Chapter 3

Methods

In this study test stationary of the data exchange rate and export volumes that were gathered from department of export Thailand. Then, model univariate GARCH model for estimating the volatility of e (exchange rate) and volatility of x (export volumes) which are selected appropriate GARCH/ARCH model and the last part studies the relationship between exchange rate volatility and export volume volatility by using Multivariate GARCH model and testing Hypothesis.

3.1 Unit Root Test Model

3.1.1 The Augmented Dickey-Fuller (ADF) Test

The standard DF test is carried out by estimating Equation after y_{t-1} subtracting from both sides of the equation:

$$\Delta y_t = \alpha y_{t-1} + \chi_t'\delta + \varepsilon_t$$

where $\alpha = \rho - 1$. The null and alternative hypotheses may be written as,

$$H_0 : \alpha = 0$$

$$H_1 : \alpha < 0 \tag{9}$$

where $\hat{\alpha}$ is the estimate of α , and $se(\hat{\alpha})$ is the coefficient standard error. The t-ratio shows testing of unit root, the null hypothesis means that the series under consideration is not stationary and a unit root is present.

Where y_t are the logarithm of export volumes ($\ln X_t$) and logarithm of exchange rate ($\ln e_t$)

3.1.2 The Phillips-Perron (PP) Test

The alternative (nonparametric) method of controlling for serial correlation tests for a unit root. The PP method estimates the non-augmented- DF test modifies the t-ratio of the α coefficient so that serial correlation does not affect the asymptotic distribution of the test statistic.

Where $\hat{\alpha}$ is the estimate, and t_{α} the t-ratio of α, $se(\hat{\alpha})$ is coefficient standard error, and s is the standard error of the test regression. The addition γ_0 is a consistent estimate of the error variance

$$\tilde{t}_{\alpha} = t_{\alpha}\left(\frac{\gamma_0}{f_0}\right)^{\frac{1}{2}} - \frac{T(f_0 - \gamma_0)(se(\hat{\alpha}))}{2 f_0^{\frac{1}{2}} s} \tag{12}$$

The PP statistic value which less than critical value, Stationary can be rejected. The PP Test Statistic of variables at level, which is less than MacKinnon statistic, means that both variables are stationary. Setting the model to test PP model as same as ADF model.

3.1.3 The Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) Test

The testing differs from the other unit root tests described here in that the series y_t is assumed stationary under the null hypothesis. The KPSS statistic is based on the residuals from the OLS regression of y_t on the exogenous variables χ_t:

$$y_t = \chi_t{}'\delta + u_t \tag{13}$$

The LM statistic is be defined as:

$$LM = \sum_t S(t)^2 / (T^2 f_0) \tag{14}$$

where f_0, is an estimator of the residual spectrum at frequency zero and where $S(t)$ is a cumulative residual function:

$$S(t) = \sum_{\gamma=1}^{t} \hat{u}_{\gamma} \tag{15}$$

based on the residuals $\hat{u}_t = y_t - \chi_t{}'\delta(0)$. Where are the logarithm of export volumes ($\ln X_t$) and logarithm of exchange rate ($\ln e_t$). Where x_t are the lag variables of logarithm of export volumes ($\ln X_t$) and logarithm of exchange rate ($\ln e_t$) respectively.

3.2 Univariate ARCH/ GARCH Model

The autoregressive conditional heteroskedasticity (ARCH) model is the first model of conditional heteroskedasticity. Let ε_t be a random variable that has a mean and a variance conditionally on the information set F_{t-1} (the σ-field generated by $\varepsilon_{t-n}, n \geq 1$):The ARCH model of ε_t has the following properties. First, $\mathrm{E}\left\{\varepsilon_t \middle| F_{t-1}\right\} = 0$ and second, the conditional variance $h_t = \mathrm{E}\left\{\varepsilon_t^2 \middle| F_{t-1}\right\}$ is a nontrivial positive-valued parametric function of F_{t-1} the sequence $\{\varepsilon_t\}$ may be observed directly, or it is an error or innovation sequence of an econometric model. In the latter case,

$$\varepsilon_t = y_t - \mu_t(y_t) \tag{16}$$

$$\varepsilon_{\ln x_t} = \ln X_t - \mu_t(\ln X_t) \tag{16.1}$$

$$\varepsilon_{\ln e_t} = \ln e_t - \mu_t(\ln e_t) \tag{16.2}$$

Where y_t are an observable random variable, the logarithm of export volumes ($\ln X_t$) and logarithm of exchange rate ($\ln e_t$), $\mu_t(y_t) = \mathrm{E}\left\{y_t \middle| F_{t-1}\right\}$, .

The conditional mean of y_t given F_{t-1} the application was of this type. The conditional variance defines an ARCH model of order q:

$$h_t = \alpha_0 + \sum_{n=1}^{q} \alpha_n \varepsilon_{t-n}^2 \tag{18}$$

$$h_{\ln x_t} = \alpha_0 + \sum_{n=1}^{q} \alpha_n \varepsilon_{\ln x_{t-n}}^2 \tag{18.1}$$

$$h_{\ln e_t} = \alpha_0 + \sum_{n=1}^{q} \alpha_n \varepsilon_{\ln e_{t-n}}^2 \tag{18.2}$$

Where $\alpha_0 > 0, \alpha_n \geq 0, n = 1,\ldots,q-1,$ and $\sum_{n=0}^{q} a_n < 1$ the parameter restrictions in (18) form a necessary and sufficient condition for positively of the conditional variance.

3.3 Models of conditional Volatility

In order to investigate the impact of real exchange rate uncertainty on the volume and volatility of trade flows, it must be provided a proxy that captures the volatility of both the exchange rate and trade flow series. The volatility measures are estimated using a multivariate GARCH system for the logarithm of export volumes ($\ln X_t$) and logarithm of exchange rate ($\ln e_t$). This strategy estimates internally consistent conditional variances of both series, which use as proxies for the logarithm of export volumes ($\ln X_t$) and logarithm of exchange rate ($\ln e_t$).

This paper proposes a new MGARCH model with time-varying correlations. This allows time vary correlation coefficient which estimates in DCC-GARCH model. Two dynamic conditional correlation models, namely the symmetric DCC - GARCH model

$$\text{Ht} = C + \sum A' u_{t-1} u'_{t-1} + \sum B' H_{t-1} \tag{21}$$

$$\varepsilon_{\ln e_t} = \ln e_t - \mu_t(\ln e_t) \tag{21.1}$$

$$\varepsilon_{\ln x_t} = \ln X_t - \mu_t(\ln X_t) \tag{21.2}$$

Equation (21) defines the conditional mean of the log real exchange rate ($\ln e_t$) as a function of its own lag as well as a first-order moving average innovation. To preserve symmetry, the conditional mean of the logarithm of export volumes ($\ln X_t$) in equation (22), is defined in terms of its own lag with a moving average innovation of order one. The vector of innovations is defined as $u_t = [\varepsilon_{\ln e_t}, \varepsilon_{\ln x_t}]'$, $u_j \ (t-1)^2$ is volatility from previous period measured as the lag of the squared residual from the mean equation. The diagonal elements of H_t , H_{jj} (t – 1) last previous forecast variance, are the conditional variances of logarithm of export volumes, $\sigma^2_{\ln x_t}$ and logarithm of exchange rate , $\sigma^2_{\ln e_t}$ respectively.

To estimate a DCC-GARCH model is dynamic conditional correlation models, namely the symmetric DCC-GARCH model

$$H_{ii}\ (t) = \mathrm{c}_{\mathrm{ii}} + \sum_j \mathrm{a}_{\mathrm{ij}}\, u_j\ (t-1)^2 + \sum_j \mathrm{b}_{ij}\, \mathrm{H}_{jj}\ (\mathrm{t}-1) \tag{23}$$

Where; $u_j \ (t-1)^2$ is volatility from previous period measured as the lag of the squared residual from the mean equation; $H_{jj}(t-1)$ is last previous forecast variance. Given i= $\ln X_t$ and j= $\ln e_t$.

Given c_{ij}, a_{ij}, b_{ij} are parameters which show the relationship between volatility of export volumes and exchange rate. Where a_{ij} , b_{ij} are the coefficient of volatility relationship between export volumes and exchange rate. The hypothesis test c_{ij}, a_{ij}, b_{ij} where $i \neq j$; i , j > 0 (Barkoulas, T. John; Baum, C. F. and Caglayan, M., 2002)

The hypothesis is given by

H_0 : a_{ij}, b_{ij} = 0

H_a: a_{ij}, b_{ij} > 0

Rejection null hypothesis means that there is correlation on conditional variance of exchange rate and export volumes.

3.4 Definition

Export is any good and commodity, transported from one country to another country in a legitimate fashion, typically for use in trade.

Exchange rate is an exchange between two currencies specifies how much one currency is worth in terms of the other.

Volatility is the measure of the state of instability. Volatility refers to the standard deviation of the change in value of a financial instrument with a specific time horizon. It is often used to quantify the risk of the instrument over that time.