals and resilience to external shocks. In addition, during this time Prime Minister Thaksin Sinnawat, who employed the expansion fiscal policy, especially supported investment and household sector. By combining these two main and other positive factors, the Thai economy rebounded robustly and adjusted

to a new, higher standard of mean level since then. Therefore, this paper uses the period after 2003:06 equate to 1 to represent the real structural change of economy, 0 is otherwise.

Secondly, during 2008 Subprime crisis occurred. It caused the price of SET index to dropdown dramatically. However, this shock had an impact on the Thai economy and the Thai stock market for just a short period, from 2008:05 to 2008:12. After that, the Thai stock market had recovered and fluctuated around its normal mean. Hence, this paper assigns 1 during the effect of crisis to detect this abnormal phenomenon and 0 is otherwise.

Third, during 2009:10 to 2012:12, even if the US economy has not recovered fully from the considered crisis, the Federal Reserve lounged a new policy, so-called Quantitative-easing with the hope of recovering the US economy. This monetary policy not only affects the US economy but the globe. Many countries, especially emerging market economies in the Asian region, had to absorb this excessive liquidity of global financial imbalance. Consequently, the amount of capital mobility flows into these Asian countries especially in the equity and bond market which have the capability to clean money easily. Furthermore, during this period, Chinese economy delivered positive news to the world by announcing its impressive Gross Domestic Product growth. This caused the stock price to increase continuously beyond the normal mean. Therefore, this paper assign 1 during 2009:10-2012:12, and 0 is otherwise.

Therefore the final equation for econometric is

$$P_t = \gamma + \P (EPSt) + D1 + D2 + D3 + \pounds$$

Step 3: Run regression by using GARCH method

First, the paper begins with testing the stationary of SET index and earnings per share series by using Augmented Dickey-Fuller (ADF) test with trend and intercept. The paper found that both of these two variables are non-stationary with the level but it will be stationary after taking the first differential. Furthermore, since this paper's objective is to see the long-term relationship between these two variables, the Johansen Cointegration test is suitable to employ. This paper found that, empirically, there is long run relationship between these two variables.

Next, in terms of regression tools, since this paper mainly deals with the time series data such as asset price there are special problems involved in this beta estimation of financial assets. These asset prices are characterized by the phenomenon known as "volatility clustering", that is, periods in which they exhibit wide swings or as extended time period followed by a period of comparative tranquility. Hence to capture this volatility clustering problem, Generalized Autoregressive Conditional Heteroscedasticity (GARCH) models is employed.

Step4: Get the proxy fundamental value of stock price based on earnings per share approach.

$$P_t^f = \P (EPSt) + D1 + D2 + D3$$

Step5: To get the proxy of the gap between real price of stock and estimated fundamental value of the stock, so-called price gap or over-valuated size of SET index.

$$b_t = \frac{P_t - P_t^f}{P_t}$$

After we estimated over-valued size of SET index, the next objectives are to study the relationship between the proxy of over-valuation size, policy rate, portfolio investment and real effective exchange rate. Although we are not certain about the structural relationship between those variable, we know that based on theory and empirical evident these variables are endogenous among each other. This paper has to employ econometric techniques that need minimal theoretical demands on structure of a model. The Vector Autoregressive (VAR) technique is fitted to this constraint. In the next section, we will briefly discuss works on VAR model, which include lag length selection, model selection and methods of interpreting the VAR model, namely Impulse Response function and Variance decomposition.

4.3 Vector Autoregressive (VAR) methodology

In the VAR model, all variables in the system are assumed to be endogenous; however, this paper also has theoretical support as well. Next, since the estimation of VAR originated from the theory of stationary processes; variables used in VAR should be tested for unit root and transformed to stationary series. In this paper, the author uses differentiation as a tool to convert series to stationary.

4.3.1 The set of variables

The set of endogenous variables to be included in the VAR are pre-selected in accordance with the relevant economic theories, the relationship of asset price (SET index), interest rate, portfolio investment and exchange rate. The details of variable in VAR system are given below.

- Proxy of over-valued size of SET index

Proxy of the over-valued sizes is calculated as described in the earlier section.

- Policy rates (Interest rates)

Following the objective of study to test the monetary policy on asset price over-valuation, this study uses policy rate to seam the direct relationship of this channel while many other papers use minimum lending rate (MLR) because it directly influenced the lending cost and investment. However, this paper aims to see the direct effect between monetary instrument and asset price gap.

- Portfolio Investment

Since Thailand is the open economic country who has been increasing the degree of openness every year, in order to see the cause of volatility in price of the financial instrument,

considering the amount of capital inflow is inevitable. Portfolio investment refers to transactions that involve buying and selling equity securities, debt securities in form of bonds, notes, money market instruments with the exception of securities classified as direct investment and reserve assets from the Bank of Thailand (2005). Furthermore this paper decides to use only liabilities which refer to nonresidents' investment in securities issued by Thai residents to see the pure effect of capital inflow to Thailand.

- Real Effective Exchange rates (REER)

REER is the weighted average of a country's currency relative to an index or basket of other major currencies, such as US, EU, Japan and China, adjusted for the effects of inflation. This paper decides to use REER instead of nominal effective exchange rate (NEER) because we expect to see the result without inflation involved in exchange rate.

5. Empirical Results

5.1 Results of unit root test of Stock Exchange of Thailand index (P_t) and earning per share (EPS_t)

A characteristic of most of these financial time series is that in their "level form" they are random walks; that is, they are non-stationary. In other words, in the first difference form, they are generally stationary. The Augmented Dickey-Fuller (ADF) test, with trend and intercept, is employed to test the monthly data series, 2000-2012. Results of the ADF test are given in Appendix A. The maintained hypothesis (Ho) is that the tested data series is non-stationary. If the test statistic generated from ADF is higher than the critical value at 95% confident level, the maintained hypothesis of non-stationary will be rejected. Then such data series has a stationary property.

Table 1: Unit Root result of SET index and earning per share

Variable	ADF Test	Property
lnset_sa	First Difference	Stationary
lneps_sa	First Difference	Stationary

Source: Author's Calculation

The results of ADF tests indicate in Table 1 that both SET index (lnset_sa) and earning per share (lneps_sa) are stationary after making a first difference. Moreover, since the purpose of this paper is to see the long-term relationship of these two variables, testing co-integration by Johansen Co-integration Test is employed. The null hypothesis is that there is no co-integration at 95% confident level. The result is in Appendix B. Trace table and Maximum Eigenvalue in Table 2 indicate one co-integration between these two variables, and we reject null hypothesis at 95% confident level, meaning that these two variables will eventually move together in long run.

Table 2: Johansen Cointegration Test

Relationship Between lnset_sa & lneps_sa	Trace Table	Maximum Eigenvalue
Long-term relationship is existed	√	√

Source: Author's Calculation

5.2 Results of GARCH analysis

GARCH (1, 1) is employed to use in this model.

The result of GARCH regression lnset_sa on lneps_sa is as follows;

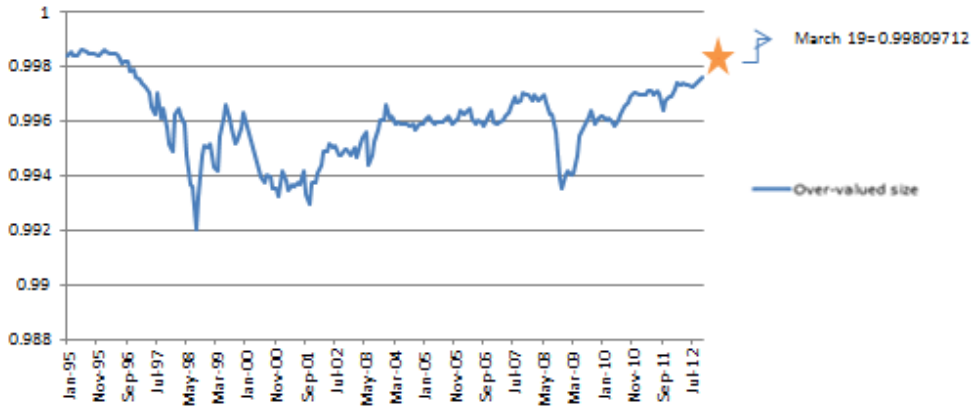
$$\begin{array}{lllllll} lnset\_sa = & 5.088929 & + 0.160357(lneps\_sa) & + 0.768583D1 & - 0.202437D2 & + 0.37498D3 \\ & (46.0368) & (5.864216) & (52.58106) & (-5.463409) & (23.06840) \\ & (0.00000) & (0.00000) & (0.00000) & (0.00000) & (0.00000) \end{array}$$

where lnset_sa is log of SET index after seasonal adjusted, lneps_sa is log of earnings per share after seasonal adjusted, D1 is 2003:06-2012:10, D2 is 2008:05-2008:12 and D3 is 2009:10-2012:12. Numbers in the upper and lower parentheses are Z-Statistic and P-value, respectively. The P-value indicates that both estimated coefficients are statistically different from zero.

Then this paper uses the estimated coefficient of every variable to estimate the fundamental SET index.

Next, this paper also expands the same method and the same equation to 1995 in order to see the proxy of over-valued size of SET index in which include Tum Yum Kung crisis during 1997. As it can be seen in Figure 2, in 1995- 1996 before the crisis hit the Thai economy, the size of over-valuation hit the highest record and dropped substantially in following year.

Figure 2: Proxy of over-valued size of SET index from January 1995- October 2012



Source: Author's Calculation

On the other hands, in 2013, March 19th, the proxy of over-valued size reached the highest at 0.998097 which is close to the size in 1996 but still a little bit lower. It implies that close monitoring from policy maker is needed during this high-ratio period. According to this approach, it means that the existing price greatly exceeded its fundamental value. Therefore it

had to be readjusted by dropping it down to reflect the fundamental value of investors' return. However, the severe in 2013 was not serious damage to Thai economy as much as in 1997. The possible explanation is because after the Tum Yum Kung crisis in 1997, Thai government, Bank of Thailand, and private investor had learnt some lessons to improve their financial market to be more effective and efficient. From that day until now, the financial market has developed and a closer monitoring in capital inflow has been employed, especially for short term capital inflow, in order to strengthen Thai economy. Moreover, there is a change of exchange rate regime from fixed to managing exchange rate system. With these policies, they yield flexibility and the ability of absorption for the Thai economy to face unforeseen situations.

The only way that may increase the SET index to stand above 1,600 firmly, according to this approach, is to improve the fundamental value of companies, in other words, to increase earnings per share.

In conclusion, with this real historical evidence, it somehow reconfirms the usefulness of earnings per share approach in function of detecting the fundamental value. The author believes that we may take advantage of acknowledging this approach as the standard to track the over-valued size of stock price. Moreover, this usefulness does not only give policy makers a guide to forecast the next coming asset price bubble, but also the ability to indicate and find an appropriate solution on time.

In addition, this paper would like to note that the possible reason for finding fundamental value relatively low is probably because today's investors might not only look at return from earnings per share as a strong variable in their purchasing decision but also take into account other factors as well. As state above, we may use other advance approaches to detect a stock's fundamental value and the result may be only different in terms of numerical size of fundamental value. This will leave room for further study.

5.3. Result of Vector Autoregression (VAR) analysis

5.3.1 The Role of Bank of Thailand and Monetary Policy Implementation

As state above, the current situation of over-valued size of SET index is relatively high, a little bit lower than its size in 1996. Hence it is the must for manging policy from Bank of Thailand to monitoring closely with this over-valuated part.

Since Thailand is an inflation targeting country, interest rate is the main tool for the Bank of Thailand to keep inflation in range. However, according to study of Krugman and Obstfeld (2005), using this tool also induces some difficulties of managing monetary policy. When reducing policy rate is employed, it not only causes asset price to increase but also exchange rate to depreciate and vice versa. Depreciation in exchange rate, of course, has positive effect to exporters but increasing in asset price may induce inflation out of range. On the other hand, increasing policy rate to slow down inflation certainly causes exchange rate appreciation which has negative effects on exporters, then eventually on the economy.

Firstly, this paper attempt to test whether these relationships also apply to the Thai economic condition by using the VAR model.

In this analysis, the VAR system estimation steps are as follows.

5.3.2 Test the stationary property of data series: Results of Unit Root Tests

The Augmented Dicky-Fuller (ADF) test is employed to test the stationary property of all data series.

As investigated from the nature representing each variable, the series of over-valuated size of SET index, policy rate, and REER should be tested to test a stationary property by performing with intercept and trend, while the value of portfolio investment inflow is tested by performing intercept without trend. The results show that every variable is non-stationary without first difference, except for the value of portfolio investment inflow. However, the VAR model needs the stationary property of the variables; therefore, we prefer to use the system with stationary series by taking first difference to all non-stationary variables. (Appendix C)

Table 3: Unit Root result Source: Author's Calculation

Variable	ADF Test	Property
bub_sa	First difference	Stationary
Portfo_sa	Level	Stationary
lnREER_sa	First difference	Stationary
RP_sa	First difference	Stationary

5.3.3 Lag Length Selection

The appropriate lag length is chosen by the Akaike information criterion (AIC test). One advantage of AIC is that it is useful not only for the sample but also out-of sample forecasting performance of a regression model. (Gujarati, 2005)

The results of lag length selection of VAR model are presented in Table 4. The AIC test results suggest using three lags for this model at statistically significant at 5 % level.

Table 4: Results of Lag Length Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	171.9496	NA	2.37e-07	-3.905805	-3.791650*	-3.859863*
1	192.7621	39.20497	2.12e-07	-4.017724	-3.446946	-3.788012
2	206.4820	24.56813	2.24e-07	-3.964698	-2.937297	-3.551217
3	227.3927	35.49946	2.01e-07*	-4.078899*	-2.594875	-3.481648
4	239.0537	18.71193	2.25e-07	-3.977993	-2.037347	-3.196973
5	249.5434	15.85650	2.60e-07	-3.849846	-1.452577	-2.885056
6	265.3611	22.43903	2.69e-07	-3.845606	-0.991714	-2.697047
7	285.7864	27.07540*	2.53e-07	-3.948520	-0.638005	-2.616191
8	292.3727	8.118058	3.33e-07	-3.729598	0.037540	-2.213500

Source: Author's Calculation

5.3.4 Ordering the variables

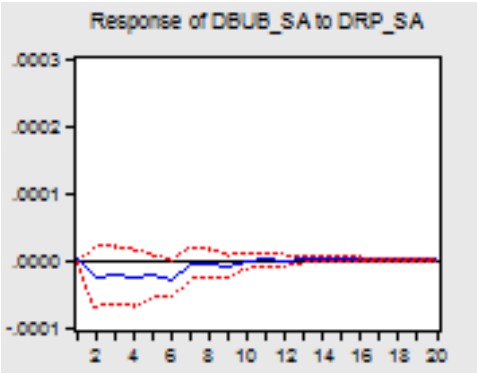
As stated in the methodology section, the order of the variable is over-valuated size of SET index, portfolio investment inflow, REER, and policy rate. However, this paper also tests by changing the position of each variable. It turns out that changing the order of variables does not have a significant effect on the result.

5.3.5 Impulse Response of variables

Response of the over-valued size to the innovation of policy rate

One standard deviation innovation of policy rate tends to induce a negative effect on the over-valuated size of Stock Exchange of Thailand index after the first period. Possible explanations are investors may not take policy rate into their consideration while they are purchasing a stock, the return from savings is not as attractive as the return from SET index, or also they may need some time to acknowledge the shock from policy rate change and then adjust to it accordingly. After the negative effect, the size of over-valuation slowly moves up close to the zero line in one year. This finding is consistent with the theoretical presumption that the increase in interest rate should have or tend to have a negative effect on the over-valuated SET index.

Figure 3: Response of the over-valued size to the innovation of policy rate

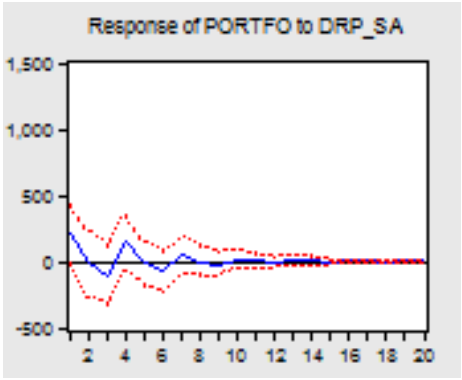


Source: Author's Calculation

Response of value of portfolio investment to the innovation of policy interest rate

When the shock of policy interest rate has occurred, one standard deviation innovation of it directly has a positive effect on the value of portfolio investment significantly. As it can be seen in the first period, the value of portfolio investment goes up a large amount; however, it continues to drop down during the second and third period and then fluctuates around the zero line. The possible reason of this phenomenon is that at the beginning of the interest rate's shock, the flow of capital may move in quick due to development of transferring money between countries and effectiveness of information. However, this capital inflow may be a short term instrument; therefore this explains the substantial reduction in the second and third period. For the rest of the fluctuation before reaching zero line in the fifteenth period, this paper expects that it is an adjusting process to normality. Hence, this finding is consistent with the theoretical presumption that the increase in policy interest rate should have the positive effects on the value of portfolio investment because the nature of capital will move to the place where it gets the better return.

Figure 4: Response of value of portfolio investment to the innovation of policy interest rate

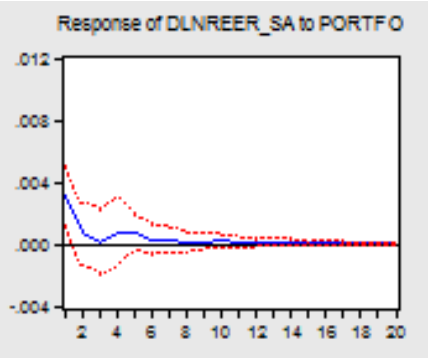


Source: Author's Calculation

Response of REER to the innovation of value of portfolio investment

One standard deviation innovation of value of portfolio investment directly induces positive effects on REER along with the timeline significantly. Its effect dies out in the sixteenth month of forecasted periods. Hence, this finding is consistent with our theoretical presumption that the increase in portfolio investment should have positive effects on REER because when foreign investors decide to buy financial instruments issued by a Thai agency, they need to convert their currency to Thai Baht by buying Thai Baht. Therefore, the demand for Baht currency increase, REER appreciates.

Figure 5: Response of REER to the innovation of value of portfolio investment



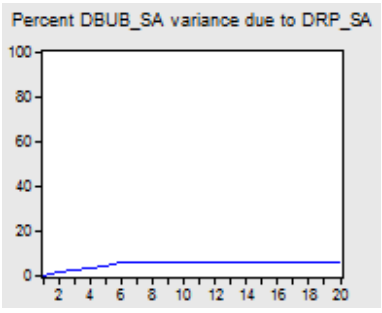
Source: Author's Calculation

5.3.6 Variance Decomposition

Before coming to the conclusion of policy recommendation, the component of each variable on volatility of each variable is necessary to take into account. Since this paper aims to see the impact of change in policy rate to the change in over-valued size of SET index and value of portfolio investment, variance decomposition is employed. According to variance decomposition's result in Figure 7, the volatility of over-valuated size of SET index generated from interest rate shock is 1.3345% while the influence of interest rate volatility on the value of portfolio investment is 3.45% in second period. Therefore, it implies that the shock from policy rate affects the value of portfolio investment greater than the over-valuated size of SET index.

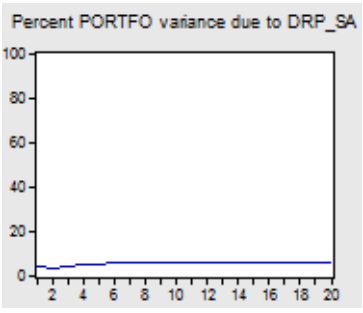
Figure 6: Results on Variance Decomposition

Percent over-valued size variance due to policy rate



Source: Author's Calculation

Percent value of portfolio investment variance due to policy rate



Source: Author's Calculation

6. Conclusion and Policy recommendations

6.1 In the case of Thailand

According to the empirical results about the usefulness of earnings per share approach on detecting over-valuated size of SET index, it shows that the level of the over-valued size on March 19th is close to its size in 1996, the period before the Tomyung Kung crisis in 1997. Consequently, the SET index has dropped due to the over-valuation exceeded its fundamental value. However, this decrease in SET index this time did not contribute as much to the negative effect of the Thai economy as it did in 1997. The possible reasons are government and Bank of Thailand learnt some lessons from the previous crisis, improvement in financial market's structure and change of exchange rate regime. Therefore this paper expects that, based on this approach, the scale of this standard measurement could increase in pre-crisis.

In terms of the role of the Bank of Thailand and policy implementation, Thailand is an inflation target country, having policy rate as the main monetary tool for keeping inflation in a target range. However, by using this tool, it also induces some difficulty in monetary managing, especially between inflation in asset price and exchange rate.

The empirical result, based on Thailand's economic data, somehow confirms theories' belief. Even though some impulsive response results may not be significant, its trend is still consistent with the theories. The result from variance decomposition also tells us that the effect of interest rate's shock contributed to the volatility of over-valuated size of SET index less than portfolio investment. Meaning, if the Bank of Thailand agrees to increase interest rate in order to slow down the inflation on SET index, this policy might not be an effective solution, but rather create even higher appreciation to Thai Baht. On the other hand, if the Bank of Thailand decides to employ deduction in policy rate in order to depreciate Thai Baht, the SET index tends to be even higher. Empirically, figure 2, it shows that the over-valuated size of SET index is already in danger of taking any further inflation. Therefore, employing policy rate or not may not be a practical solution given the current Thai economic position.

Hence this paper suggests that policy makers should consider other policy tools, monetary and/or fiscal policy, to crop up with this situation. For example, to employ policy that encourage private sector to import more technological machine, to employ fiscal expansion in encouraging investor to invest in real market, to encourage the existing firms to improve their fundamental value and lastly to employ capital control. However, by employing capital control policy marker should select carefully in terms of type of capital. This paper will let this challenging question for further research.

6.2 Suggestions for Further Study

The study on SET index over-valuation in the Thai economy by using various methods to evaluate fundamental prices of the assets is also interesting. There are so many methods to detect the fundamental value of asset price provided by many literatures, such as State Space. Results from the different study method on detecting over-valuation might change the numerical size of over-valuation.

Furthermore, the study of other monetary tools should be further researched. Results from those researches might be helpful in answering which monetary policy should be effective for this given situation since there is no certain consensus to the appropriate answer and there is great advantage in designing monetary policy implementations.

Appendix A

UNIT ROOT TEST

ADF Test: SET index (lnset_sa)

Null Hypothesis: LNSET_SA has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.751795	0.7230
Test critical values:	1% level	-4.020822	
	5% level	-3.440263	
	10% level	-3.144585	

*MacKinnon (1996) one-sided p-values.

ADF Test: SET index after taking first difference (dlnset_sa)

Null Hypothesis: D(LNSET_SA) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.83467	0.0000
Test critical values:	1% level	-4.021254	
	5% level	-3.440471	
	10% level	-3.144707	

*MacKinnon (1996) one-sided p-values.

ADF Test: Earnings per Share (lneps_sa)

Null Hypothesis: LNEPS_SA has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.986195	0.6037
Test critical values:	1% level	-4.020822	
	5% level	-3.440263	
	10% level	-3.144585	

*MacKinnon (1996) one-sided p-values.

ADF Test: Earning per share after taking first difference (dlneps_sa)

Null Hypothesis: D(LNEPS_SA) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.44407	0.0000
Test critical values:	1% level	-4.021254	
	5% level	-3.440471	
	10% level	-3.144707	

*MacKinnon (1996) one-sided p-values.

Appendix B

COINTEGRATION TEST

Johansen Cointegration Test

Johansen Cointegration Test

Date: 04/28/13 Time: 15:01
Sample (adjusted): 2000M10 2012M10
Included observations: 145 after adjustments
Trend assumption: Linear deterministic trend
Series: LNSET_SA LNEPS_SA
Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.108995	18.50238	15.49471	0.0171
At most 1	0.012123	1.768602	3.841466	0.1836

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.108995	16.73378	14.26460	0.0199
At most 1	0.012123	1.768602	3.841466	0.1836

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Appendix D

UNIT ROOT TEST

ADF Test: Proxy of over-valued size of SET index (bub_sa)

Augmented Dickey-Fuller Unit Root Test on BUB_SA

Null Hypothesis: BUB_SA has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.641117	0.2630
Test critical values:	1% level	-4.021254	
	5% level	-3.440471	
	10% level	-3.144707	

*MacKinnon (1996) one-sided p-values.

ADF Test: Proxy of over-valued size of SET index after taking first difference (dbub_sa)

Augmented Dickey-Fuller Unit Root Test on D(BUB_SA)

Null Hypothesis: D(BUB_SA) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.82241	0.0000
Test critical values:	1% level	-4.021691	
	5% level	-3.440681	
	10% level	-3.144830	

*MacKinnon (1996) one-sided p-values.

ADF Test: Portfolio Investment (portfo)

Augmented Dickey-Fuller Unit Root Test on PORTFO

Null Hypothesis: PORTFO has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.381207	0.0000
Test critical values:	1% level	-3.502238	
	5% level	-2.892879	
	10% level	-2.583553	

*MacKinnon (1996) one-sided p-values.

ADF Test: Real Effective Exchange rate (lnreer_sa)

Augmented Dickey-Fuller Unit Root Test on LNREER_SA

Null Hypothesis: LNREER_SA has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.810781	0.1958
Test critical values:	1% level	-4.021691	
	5% level	-3.440681	
	10% level	-3.144830	

*MacKinnon (1996) one-sided p-values.

ADF Test: Real Effective Exchange rate after taking first difference (dlnreer_sa)

Augmented Dickey-Fuller Unit Root Test on D(LNREER_SA)

Null Hypothesis: D(LNREER_SA) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.914059	0.0000
Test critical values:	1% level	-4.021691	
	5% level	-3.440681	
	10% level	-3.144830	

*MacKinnon (1996) one-sided p-values.

ADF Test: Policy rate (rp_sa)

Augmented Dickey-Fuller Unit Root Test on RP_SA

Null Hypothesis: RP_SA has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.911261	0.6436
Test critical values:	1% level	-4.022135	
	5% level	-3.440894	
	10% level	-3.144955	

*MacKinnon (1996) one-sided p-values.

ADF Test: Policy rate after taking first difference (drp_sa)

Augmented Dickey-Fuller Unit Root Test on D(RP_SA)

Null Hypothesis: D(RP_SA) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic based on SIC, MAXLAG=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.674196	0.0000
Test critical values:	1% level	-4.022135	
	5% level	-3.440894	
	10% level	-3.144955	

*MacKinnon (1996) one-sided p-values.

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