# International Reserve Holdings as a Means of External Risk Management: Comparative Study of Thailand and Indonesia

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## I. INTRODUCTION

When one looks back over the past three decades in the Southeast Asia, it would be immediately remembered that some occasional external shocks led to cause devastating damages upon this region. One most significant case was the so-called Asian currency crisis. This shock eventually brought extremely harmful effects on those economies in 1997 and afterward. One found that this crisis created more lethargic economic situation in various Asian economies than the twice oil crises together.[1] It should be noted that this crisis unexpectedly emerged. Thus those countries were not well-prepared how to deal with first of all. In those days, the Southeast Asian economies were in the midst of the comfortable economic growth stage since 1970s. Almost a decade later, the second external shock was detected in 2008. This one was the worldwide financial crisis. The crisis was triggered by the Lehman shock. It is said that the deteriorating financial environment had been brought about by the wide-spread sub-prime mess initiated by the US financial troubles. Quite interestingly, this latest shock has created less serious devastation over the region, relative to the advanced industrial countries. This second shock helps reconfirm the emerging Asian economies once more.

For over two decades, many observers openly commented that Asian region including China would come to gain more significant share in the world economy. There was a clear reason for such a view at that time. The regional economic activities were increasingly integrated and the economic framework over the region successfully created the interdependent structure by evidently enhancing further international trade and foreign direct investment. The growth in merchandise trade and clear growth path of those economies were taken it for granted to generate furthermore sustainable growth circumstance for some foreseeable future. Nonetheless, in such a rosy circumstance, many failed to predict the speculative attack on the Thai currency baht. Just before this crisis took place, the world was observing the extravagant handover ceremony of Hong Kong to China. That was on July 1, 1997. This currency crisis in Thailand was reported in the following days.

Failure to make a sound and balanced analysis on the Thai financial situation in a very unruffled manner came from the wide-spread exuberant mood over the Asian region. Thai economy was regarded as one of the most successful cases in the region. Thailand had been enjoying higher economic growth rates and advancing industrialization.[2] With hindsight we could have learned that the balance of payments difficulty due mostly to the accelerating pace of imports. In addition, the excessive exposures to the external financial debts, in particular through the private sectors, were built quietly in the growth oriented Thai economy.

The economic shock soon transmitted to other parts of the region. It is remembered that South Korea, Malaysia and Indonesia were forced to confront the similar or much worse economic crisis. The size and magnitude of such shock in this region were surely unprecedented. Each government did not find any appropriate and effective policy measure to cope with the devastating effects. Such damages were initiated primarily by the currency free fall. IMF involvement was unfortunately not well serving to resolve the difficult circumstances of those Asian economies. The tough conditionality imposed by IMF served simply to aggravate the deteriorating economic environment in every case.

Many confusion and disorders were immediately wide spread not necessarily over the economic and business community but over the political and social areas. It was reported the crisis brought in various riots and violent confrontations in the economies, where once regarded as successfully industrialized development.[3] This contagion issue attracted a lot of attention of many economists.[4] Why did some of the Southeast countries with excellent records in growth fall commonly into such a crisis? And why did they suffer from the similar financial and economic disorders? Generally speaking, the cases in the Southeast Asia are clearly different from the Latin American cases. The most of the latter cases have primarily suffered from the chronic balance of payments difficulties.[5] The surmounting sovereign debts were every financier's headache. That was a general picture in the Latin America. The Southeast Asian economies looked far well-managed. Nonetheless, the currency values of those Southeast Asian economies were commonly

[1] In the Asian region, Indonesia is the only major oil exporting country through the 1970s and since then.

[2] One of many descriptions about Thailand is the notion of 'Detroit in Asia'. Bangkok successfully attracted massive foreign investment, especially related to automobile manufacturing and parts and components industry.

[3] The serious casualty outcomes due to the crisis disruption were reported in Indonesia. Eventually this initiated the political turmoil and the end of the President Suharto era.

[4] Masson (1999), Goldstein (1998), Kaminsky, Reinhart and Vegh (2003), Radelet and Sachs (1998) are only some of examples.

[5] See, for example, Edwards (2004).

deteriorated in an unimaginable pace.

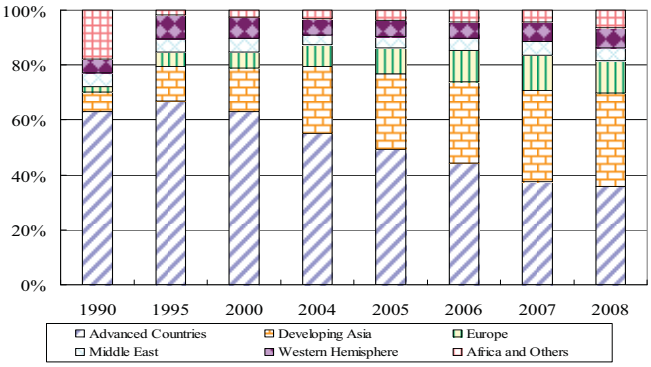
Although the recovering process from the crisis was not so easy, the policy-makers could have leant at least one crucial lessen from this crisis. Since any country would not possibly keep distance from the progressing globalization, thus the country has to facilitate various measures to protect own markets from the external source. Though such measures are not yet definitive, the authorities must consider some instruments which help improve the general outlook on country risk. This corresponds to the necessity for the clear principle and guideline toward the macroeconomic risk management against any possible external shock.

Most of the Asian currencies belong to the flexible or to some kind of managed floating exchange mechanism. Under such an exchange rate system, the currency value of this economy would be forced to directly encounter the market turbulence once the massive capital flows in or out from the financial market. This is exactly what happened in the Southeast Asian economies in 1997. As Stiglitz (2002) criticized, IMF would not have effectively served as the last resort of lenders to any troubled Southeast Asian economy.[6] Rather Thailand, South Korea and Indonesia, for example, were forced to agree the harsh conditionality imposed by IMF.[7] Therefore, apart from their efforts to create more transparent and competitive financial markets within the economy, the monetary authorities start considering better to possess some kind of buffer measure to any disrupting external shock.[8]

The stock of foreign reserve is expected to serve for mitigating such difficulties. In many cases such troubles are likely to appear on the balance of payments disequilibrium or on exchange market disruptions. Unfortunately there is no theoretical agreement among economists regarding the optimum holding of the foreign exchange reserves.[9] However, the level of the foreign reserve is regarded as an important indicator to assess the country risk conditions. In fact, many investors regularly monitor the level and changes in the foreign reserve position of any concerned economy.[10] Since the foreign reserve data are openly available, this information serves to examine to some extent the healthiness of the country's solvency.[11]

While the Southeast Asian economies have demonstrated impressive improvement in their economic activities, some academic studies point out a common feature of those economies. That is the high demand for international reserves. As Figure 1 tells, the relative share of the international reserve holding by region has been dramatically changing. Especially, Developing Asia, as given in the table, has been gaining very substantial share relative to any other region since 1990. Although this group covers the wider Asian region, the increasing reserve holding can be observed in many individual countries as well. For example, it is well known that China's holding of the international reserves has been monotonically increasing. As of the latest, the recent report reveals that its size has surpassed the level of US$2 trillion. Southeast Asian economies like South Korea, Thailand, Malaysia and Indonesia are also following the similar policy stance. Figure 2 describes the trend of the reserve increase of those four countries. One can find there that each country has been steadily accumulating such a stock since the year 2000.

Figure 1. Relative Share of International Reserve Holding by Region




[6] Some critically commented that the IMF approach toward the Asian countries was visibly different from the programs prepared to the South American countries previously.

[7] Conditionality is aiming first of all to materialize the balance of payments correction. For this purpose, it is thought more effective to establish the fiscal discipline and to scale down the domestic demand. By this approach, the fiscal position of the country would become more solid and the balance of payments deficits would be able to mitigate the pressure on depreciating exchange rates. However, this approach has been not popular among many developing countries. Thus it was harshly criticized since the social costs, like increasing unemployment and worsening poverty, are extremely high once the conditionality would be hastily imposed on any developing country.

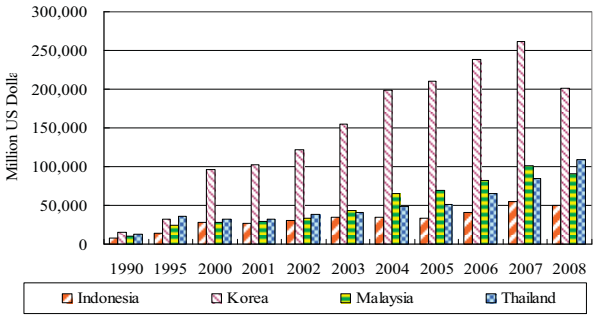
[8] Mishkin (2003) states clearly what to be done or how to be prepared in the policy institutions against any possible financial crisis..

[9] The accounting treatment of the international reserve holding is explained in many macroeconomics textbooks like Blanchard (2000). International macroeconomics textbooks tell simply that the foreign exchange reserve is endogenous under the fixed exchange rate regime and is exogenous under the full-flexible regime.

[10] It is widely discussed in the business community that it is rather comfortable if the level of international reserve covers the payments for three month of the imports. This is not the theoretical argument. However this suggests that the level of the reserve holding is an important indicator for their business risk judgment.

[11] The reserve holding may cause some costs to the society. This issue is argued by Rodrik (2006).

Figure 2. International Reserve Stock of Four Asian Economies




Naturally this attracts a lot of attention by economists.[12] Is there any logical justification for the high demand for the international reserves? Is there any economic reason to support such a policy stance? To what extent does the larger international reserve stock serve to mitigate the exchange rate disruption?

In this paper, we deal with the international reserve holding of Thailand and Indonesia and quantitatively investigate their behavior in terms of the economic view points. In particular, we are more interested in any possible change in their policy stance regarding the role of international reserve holding.

## II. WHY INTERNATIONAL RESERVE HOLING IS NECESSARY

Once the Bretton-Woods System was installed after the Second World War, every member country of IMF was required to fix its exchange rate relative to either gold or US dollar. This means that each country obligated to maintain such a fixed exchange rate even during the difficult situation in her balance of payments. The monetary authorities had managed to control its exchange rates within the specified narrow margin.[13] To carry out such a policy requirement, it is inevitable for each country to accumulate at least a certain level of the international reserves. Quite interestingly, IMF did not specify the required size or amount of the international reserve holding in each member country. When any member country of IMF would confront with the so-called 'rainy days', it was assumed that the disequilibrium has to be overcome by running down the international reserve holding. Therefore, while the world economy was operated under the fixed exchange rate system, there is at least a certain justification to support the importance of the international reserve holdings.

Contrary to what the present trade surplus issue poses, Japan had constantly confronted with the chronic balance of payments difficulties up until 1965. In order to pursue the economic growth strategy in those days, this phenomenon was acknowledged by many as the single most serious constraint. That is, although Japanese attempted to materialize some significant growth process throughout the 1950s and the early part of 1960s, the increasing income level was very likely to generate the induced upward demand for imported goods. Due to Japan's unfavorable economic conditions that were regarded inherent, the economic growth depended on more imported natural resources and many other items produced abroad. This did naturally create a tendency of the trade balance deficits. Thus the authorities were routinely concerned about the issue of how to cope with the difficulty in the external balance management. Owing to the persistent policy support for the exportable sectors, Japan has managed to improve the fundamental economic structure.[14] Efficient usage of resources and continuous innovation activities for higher value-added products help gradually improve the balance of payment constraint. This industrial approach made possible to produce the balance of payments surplus since after 1965.[15] Thus Japan started to record the trade balance surpluses year after year. Contrary to what they worried in the past, the monetary authorities now needed to intervene by absorbing a massive scale of foreign currencies simply to sustain the pledged fixed exchange rate.

Many trading partners, in particular the United States, were increasingly frustrated with such a chronic trade imbalance.[16] With a premise of the Bretton-Woods rules, Japan, for example, could not but accumulate unilaterally the international reserves. The hugely expanded size of the international reserves raised a question whether the exchange rate system would be desirable for the future international economic development. In fact, many were inclined to consider that the present situation looked less and less feasible in order to sustain the fixed exchange rate at least with respect to the yen value relative to the American dollar in particular. The long lasted system of the fixed exchange rates ended in 1973. The newly employed system was the flexible exchange rate mechanism. It is believed that the market would work to find easily any equilibrium exchange rate. If so, it is assumed that the exchange rate helps materialize balancing for the external account positions. This system, at least theoretically, allows the country free from the international reserve management. On the contrary, the Japanese monetary authorities found by themselves not free from the external adjustment but persistently

[12] Flood and Marion (2001), Aizenman and Marion (2003) and Odano (2008) are some of those studies.

[13] The Bretton-Woods system assumes the fixed exchange rates more suitable in order to promote more international commercial and financial activities during the post war period. In that system, it is more precise to say that the exchange rate should be managed within the narrow margin, plus or minus one percent. Thus it is sometimes called as the adjustable peg system by economists.

[14] One of the strongest critical views on the Japanese industrial policy is found in Johnson (1982).

[15] Japanese industrial policy was steadily criticized by the western economists. This policy is guided by the authorities like MITI, thus the outcome would be likely to be more costly for the society.

[16] The insightful description regarding the trade imbalances between Japan and the United States is made by Encarnation (1992).

concerned about the overshooting of the yen exchange rates from time to time. The new exchange rate system is hardly independent from very wildly fluctuating situations. This is what Japan leant since the advent of the flexible exchange rates.

It is meant that the monetary authorities need to intervene once it is perceived necessary at least aiming to smooth the magnitude of the currency variations. Otherwise the exchange rates may depreciate wildly and may drive the rates to the extreme level.[17] In such a circumstance it urges the authorities to intervene and to take a decisive operation. In the past years those voices were frequently heard from wider spectrum of the society. Nevertheless it is not guaranteed that any intervening operation brings always successful or intended outcomes. Once many developed economies practiced this kind of market operations routinely, whether it is concerted or it is done in the unilateral way, the practical approach to the exchange rates turn out to be the 'managed' floating system. This corresponds to a fact that the role of the international reserves never end. It is still expected to share a certain significant part in the currency value adjustments. However it is not widely supported a notion that a country is allowed solely to depend on the intervention practices with respect to find more appropriate exchange rate. In this regard, it comes to a central theme how much countries in fact demand for the international reserves in order to enhance the international economic commerce and finance.

## III. THE PRESENT SITUATION OF INTERNATIONAL RESERVE HOLDINGS

The issue is now raised about the aggravating imbalances in the international accounts among many concerned countries.[18] China and the United States are the two extreme cases. It is perceived that China has monotonically produced the massive trade surplus year after year and has piled up the enormous stock of the international reserves. On the other hand, the United States is experiencing the worsening trade deficits especially with China. Many policy-makers in the Unites States and Europe insist that the export-led growth strategy need to be overhauled. They assert that the present exchange rates of some countries are misaligned. Therefore as a part of adjustments the significant appreciation of exchange rates would be definitely needed.

Even in the case of the managed exchange rates, it is argued that mutually acceptable exchange rates should be sought. However, it is generally understood that the exchange appreciation per se would not help sufficiently to correct the trade imbalances. To make matters worse, it is an extremely difficult task to define the equilibrium or appropriate rate of exchanges. This can be exemplified from the Japanese experiences throughout the 1980s. The currency yen seemed rather abused by many international criticisms. As a consequence the yen exchange rates appreciated with unprecedented speed and magnitude. Yet the trade surplus persisted. The J-curve effect in fact aggravated the trade imbalance furthermore against the United States. That implies that any simple minded pressure such like bashing may not effectively work to mitigate the current imbalances. Issues need to be examined not from simplistic approach.

Various Asian economies also attempt tirelessly to strengthen their external positions.[19] This policy comes from their experiences during the crisis period. It is believed that the vulnerability is originated from the weak readiness to face the external pressure. A lack of appropriate policy measures is likely to invite the speculator's attack and to create the crisis. In this regard, policy-makers come to a general conclusion that the 'enough' size of international reserve stock would be at least necessary. In that case, this approach is expected to be helpful even though not completely, once the country has to deal with any emerging circumstance. As the above Figure 1 and Figure 2 show, the Asian countries were willingly to build up the massive international reserves, especially since the currency crisis stage ended.

After having observed this new development in the international reserve holding behavior, it is needed to examine various important arguments empirically. Some of those are as follows: Is there any structural change in such policy approach? Is the authority working to defend some risk exposures? Are the actual exchange management actions corresponding to the 'leaning against the wind' type or 'let it be in the market tendency' stance? We will take the two cases of Thailand and Indonesia and compare both with respect to those issues. Both were equally experienced the severe crisis during and after 1997. Figure 3 and Figure 4 present the path of exchange rates and international reserve holding by Thailand and Indonesia, respectively. It can be detected that both countries have been working to solidly build up the international reserve position for the shock mitigation. The following section will show the outcomes of the empirical examination for two countries.

[17] Crisis cases usually correspond to the currency depreciation. Of course the opposite is possible such like Japan encountered in the 1990s (referred as the yen-daka crisis).

[18] The global imbalance issue was initially pointed out by the speech of Bernanke (2007). He argued that this issue is related to the global saving glut, the current account imbalance and the U.S. trade balance deficits. More detailed discussion is given by Cooper (2007) and several comments to Cooper's paper.

[19] See Figure 2 on this point.

Figure 3. Trend of Exchange Rates and Foreign Reserve Holding (Thailand)

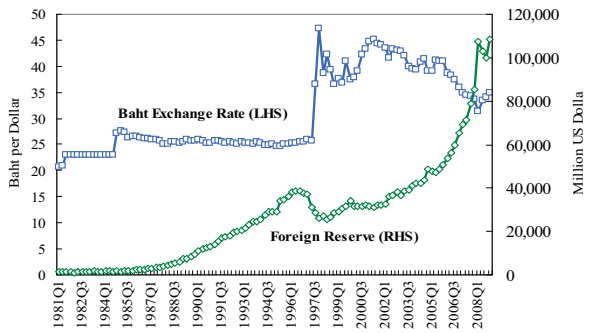
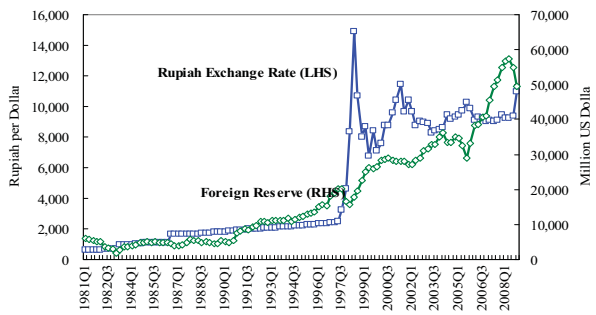



Figure 4. Trend of Exchange Rates and Foreign Reserve Holdings (Indonesia)




## IV. EMPIRICAL ANALYSES FOR THAILAND AND INDONESIA

The conventional economic approach to the demand for international reserve is described in the following simple equation:

$$FR_i = f(IM_i, r_k) \quad (1)$$

where $FR_i$ is the stock of international reserves held by country i. $IM_i$ is the level of imports of country i. This variable represents the size of international economic activities of country i. The variable $r_k$ means of the costs of holding FR. In many countries, a substantial volume of the international reserves is invested in country k, mostly held in the US securities. The Treasury Securities are assumed as relatively risk free asset. Thus the variable $r_k$ is considered to affect the holding position of each country's international reserves.

In this section we will examine and compare the international reserve holding of Thailand and Indonesia. Therefore the subscript i represents two countries, respectively. To rewrite the equation for the estimation purpose, we obtain the following equation. All the variables are transformed into the *log* form. By this the estimated coefficients can be translated as the elasticity measure with respect to the explanatory variables. The estimated equation is now given as:

$$\log FR_i = \alpha_0 + \alpha_1 \log IM_i + \alpha_2 \log(1 + r_k) + \varepsilon_i \quad (2)$$

FR represents the stock of the international reserve (total reserve minus Gold in the IMF definition) which is held by the monetary authorities in each respective country. IM is the dollar value of imports, which is recorded in the balance of payments accounts. The variable $r_k$ implies the three month US Treasury Bill rate. The term $\varepsilon_i$ is the error of the regression, assuming zero mean and normally distributed with a constant variance. Affixed i and k are i-th and k-th country, respectively. All data sources are given in the appendix. In the above equation, the expected sign of $\alpha_1$ is positive and that of $\alpha_2$ is negative, respectively.

Data of both countries apply to the equation (2). Sample period is from 1981 to 2008 and we use the quarterly data. Table 1 represents the summary of the estimation for Thailand. It is striking to learn that all estimated coefficients in full-sample period and the first sub-sample period are statistically significant at 1 percent level. In the second sub-sample period, only estimated coefficient on the opportunity cost is not statistically significant at any meaningful level. Nonetheless all signs of the estimated coefficients are same as what being previously expected. Table 2 summarizes the case of Indonesia. The estimated results of full-sample and two sub-samples are statistically significant either at 1 or 5 percent level. Again the signs of the estimated coefficients are in line with the prior expectations.

Table 1. Estimation Results of Equation (2) for Thailand
Dependent Variable: log FR

| | Full Sample Period | Sub Sample Period | Sub Sample Period |
|---|---|---|---|
| | 1981Q1 to 2008Q4 | 1981Q1 to 1997Q4 | 1998Q1 to 2008Q4 |
| C | -1.4644** | -2.3205** | 2.5174** |
| | ( -4.247 ) | ( -9.548 ) | ( 5.187 ) |
| log IM | 1.2603** | 1.3654** | 0.8337** |
| | ( 38.133 ) | ( 56.369 ) | ( 17.374 ) |
| log (1+r) | -6.6602** | -7.2225** | -0.5007 |
| | ( -6.154 ) | ( -9.867 ) | ( -0.378 ) |
| R-squared | 0.9749 | 0.9912 | 0.8895 |
| SSR | 4.8188 | 0.8659 | 0.7929 |
| F-statistic | 2117.02 | 3690.98 | 164.97 |
| Durbin-Watson Stat. | 0.2261 | 0.7946 | 0.3320 |

Note: Numbers in parenthesis imply the figures of t-statistic.
SSR represnets Sum Square Rediduals.
Figures with ** implie the coefficient is statistically significant at 1 percent level.
Figures with * implies the coefficient is statistically significant at 5 percent level.

Table 2. Estimation Results of Equation (2) for Indonesia
Dependent Variable: log FR

| | Full Sample Period | Sub Sample Period | Sub Sample Period |
|---|---|---|---|
| | 1981Q1 to 2008Q4 | 1981Q1 to 1997Q4 | 1998Q1 to 2008Q4 |
| C | 0.2717 | 1.0999 | 5.2049** |
| | ( 0.418 ) | ( 1.499 ) | ( 11.332 ) |
| log IM | 1.1799** | 0.9383** | 0.5615** |
| | ( 16.102 ) | ( 11.742 ) | ( 11.740 ) |
| log (1+r) | -8.4662** | -4.6868* | -3.2996* |
| | ( -5.777 ) | ( -3.405 ) | ( -2.579 ) |
| R-squared | 0.8594 | 0.7898 | 0.7920 |
| SSR | 12.5094 | 4.3204 | 0.7806 |
| F-statistic | 333.110 | 122.088 | 78.072 |
| Durbin-Watson Stat. | 0.2324 | 0.4103 | 0.4040 |

Note: Numbers in parenthesis imply the figures of t-statistic.
SSR represnets Sum Square Rediduals.
Figures with ** implie the coefficient is statistically significant at 1 percent level.
Figures with * implies the coefficient is statistically significant at 5 percent level.

The one hypothesis is that the monetary authorities are increasingly concerned about any possible international risk which would immediately appear in the financial markets. Since the progress of globalization creates the tightly interwoven network system of financial markets worldwide, it is almost impossible that the domestic market attempts to be isolated from such a development. This means that every financial market in any country will be simultaneously influenced by any risk element once that will appear in any market in the world.

Network of the capital and financial markets is in fact so widely and deeply developed. This network connects all the markets worldwide through various channels.[20] Therefore the capital flow−in or flow−out in any market is assumed to be swift and massive in scale. The Asian currency crisis and the present sub-prime related crisis in fact taught us those market forces are real. Once the monetary authorities have detected such a possibility, they have to act swiftly to defend their own domestic markets. Otherwise, the exchange rate sustainability, for one thing, would be seriously damaged. For this purpose, we try to examine the reacting behavior of the international reserve management against any risk factor. It is obviously not so easy to construct a single indicator from the wider spectrum of risk factors. Here we note the London Inter-bank Market (LIBOR). That is the most advanced international financial market, especially for the financial institutions. It is therefore understood that its rates always reflect instantaneously any risk element from every source of the world. Knowing this fact, we assume that the difference between the domestic and LIBOR interest rates indicates the risk element perceived by the market. If both international and domestic markets perceive the risk factor in an equivalent degree, then the rate difference would be less significant. On the other hand, if the domestic market is expected to be more seriously affected, the rate difference will send an alarming message about a certain risk to the monetary authorities. The variable RISK represents the difference of such two interest rates. The estimated equation is given as (3) below:

$$\log FR_i = \alpha_0 + \alpha_1 \log IM_i + \alpha_2 \log(1 + r_k) + \alpha_3 RISK_i + \varepsilon_i \quad (3)$$

Table 3 and Table 4 are summary of the estimation of equation (3) for Thailand and Indonesia, respectively. In both cases, the coefficients on IM and (1+r) are similar to the ones of Table 1 and Table 2. However, the estimated coefficient in the Thailand case is statistically less significant. This suggests that the Thailand authorities are little concerned about the risk factor, which would appear on the international and domestic financial markets. On the other hand, Indonesian authorities are dealing with the risk factor in earnest, especially after the crisis period of 1997. This coefficient has the minus sign. Therefore it suggests that the authorities are actively intervening in the exchange market by running down the reserve holding simply to defend the domestic currency value. Also this policy stance became more apparent during the post crisis period. Note that this policy action cannot be found prior to the crisis period, as Table 4 tells.

Table 3. Estimation Results of Equation (3) for Thailand
Dependent Variable: log FR

| | Full Sample Period | Sub Sample Period | Sub Sample Period |
|---|---|---|---|
| | 1981Q1 to 2008Q4 | 1981Q1 to 1997Q4 | 1998Q1 to 2008Q4 |
| C | -1.5468** | -2.3436** | 2.4120** |
| | ( -4.496 ) | ( -9.280 ) | ( 4.895 ) |
| log IM | 1.2674** | 1.3688** | 0.8439** |
| | ( 38.497 ) | ( 52.510 ) | ( 17.334 ) |
| log (1+r) | -6.6112** | -7.2226** | -0.2218 |
| | ( -6.193 ) | ( -9.802 ) | ( -0.165 ) |
| RISK | 1.1030 | -0.2185 | 0.7444 |
| | ( 1.841 ) | ( -0.369 ) | ( 1.125 ) |
| R-squared | 0.9757 | 0.9913 | 0.8929 |
| SSR | 4.6721 | 0.8641 | 0.7686 |
| F-statistic | 1443.42 | 2427.99 | 111.11 |
| Durbin-Watson Stat. | 0.2467 | 0.7968 | 0.3625 |

Note: Numbers in parenthesis imply the figures of t-statistic.
SSR represnets Sum Square Rediduals.
Figures with ** implie the coefficient is statistically significant at 1 percent level.
Figures with * implies the coefficient is statistically significant at 5 percent level.

Table 4. Estimation Results of Equation (3) for Indonesia
Dependent Variable: log FR

| | Full Sample Period | Sub Sample Period | Sub Sample Period |
|---|---|---|---|
| | 1981Q1 to 2008Q4 | 1981Q1 to 1997Q4 | 1998Q1 to 2008Q4 |
| C | 0.0531 | 0.9197 | 6.2827** |
| | ( 0.079 ) | ( 1.156 ) | ( 14.419 ) |
| log IM | 1.0956** | 0.9564** | 0.4524** |
| | ( 15.902 ) | ( 10.764 ) | ( 10.048 ) |
| log (1+r) | -7.9051** | -4.4467* | -2.4320* |
| | ( -5.264 ) | ( -3.062 ) | ( -2.312 ) |
| RISK | 0.6363 | 0.0775 | -0.8010** |
| | ( 1.685 ) | ( 0.108 ) | ( -4.748 ) |

| | Full Sample Period | Sub Sample Period | Sub Sample Period |
|---|---|---|---|
| | 1981Q1 to 2008Q4 | 1981Q1 to 1997Q4 | 1998Q1 to 2008Q4 |
| R-squared | 0.8604 | 0.7903 | 0.8670 |
| SSR | 12.1605 | 4.2561 | 0.4992 |
| F-statistic | 217.71 | 77.8983 | 86.9061 |
| Durbin-Watson Stat. | 0.2552 | 0.4214 | 0.5261 |

Note: Numbers in parenthesis imply the figures of t-statistic.
SSR represnets Sum Square Rediduals.
Figures with ** implie the coefficient is statistically significant at 1 percent level.
Figures with * implies the coefficient is statistically significant at 5 percent level.

These four tables suggest that the demand for international reserve holding by Thailand and Indonesia corresponds invariantly to the theoretical prediction, as given in the equation (1). The scale of the reserve holding is increasing as long as the international commerce activities are expanding. However it is noted that the estimation outcomes suffer from a possible serial correlation, which can be detected in the low Durbin-Watson Statistics. As the first attempt to correct this problem, the distributed lag approach is applied to the same set of data. The estimation equation can be summarized as follows:

$$\log FR_i = \alpha_0 + \alpha_1 \log IM_i + \alpha_2 \log(1 + r_k) + \alpha_3 RISK + \alpha_4 \log FR(-1) + \varepsilon_i \quad (4)$$

The estimated results for full sample period are summarized in Table 5. Although the Durbin-Watson Statistic figures tell markedly improved for both cases, the estimated coefficients on other variables become less

[20] Globalization throughout the world financial markets is discussed by Mishkin ((2006).

convincing. This suggests that it would be better to search another approach which can correct the auto correlation, rather than the distributed lag approach. Even though the estimation performance may be to some extent influenced by the serial correlation, the estimated coefficients indicate that the model specification seems valid to explain the international reserve holding. Thailand results show relatively more explanatory power, as to be compared Table 3 with Table 4.

Table 5. Estimation Results of Equation (4) for Thailand and Indonesia

Dependent Variable: log FR

| | Thailand | Indonesia |
|---|---|---|
| | 1981Q1 to 2008Q4 | 1981Q1 to 2008Q4 |
| C | 0.0236 | 0.0650 |
| | ( 0.165 ) | ( 0.303 ) |
| log IM | 0.1170* | 0.0521 |
| | ( 2.539 ) | ( 1.266 ) |
| log (1+r) | -1.0551* | -0.7676 |
| | ( -2.283 ) | ( -1.362 ) |
| RISK | -0.1048 | 0.0969 |
| | ( -0.460 ) | ( 0.796 ) |
| log FR(-1) | 0.8967** | 0.9494** |
| | ( 25.934 ) | ( 29.681 ) |
| R-squared | 0.9966 | 0.9861 |
| SSR | 0.6351 | 1.2067 |
| F-statistic | 7759.85 | 1838.39 |
| Durbin-Watson Stat. | 2.2946 | 1.7978 |

Note: Numbers in parenthesis imply the figures of t-statistic.
SSR represnets Sum Square Rediduals.
Figures with ** implie the coefficient is statistically significant at 1 percent level.
Figures with * implies the coefficient is statistically significant at 5 percent level.

Above quantitative study reveals that Thailand and Indonesia have worked to accumulate the international reserve holdings in line with the traditional approach. Size of the reserve holding has been increasing according to the economic expansion. The estimated coefficients on IM (total imports as a scale variable) are more than one for both countries through full sample period.[21] During the post crisis period, that number is still positive but declines below one for both countries.[22] Generally speaking, both Thailand and Indonesia maintain the policy stance to expand the stock of international reserves. The trend of such stock expansion is clearly described in Figure 3 for Thailand and Figure 4 for Indonesia.

Both countries are certainly concerned about the development in their exchange rates. With the certain level of the international reserve holding, it is believed that each country can possess a policy instrument to manage their currency value. In other words, the international reserves can be used at least to slow down the pace of exchange rate fluctuations. If the smoothing of the exchange rate fluctuation is the policy aim of the monetary authorities, then they can intervene into the exchange market by selling or buying the foreign currencies. Such smoothing operations are generally called as the 'leaning-against-the-wind' policy. Did two countries actually implement this operation in the foreign exchange market? If yes, to what extent did they attempt to mitigate the exchange rate depreciation or appreciation? Those arguments are in fact the testable hypothesis. We will examine this hypothesis by specifying the testable equation as follows:

$$\left(FR_i - \log FR_i(-1)\right) = \beta_0 + \beta_1\left(\log EX_i - \log EX_i(-1)\right) + \delta_i \qquad (5)$$

If the monetary authorities attempt the leaning against the wind policy, then the estimated coefficient $\beta_1$ should be negative and statistically significant. This means that a part of the international reserves would be sold to resist the depreciating pace of her exchange rates (i.e., EX is increasing). The estimated results are summarized in Table 6 for Thailand and Table 7 for Indonesia.

Table 6. Estimation Results of Equation (5) for Thailand
--Test of Leaning against the Wind Hypothesis--

Dependent Variable: (log FR-logFR(-1))

| | Full Sample Period | Sub Sample Period | Sub Sample Period |
|---|---|---|---|
| | 1981Q1 to 2008Q4 | 1981Q1 to 1997Q4 | 1998Q1 to 2008Q4 |
| C | 0.0405** | 0.0471** | 0.0291** |
| | ( 5.451 ) | ( 4.047 ) | ( 4.1876 ) |
| log EX-logEX(-1) | -0.3502* | -0.3295 | -0.4663** |
| | ( -2.643 ) | ( -1.660 ) | ( -3.468 ) |
| R-squared | 0.0602 | 0.0406 | 0.2227 |
| SSR | 0.6616 | 0.5640 | 0.0878 |
| F-statistic | 6.9836 | 2.7540 | 12.0304 |
| Durbin-Watson Stat. | 2.5360 | 2.6833 | 1.6865 |

Note: Numbers in parenthesis imply the figures of t-statistic.
C in the table implies a constant term.
SSR represnets Sum Square Rediduals.
Figures with ** implie statistically significant at 1 percent level.
Figures with * implies statistically significant at 5 percent level.

Table 7. Estimation Results of Equation (5) for Indonesia
--Test of Leaning against the Wind Hypothesis--

Dependent Variable: (log FR-logFR(-1))

| | Full Sample Period | Sub Sample Period | Sub Sample Period |
|---|---|---|---|
| | 1981Q1 to 2008Q4 | 1981Q1 to 1997Q4 | 1998Q1 to 2008Q4 |
| C | 0.0203* | 0.0133 | 0.0267* |
| | ( 1.959 ) | ( 0.786 ) | ( 2.934 ) |
| | Full Sample Period | Sub Sample Period | Sub Sample Period |
| | 1981Q1 to 2008Q4 | 1981Q1 to 1997Q4 | 1998Q1 to 2008Q4 |
| log EX-logEX(-1) | -0.0591 | 0.0505 | -0.0947 |
| | ( -0.0690 ) | ( 0.247 ) | ( -1.696 ) |
| R-squared | 0.0043 | 0.001 | 0.0641 |
| SSR | 1.2452 | 1.0850 | 0.1513 |
| F-statistic | 0.4757 | 0.0610 | 2.8758 |
| Durbin-Watson Stat. | 1.8115 | 1.7917 | 1.4128 |

Note: Numbers in parenthesis imply the figures of t-statistic.
C in the table implies a constant term.
SSR represnets Sum Square Rediduals.
Figures with * implies statistically significant at 5 percent level.

It is very clear that Thailand has committed to the mitigation operations toward the exchange rate fluctuations. The estimated coefficient$\beta_1$ is -0.3502 for full sample period. In particular, the figure -0.4663 in the second sub sample period becomes more statistically significant than the previous sample period. This suggests that the Thailand authorities are sensitive to the development in the baht exchange rate.[23] Thus they have

[21] Table 3 shows the scale elasticity of international reserve holding is 1.267 for Thailand and Indonesian case is 1.096 as given in Table 4.

[22] The scale elasticity figures for Thailand and Indonesia are 0.844 and 0.452, respectively. See Tables 3 and 4.

[23] This reflects the economic structure of the Thai external trade activities. Thai manufacturing sectors are

worked actively to smooth its exchange rate baht. On the other hand, this leaning against the wind actions are not found in the case of Indonesia, as given in Table 7. It is speculated that the Indonesian authorities might simply focus on the reserve accumulation, rather than manipulating the frequent fluctuation of their exchange rates.

Why are such differences born in these two countries? Figures 3 and 4 may suggest the clear difference in the policy authorities when they face the exchange rate markets. In case of Thailand, the authorities face the general trend of appreciating baht after 2000. In order to support the export promotion, the excessive exchange rate appreciation may be harmful for the trade expansion. It is widely understood in Thailand that export expansion is the main factor to support the higher economic growth. Therefore the Thai monetary authorities have attempted to mitigate the fluctuations of the baht rate, especially relative to the US dollar.[24] Buying action of the foreign exchange means the increase in the international reserve holding as seen in Figure 3.

Indonesia has faced from time to time the currency depreciation relative to the US dollar. It is understandable that Indonesian authorities are mostly concerned how quickly establish its credibility in the international markets. For this purpose, it is urged to accumulate the stock of international reserve holdings. By seeking such a straightforward policy, they thought more effective to gain the market credibility in their currency value. Once Indonesia gains her credibility in the financial market, the international capital would be coming back easily and hopefully massively. Then it is hoped that the stability of the exchange rates would be easily established. The difference between those two cases in fact reflects the difference in their position regarding the financial market development.

## V. CONCLUDING REMARKS

In this study, we try to examine the international reserve holding for Thailand and Indonesia. There is an increasing voice in the world that various Asian nations are rather hastily accumulating the international reserve stock. It is said that this policy stance becomes a part of the significant imbalances to the world economy. Although such critical views are acknowledged, the Asian economies take more cautious stance to any possible external shocks. This rather conservative position comes from their experiences of the Asian currency crisis. The empirical examination for Thailand and Indonesia clearly identifies that both countries try to build up the stock of the international reserves in line with the international trade activities. Also, monetary authorities are concerned about the cost of holding international reserves. These statistical results are consistent with the traditional studies on the demand for international reserves.

However, Thailand and Indonesia take a different approach respectively to the changes in the short run exchange rates. Thailand has attempted the so-called leaning-against-the-wind policy. By this, the Thai authorities have often intervened in the exchange market to smooth the fluctuations of the Thai currency rates. This policy action becomes more significant after the period of the 1997 currency crisis. The monetary authorities in Thailand seem to pay more attention to any development appeared in the currency values. The management of the price competitive advantage is regarded quite important for the economy. This eventually serves to help support the exportable sector activities. On the other hand, we could find only weak evidence in the Indonesian leaning-against-the-wind operation. Indonesia is more concerned about the level of accumulating reserves. The Indonesian authorities tend to believe that the larger reserve stock would more effectively contribute to the international credibility rather than short-run interventions in the exchange rate market. It is noted that the currency value of rupiah showed a general trend of depreciation over the years. Therefore the monetary authorities in Indonesia have actively worked in order to produce more credible economic environment for the economy.

We live in more turbulent world. It should not be forgotten that many risk factors come often from the external sources. And such risky shocks are likely to possess larger devastation effects on any economy. The responsibility of the policy-makers is growing to cope with any crisis development. With the critical lesson from the past, Thailand and Indonesia have engaged to increase their holdings of the international reserves. It is found by this study that their behavior is solely designed to prepare for any possible external shock. The pace to expand the reserve holding, however, is not deviating from the general trend of the world economy.

The sustainability issue of the global economy receives now a lot of attention by many economists and policy-makers. There are many critical issues involved in this subject, such as the global saving glut, current account imbalances and the exchange rate adjustments and so on. As far as the Asian economies are expected to play broader key roles in the world economy, it is needed more numbers of researches on the Southeast Asian economies. We dealt with only a few issues in this study. We will continuously investigate some other issues in a coming study.

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more export-oriented than other Southeast Asian economies like Indonesia. Naturally the movement in the exchange rates is perceived sensitively by many manufacturing exporters.

[24] Remember the 'renewed crisis in baht' argument in 2008. This time, many Thai business people started worrying about the acceleration of appreciating baht. The Bank of Thailand received a pressure from the exporting sectors to deal with the currency value management. As a consequence, it was reported a sizable intervening action by running down of the reserve holdings.

## VI. VARIABLES AND DATA SOURCE

All the variables used in this paper are as follows:

FR: Total international reserve minus Gold in IMF statistics

IM: The dollar value of imports in the balance of payments data

r: Three month Treasury Bill rate in the United States

RISK: Defined as the difference between three month Dollar LIBOR rates and Domestic Bill rates.

EX: The end of quarter exchange rates in the domestic currency units relative to the US dollar

All data are taken from International Financial Statistics, IMF Database. And data coverage is from the first Quarter in 1981 to the last Quarter in 2008.

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