CHAPTER III

METHODOLOGY

3.1 Research Hypotheses

The macroeconomic announcement effects on asset returns possibly occur via two channels. The first is due to the equilibrium adjustments. As macroeconomic announcements reveal new information that not previously incorporated into asset prices, market participants will realize the difference between the actual announcement and their expectations and consequently adjust their expectation. The second channel is the anticipation of a policy response by the central bank; called 'policy anticipation hypothesis'. Given the injection of new information, the market equilibrium must be restored by incorporating the expected future policy response of the central bank. Finally, the market participants' response to new information will finally affect risk premium and volatility of asset returns. One would expect high volatility on macroeconomic announcement days and risk premium should be higher than average when exposed to macroeconomic risks.

Hypothesis I: Risk premium of stock and government bond on macroeconomic announcement days are significantly different from the other days.

Hypothesis II: Variance and covariance of stock and government bond on macroeconomic announcement days are significantly different from variance and covariance on the other days.

Under the condition of the market efficiency, the market prices should quickly incorporate new information and the trading process does not generate persistent volatility in response to news. One would expect that the days after announcement do not have higher volatility than the average.

Hypothesis III: Variance and covariance of stock and government bond on the days after announcements are significantly different from variance and covariance on the other days (Test for the speed of adjustments to new information).

The financial press in foreign markets, i.e. US, often claims that financial markets are particular quiet on the day prior macroeconomic announcement. This is called the "calm before the storm effect". One possible explanation is that market participants wait for the upcoming releases and then slow their investment activities. As a result, one would expect that the day before announcement should have lower volatility than the average.

Hypothesis IV: Variance and covariance of stock and government bond on the days before announcements are significantly different from variance and covariance on the other days (Test for pre-announcement effect).

The information content of announcements should have different impact to the stock and bond markets. Inflationary shocks trivially raise bond yields. Meanwhile, stock prices depend on the expected cash flows, the discount rate, and risk premium. Holding risk premium constant, a positive macroeconomic shock increase the expected cash flows and then increase stock price. However, it also increases the discount rate and then decreases stock prices. So, the final result variably depends on which effect dominates. Conclusively, one might expect that inflation announcement should have greater impact on the bond market, while the state of economy announcement should have greater impact on the stock market.

Hypothesis V: Variances and covariance of stock and government bond on individual announcement (Real economic activity, consumer confidence index, gross domestic product, inflation, and trade balance announcement) are significantly different from the other days.

Abbreviations used in this paper

$R_{stock,t}$ and $R_{bond,t}$ are risk premiums of stock and government bond respectively.

I^{A}_{t} is dummy variable, equal to 1 on the announcement days and 0 on the other days.

I^{A}_{t+1} is dummy variable, equal to 1 on the days after announcement and 0 on the other days.

I^{A}_{t-1} is dummy variable, equal to 1 on the days before announcement and 0 on the other days.

I^{BOT}_{t} is dummy variable, equal to 1 on the days of the Bank of Thailand press release on economic conditions and 0 on the other days.

I^{CCI}_{t} is dummy variable, equal to 1 on the days of Consumer Confidence Index announcement and 0 on the other days.

I^{INF}_{t} is dummy variable, equal to 1 on the days of Inflation announcement and 0 on the other days.

I^{TB}_{t} is dummy variable, equal to 1 on Trade Balance announcement days and 0 on the other days.

I^{M}_{t} is dummy variable, equal to 1 on monetary announcement days and 0 on the other days.

$\varepsilon_{stock,t}$ and $\varepsilon_{bond,t}$ is the residual error with conditional mean of 0, and conditional variance and covariance of $h_{stock,t}$, $h_{bond,t}$ and $h_{stock.bond,t}$ respectively.

$h_{stock,t}$ and $h_{bond,t}$ is the conditional variance of stock and government bond respectively.

$h_{stock.bond,t}$ is the conditional covariance of stock and government bond.

H_t is the conditional variance-covariance matrix of stock and government bond.

$Volume_t$ is the trading volume.

3.2 Model Specification and Hypothesis Testing

1) To test the impact of macroeconomic announcements on risk premium of stock and bond separately, using the univariate GARCH-M model under the following equations (1) and (2):

$$R_{i,t} = \mu_i + (\beta_{i0} + \beta_{i1} I^A_t) * h_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$h_{i,t} = \omega + \alpha\, \varepsilon^2_{i,t-1} + \theta\, h_{i,t-1} \quad (2)$$

2) To test the impact of macroeconomic announcements on risk premium of stock and bond simultaneously, using the bivariate GARCH-M model. The parameters are estimated by maximum likelihood estimation under the following equations (3) and (4):

$$R_{stock,t} = \alpha_1 + (\beta_{10} + \beta_{11} I^A_t) * h_{stock,t} + (\delta_1 + \delta_{11} I^A_t) * h_{stock.bond,t} + \varepsilon_{stock,t} \quad (3)$$

$$R_{bond,t} = \alpha_2 + (\beta_{20} + \beta_{21} I^A_t) * h_{bond,t} + (\delta_2 + \delta_{21} I^A_t) * h_{stock.bond,t} + \varepsilon_{bond,t} \quad (4)$$

This model uses the multivariate GARCH process proposed by Engle and Kroner (1995), the BEKK parameterization. The BEKK parameterization of multivariate process ensures a positive definite variance-covariance matrix, which is necessary for the estimated variance to be greater than or equal to zero. The 2x2 variance-covariance matrix is written as:

$$H_t = C'C + A'H_{t-1}A + B'\varepsilon_{t-1}\varepsilon_{t-1}'B \quad (5)$$

$$= \begin{bmatrix} h_{stock,t} & h_{stock.bond,t} \\ h_{stock.bond,t} & h_{bond,t} \end{bmatrix}$$

$$\varepsilon_t \sim N(0, H_t)$$

A, B, and C are matrices of coefficient.

$$C = \text{2x2 lower triangular} = \begin{bmatrix} c_{11} & 0 \\ c_{21} & c_{22} \end{bmatrix}$$

$$A = \text{2x2 diagonal} = \begin{bmatrix} a_{11} & 0 \\ 0 & a_{22} \end{bmatrix}$$

$$B = \text{2x2 diagonal} = \begin{bmatrix} b_{11} & 0 \\ 0 & b_{22} \end{bmatrix}$$

ε_t is the vector of residuals with mean 0 and conditional variance-covariance H_t.

Test of Hypothesis I based on equations (3) – (5)

2.1) The impact on risk premium of stock

H_0: $\beta_{11} = 0$ and H_0: $\delta_{11} = 0$

H_1: $\beta_{11} \neq 0$ H_1: $\delta_{11} \neq 0$

2.2) The impact on risk premium of government bond

H_0: $\beta_{21} = 0$ and H_0: $\delta_{21} = 0$

H_1: $\beta_{21} \neq 0$ H_1: $\delta_{21} \neq 0$

3) To test the impact of macroeconomic announcements on variance and covariance of Thai government bonds and stocks and to test the impact of new releases on the days after announcements, using the Ordinary Least Square estimation in the following equations (6)-(8):

$$h_{stock,t} = \rho_{10} + \rho_{11} h_{stock,t-1} + \rho_{12} I^{A}_{t} + \rho_{13} I^{A}_{t-1} + \rho_{14} I^{A}_{t-2} + \rho_{15} I^{A}_{t+1} + \rho_{16} I^{A}_{t+2} + \rho_{17} Volume_t + \varepsilon_t \quad (6)$$

$$h_{bond,t} = \rho_{20} + \rho_{21} h_{bond,t-1} + \rho_{22} I^{A}_{t} + \rho_{23} I^{A}_{t-1} + \rho_{24} I^{A}_{t-2} + \rho_{25} I^{A}_{t+1} + \rho_{26} I^{A}_{t+2} + \rho_{27} Volume_t + \varepsilon_t \quad (7)$$

$$h_{stock.bond,t} = \rho_{30} + \rho_{31}\, h_{stock.bond,t-1} + \rho_{32}\, \Gamma^{A}_{t} + \rho_{33}\, \Gamma^{A}_{t-1} + \rho_{34}\, \Gamma^{A}_{t-2} + \rho_{35}\, \Gamma^{A}_{t+1} + \rho_{36}\, \Gamma^{A}_{t+2} + \rho_{37}\, Volume_{t} + \varepsilon_{t} \qquad (8)$$

The conditional variances and covariance as the dependent variables are derived from the bivariate GARCH-M estimation. To capture the autocorrelation of the conditional variance and covariance, the estimation is also included the first lag of the dependent variables. In addition, this paper also use the trading volume as an independent variable to capture possible volatility changes caused by trading per se, and the independent of information effects.

Note that, macroeconomic announcements will affect the conditional variance and covariance via equations (6)-(8). The conditional variance and covariance will consequently affect expected value of risk premium, which is shown in Appendix.

Test of Hypothesis II based on equations (6) – (8)

3.1) The impact on variance of stock

H_0: $\rho_{12} = 0$

H_1: $\rho_{12} \neq 0$

3.2) The impact on variance of bond

H_0: $\rho_{22} = 0$

H_1: $\rho_{22} \neq 0$

3.3) The impact on covariance of stock and bond

H_0: $\rho_{32} = 0$

H_1: $\rho_{32} \neq 0$

Test of Hypothesis III based on equations (6) – (8)

3.4) The impact on variance of stock

$H_0: \rho_{15} = 0$ and $H_0: \rho_{16} = 0$

$H_1: \rho_{15} \neq 0$ $H_1: \rho_{16} \neq 0$

3.5) The impact on variance of bond

$H_0: \rho_{25} = 0$ and $H_0: \rho_{26} = 0$

$H_1: \rho_{25} \neq 0$ $H_1: \rho_{26} \neq 0$

3.6) The impact on covariance of stock and bond

$H_0: \rho_{35} = 0$ and $H_0: \rho_{36} = 0$

$H_1: \rho_{35} \neq 0$ $H_1: \rho_{36} \neq 0$

Test of Hypothesis IV based on equations (6) – (8)

3.7) The impact on variance of stock

$H_0: \rho_{13} = 0$ and $H_0: \rho_{14} = 0$

$H_1: \rho_{13} \neq 0$ $H_1: \rho_{14} \neq 0$

3.8) The impact on variance of bond

$H_0: \rho_{23} = 0$ and $H_0: \rho_{24} = 0$

$H_1: \rho_{23} \neq 0$ $H_1: \rho_{24} \neq 0$

3.9) The impact on covariance of stock and bond

$H_0: \rho_{33} = 0$ and $H_0: \rho_{34} = 0$

$H_1: \rho_{33} \neq 0$ $H_1: \rho_{34} \neq 0$

4) To test whether stock and bond volatilities react differently on news content of announcements, using equations (9) – (11):

$$h_{stock,t} = \rho_{10} + \rho_{11}h_{stock,t-1} + \rho_{121}I^{BOT}_{t} + \rho_{122}I^{BOT}_{t-1} + \rho_{123}I^{BOT}_{t+1} + \rho_{131}I^{CCI}_{t-1} + \rho_{132}I^{CCI}_{t+1} + \rho_{133}I^{CCI}_{t+2} + \rho_{141}I^{GDP}_{t} + \rho_{142}I^{GDP}_{t-1} + \rho_{143}I^{GDP}_{t+1} + \rho_{151}I^{INF}_{t} + \rho_{152}I^{INF}_{t-1} + \rho_{153}I^{INF}_{t+1} + \rho_{161}I^{TB}_{t} + \rho_{162}I^{TB}_{t-1} + \rho_{163}I^{TB}_{t+1} + \rho_{17}Volume_t + \varepsilon_t \quad (9)$$

$$h_{bond,t} = \rho_{20} + \rho_{21}h_{bond,t-1} + \rho_{221}I^{BOT}_{t} + \rho_{222}I^{BOT}_{t-1} + \rho_{223}I^{BOT}_{t+1} + \rho_{231}I^{CCI}_{t-1} + \rho_{232}I^{CCI}_{t+1} + \rho_{233}I^{CCI}_{t+2} + \rho_{241}I^{GDP}_{t} + \rho_{242}I^{GDP}_{t-1} + \rho_{243}I^{GDP}_{t+1} + \rho_{251}I^{INF}_{t} + \rho_{252}I^{INF}_{t-1} + \rho_{253}I^{INF}_{t+1} + \rho_{261}I^{TB}_{t} + \rho_{262}I^{TB}_{t-1} + \rho_{263}I^{TB}_{t+1} + \rho_{27}Volume_t + \varepsilon_t \quad (10)$$

$$h_{stock.bond,t} = \rho_{30} + \rho_{31}h_{stock.bond,t-1} + \rho_{321}I^{BOT}_{t} + \rho_{322}I^{BOT}_{t-1} + \rho_{323}I^{BOT}_{t+1} + \rho_{331}I^{CCI}_{t-1} + \rho_{332}I^{CCI}_{t+1} + \rho_{333}I^{CCI}_{t+2} + \rho_{341}I^{GDP}_{t} + \rho_{342}I^{GDP}_{t-1} + \rho_{343}I^{GDP}_{t+1} + \rho_{351}I^{INF}_{t} + \rho_{352}I^{INF}_{t-1} + \rho_{353}I^{INF}_{t+1} + \rho_{361}I^{TB}_{t} + \rho_{362}I^{TB}_{t-1} + \rho_{363}I^{TB}_{t+1} + \rho_{27}Volume_t + \varepsilon_t \quad (11)$$

Test of Hypothesis V based on equations (9)-(11)

4.1) The impact on variance of stock

H_0: $\rho_{1i1} = 0$

H_1: $\rho_{1i1} \neq 0$;i = 2,3,…,6

4.2) The impact on variance of bond

H_0: $\rho_{2i1} = 0$

H_1: $\rho_{2i1} \neq 0$;i = 2,3,…,6

4.3) The impact on covariance of stock and bond

H_0: $\rho_{3i1} = 0$

H_1: $\rho_{3i1} \neq 0$;i = 2,3,…,6