

Chapter 3

Research Design and Methods

3.1 Information adjustment

Adjust information both Gold spot price and Gold Future price to return terms as:

$$x_t = \ln\left(\frac{p_t}{p_{t-1}}\right) \quad (3.1)$$

Where

- x_t = Return on Gold Spot and Gold Future Price
 p_t = Price of Gold Spot and Gold Future at time t
 p_{t-1} = Price of Gold Spot and Gold Future at time $t - 1$

Then, there are four pairs of information to find relationship as;

- S1 Return on Gold Spot price from October 2009 – December 2009
- F1 Return on Settlement price from October 2009 – December 2009 (GFZ09)
- S2 Return on Gold Spot price from December 2009-February 2010
- F2 Return on Settlement price from December 2009-February 2010 (GFG10)
- S3 Return on Gold Spot price from August 2010-October 2010
- F3 Return on Settlement price from August 2010-October 2010 (GFV10)
- S4 Return on Gold Spot price from October 2010-December 2010
- F4 Return on Gold Spot price from October 2010-December 2010 (GFZ10)

3.2 Estimation

3.2.1 Unit Root test

Test for the stationary of information under study by ADF (Augmented Dickey–Fuller) test as:

1. Test for a unit root:

$$\Delta x_t = \delta x_{t-1} + \sum_{i=1}^m \alpha_i \Delta x_{t-i} + e_t \quad (3.2)$$

2. Test for a unit root with drift:

$$\Delta x_t = \beta_1 + \delta x_{t-1} + \sum_{i=1}^m \alpha_i \Delta x_{t-i} + e_t \quad (3.3)$$

3. Test for a unit root with drift and deterministic time trend:

$$\Delta x_t = \beta_1 + \beta_2 t + \delta x_{t-1} + \sum_{i=1}^m \alpha_i \Delta x_{t-i} + e_t \quad (3.4)$$

where

x_t, x_{t-1} = Variable time series at time t and $t - 1$

β_1, β_2, δ = Parameters

t = Trend

e_t = Random error

Where $\delta = \rho - 1$, which also means that if $\delta = 0$ then $\rho = 1$ and that H_0 is accepted. In another way round, if $\delta = 1$ then $\rho = 0$ and that H_a is accepted and they are stationary. Then the hypotheses can be written as:

$$H_0 : \delta = 0$$

$$H_a : \delta < 1$$

In this case, x as variable time series is return on Gold Spot price and also Gold Future price which calculated as logarithm of today price and yesterday price. T-statistic will be calculated and compared to critical t-statistic. There are three different various cases of test equation, which include in the estimation. They are

constant, constant and trend and no constant no trend. Accept null hypothesis of non-stationary when calculated t-statistic is larger than MacKinnon critical-t-statistic and reject null hypothesis if calculated t-statistic is smaller than MacKinnon critical t-statistic.

3.2.2 Lag Length Criteria

Determine the lag length by using five different criteria as:

1. Sequential modified LR test statistic

$$LR = (T - m)\{\log|\Omega_{l-1}| - \log|\Omega|\} \sim \chi^2(k^2)$$

2. Final prediction error

$$FPE_p = \ln(\hat{\sigma}^2) (n + p)(n - p)^{-1}$$

3. Akaike information criterion

$$AIC_p = n \ln(\hat{\sigma}^2) + 2p$$

4. Schwarz information criterion

$$SIC_p = n \ln(\hat{\sigma}^2) + n^{-1}p \ln(n)$$

5. Hannan-Quinn information criterion

$$HQC_p = n \ln(\hat{\sigma}^2) + 2n^{-1}p \ln(\ln(n))$$

3.2.3 Cointegration Test

Johansen Cointegration test is used to test whether they are full rank or not because Johansen Cointegration test is more suitable for more than one cointegrating relationship. Null hypothesis that there are r or fewer cointegrating vectors is tested using the test statistic

$$\text{TRACE TEST} = -T \sum_{i=r+1}^M \ln[1 - (r_i^*)^2]$$

If the correlations based on actual disturbances had been observed instead of estimated, then this statistic would be referred to the chi-squared distribution with $M - r$ degrees of freedom.

3.2.4 Vector Autoregressive (VAR) model

If x and y are stationary $I(0)$ variables, the relationship can be studied under VAR model as:

$$y_t = \beta_{10} + \beta_{11}y_{t-1} + \beta_{12}x_{t-1} + v_t^y \quad (3.5)$$

$$x_t = \beta_{20} + \beta_{21}y_{t-1} + \beta_{22}x_{t-1} + v_t^x \quad (3.6)$$

All variables are stationary $I(0)$, and the system can again be estimated by least squares. The VAR model is a general framework to describe the dynamic interrelationship between stationary variables. If x and y are stationary $I(0)$ variables, the system will be used. But if they are not cointegrated, the interrelation between them using a VAR framework differences. If they are non-stationary $I(1)$ and cointegrated, we need to modify the system of equation to allow for the cointegrated relationship between the $I(1)$ variables.

3.2.5 Impulse responses

Test for Impulse response functions both in univariate case and bivariate case to study;

- The effect of a shock to y on the time path of y and x .
- The effect of a shock to x on the time path of y and x .

3.2.6 Least Squares Equation

In the case of all variables are stationary $I(0)$, estimating Least Squares

Equation with:

$$\hat{y}_i = b_1 + b_2 x_i \quad (3.7)$$

The vertical distances from each point to the fitted line are the least squares residuals. They are given by

$$\hat{e}_i = y_i - \hat{y}_i = y_i - b_1 + b_2 x_i \quad (3.8)$$

The least squares estimators:

$$b_2 = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sum(x_i - \bar{x})^2} \quad (3.9)$$

$$b_1 = \bar{y} - b_2 \bar{x} \quad (3.10)$$

Where $\bar{y} = \frac{\sum y_i}{N}$ and $\bar{x} = \frac{\sum x_i}{N}$ are the sample means of the observations

on y and x .

- Coefficient of determination (R^2)

Calculate the Coefficient of determination (R^2) with the regression model:

$$R^2 = \frac{SSR}{SST} = 1 - \frac{SSE}{SST}$$

Where

$\sum(y_i - \bar{y})^2$ = Total sum of squares: SST (total variation in y)

$\sum(\hat{y}_i - \bar{y})^2$ = Sum of squares due to the regression: SSR (explained

sum of squares)

$\sum \hat{e}_i$ = Sum of squares due to error: SSE (unexplained sum of squares)

- Durbin-Watson (DW) Statistic

Calculate the autocorrelation by Durbin-Watson (DW) statistic with the test statistic:

$$d = \frac{\sum_{i=2}^n (e_i - e_{i-1})^2}{\sum_{i=2}^n e_i^2}$$

3.2.7 Cointegrating Regression

In this study, the cointegrating regression is estimated under the Dynamic Ordinary Least Squares (DOLS) approach with Schwarz criteria with maximum lag.

Termed Dynamic OLS (DOLS), the method involves augmenting the cointegrating regression with lags and leads of so that the resulting cointegrating equation error term is orthogonal to the entire history of the stochastic regressor innovations:

$$y_t = x_t' \beta + D_{1t}' \gamma_1 + \sum_{j=-q}^r \Delta x_{t+j}' + \delta + v_{1t} \quad (3.11)$$

Under the assumption that adding q lags and r leads of the differenced regressors soaks up all of the long-run correlation between u_{1t} and u_{2t} .

3.3 Location of Research Operation and Data Collection

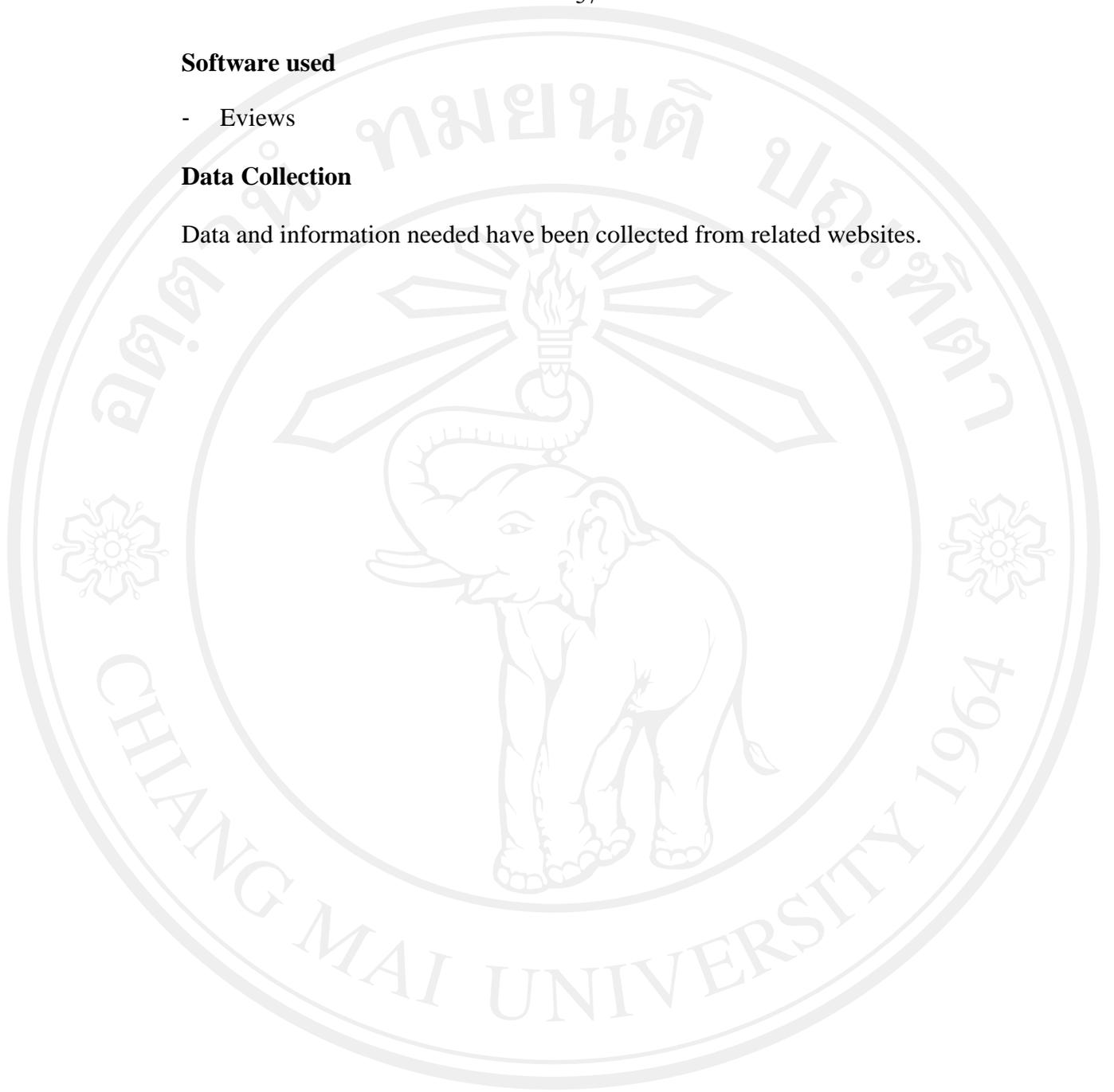
- Libraries (Main, Economics Faculty and BA Faculty, Chiang Mai University, Thailand)
- FIC (Financial and Investment Center, BA Building, Chiang Mai University, Thailand)
- QA Room (Economics Building, Chiang Mai University, Thailand)

Software used

- Eviews

Data Collection

Data and information needed have been collected from related websites.



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