Econometric Analysis of the Exchange Rate Regimes for Asia-5 Countries during Pre and Post-Asian Economic Crisis in 1997

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Abstract

In the "impossible trinity", the exchange rate policy implies the choice of exchange rate regime in which a country determines their exchange rate regime either following the free exchange rate regime or fixed regime. In fact, during the twentieth century the possible choice of exchange rate regime was not only either fix or free-floating but also something in between, e.g. adjustable rates, crawling peg, etc. The exchange rate regime other than fix and free-floating regimes have also been widely implemented by many countries especially emerging market. We review studies on taxonomy of the exchange rate regime as well as the description of the types of exchange rate regime which is usually adopted in many countries.

International Monetary Funds (IMF) has considerable influence in the development of the exchange rate regime, besides IMF play important role as the world's financial institutions that provide financial support for its member countries. Related to the exchange rate regime, since 1970's the IMF recorded the official announcement (or usually known as "*de jure*") exchange rate regime in member countries. However, in the late 1990s the IMF changed the classification method of the exchange rate regime in member country and put more emphasis to observe on what member country actually conducted to their exchange rate regime (or known as "*de facto*").

Since 1970's, the official announcement regarding the exchange rate regimes in Indonesia has been conducted 3 times. Therefore, until recently the *de jure* exchange rate regime in Indonesia can be divided into 3 periods as follows: (1) 1966 – October 1978: rupiah was under fixed regime (fixed to the US dollar); (2) November 1978 – July 1997: rupiah was under managed-floating with basket currencies under several adjustment including widening band intervention during 1992 – July 1997; (3) August 1997 - present: regime changed to free-floating (rupiah was highly volatile against the US dollar during the Asian Crisis).

It is obvious that by observing the rupiah movement during period (1), the evidence shows that rupiah was really fixed to the US dollar. The same thing also happened during the period (2), where the movement of rupiah was no longer fixed as in previous period. However, some evidences are needed to exactly understand about what is really happening with Indonesian currency movement during period (3). Since the exchange rate regime was officially announced as free-floating but the rupiah movement in reality does not really reflect high volatile movement, since the rupiah movement, theoretically, should be determined mainly by market mechanism. The purpose of this chapter is to obtain statistical evidence related to the de facto exchange rate regime, particularly during the post-Asian crisis 1997.

We examine *de facto* regime which is conducted by Bank Indonesia. By examining *de facto* regime we will obtain statistical evidence that explains the exchange rate management conducted by Bank Indonesia during pre-Asian crisis. The estimation result shows that there was no deviation between *de jure* and *de facto* in period (1). Although the estimation results show that during period (2) rupiah was under managed-floating but the US dollar still became main reference to the Indonesian rupiah. The actual movement of rupiah in the period (3) was still tightly pegged mainly to the US dollar except in several periods with different degree of pegging depend on the market pressures.

We modified and applied Frankel-Wei (2008) model to infer the *de facto* exchange rate regime in Indonesia. This model is regression equation and used as a technique for inferring implicit basket weight and exchange rate flexibility (or inflexibility) in several countries under the assumption that the home currency is determined by a basket of currency. By applying these methods, we found that during the fixed regime, the exchange rate was consistently followed fixed exchange rates, in other words *de jure* equal to the *de facto* regime. During the *de jure* managed-floating regime, our finding shows that rupiah was still heavily managed and tightly pegged to the USD (although the official statement of the regime was the rupiah will be pegged on a basket currencies). Therefore, we classify the *de facto* regime as adjustable peg or crawling peg. We conclude that under *de jure* managed-floating, the actual rupiah movement was more volatile but still heavily pegged to single hard currency rather than to basket of currencies. Our estimation results show that during the post-Asian crisis period, the exchange rate regime can be classified as managed-floating rather than free-floating. In addition, the regression results clearly reveal a situation where

intervention might be taken to maintain the rupiah movement. During the "tranquil" period, an intervention was taken by accumulating foreign reserve to avoid appreciation of the rupiah, while during the "turbulent" period the intervention was taken by dis-accumulating foreign reserve to avoid further depreciation.

During the onset of Asian crisis 1997, five Asian countries i.e. Indonesia, Malaysia, Philippines, Thailand and South Korea (later, it is called as Asia-5) officially announced to switch their exchange rate regimes. Malaysia decided to change their regime to fixed regime (Malaysia ringgit was perfectly pegged to the US dollar), while other four Asia-5 countries decided to adopt free-floating regimes. However, in July 2005 Malaysia announced that Malaysia ringgit was no longer perfectly pegged to the US dollar. Although the official exchange rate regimes announced to follow free-floating regime but realization of the nominal exchange rate of the Asia-5 currencies during 2000-2013 did not fully reflect this condition. It seems that these Asia-5 currencies were not only determined by market mechanism there were strong intentions to bring the exchange rate of their currencies in a particular direction or particular level.

There are several statistical tests conducted in this chapter, including regression model developed by Frankel-Wei (2008), index of flexibility as in Baig (2001), recursive regression analysis, asymmetric response model, scatterplot analysis, and Wald test. The estimation using of mentioned statistical tests as well as the comparison analysis among the surveyed countries verifies whether the exchange rate arrangements revert to the regime as before the 1997 crisis. Based on the statistical evidences, it can be concluded that the Asia-5 exchange rate arrangement during the post-Asian crisis 1997 did not fully follow the floating regime, rather it more likely to be managed float with the US dollar as the main reference. In addition, the Asia-5 countries allow their currencies to move more flexibly as indicated by the index of flexibility. These findings suggest that returning to the US dollar pegged is inevitable but in slightly lower degree of pegging.

A structural change usually appears in time series data due to external or internal shocks (i.e. policy change, natural disaster, etc). Therefore, we consider structural change in a linear time-series regression model with GARCH errors where a structural change implies the change in the regression coefficients at time m. Then we detect the time of the structural change by testing the

null of H_0: no structural change at time m against the alternative H_1: there is structural change at time m. The most common test for this is the Chow test based on the F-statistic. It is generally difficult to obtain a theoretical distribution of the estimated change point regardless the statistical test we used. To overcome this difficulty, we consider the use of a circular block bootstrap (CBB) method to obtain the sampling distribution of $\hat{m}$ and use this to construct confidence intervals.

We evaluate the performance of the sum of squares of residual and circular block bootstrap (SSR/CBB) as well as log-likelihood ratio and circular block bootstrap (LR/CBB) methods using Monte Carlo experiments. The LR/CB is generally better than the SSR/CBB in many respects, the performance of the LR/CBB is more sensitive than the SSR/CBB to the location of the true change point, the block length specified in the CBB, and the number of parameters to be estimated. Our empirical study, the SSR/CBB detect a change point and drew a reasonable economic interpretation that even though the Indonesian government had officially announced a floating exchange rate regime, the IDR was not floating throughout the whole sample period but has moved with the USD since March 2002 and has also become less volatile.

The economic phenomena can be described by explaining a relationship of several variables that shows cause and effect among the variables. To scrutiny the relationship among these variables, economics theories are needed as a basis to describe the relationship among observable variables as required in the theory. Unfortunately, not all economic variables are observable but some of them are unobservable, and consequently the data of the unobservable variables cannot be provided. To overcome this problem, a measurement of relationship among the variables is needed. There are two important issues arise here, i.e. theory and measurement.

The causal order of hard and soft currencies will be presented as an example of the application of Independent Component Analysis (ICA) with real data analysis. Several hard currencies such as US dollar, Japanese yen, Germany mark as well as soft currencies such as Singapore dollar and Indonesian rupiah is selected to be analyzed in term of its causal order. Our conjecture is that the soft currencies will be highly affected by fluctuation of the hard currencies value.

Our empirical study in this chapter estimates the causal order based on four nominal exchange rates of the US dollar against Special Drawing Right (USD/SDR), Euro against Special Drawing Right (EUR/SDR), Japanese yen against Special Drawing Right (JPY/SDR), and Indonesian rupiah against Special Drawing Right (IDR/SDR). We collect monthly data from January 2000 to December 2014 and divided into 2 periods, i.e. pre-Lehman shock (January 2000 – August 2008) and post-Lehman shock (September 2008 – December 2014). The estimation result (see Table 5.4) show that the causal order before Lehman shock is $USDSDR \rightarrow EURSDR \rightarrow JPYSDR \rightarrow IDRSDR$ and the causal order after Lehman shock is $EURSDR \rightarrow USASDR \rightarrow JPYSDR \rightarrow IDRSDR$.

The circular block bootstrap (CBB) method has been applied to construct a confidence interval for the estimated single change point. To apply the CBB, it requires user to specify the length of block length. Our simulation results have shown that under the same scenario, the use of different block length lead to construct different confidence interval. In some cases, using short block length obtained better results, and in other cases longer block length also produced better result in constructing the confidence interval.

Our simulation result suggests that the block length is very sensitive in constructing confidence interval, especially when CBB method is applied. In addition, time dependent in the error term must be considered when choosing the block length. In this simulation study, we obtain some evidences that the short block length should be chosen when the series is less time dependent as well as for strong time dependency data.