CHAPTER 4

Result

In this study, I would like to examine the QE policy effects on Thailand, Indonesia and Philippines markets, namely exchange rate market, stock market and bond market, from one regime to another regime and also signal ahead a turbulent regime as an early warning system. by using Markov-Switching, Bayesian, Vector Autoregressive (MS-BVAR) models as an innovative tool for dating effect of volatility in each period as well as identify the factors that lead an TIP markets from one state to another state and also signal ahead a turbulent regime as an early warning systems through regime probabilities. Impulse response function (IRF) and forecast error variance decompositions (FEVDs) are, then, conducted in each regime to forecast the duration and volatility which are affected by Quantitative easing and Quantitative tapering. Finally, discussion is present in last section. This data contains 7 variables which are the monthly secondary data from the period 14 January 2009 to 10 July 2014 covering 68 observations. Whereas, all of these observations have been transform to the first difference of logarithms form as follows

RMBS = the rate of return on Mortgage back securities.

RTS = the rate of return on US's Treasury securities.

RFB = the rate of return on Fed's balance sheet.

RSET = the rate of return on Stock exchange of Thailand index.

REXth = the rate of return on Thai baht against US dollar.

*REX*ind = the rate of return on Indonesia rupee against US dollar.

REXph = the rate of return on Philippines peso against US dollar.

RJKSE = the rate of return on Jakarta Composite Index.

RPSEi = the rate of return on Philippine Stock Exchange composite index.

RTHY = the rate of return on Thai government bond yield.

RINDY = the rate of return on Indonesia government bond yield.

RPHY = the rate of return on Philippines government bond yield.

4.1 Unit root test

To avoid the phenomenon of false regression caused by the regression analysis of non-stationary time series which often bring spurious results and that may obtain incorrect inferences in this study. Thus there is need of stationary checking in all variables should before estimating the MS-BVAR model. If the value of t-statistic exceeds the ADF t-statistic value, we can reject the null hypothesis, in which case the time series is stationary. On the other hand, if the value of t-statistic does not exceeds the ADF t-statistic value we do not reject the null hypothesis, in which case the time series is non-stationary.

Table 4.1 The ADF test statistic of variables

Variable	**None**		**Intercept**		**Trend and Intercept**	
	ADF t-statistic	Critical values	ADF t-statistic	Critical values	ADF t-statistic	Critical values
RFB	-4.2149	(1%)-2.57 (5%)-1.94 (10%)-1.61	-5.6376	(1%)-3.45 (5%)-2.87 (10%-2.57	-6.1241	(1%)-3.992 (5%)-3.426 (10%)-3.13
RTS	-2.1444	(1%)-2.57 (5%)-1.94 (10%)-1.61	-2.7931	(1%)-3.45 (5%)-2.87 (10%-2.57	-3.0133	(1%)-3.99 (5%)-3.42 (10%)-3.13
RMBS	-5.7539	(1%)-2.57 (5%)-1.9 (10%)-1.61	-6.3641	(1%)-3.45 (5%)-2.87 (10%-2.57	-6.4143	(1%)-3.99 (5%)-3.42 (10%)-3.13
RSET	-16.1895	(1%)-2.573 (5%)-1.94 (10%)-1.61	-16.5441	(1%)-3.45 (5%)-2.87 (10%-2.57	-16.756	(1%)-3.99 (5%)-3.42 (10%)-3.13

Table 4.1 The ADF test statistic of variables (continues)

Variable	**None**		**Intercept**		**Trend and Intercept**	
	ADF t-statistic	Critical values	ADF t-statistic	Critical values	ADF t-statistic	Critical values
RJKSE	-15.6022	(1%)-2.57 (5%)-1.94 (10%)-1.61	-16.1214	(1%)-3.45 (5%)-2.87 (10%-2.57	-16.473	(1%)-3.99 (5%)-3.42 (10%)-3.13
RPSEi	-17.5526	(1%)-2.57 (5%)-1.94 (10%)-1.61	-18.0763	(1%)-3.45 (5%)-2.87 (10%-2.57	-18.220	(1%)-3.99 (5%)-3.42 (10%)-3.13
REXth	-14.4273	(1%)-2.57 (5%)-1.94 (10%)-1.61	-14.4293	(1%)-3.45 (5%)-2.87 (10%-2.57	-14.566	(1%)-3.99 (5%)-3.42 (10%)-3.13
REXind	-13.7185	(1%)-2.57 (5%)-1.94 (10%)-1.61	-13.6925	(1%)-3.45 (5%)-2.87 (10%-2.57	-14.17	(1%)-3.99 (5%)-3.42 (10%)-3.13
REXph	-16.9337	(1%)-2.57 (5%)-1.94 (10%)-1.61	-16.9155	(1%)-3.45 (5%)-2.87 (10%-2.57	-16.984	(1%)-3.99 (5%)-3.42 (10%)-3.13

Source: calculation

In table 4.1, the results of ADF test at level with none, intercept and trend and intercept suggest that the value of ADF test at this level of all variables are less than Mackinnon critical value at 1% level. Therefore, the null hypothesis of unit root test can be rejected and accept the alternative hypothesis which all variables are stationary at level under 99% confidence level. As a result, we can use these variables as an endogenous variable in MS-BVAR model in order to estimate the impact of QE policy.

In addition, before estimating the MS-BVAR model, I separate these variables into 3 information sets (Y_t) as follow,

TIP stock markets information set $Y_{\text{stock,t}} = (FB_t, MBS_t, TS_t, SET_t, JKSE_t, PHEi_t)$

TIP exchange markets information set $Y_{\text{ex,t}} = (TS_t, MBS_t, FB_t, EXth_t, EXind_t, EXph_t)$

TIP bond markets information set $Y_{\text{bond,t}} = (TS_t, MBS_t, FB_t, THY_t, INDY_t, PHY_t)$

4.2 Model fit

There are many MS-BVAR specifications which depend on their prior, lag term and number of regime. In this section, therefore, I compared the various types of specifications in order to figure out the best fit specification for estimating the parameter in TIP stock market model, TIP exchange market model, and TIP bond market model. In each specification, the Normal-wishart prior, Normal-flat prior, and Flat-flat prior has been conducted. Moreover, I also compared the number of change point and lag length. The comparison of specification is based on marginal log likelihood, also known as a log marginal data density for the various models. For the MS-BVAR models, the importance sampler of Fruwirth-Schnatter (2006) is used to compute marginal log likelihood.

In the Appendix1.1 reports the results of marginal log likelihood of MS-BVAR specifications in TIP stock market model, TIP exchange market model, and TIP bond market model. It shows the asterisk symbol;*; which indicates the occurrence of problem in eigenvalue. It also shows "NaN" which indicates the convergence problems for the MCMC simulator of MS-BVAR that shows up as poorly approximated marginal log likelihood. Among the trial runs of several alternative specifications for each model, the results provide evidence that Normal-wishart prior, two changes point with 1 lag term which has highest marginal log likelihood, has a best fit in all 3 models. Furthermore, the results of lag length of MS-BVAR model seem to correspond with the results of standard informational criteria, including AIC, SC and HQ, in BVAR model. It confirms that lag 1 has a lowest value of SC and HQ (Appendix 1.2-1.4).

In addition, by Bayesian Approach, Appendix 1.5-1.10 provide the results of Gibbs sampler draws which produce trace plots and density plot of intercepts and coefficients in each model. In the results of trace plot, The Markov chain has reached it stationary because the mean and variance of the trace plot of these intercepts and coefficients are constant over time. Moreover, in the result of density plot also confirm that the distribution of intercepts and coefficients are converge to the normal distribution after a burn in of 1,000 steps. These results confirm that 1,000 burn in steps and 5,000 final posterior draws are sufficient condition for convergence. Therefore, these parameters can be estimated under Normal-wishart prior.

.Finally, I will report the results of the best fit specification, which is a Normal-wishart prior, two changes point with 1 lag term, for TIP stock market model, TIP exchange market model, and TIP bond market model in nest section.

4.3 The Estimation of the Model

4.3.1 Estimates of MS-BVAR Model of TIP stock markets

Regime 1

$$\begin{bmatrix} RFB \\ RTS \\ RMBS \\ RSET \\ RJKSE \\ RPHEi \end{bmatrix} = \begin{bmatrix} 10.014 \\ 2.592 \\ 27.391^{**} \\ 7.515^{**} \\ 8.384^{*} \\ 0.421 \end{bmatrix} + \begin{bmatrix} 6.422 & 3.905 & 5.883 & 9.4382^{*} & -5.107 & -0.115 \\ -1.900 & -0.324 & -1.832 & -1.783 & 3.854^{***} & -0.054 \\ -2.736 & 6.865 & -8.214^{**} & -7.256 & 6.847 & -0.072 \\ 0.605 & -0.832 & -0.301 & 0.302 & -0.612 & -0.052 \\ -3.665 & 2.123 & -0.948 & 1.177 & 0.651 & 0.042 \\ 1.125 & 5.620^{**} & 0.492 & -0.720 & 0.177 & 0.101^{**} \end{bmatrix} \begin{bmatrix} RFB \\ RTS \\ RMBS \\ RSET \\ RJKSE \\ RPHEi \end{bmatrix}_{t-1} + \begin{bmatrix} \varepsilon_{RFB} \\ \varepsilon_{RTS} \\ \varepsilon_{RMBS} \\ \varepsilon_{RSET} \\ \varepsilon_{RJKSE} \\ \varepsilon_{RPHEi} \end{bmatrix} \quad (4.1)$$

Regime 2

$$\begin{bmatrix} RFB \\ RTS \\ RMBS \\ RSET \\ RJKSE \\ RPHEi \end{bmatrix} = \begin{bmatrix} -4.911 \\ 4.18696 \\ 8.51725 \\ 0.62959 \\ -1.841 \\ 0.92681 \end{bmatrix} + \begin{bmatrix} 7.581 & 6.450 & -4.760 & -6.332 & 1.594 & -0.101 \\ 0.591 & 1.492 & -0.714 & 0.553 & -0.789 & -0.014 \\ -9.596^{**} & -3.530 & 3.433 & 4.814 & -3.261 & -0.108 \\ -1.107 & 4.304 & -0.555 & -1.233 & 0.195 & 0.033 \\ -1.446 & -7.345^{*} & -5.456^{*} & 3.245 & 1.071 & -0.054 \\ 0.317 & -4.096 & 1.514 & -0.746 & -1.254 & -0.012 \end{bmatrix} \begin{bmatrix} RFB \\ RTS \\ RMBS \\ RSET \\ RJKSE \\ RPHEi \end{bmatrix}_{t-1} + \begin{bmatrix} \varepsilon_{RFB} \\ \varepsilon_{RTS} \\ \varepsilon_{RMBS} \\ \varepsilon_{RSET} \\ \varepsilon_{RJKSE} \\ \varepsilon_{RPHEi} \end{bmatrix} \quad (4.2)$$

*,**, and *** denotes 10%, 5%, and 1% significant level respectively

Eq. (4.1) and Eq. (4.2) provide the parameter estimated of the 2 regimes in the TIP stock markets model. These equations show that the estimated means (intercept) of the MS-BVAR(1) model for each 2 regimes seem to have an economic interpretation. The first regime indicates that most of the value of mean in each equation is larger than the second regime. Thus, this indicates that regime 1 is in the high growth regimes or expansion of QE programs and TIP stock markets, while regime 2 is in the low growth regime or remaining the QE programs in the same level and contraction of TIP stock markets. Furthermore, considering Stock exchange of Thailand index (RSET), Jakarta Composite Index (RJKSE) and Philippine Stock Exchange composite index (RPHEi) equation in high growth regime (regime 1), Philippine Stock Exchange composite index (RPHEi) seem to be significantly driven by purchasing U.S.'s Treasury securities (RTS) whereas the reaction of Philippine Stock Exchange composite index (RPHEi) is positive

in first lag period of purchasing U.S.'s Treasury securities (RTS) and the shock coefficients are statistically significant at 10% level. Result shows that when purchasing U.S.'s Treasury securities increase 1% increase then Philippine Stock Exchange composite index (RPHEi) will increase 5.620% in the next month. However, the shock coefficients of Stock exchange of Thailand index (RSET) and Jakarta Composite Index (RJKSE) are basically not statistically significant among Fed's balance sheet (RFB), purchasing U.S's Treasury securities (RTS) and purchasing U.S.'s Mortgage back securities (RMBS). For the low growth regime (regime 2), the reaction of the decrease in Jakarta Composite Index (RJKSE) is negative in the first lag period of purchasing U.S.'s Treasury securities (RTS) and purchasing U.S.'s Mortgage back securities (RMBS), and the shock coefficients are statistically significant at 10% level.

4.3.2 Estimates of MS-BVAR Model of TIP exchange markets

Regime 1

$$\begin{bmatrix} RFB \\ RTS \\ RMBS \\ REXth \\ REXind \\ REXph \end{bmatrix} = \begin{bmatrix} 0.919 \\ 8.078 \\ -1.383 \\ 19.342 \\ -3.688 \\ 4.489 \end{bmatrix} + \begin{bmatrix} -0.773 & 21.352^{**} & 5.068 & -26.577^{*} & -15.522 & 0.279^{*} \\ -2.165 & -1.090 & -9.867 & 5.563 & 5.572 & -0.010 \\ -5.141 & -6.856 & -0.076 & 2.879 & 24.131 & -0.128 \\ 3.241 & -20.061 & 2.428 & 23.025 & -14.160 & 0.282 \\ 0.720 & 4.310 & 28.200 & -4.782 & -23.275 & -0.141 \\ -1.027 & -17.338 & -24.679 & 3.423 & 4.129 & -0.062 \end{bmatrix} \begin{bmatrix} RFB \\ RTS \\ RMBS \\ REXth \\ REXind \\ REXph \end{bmatrix}_{t-1} + \begin{bmatrix} \varepsilon_{RFB} \\ \varepsilon_{RTS} \\ \varepsilon_{RMBS} \\ \varepsilon_{REXth} \\ \varepsilon_{REXind} \\ \varepsilon_{REXph} \end{bmatrix} \quad (4.3)$$

Regime 2

$$\begin{bmatrix} RFB \\ RTS \\ RMBS \\ REXth \\ REXind \\ REXph \end{bmatrix} = \begin{bmatrix} -0.495 \\ -3.438 \\ 10.581 \\ 11.598 \\ -5.811 \\ 8.528 \end{bmatrix} + \begin{bmatrix} -3.717 & 19.744 & -6.649 & -12.593 & 17.801 & 0.277 \\ -0.109 & -1.443 & -14.457 & -3.961 & 17.424^{**} & -0.082 \\ -2.038 & 1.829 & -8.130 & 0.886 & -7.226 & -0.142 \\ -10.00 & 7.337 & -41.874 & -22.810 & 14.414 & 0.421^{*} \\ -14.847^{**} & 18.796^{**} & 6.621 & -31.623^{*} & 21.062 & 0.212 \\ -6.202 & 0.73205 & 13.149 & -2.639 & 19.517 & -0.219 \end{bmatrix} \begin{bmatrix} RFB \\ RTS \\ RMBS \\ REXth \\ REXind \\ REXph \end{bmatrix}_{t-1} + \begin{bmatrix} \varepsilon_{RFB} \\ \varepsilon_{RTS} \\ \varepsilon_{RMBS} \\ \varepsilon_{REXth} \\ \varepsilon_{REXind} \\ \varepsilon_{REXph} \end{bmatrix} \quad (4.4)$$

*,**, and *** denotes 10%, 5%, and 1% significant level respectively

Eq. (4.3) and Eq. (4.4) provide the parameter estimated of the 2 regimes in the TIP exchange markets model. The first regime and second regime does not seem to have a lot of difference in the means of each equation. Therefore, I interpreted the regime by considering the interested variables. It can be seen that the RFB, RTS and RMBS equations mostly has a positive sign in regime 1 more than regime 2. This indicates that regime 1 is in high growth regime or expansion of QE and currency appreciation, while

regime 2 is in the low growth regime or contraction of QE and currency depreciation. The result significantly reveals some relationship between QE programs and Indonesia exchange rate market. It has only purchasing U.S.'s Treasury securities (RTS) and Fed's balance sheet (RFB) which seems to significantly influence Indonesia rupee against US dollar (REXind) in the low growth regime. In the low growth regime, an increase in Fed's balance sheet (RFB) by 1% will decrease an Indonesia rupiah appreciation by 14.87%, while an increase in only purchasing U.S.'s Treasury securities (RTS) will increase Indonesia Rupiah appreciation by 18.89% in the next month.

4.3.3 Estimates of MS-BVAR Model of TIP bond markets

Regime 1

$$\begin{bmatrix} RFB \\ RTS \\ RMBS \\ RTHY \\ RINDY \\ RPHY \end{bmatrix} = \begin{bmatrix} 10.351 \\ 0.745 \\ 3.79 \\ -0.506 \\ -3.061 \\ 0.111 \end{bmatrix} + \begin{bmatrix} -4.22 & 1.239 & -7.098 & 1.707 & -0.007 & 0.211 \\ 0.316 & 0.217 & -1.220 & -1.111 & -0.793 & 0.082 \\ -3.235 & 8.139 & -1.682 & -2.345 & -0.488 & 0.05 \\ -0.775 & 5.15^{*} & -0.020 & 0.302 & -0.258 & 0.077^{*} \\ -2.346^{**} & 2.477 & 0.136 & 1.177 & 0.002 & -0.058 \\ -0.205 & 0.010 & -0.839 & -0.720 & -0.058 & -0.025 \end{bmatrix} \begin{bmatrix} RFB \\ RTS \\ RMBS \\ RTHY \\ RINDY \\ RPHY \end{bmatrix}_{t-1} + \begin{bmatrix} \varepsilon_{RFB} \\ \varepsilon_{RTS} \\ \varepsilon_{RMBS} \\ \varepsilon_{RTHY} \\ \varepsilon_{RINDY} \\ \varepsilon_{RPHY} \end{bmatrix} \quad (4.5)$$

Regime 2

$$\begin{bmatrix} RFB \\ RTS \\ RMBS \\ RTHY \\ RINDY \\ RPHY \end{bmatrix} = \begin{bmatrix} -0.999 \\ 9.785^{**} \\ 2.460 \\ 0.754 \\ -0.715 \\ 0.667 \end{bmatrix} + \begin{bmatrix} -0.747 & -2.795 & 1.397 & 5.815^{**} & 0.527 & 0.038 \\ 3.448 & -11.288^{*} & 1.467 & -2.143 & 0.755 & -0.144 \\ -2.623 & 6.831 & -2.069 & 1.308 & 1.692 & 0.071 \\ -0.764 & 2.194 & 3.570^{*} & -1.152 & 1.239^{**} & -0.001 \\ -3.054 & 2.132 & 1.476 & 1.673 & -0.618 & 0.010 \\ 1.110 & -3.513^{*} & -0.231 & -0.717 & 1.424^{*} & 0.047 \end{bmatrix} \begin{bmatrix} RFB \\ RTS \\ RMBS \\ RTHY \\ RINDY \\ RPHY \end{bmatrix}_{t-1} + \begin{bmatrix} \varepsilon_{RFB} \\ \varepsilon_{RTS} \\ \varepsilon_{RMBS} \\ \varepsilon_{RTHY} \\ \varepsilon_{RINDY} \\ \varepsilon_{RPHY} \end{bmatrix} \quad (4.6)$$

*,**, and *** denotes 10%, 5%, and 1% significant level respectively

Eq. (4.5) and Eq. (4.6) provide the parameter estimated of the 2 regimes in the TIP bond markets model, the first regime and second regime have a difference in the means in each equation. Therefore, I interpreted the regime by considering the interested variables. The first regime indicates that the value of mean in RFB, RTS and RMBS equations are mostly larger than the second regime. In addition, RTHY, RINDY and RPHY are mostly lower than the second regime. Thus, this indicates that regime 1 is in the high growth regimes or expansion of QE programs and TIP bond markets (price rise causes yield fall) while regime 2 is in the low growth regime or remaining the QE

programs in the same level and contraction of TIP bond markets (price fall causes yield rise). Moreover, it also provides the result of estimated coefficient in first lag term. In the high growth regime, Fed's balance sheet (RFB), first lag period, seem to significantly influence Indonesia government bond yield (RINDY) at 5% level while Thai government bond yield (RTHY), first lag term, significantly influence Thai government bond yield (RTHY) at 10% level. Result shows that purchasing Fed's balance sheet (RFB) increase 1% then Indonesia government bond yield (INDY) will decrease 2.346% in the next month. While an increase in purchasing U.S.'s Treasury securities (RTS) by 1% will increase Thai government bond yield by 14.87% in the next month. In the low growth regime, the reaction of the decrease in Thai government bond yield (RTHY) is positive in the first lag of purchasing U.S.'s Mortgage back securities (RMBS), and the shock coefficient is statistically significant at 10% level. Conversely, the decrease in Philippines government bond yield (RPHY) is negative in the first lag of purchasing U.S.'s Treasury securities (RTS) which statistically significant at 1% level. The results show that the increase in purchasing U.S.'s Mortgage back securities (RMBS) by 1% cause the decrease in Thai government bond yield (RTHY) increase by 3.57%. In addition, an increase in purchasing U.S.'s Treasury securities (RTS) by 1% causes the decrease in Philippines government bond yield (RPHY) decrease by 3.513%.

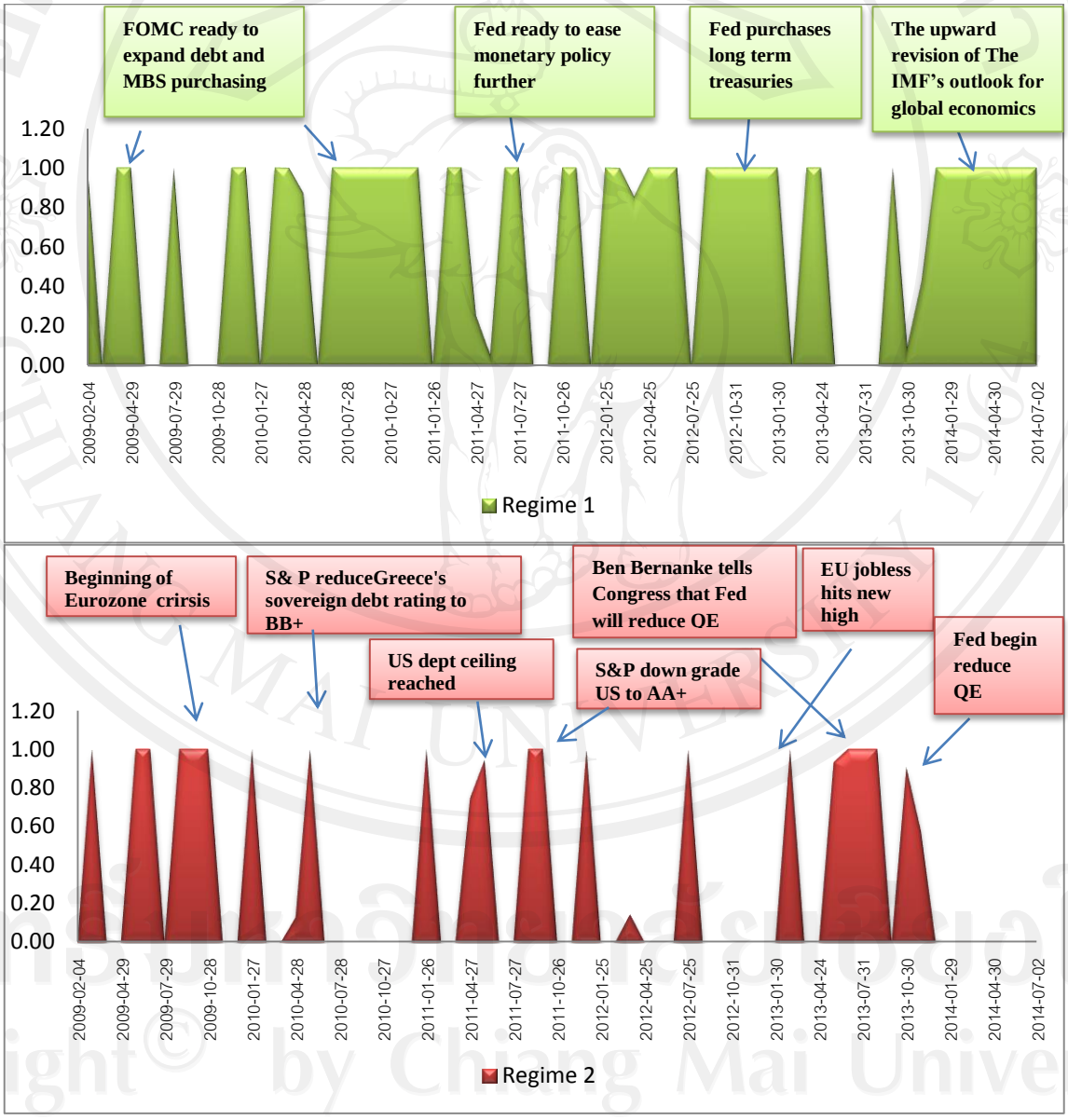
4.4 Regimes Probabilities

In this section, the best fit MS-BVAR also provide a regime probabilities with 2 regimes, which are plotted by smooth probabilities, to identify the event that lead TIP markets from one state to another state and dating the effect of each event in each regime. A regime probability for MS-BVAR model of TIP stock markets is plotted in figure 4.1. Figure 4.2 presents probabilities for MS-BVAR model of TIP exchange markets. Lastly, the MS-BVAR model TIP bond markets, which is a single Markov chain with 2 regimes, is found in figure 4.2

Table 4.2 Estimates of transition matrices

Transition Matrices					
Q:TIPStock Markets		**Q: TIP Exchange Markets**		**Q: TIP bond markets**	
0.706	0.619	0.01	0.015	0.99	0.741
0.294	0.381	0.99	0.985	0.01	0.259
	Duration		**Duration**		**Duration**
Regime 1	3.40	Regime 1	1.01	Regime 1	67
Regime 2	1.61	Regime 2	66.67	Regime 2	1.349

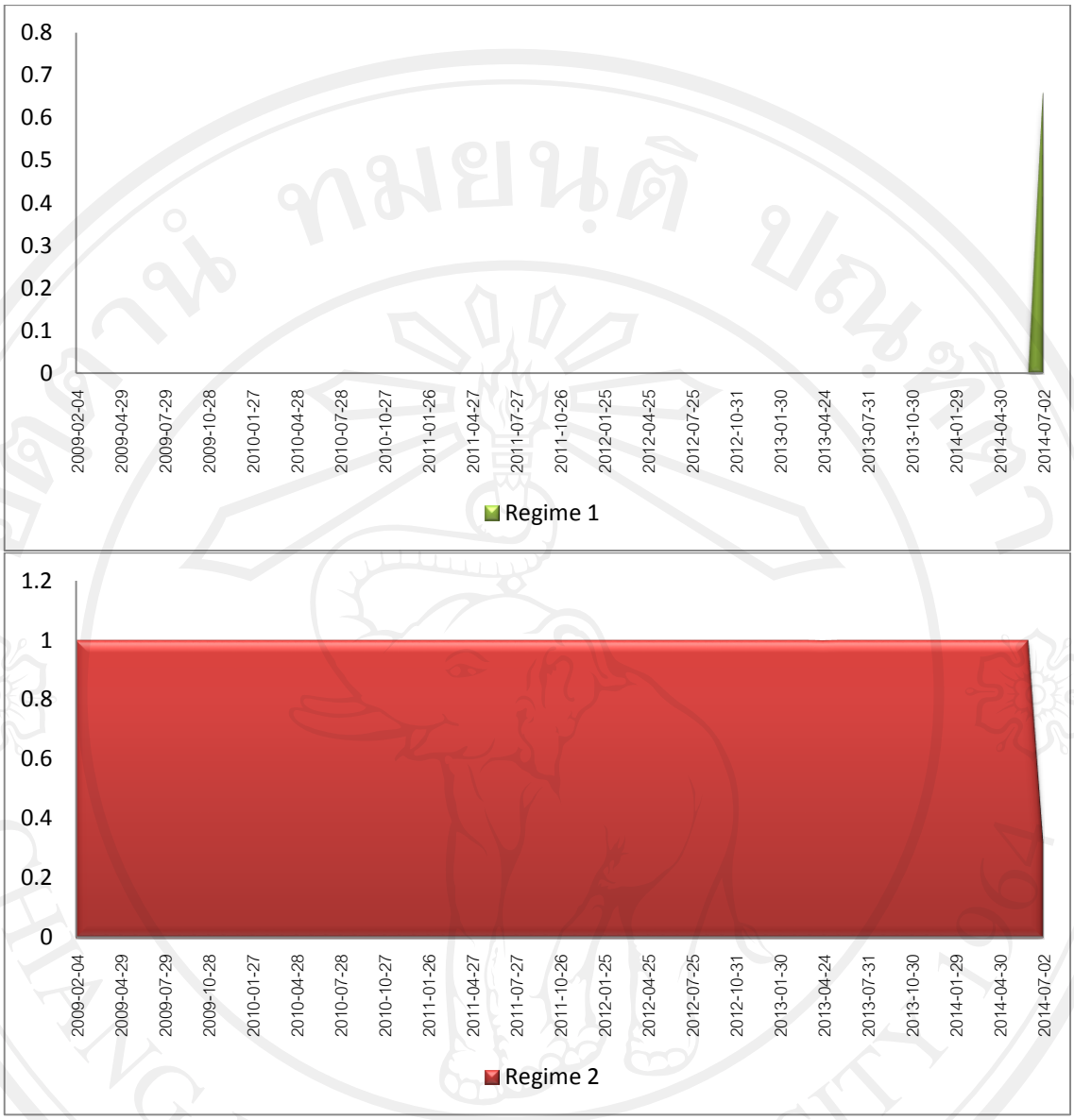
Source : calculation



Source : calculation

Figure 4.1 2 Regime Probabilities: TIP stock markets, 2009-2014 (continued)

Figure 4.1 shows the smoothed probability plots, which is the probability of staying in either regime 1 or regime 2, between the periods of 2009 to 2014. It shows that TIP stock markets model is consistent with the hypothesis that high growth and low growth represent different financial outcomes. Regime 1 of TIP stock markets model is plotted in the top panel of figure 4.1.This regime is mainly observed the 4 periods of QE announcement. The first period and second period are March, 2009 to April, 2009 and April, 2010 to January, 2011, respectively and corresponds to the expansion of debt and MBS purchased program. The third period is April, 2011 to July, 2011 and corresponds to the monetary policy easing. Finally, the fourth period is July, 2012 to January, 2013 and corresponds to purchasing of long term treasuries program. The bottom panel contains regime 2, which consists of the Eurozone crisis, speculative shock in financial markets and QE tapering. This regime seems to observe the Eurozone crisis since 2009. IMF (2012) reported that lowering sovereign debt rating in many European countries lead investors to lose 30–50% of their money. Therefore, stock markets worldwide and the euro currency declined in response to the downgrade. Moreover, it also observes 2 periods of QE tapering. The first period corresponds to the signal of QE tapering in the future. The second period is the beginning of QE tapering. A distinguishing feature of regime 1 and regime 2 is the stark differences in the impact of QE programs. This result indicates that an announcement of each QE programs are captured by the MS-BVAR(1) model since the first announcement of QE program. Apart from the global financial event, the announcement of QE expansion seem to lead TIP stock markets stay in high growth regime while QE tapering lead TIP stock markets stay in low growth regime. In addition, the results also shown that regime 1 seem to have higher probability than regime 2. Thus, TIP stock markets have a probability of staying in high growth regime than low growth regime. Moreover, in table 4.2, the estimated of the transition matrix Q for the TIP stock markets shows that theirs regime 1 is persistent because the probability are 70.6% of staying in regime 1 while the probability of moving , regime 1 to regime 2, is 29.4% and regime 2 to regime 1 is 61.9%. The probability of staying in their own regime is 38.1%. Moreover, the result also shows that the regime 1 has duration of approximately 3.4 months while the regime 2 has a duration 1.61 months. These results indicate that QE policy can switch the series to change between these 2 regimes and it has a high volatility in TIP stock markets.

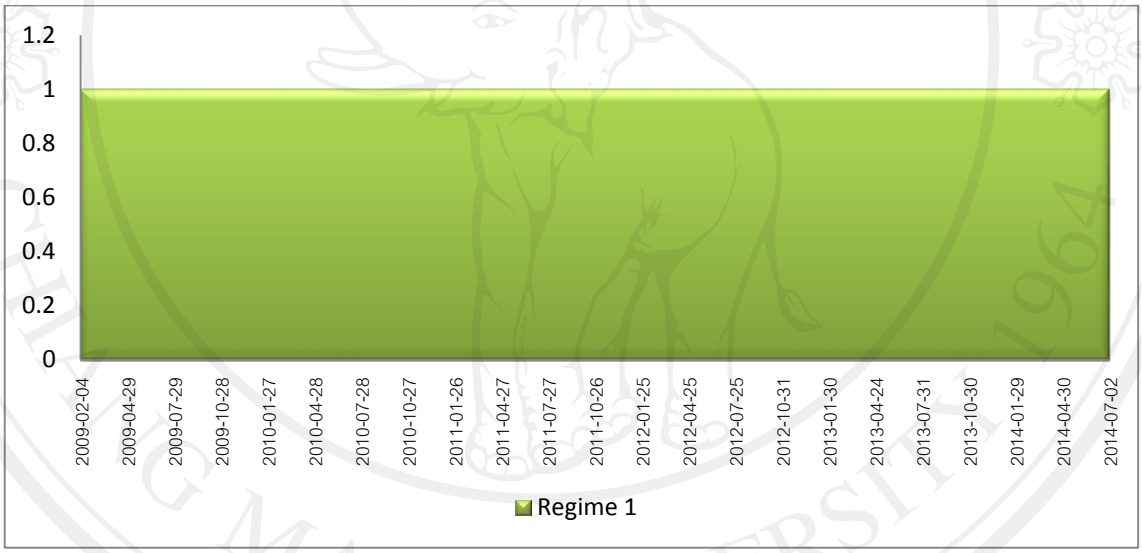


Source : calculation

Figure 4.2 2 Regime Probabilities: TIP exchange markets, 2009-2014 (continued)

Figure 4.2 shows the smoothed probability of regime 1 and 2 TIP exchange markets model. Regime 1 and 2 are plotted in the top panel and bottom panel, respectively. Regime 1 is interpreted as high growth regime. It is not likely detected by the MS-BVAR(1) model in this long period, however it appear the probability of staying the last period. For Regime 2, I interpret this regime as the era of low expansion of QE and currency depreciation. The probability of staying in the regime 2 is longer than regime 1. This result indicates that the TIP exchange markets are mostly staying in the low expansion of QE and currency depreciation. Considering the QE's event, the model cannot detect any QE's event which affect to TIP exchange market in both regimes.

This indicates that TIP exchange markets have low volatility and only severe event can switch TIP exchange markets to stay in high growth regime. Furthermore, the transition matrices of TIP exchange markets are also shown in table 4.2, the results confirm that the Markov chain capture a short period of time of probability in regime 1, which has a probability to stay in regime 1 at 0.01% . In addition, I have learned from Eq. (4.3) that the estimate of coefficient is not significant in regime 1 and it also reflect in figure 4.2 with times series plot of the smoothed probability estimates for the regime 1 that almost constant over time. On the other hand, the smoothed probability estimates for the regime 2 is highly erratic. The result also shows that it is only for the regime 1 that it is more likely to move to regime 2 while the probability to stay, regime 2, is estimated around 99 %. Whereas regime 1 has a duration of approximately 1.01 month, and low growth regime have a duration 66.67 months, respectively.



Source : calculation

Figure 4.3 High Growth Regime Probabilities: TIP bond markets, 2009-2014

Figure 4.3 is similar to figure 4.2. Regime 2 is not likely detected by the MS-BVAR(1) model in this long period. The time series plot of the smoothed probability estimates for the regime 2 that typically close to 0. On the other hand, the smoothed probability estimates for the regime 1 is highly erratic. Regime 1 is interpreted as high growth regime or low bond yield. In addition, the transition matrix arises for TIP bond market model, table 4.2, which implies that it is only for the regime 2 that it is more likely to move to regime 1 while the probability to stay, regime 1, is estimated around 99 %. Conversely, the probability of staying in regime 2 is less than 30%, whereas regime 1 has duration of approximately 100 months while the low growth regime has a duration

1.349 months. These result indicates that only an extremely event can switch the series to change regime 1 to regime 2. TIP bond markets remain in the high growth regime more than the low growth regime. Moreover, I suggest that QE policy cause substantial foreign capital inflow on the TIP bond markets and consequently lowered their bond yield in long period.

In the next section, I separate the observation in each model by smoothed probabilities of each model. For the case of 2 regimes, Krolzig (1997) suggested to assigning the observation to the first regime if the smooth probability of observation is more than 0.5 and assigning it to second regime if the smoothed probability of the observation is less than 0.5.

4.5 Economic Implication

In this section, I discuss the economic implications of the best fit model. First I present Forecast Error Variance Decompositions (FEVDs) which examine the role of each QE program shock in driving the TIP market fluctuations. Second, I present a reaction of any TIP financial markets in response to the shock in QE programs.

4.5.1 Forecast Error Variance Decompositions (FEVDs)

I employed the TIP stock markets model, TIP exchange markets model, and TIP bond markets model to generate FEVDs in each regime, which appears in table 4.3, 4.4, and 4.5, respectively, in order to characterize the dynamic behavior of the TIP financial markets to the shock of QE programs. These tables present FEVDs of regimes high growth, and low growth for TIP financial markets.

Table 4.3 Variance Decompositions of TIP Stock Markets Model

Variance Decomposition of RJKSE:								
	Regime 1				Regime 2			
Period	RJKSE	RMBS	RFB	RTS	RFB	RJKSE	RMBS	RTS
1	100.000	0.000	0.000	0.000	5.876	94.124	0.000	0.000
10	99.447	0.060	0.011	0.030	5.890	93.901	0.166	0.026
Variance Decomposition of RPHEi:								
	Regime 1				Regime 2			
Period	RMBS	RPHEI	RFB	RTS	RFB	RMBS	RPHEI	RTS
1	0.023	55.978	0.000	0.000	0.022	4.817	47.395	0.000
10	0.059	55.448	0.017	0.021	0.057	4.946	47.335	0.032
Variance Decomposition of RSET:								
	Regime 1				Regime 2			
Period	RMBS	RSET	RFB	RTS	RFB	RMBS	RSET	RTS
1	0.997	41.565	0.000	0.000	0.266	10.832	17.553	0.000
10	0.992	41.405	0.001	0.000	0.315	10.968	17.501	0.032

Source: calculation

Table 4.3 presents the results of FEVDs for the high growth regime (left column) and low growth regime (right column). Each entry in the table denotes the percentage of forecast error covariance of the QE programs and TIP stock markets. In the high growth regime, it is apparent that 3 types of QE programs, Mortgage back securities (MBS), purchasing U.S.'s Treasury securities (TS), Fed's balance sheet (FB), do not explain a large part of RJKSE (Jakarta Composite Index) variations. However, the variance in Jakarta Composite Index (RJKSE) is significantly explained by its own variance, which accounts for 100% in the 1st period and about 99.447% in the 10th period. , purchasing U.S.'s Mortgage back securities(RMBS) account for the largest share of shock to Jakarta Composite Index (RJKSE) amounting to about 0.060%, followed by purchasing U.S.'s Treasury securities(RTS)(0.030%) and Fed's balance sheet (RFB)(0.011%), respectively, since the 2nd month period. In addition, the result of Philippine Stock Exchange composite (RPHEi) is similar to Jakarta Composite Index (RJKSE). Apart from its own shock contribution of exactly 55.448% in 10th period, purchasing U.S.'s Mortgage back securities (RMBS) account for the largest share of shock to Jakarta Composite Index (RJKSE) amounting to about 0.059% and followed by purchasing U.S.'s Treasury securities (RTS) and Fed's balance sheet (RFB), respectively. The result of variance decomposition Stock exchange of Thailand index (RSET) is seemed different. Apart from its own shock contribution of exactly 41.405% in 10th period,

purchasing U.S.'s Mortgage back securities (RMBS) account for the largest share of shock to Stock exchange of Thailand index (RSET) amounting to about 0.992%, followed by, Fed's balance sheet (RFB)(0.001%) while purchasing U.S.'s Treasury securities (RTS) is not explain RSET variations. For the low regime, the results of variance decomposition of Stock exchange of Thailand index (RSET), Jakarta Composite Index (RJKSE) and Philippine Stock Exchange composite index (RPHEi) are also similar to the high growth regime.

Table 4.4 Variance Decompositions of TIP exchange markets Model

Variance Decomposition of EXIND:				
	Regime 2			
Period	REXIND	RMBS	RFB	RTS
1	100	0	0	0
10	98.897	0.752	0.080	0.266
Variance Decomposition of REXPH:				
	Regime 2			
Period	REXPH	RMBS	RFB	RTS
1	76.297	0	0	0
10	76.2818	0.0169	0.0002	0.0029
Variance Decomposition of REXTH:				
	Regime 2			
Period	REXTH	RMBS	RFB	RTS
1	72.184	0	0	0
10	71.840	0.270	0.066	0.135

Source : calculation

I have learned from Eq. (4.3) that the estimate of coefficient is not significant in regime 1 and it also reflect in figure 4.2 with times series plot of the smoothed probability estimates for the regime 1 that almost constant over time. Therefore, table 4.4 shows only the result of FEVDs of Thai baht against US dollar (REXTH), Indonesia rupee against US dollar (REXIND) and Philippines peso against US dollar (REXPH) for low growth regime. Apart from its own shock contribution of exactly 100% in the 1st month period and about 94.12% in the 10th month period, the purchasing U.S.'s Mortgage back securities (RMBS) changes accounts for the largest share of shock to Indonesia rupee against US dollar (EXIND) amounting 0.752% in the 10th month period, followed by purchasing U.S.'s Treasury securities (RTS)(0.226%) and Fed's balance sheet (RFB) (0.080%), respectively. In addition, this column shows the variance decomposition of Philippines peso against US (REXPH). Apart from its own shock contribution of

76.297% in the 1st month period and about 76.2818% in the 10th month period, the purchasing U.S.'s Mortgage back (RMBS) changes accounts for the largest share of shock to Indonesia rupee against US (EXIND) amounting 0.0169% in the 10th month period, followed by purchasing U.S.'s Treasury securities (RTS)(0.0029%) and Fed's balance sheet (RFB)(0.0002%), respectively. Moreover, it also shows the variance decomposition of Thai baht against US dollar (REXTH) that is similarly from those of variance decomposition of Philippines peso against US dollar (REXPH). Apart from its own shock contribution of 72.184% in the 1st month period and about 71.840% in the 10th month period, the RMBS changes accounts for the largest share of shock to Thai baht against US dollar (EXTH) amounting 0.270% in the 10th month period, followed by purchasing U.S.'s Treasury securities (RTS)(0.135%) and Fed's balance sheet (RFB) (0.066%), respectively.

Table 4.5 Variance Decompositions of TIP bond markets Model

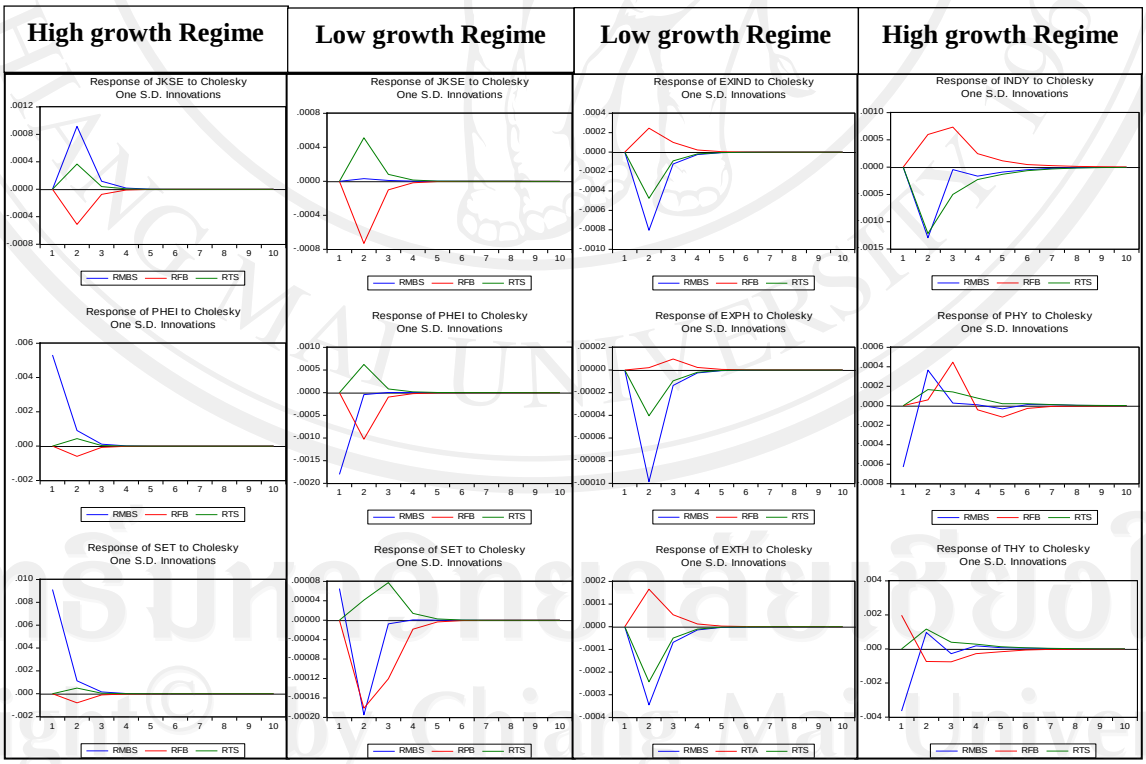
Variance Decomposition of RINDY:				
	Regime 1			
Period	RINDY	RMBS	RTA	RTS
1	100	0	0	0
10	98.244	0.205	0.116	0.215
Variance Decomposition of RPHY:				
	Regime 1			
Period	RMBS	RPHY	RTA	RTS
1	0.018	83.796	0	0
10	0.024	83.226	0.010	0.002
Variance Decomposition of RTHY:				
	Regime 1			
Period	RMBS	RTA	RTHY	RTS
1	1.580	0.467	82.100	0.000
10	1.652	0.593	79.592	0.188

Source: calculation

Conversely, table 4.5 shows only the result of variance decomposition of the TIP bond markets in the high growth because the result, figure 4.2, shows that only regime 1 is detected by Markov chain while smoothed probability estimates for the regime 2 is close to 0. In the case of the variance decomposition of Indonesia government bond yield (RINDY), apart from its own shock contribution of 100% in the 1st month period and about 98.244% in the 10th month period, the purchasing U.S.'s Treasury securities

(RTS) changes accounts for the largest share of shock to Indonesia government bond yield (RINDY) amounting 0.215% in the 10th month period, followed by purchasing U.S.'s Mortgage back securities (RMBS)(0.205%) and Fed's balance sheet(RFB) (0.116%), respectively. Nonetheless, the variance decomposition of Philippines government bond yield (RPHY) and Thai government bond yield (RTHY) are different from those of Indonesia government bond yield (RINDY). Apart from their own shock, purchasing U.S.'s Mortgage back securities (RMBS) changes accounts for the largest share of shock to Philippines government bond yield (RPHY) and Thai government bond yield (RTHY).These results indicate that TIP financial markets are mainly changed by their own shock. However, there are some effects of QE programs to the TIP financial markets. Apart from their own shock, Mortgage Backed Securities (MBS) changes account for the largest share of shock to TIP financial markets. This finding, therefore, confirms that purchasing Mortgage Backed Securities (MBS) may have an effect on the TIP financials market, while other programs are not likely to have direct substantial effects on the TIP financials market.

4.5.2 Impulse response (IRF)



Source : calculation

Figure 4.4 Impulse responses of TIP financial markets to shock in QE.

The impulse response functions are presented for the specification of the Markov-Switching model that allows for two different regimes in the model of TIP stock markets, TIP exchange markets, and TIP bond markets. It presents a reaction of any TIP financial markets in response to QE programs. In this section, I focus only a shock of this policy to TIP stock markets and TIP bond markets in high growth regime; TIP stock markets and TIP exchange markets in low growth regime rather because a large data in those regimes were obtained. Moreover, I also focus on a shock of variables which have a significant following Eq.(4.1), Eq.(4.2), Eq.(4.3), Eq.(4.4), Eq.(4.5), and Eq.(4.6). In Figure 4.4 provide the feedback of QE programs differs considerably between regimes. In the high growth regime, TIP stock markets, the shock in purchasing U.S.'s Treasury (RTS) has great and persistent positive effects on Philippine Stock Exchange composite index (PHEi) and reaches its maximum after about 2 months and then falls sharply and reaches the steady state within 4 months. In the case of TIP bond markets, the result shows that Fed's balance sheet (RFB) and purchasing U.S.'s Treasury securities (RTS) create a positive sharp-shaped response in Indonesia government bond yield (RINDY) and Thai government bond yield (RTHY) about 2 months and 3 months, respectively, and then there fall to the equilibrium within 7 months. In the low growth regime, TIP stock market, the shock in purchasing U.S.'s Treasury (RTS) has negative effects on Jakarta Composite Index and reaches it maximum after 2 months and then fell to the steady state within 4 month. Furthermore, purchasing U.S.'s Treasury securities (RTS) and purchasing U.S.'s Mortgage back securities (RMBS) create a positive response in Jakarta Composite Index(JKSE), whereas U.S.'s Mortgage back securities (RMBS) have a larger impact than purchasing U.S.'s Treasury securities (RTS). In TIP exchange markets case, the shock in Fed's balance sheet (RFB) has a positive effect on Indonesia rupee against US dollar (Exind). It cause Indonesia rupee against US dollar (Exind) to increase (depreciation) about 2 months then it begins to fall (appreciation) to the equilibrium within 4 months. However, a shock to purchasing U.S.'s Treasury securities (RTS) creates a negative sharp response in Indonesia rupee against US dollar (Exind) and it then rises to equilibrium in 4 months.

4.6 Discussion

We learned that when the Fed started the quantitative easing programs they aroused the TIP financial markets. I also found that the heterogeneous effects, with regards to the

QE programs. In TIP stock markets case, the results indicate that the expansion of Treasuries securities purchase program, in high growth regime, will increase the Philippine Stock Exchange Composite Index in the next month because the capital inflow could generate wealth effect through the appreciation of domestic stock market (Chua, Endut, Khadri, and Sim, 2013). The foreign funds in Philippine stocks is one of the reasons that the Philippine Stock Exchange index rose to all-time high levels in 2012 and in the early months of 2013 (Bloomberg, 2013). Nevertheless, in low growth regime, an increase in Treasuries securities and Mortgage Backed Securities purchase program will decrease the decrease in Jakarta Composite Index which two thirds of the market capitalization was in the form of foreign funds. The foreign fund in Indonesia stock market seems to have high proportion when compare domestic fund. According to, monetary approach, an increase in QE causes a capital inflow to Indonesia stock markets, thus it will increase a Jakarta Composite Index during bear market. In Stock Exchange of Thailand, it has not been affected by US QE both in the high growth regime and low growth regime because one thirds of the market capitalization was hold by foreign investors. Therefore, the low proportion of foreign stock holding and domestic stock holding is represented as a weak integration with foreign investment. The country, which has low interaction with foreign investment, is not likely to face with the effects of QE (Chua, Endut, Khadri and Sim , 2013). In TIP exchange markets case, in the low growth regime, The impact of US QE is not big on the TIP exchange markets, except Indonesia rupiah. The result indicates that the Indonesia rupiah have been affected through different channel. According to Mundell-Fleming approach, an increase in money supply will reduce the US interest rate lower than Indonesia interest rate so, the hot money flows out to take advantage from higher interest rate in other countries, thereby appreciating Indonesia rupiah. While, the expansion of Treasuries Securities purchase program seem to effect Indonesia rupiah through confidence channel which can affect portfolio decisions and asset price by altering the risk appetite of investors (Fratzscher, Duca and Straub, 2013). In the period of low expansion in QE programs, the foreign investors might understand that US economic condition become well therefore, they will move their investment back to US. Furthermore, a reversal of portfolio outflows could exert heavy pressure on the balance of payments, causing the Indonesian rupiah to depreciate substantially. Moreover, Indonesia central bank reported that Indonesia's current account deficit at USD $9.8 billion in the second

quarter of 2013, and which is particularly caused by a trade deficit in the country's oil and gas sector. This issue is concerned by foreign investors thus an increase of Treasuries Securities purchase may offset by Indonesia's current account deficit and cause depreciating rupiah. The Indonesia rupiah, therefore, is expected to continue its downward spiral as the QE tapering issue will translate into a stronger US dollar. For Thai baht and Philippines peso, the capital flows probably is not sufficient to cause their currencies change. Moreover, their central bank stands ready to intervene in the foreign exchange market when the volatility of the exchange rate is at a level that the economy is worse than expect. Lastly, in TIP bond markets case, The result in Indonesia bond market, in the high growth regime, and Thai bond market, in the low growth regime, are consistent with Chen, Filardo, He and Zhu (2011), who confirmed that QE1 and QE2 could lowered government bond yield. They suggest that foreign reserve accumulation of these countries were rapid. Markets have seen further QE as an indicator that policy would stay low. Therefore, the foreign reserve accumulation will continue and push government bond yields down. In addition, Moore, Nam, Suh, and Tepper (2013) confirmed that the 100 and 13 basis point decreases in the US 10-year government bond yield attributable to QE 1 and QE 2, respectively. On the other hand, the impact of treasury securities push Thai government bond yield, in high growth regime, and Philippines government bond yield, in the low growth regime, up by 5.15 and 3.513 %, respectively. It is surprising to see that the impact on Thai bond market and Philippines were increase a bond yield. This result is conflict with the other studies. Treasury securities and Mortgage Backed Securities purchase program supposed to have a negative effect to these bond yield. This suggests that Thai bond market and Philippine market are more affected by domestic monetary policy than by foreign policy in those regimes. In particular Thai bond market, foreign ownership of Thai bonds represents only 12 per cent of the total bond market. It has a low proportion when compared to the country’s international reserves of US $200billion. Although foreign investors abandon their bond holdings, the international reserves remain sufficient (Bank of Thailand, 2014)

Moreover, the best fitting MS-BVAR also produces a regime for the positive effect of QE programs to the TIP financial markets, including the announcement of QE programs, expansion of purchasing programs, and a positive signal from (Federal Open

Market Committee: FOMC), which are all placed within the high growth regime. On the other hand, Eurozone crisis, speculative shock in financial markets, and QE tapering, are placed within the low growth regime by the MS-BVAR. These results indicate that QE policy may not a main factor which drives a TIP financial market. According to figure 4.1, in the TIP stock markets case, QE events are detected in both 2 regimes, however, Eurozone crisis events are also detected in both 2 regimes as well. In figure 4.2, TIP exchange market case, the probability to stay in high growth regime is close to 0, while the probability to stay in low growth regime is close to 1. This means that QE events may not a factor which drives TIP currencies change between regimes. Moreover, I found that Thailand, Indonesia and Philippines are exporting countries thus stabilizing exchange rate is a main goal of their economy in order to avoid overshooting of either direction. Therefore, TIP central banks have to intervene their exchange rate and depreciate their currencies. As a result, TIP exchange rate are stay in low growth regime. In figure 4.3, TIP bond markets case, low growth regime is not likely detected by the MS-BVAR(1) model in this long period. It provides only the high growth regime. This result indicate that QE policy cause substantial foreign capital inflow on the TIP bond markets and consequently lowered their bond yield in long period. According, portfolio approach, Fed employs an expansion monetary policy, purchasing domestic bonds, in order to stabilizing the economy. Following that, private resident asset holders find themselves with excess supply of reserve money and the excess demand for bonds can be eliminate by a decline in domestic interest rate. This decline in domestic interest rates then induces resident asset holders to switch from U.S to TIP bonds, the increase in demand for TIP bonds put a downwards pressure on the US currency's value and put a upwards pressure on the TIP currency's value. Furthermore, the result of regimes probabilities present those TIP stock markets and bond markets have a possibility to stay in the high growth regime more than low growth regime while TIP exchange markets have a possibility to stay in the high growth regime less than low growth regime. Moreover, these models produce an impulse response function which indicates that the feedback of QE programs differs considerably between the regimes. In the high growth regime, the shock in purchasing treasury securities has a positive effects on Philippine Stock Exchange composite index and Thai bond yield while the innovation shock to Fed's balance sheet produce a positive response to Indonesia bond yield. In the low growth regime, purchasing U.S.'s Treasury securities and purchasing

U.S.'s Mortgage back securities create a positive response in Jakarta Composite Index(JKSE. Moreover, the shock in to Fed total asset has a positive effect on Indonesia rupiah. However, a shock to purchasing treasury securities creates a negative response in Indonesia rupiah. The shocks of QE programs are likely to affect to TIP financial about 2 months then it begins to reach their equilibrium within 4 months. The best fitting MS-BVAR also generates FEVDs which characterize the dynamic behavior of the TIP financial markets to the shock of QE programs. the results provide that TIP financial markets are mainly changed by their own shock. However, there are some effects of QE programs to the TIP financial markets. Apart from their own shock, Mortgage Backed Securities (MBS) changes account for the largest share of shock to TIP financial markets. This finding, therefore, confirms that purchasing Mortgage Backed Securities (MBS) may have an effect on the TIP financials market, while other programs are not likely to have direct substantial effects on the TIP financials market.