DETERMINANTS OF INTERNATIONAL RESERVES IN THAILAND

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Abstract

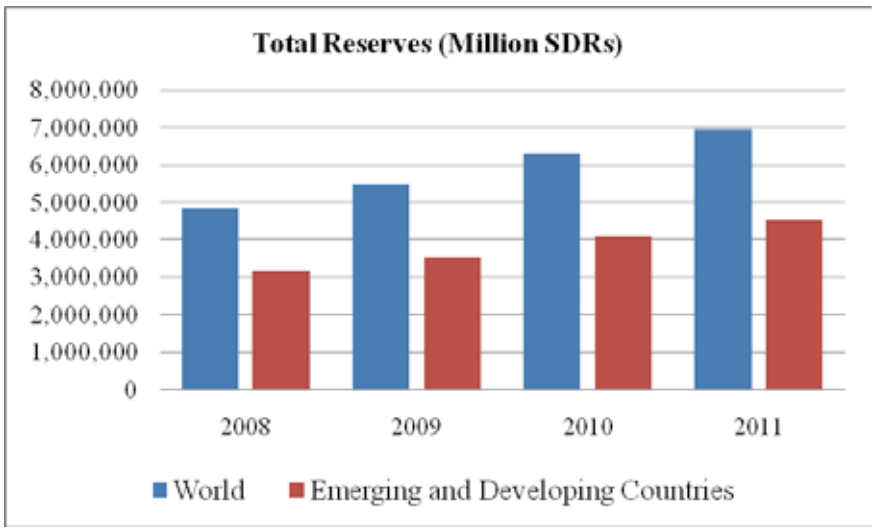
The study of determinants of international reserves in Thailand employs the multiple regression with ordinary least square to test the monthly data of international reserves (IR), gross domestic product (GDP), propensity to import (PIM), trade balance (TB), external debt (DEBT) and exchange rate (EXR) during 2000-2011. The study finds that DEBT and EXR are statistically significant determinants of IR at 95% confident level and 99% confident level consecutively. External debt positively relates to internal reserves because of precautionary motive, especially, after the 1997 Asian financial crisis. Moreover, exchange rate (US$/Thai Baht) positively determines internal reserves because an appreciation of Thai Baht leads to an increase in import so that there will be an increase in international reserves. Government, business and academic can apply these results accordingly.

1. Introduction

There are four major reasons for holding international reserves, including stabilizing exchange rate, servicing foreign debt, protecting against unanticipated exogenous shocks, and assuring foreign investors of the political and economic strength of the country. Since international reserves have both benefits and costs, every country has to be certain that the benefits from having international reserves justify their cost (Archer and Holiday, 1998). In addition, holding higher international reserves is beneficial to decrease the likelihood of currency crises as well as a sudden unwillingness of the international lenders to provide new loans (Calvo and Reinhart, 1999); to lower external borrowing costs through the improvement of credit ratings on sovereign foreign currency debt (Mulder et al., 2002); and to reduce real exchange rate volatility (Hviding et al., 2004). However, international reserve levels may vary according to policy choice (higher reserves lead to more active use of currency intervention) and market sentiment (higher reserves increase market confidence by lowering the probability of a currency crisis) (Hviding et al., 2004).

Asian countries have been holding high level of international reserves since the 1997 Asian financial crisis. According to Matthew and Thomas (2004), Rodrik (2006), Joshua and Jaewoo (2007), and Cheung and Qian (2009), this increasing trend in international reserve holding is viewed as a precautionary for self-insurance against possible crisis in future. The world reserves had increased from 4,843,975 million SDRs in 2008 to 6,968,131 million SDRs in 2011 as shown in figure 1. Moreover, approximately 65% of the world reserves had come from emerging and developing countries. Figure 1 also exhibits the rise in the reserves of emerging and developing countries from 3,165,445 million SDRs in 2008 to 4,525,614 million SDRs in 2011.

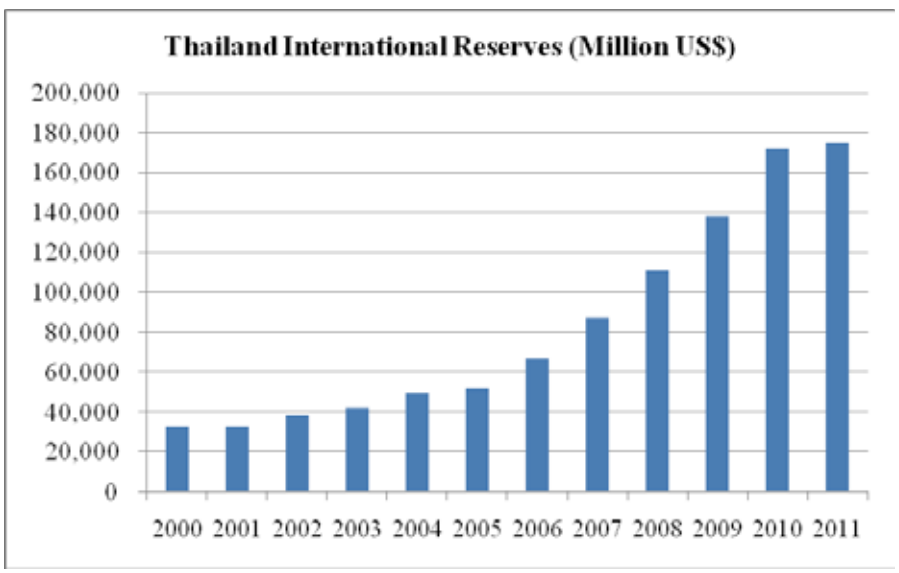
Figure 1 Total reserves of world and emerging & developing countries during 2008-2011



Source: International Financial Statistics, IMF (2011)

Thailand, one of the emerging and developing countries, had claimed as the originator of the 1997 Asian financial crisis. After the crisis, international reserves of Thailand have been increasing. As demonstrated in figure 2, the reserves in Thailand were 32,661.30 million US$ in 2000, and the reserves had risen more than five times to 175,123.77 million US$ in 2011.

Figure 2 International reserves of Thailand during 2000-2011



Source: Bank of Thailand (2011)

Previous studies on international reserve holdings have analyzed using data from developed countries such as Flood and Marion (2002) and Bahmani-Oskooee and Brown (2004) and developing countries such as Aizenman and Marion (2003), Mendoza (2004), and Zhou (2005). Some studies compare the behavior of international reserve holdings for both developed and developing countries include Lane and Burke (2001),Choi and Beak (2004), and Joshua and Jaewoo (2007). However, there is no clear evidence about the determinants of recent large reserve holding in Thailand from the empirical literatures on the demand for international reserves. Therefore, it is attractive to conduct a study to examine the determinants of international reserves in Thailand and to fill up the gap in the literature.

1.2 Objective

The objective of this study is to examine the determinants of international reserves in Thailand during the period from 2000 to 2011.

1.3 Hypothesis

H_0: None of the variables examined, namely gross domestic product, propensity to import, trade balance, external debt, and exchange rate is statistically significant in determining international reserves in Thailand.

H_1: At least one of the variables examined, namely gross domestic product, propensity to import, trade balance, external debt, and exchange rate, is statistically significant in determining international reserves in Thailand.

1.4 Scope of the Study

In order to study factors that determine international reserves in Thailand after the 1997 Asian financial crisis, the monthly time series data of international reserves, gross domestic product, propensity to import, trade balance, external debt, and exchange rate spanning from 2000 to 2011 are utilized. All the data can be obtained from International Financial Statistics published by International Monetary Fund and Economic Statistics published by Bank of Thailand.

1.5 Benefits of the Study

The study of determinants of international reserves in Thailand is beneficial to government, business, and academic. Understanding factors influencing international reserves, government can adjust macroeconomic policies accordingly in order to achieve the target level of international reserves. Multinational enterprises (MNEs) can comprehend the relationship among the major economic factors, comprising of international reserves, gross domestic product, propensity to import, trade balance, external debt, and exchange rate, so that MNEs can make decisions more reasonably on international operations and transactions. Moreover, for academicians, the results of this study will fulfill the gap in the literature regarding the determinants and reasons for recent large international reserve holding pertaining to emerging and developing countries.

2. Literature Review

Previous studies had used a lot of factors to explain international reserve holding. This study uses five explanatory variables to investigate their impacts on the international reserve holding in Thailand. These variables are gross domestic product, propensity to import, trade balance, external debt, and exchange rate.

According to the theory proposed by Frenkel (1974a) in which international reserve holding is a function of a scale variable, propensity to import, and the variability measure, gross domestic product and propensity to import are chosen in this study. The scale variable shows the volume of international transactions. The larger is the size of the country, the more the trade activities; and the demand for international reserves will increase accordingly. The positive relationship between the scale variable and international reserves is found in Guo and Tsai (2006), Wang and Ma (2008), Nor et al. (2011), and Puah et al. (2011). Therefore, gross domestic product and international reserves are expected to be positively related. Propensity to import has a positive impact on international reserves because propensity to import acts as a proxy for openness of an economy (Frenkel, 1974b). Nor et al. (2011) also find a positive impact of propensity to import on international reserves. However, Heller (1966) find that propensity to import and international reserves can be negatively related if propensity to import acts as marginal cost of adjustment. Thus, propensity to import can have a positive or negative impact on international reserve holding.

Trade balance, which is a main part of current account balance in Thailand, is selected in this study to take into account the surge in current account surplus in Thailand during 2000-2011. Dunn and Mutti (2000), Taniuchi (2006), and Nor et al. (2011) find a positive relationship between current account balance and international reserves. Therefore, trade balance and international reserves are expected to be positively related. This study also includes external debt as one of the determinants of international reserves in Thailand since the incorporation of this variable reflects the importance of the precautionary motive for holding reserves in Asia after the 1997 financial crisis as highlighted by the recent theories on international reserve holdings. Recently, the studies of Kang and Chou (2011) and Nor et al. (2011) find a positive relationship between external debt and international reserves in China and ASEAN countries, respectively. Thus, external debt and international reserves are expected to be positively related. Lastly, exchange rate is incorporated in this study. Even though Flood and Marion (2002) find that exchange rate flexibility decreases the demand for reserves because central banks do not need large reserves to maintain a peg or to enhance the peg's credibility, international reserves remain important in Thailand in order to stabilize value of Thai Baht under managed floating exchange rate regime. Moreover, Puah et al. (2011) find that the appreciation of Malaysia Ringgit leads to an increase in international reserves. Hence, exchange rate and international reserves are expected to be positively related as supported by the findings in Puah et al. (2011).

3. Methodology

There are three types of tests in this study. The first test is the Augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1979) unit root test. This test will be used to check for the stationary properties of the data. The second test is the Johansen and Juselius (1990) cointegration test. This test will be applied to examine the existence of long run relationship between international reserves and its determinants. The final test is the regression analysis as

shown in equation (1). This test will be implemented to obtain the impact (both magnitude and direction) of each of the determinants on international reserves. Moreover, in order to avoid the problem of the different unit scale, the percentage change form is applied to all the variables except the propensity to import.

$$IR_t = \alpha + \beta_1 GDP_t + \beta_2 PIM_t + \beta_3 TB_t + \beta_4 DEBT_t + \beta_5 EXR_t + \varepsilon \quad \text{--------- (1)}$$

Where:
IR_t = percentage change in international reserves at period t
GDP_t = percentage change in gross domestic product at period t
PIM_t = propensity to import at period t
TB_t = percentage change in trade balance at period t
$DEBT_t$ = percentage change in external debt at period t
EXR_t = percentage change in exchange rate (US$/Thai Baht) at period t

4. Results

The study of the determinants of international reserves in Thailand uses the monthly data of international reserves, gross domestic product, propensity to import, trade balance, external debt and exchange rate from 2000 to 2011. The results of descriptive statistics, unit-root test, cointegration test and regression analysis are as follows.

Table 1 Descriptive Statistics

	IR	GDP	PIM	TB	DEBT	EXR
Mean	1.207625	0.492051	0.193374	137.0607	0.118198	0.135846
Median	1.122985	0.406322	0.192845	-42.05706	-0.088538	0.158413
Maximum	9.380290	2.938112	0.261926	19218.83	5.791194	3.682622
Minimum	-4.523598	-5.729107	0.130006	-6306.335	-5.224548	-3.421020
Std.Dev.	2.294514	1.327160	0.025495	1856.913	1.804897	1.447748

Table 1 shows descriptive statistics of the data during the period of study from 2000 to 2011. For percentage change in international reserves (IR), the maximum is 9.38%, and the minimum is -4.52% with the mean of 1.21% and the standard deviation of 2.29%. For percentage change in gross domestic product (GDP), the maximum is 2.94%, and the minimum is -5.73% with the mean of 0.49% and the standard deviation of 1.33%. For propensity to import (PIM), the maximum is 0.26 times, and the minimum is 0.13 times with the mean of 0.19 times and the standard deviation of 0.03 times.

For percentage change in trade balance (TB), the maximum is 19,218.83%, and the minimum is -6,306.34% with the mean of 137.06% and the standard deviation of 1,856.91%. For percentage change in external debt (DEBT), the maximum is 5.79%, and the minimum is -5.22% with the mean of 0.12% and the standard deviation of 1.80%. For percentage change in exchange rate (EXR), the maximum is 3.68%, and the minimum is -3.42% with the mean of 0.14% and the standard deviation of 1.45%.

Table 2 Unit Root Test

Variable	Augmented Dickey-Fuller test statistic: constant	Augmented Dickey-Fuller test statistic: constant and trend
	Level	Level
IR	-9.119899***	-9.240337***
GDP	-5.568163***	-5.512739***
PIM	-3.047596**	-4.387956***
TB	-12.01568***	-11.98398***
DEBT	-3.104576**	-4.470567***
EXR	-7.859321***	-7.932214***

*** denotes statistical significance at 1% level
** denotes statistical significance at 5% level

Table 2 shows the results from unit-root test. According to the percentage change data (at level) of international reserves, gross domestic product, trade balance, external debt and exchange rate, Augmented Dickey-Fuller (ADF) statistics are significant at least 5% level. Thus, the percentage change in international reserves (IR), gross domestic product (GDP), trade balance (TB), external debt (DEBT) and exchange rate (EXR) are stationary at level. In addition, Augmented Dickey-Fuller (ADF) statistics indicate significance for propensity to import (PIM) at level. Therefore, for further analysis, this study uses the percentage change data of international reserves (IR), gross domestic product (GDP), external debt (DEBT) and exchange rate (EXR) at level as well as the data of propensity to import (PIM) at level.

Table 3 Correlations among Independent Variables

Variable	GDP	PIM	TB	DEBT	EXR
GDP	1.000000	-	-	-	-
PIM	-0.056833	1.000000	-	-	-
TB	-0.029401	-0.025046	1.000000	-	-
DEBT	0.286576	0.270941	0.077459	1.000000	-
EXR	0.048199	-0.130120	0.101358	0.278830	1.000000

Before running linear regression, the correlation among all of the independent variables is examined in order to check for the multicollinearity problem, which is the problem of any pairs of independent variables having absolute correlation above 0.8. Table 3 demonstrates the correlation matrix among independent variables, including gross domestic product (GDP), propensity to import (PIM), trade balance (TB), external debt (DEBT) and exchange rate (EXR). The results show no multicollinearity problem because none of the independent variables has absolute correlation above 0.8. Thus, all five independent variables can be used for further analysis.

Table 4 Cointegration Test

Hypothesized No. of CE(s)	Trace statistic		Max-Eigen statistic	
	Constant	Constant and trend	Constant	Constant and trend
None	165.6939***	186.8121***	49.52205***	57.24518***
At most 1	116.1719***	129.5669***	37.56990**	46.17164***
At most 2	78.60197***	83.39530***	31.33647**	31.96033*
At most 3	47.26550***	51.43496***	19.77321*	19.78815
At most 4	27.49229***	31.64682***	18.81443***	18.81452*
At most 5	8.677858***	12.83230**	8.677858***	12.83230**

*** denotes rejection of the hypothesis at the 0.01 level
** denotes rejection of the hypothesis at the 0.05 level
* denotes rejection of the hypothesis at the 0.10 level

Table 4 shows the significant results of cointegration test, indicating the existence of long run relationship between international reserves and its determinants. After checking and solving the problems of multicollinearity, heteroskedasticity and autocorrelation, the results of linear regression with ordinary least square (OLS) are as follows.

$$IR_t = 3.012232 + 0.210963GDP_t - 10.50371PIM_t + 0.0000134TB_t$$
$$(2.236189)^{**} \quad (1.632682) \quad (-1.531900) \quad (0.152595)$$

$$+ 0.218852DEBT_t + 0.699533EXR_t \quad \text{-------- (2)}$$
$$(2.096648)^{**} \quad (5.828665)^{***}$$

Adjusted R-Squared = 0.293180
F-Statistic = 12.77995
Prob (F-Statistic) = 0.000000
Durbin-Watson Stat = 1.914786

*** denotes statistical significance at 1% level
** denotes statistical significance at 5% level

From Equation 2, F-Statistic is 12.77995 with Prob(F-Statistic) of 0.000000, meaning that at least one independent variable can explain dependent variable (international reserves). Adjusted R-Squared is 0.29318, meaning that all five independent variables can help determine international reserves 29.318%. The rest 70.682% can be explained by other factors. Additionally, Durbin-Watson Statistic of 1.914786, which is very close to 2.0000, shows no problem of autocorrelation. Therefore, the explanation of the coefficients of significant independent variables is as follows.

External debt (DEBT)

External debt (DEBT) statistically and significantly determines international reserves (IR) at 5% level. This can be interpreted that when external debt increases 1%, international reserves will increase 0.218852%. On the other hand, when external debt decreases 1%, international reserves will decrease 0.218852%.

Exchange rate (EXR)

Exchange rate (EXR) statistically and significantly determines international reserves (IR) at 1% level. This can be interpreted that when exchange rate increases 1%, international reserves will increase 0.699533%. On the other hand, when exchange rate decreases 1%, international reserves will decrease 0.699533%.

Nevertheless, the coefficients of gross domestic production (GDP), propensity to import (PIM) and trade balance (TB) are not statistically significant.

5. Conclusion and Discussion

The study of determinants of international reserves in Thailand examine the monthly data of international reserves (IR), gross domestic product (GDP), propensity to import (PIM), trade balance (TB), external debt (DEBT) and exchange rate (EXR) during 200-2011 by using the multiple regression with ordinary least square method. The study finds that DEBT and EXR are statistically significant determinants of IR. However, GDP, PIM and TB are not significant in determining IR. The results are summarized in table 5 as follows.

Table 5 Result Summary

Independent Variable	Coefficient	Statistical Significance
GDP	+0.210963	No
PIM	-10.50371	No
TB	+0.0000134	No
DEBT	+0.218852	Yes
EXR	+5.828665	Yes

According to table 5, factors significantly affecting international reserves are external debt and exchange rate. External debt positively significantly determines internal reserves in Thailand because of precautionary motive, especially, after the 1997 Asian financial crisis. The positive association between external debt and international reserves is consistent with Kang and Chou (2011) and Nor et al. (2011). In addition, exchange rate (US$/Thai Baht) positively significantly determines internal reserves in Thailand because an appreciation of Thai Baht leads to an increase in import so that there will be an increase in international reserves. The positive association between exchange rate and international reserves is consistent with Puah et al. (2011).

Factors insignificantly affecting international reserves are gross domestic product, propensity to import and trade balance. Gross domestic product is an insignificant determinant of international reserves in Thailand. However, the positive relationship between gross domestic product and international reserves is in line with Guo and Tsai (2006), Wang and Ma (2008), Nor et al. (2011) and Puah et al. (2011) because the larger the size of the country, which is determined by gross domestic product, the more the trade activities are and the increase in the demand for international reserves.

Propensity to import is an insignificant determinant of international reserves in Thailand. Nevertheless, the negative relationship between propensity to import and international reserves is in agreement with Heller (1966) because propensity to import acts as

the marginal cost of adjustment. Furthermore, trade balance is an insignificant determinant of international reserves in Thailand. Nonetheless, the positive relationship between trade balance and international reserves is in harmony with Dunn and Mutti (2000), Taniuchi (2006) and Nor et al. (2011). Since trade balance reflects an openness of country's economy, the high trade balance leads to the high economy openness which resulting in the high demand for international reserves in order to stabilize the value of country's currency.

The results of this study can be used by government, MNEs and academicians. First, Thai government knows that if Thailand has larger external debt and/or if Thai Baht increases in value, Thai government needs to hold more international reserves. Next, multinational enterprises (MNEs) understand that external debt and exchange rate significantly affect and positively relate to international reserves. Also, gross domestic product and trade balance positively relate to international reserves, and propensity to import negatively relate to international reserves. Thus, MNEs can employ these results to evaluate the international stability of Thailand in order to make investment decision in Thailand. Finally, academicians can refer to the results of this study as the literature regarding the determinants of international reserves in another developing country, Thailand.

To broaden the knowledge about international reserves determinants, future research may examine the effects of other factors besides the ones employed in this study. Moreover, future research involving international reserve holdings should focus on other countries in Asian Economic Community (AEC) to help these countries reduce currency value volatility and create currency value stability. Additionally, future research should compare factors affecting international reserves among countries in AEC, which will be beneficial to foreign investors to make investment decision in these countries.

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