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The Cost of International Reserves: An Empirical Analysis from Malaysia

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Studies on the accumulation of international reserves by most of the crisis-hit countries have progressively gained in importance and continue to attract discussion among academics and policy-makers. Furthermore, the unprecedented increase of international reserves among the Asian crisis-hit countries (due to Asian Financial Crisis 1997/98) including Malaysia and the lack of studies on this topic underline the urgency of analyzing this issue. Thus, this paper specifically attempts to shed light on the cost of the joint decision to hold international reserves and external debt after the 1997 Asian financial crisis. The article's main findings are that holding international reserves does confer benefits on the country in terms of lower cost and improves the country's ability to protect itself from sudden shock. The results also suggest that Malaysia should hold international reserves of at least 4.96 months of imports, which is higher than the conventional rule of thumb. However, in its current international reserves position, Malaysia could finance 9.3 months of retained imports, which is too much and far above the optimal level.

1. Introduction

The financial crisis experienced by East Asian and Latin American countries in the late 1990s has resulted in a new approach to macroeconomic policy and has led to calls for reform of the international financial architecture. In addition, the newly formulated policy aims to reduce vulnerability to external shocks and lower the likelihood of external crises by maintaining public and external debt at manageable levels as well as accumulating international reserves as a self-insurance mechanism (Edwards, 2007).[1] It has been rationalized

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[1] International reserves are defined as the external assets that are readily available to and controlled by monetary authorities for meeting balance of payments financing needs, for intervention in exchange markets

that greater financial integration could lead to an increase in international reserves with the aim of reducing the incidence of costly output decline as induced by sudden reversal of capital flows, as well as speculative attack (Cheung and Qian, 2009; Aizenman, 2008; Rodrik, 2006; Mendoza, 2004). Countries with higher levels of liquid assets are better able to withstand panic induced by sudden shock in the capital market (Rodrik, 2006). However, Aizenman (2008) suggests that the international reserves are also subject to serious limitations such as macro and micro moral hazard and fiscal cost. Furthermore, in the era of financial globalization, where financial markets are integrated, countries face high exposure to international financial market vulnerability. As a result, the significant increase in international reserves accumulated by the crisis-hit countries has been interpreted as a self-insurance motive in anticipation of uncertainty in the economy.[2] In addition, developing countries cannot depend solely on the International Monetary Fund to protect them from sudden crises (Feldstein, 1999).[3]

On the other hand, the stock of external indebtedness continues to increase with the aim of supporting the domestic economy. The dual-gap theory, which explains the savings gap and foreign exchange gap and is an extension of the Harrod-Domar growth model, has highlighted the motivation behind the introduction of external debt to the growth model. If external debt has been efficiently allocated to domestic investment it could, in return, generate economic growth in the long run. Table 1 shows the average growth of reserves and external debt indicator. The upper panel presents the average growth of total international reserves and total external debt in United States dollars (millions). Meanwhile, the lower panel shows the average growth of international reserves and external debt ratio variables. In level form, it shows that during the period from 1991 to 2009, both international reserves and external debt have recorded a double-digit growth except for external debt over the period of 2001 to 2009. Despite the positive

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to affect the currency exchange rate, and for other related purposes such as maintaining confidence in the currency and the economy, and serving as a basis for foreign borrowing (IMF, 1993).

[2] Aizenman and Lee (2005) find a strong positive correlation between the international reserves holding and past balance of payment crises.

[3] However, holding high level of international reserves would also be associated with a cost. By holding too much of international reserves a country could possibly lose the opportunities and yield from other investment or portfolio diversification. In addition, an accumulation in reserves would lead to unbalanced economic growth from the global context.

growth recorded for international reserves and external debt-holding, the total external debt grows in a decreasing pattern with an average of 1.75 percent growth over the period of 2001 to 2009. Intuitively, it is notable that Malaysia continues to increase the total international reserves at a higher rate than the total external debt, which in turn raises issues related to the cost of holding reserves. This explains the reason for the growth recorded by the international reserves to external debt variable for the 2001-2009 of 9.847 percent. Meanwhile, the ratio variable of international reserves shows the highest growth for the period 2001-2009 as compared to the previous recorded year. Furthermore, the total external debt as a percentage of GNI shows a declining growth of 2.99 percent for the period 2001 to 2009. This has led to the question of whether holding more reserves could bring an additional advantage to the country.[4] As at the end of 29 April 2011, Malaysia was holding international reserves amounting to RM393.2 billion (equivalent to USD130 billion) and this is sufficient to finance 9.3 months of retained imports (Central Bank of Malaysia, 2011).[5] Meanwhile, Malaysia also has also shown a remarkably increasing pattern of total outstanding external debt which amounted to RM233.4 billion or USD77.1 billion as at the end of March 2011 (end Dec 2010: RM227.1 billion or USD72.8 billion), equivalent to 29% of GNI (Central Bank of Malaysia, 2011). As shown in Figure 1, there has been a tremendous increase in international reserves starting from the period of financial crisis; this could possibly relate to the self-insurance motive.

All the above developments highlight the need to formulate a strategy on the joint decision of holding international reserves and sovereign indebtedness, since sovereign debt also plays an income-smoothing role in the economy. While holding too many international reserves would burden the country with opportunity costs, a country with too few reserves could face a high risk of economic downturn. Therefore, the issue of adequate levels of international reserves-holding with a level of sovereign debt could also be raised.[6] However, by accumulating

[4] Despite the accumulation of international reserves to protect a country from a sudden shock, Rodrik (2006) questions why countries have not reduced the external exposure.

[5] The ratio of reserves to retained imports or reserves in months of imports is one of the indicators of reserves adequacy and it measures the number of months a country can continue to support its current level of imports if all other inflows and outflows cease (IMF, 2000).

[6] The rule of thumb to maintain reserves equivalent to three months of imports has become obsolete and needs to be revised due to high capital mobility in the emerging economies (Wijnholds and Kapteyn, 2001).

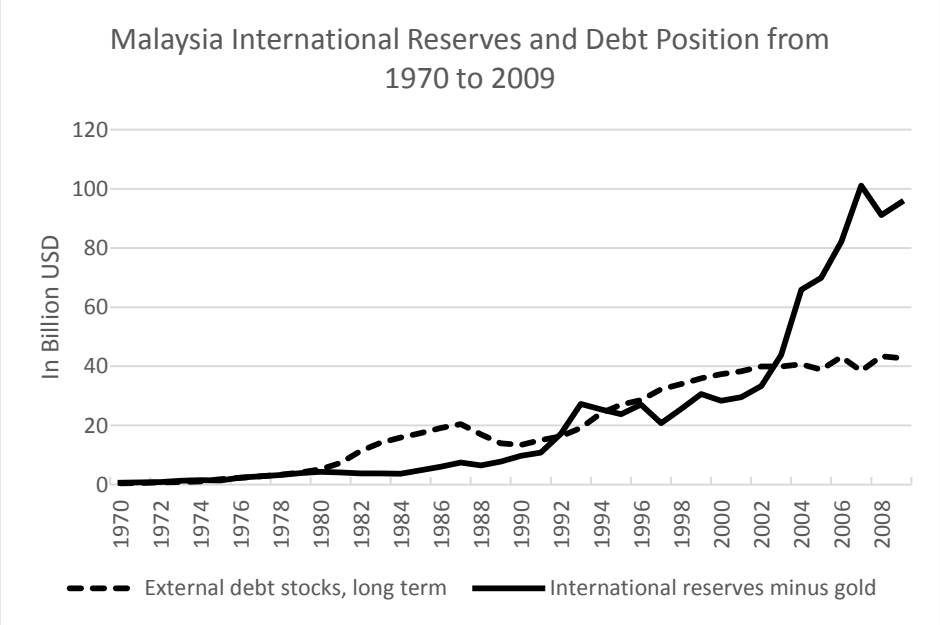
international reserves and external debt, a country could potentially default (with a high level of indebtedness). Conversely, by delaying the default, a country with a high level of debt is reducing welfare levels and, to a lesser extent, its sustainable debt position (Grossman and Han, 1997). These issues are important for policy formulation since they are related to a country's future access to the credit market. While a fair amount of empirical and theoretical literature has attempted to explain the motives of a country holding international reserves, none of the previous studies has provided an explanation of the cost of Malaysia's decision to jointly hold international reserves and external debt. Thus, the purpose of the present study is to analyze the cost of Malaysia's decision to jointly hold international reserves and sovereign indebtedness after the 1997 financial crisis. Furthermore, the paper has been motivated to investigate the optimal level of reserves-holding with a country's stock of sovereign indebtedness. This paper provides additional evidence and fills the gap in the literature by exploiting various techniques of estimation. Moreover, this paper could provide information about whether Malaysia is saving enough of her international reserves assets with regard to the stock of sovereign debt liability. In the next section, this paper reviews the existing theoretical and empirical literature. Then, the data and methodological consideration are described. The results estimation is discussed in the following section and the final section concludes the paper.

Table 1: The growth rate of the international reserves and external debt holding for Malaysia

	1970-2009	**1970-1980**	**1981-1990**	**1991-2000**	**2001-2009**
	Average growth (in percentages)				
Total international reserves	15.50	23.96	9.45	10.94	15.60
Total external debt	13.67	28.90	11.91	14.07	1.75
	Average growth (in percentages)				
International reserves/imports	3.59	1.60	-0.04	3.44	10.00
International reserves/external debt	2.70	-1.80	1.14	2.351	9.847
External debt/GNI	4.410	10.98	5.29	3.64	-2.99

Source: Authors' calculation, WDI/GDF, World Bank.

Figure 1: The pattern of international reserves and debt position from 1970 to 2009



Source: WDI/GDF, World Bank

2. Review of the Literature

There has been a surge of interest in examining the demand for international reserves. The first approach considers the element of adequacy; Triffin (1947) developed a theory that argued that the increase in demand for reserves would vary over time with the growth in world trade, specifically transactions in the current account position. In addition, by applying a monetarist balance of payment theory, Johnson (1958) points out that the international reserves-holding also depends on the country's money supply. Furthermore, if domestic money supply grows at a lower rate than the domestic demand, then a country will accumulate reserves.

On the other hand, Heller (1966) conceptualizes the idea of reserves demand as an inventory control problem. The optimization approach is utilized to analyze the demand for international reserves based on a cost-and-benefit analysis. Heller (1966) finds that the propensity to import, the opportunity cost of holding international reserves and the stability of a country's balance of payments account are all associated with a country's decision to hold international reserves. An increase in the propensity to import and the cost of holding international reserves will decrease the level of optimal reserves, while imbalances in the balance of payments position will tend to increase the international reserves-holding. Furthermore, the optimal level of international reserves-holding is given by the amount which minimizes the total cost of adjusting and financing the external imbalances. Meanwhile, Pagan (1968) reformulates the model proposed by Heller (1966) by adapting the inventory theory. Frenkel and Jovanovic (1981) develop a stochastic model to determine the optimal stock of international reserves and emphasize the important role of stochastic characteristics of external transaction and the forgone earnings with regard to holding reserves.

Despite the growing interest in analyzing the determinants of demand for reserves, Iyoha (1976), Hipple (1979), Ben-Bassat and Gottlieb (1992) and Ramachandran (2004) shed light on investigating the opportunity cost of holding reserves. The opportunity cost of holding reserves plays a role in models of optimal demand for foreign exchange. However, most studies have failed to find a significant opportunity cost effect. Iyoha (1976) estimates the opportunity costs of a cross-section of 29 Least Developed Countries (LDC) in 1970 and finds that a 10 percent

increase in the opportunity cost of holding reserves will trigger a 9 percent reduction in the level of reserves held. However, Hipple (1979) argues that the definition and proxy used by Iyoha (1976) is not suitable for representing the opportunity cost and suggests yield rates in the United States or United Kingdom. In another argument, Ben-Bassat and Gottlieb (1992) find a significant effect of opportunity cost on the demand for reserves by using the return on capital and reserves as a proxy. Ramachandran (2004) finds that the opportunity costs predominantly determine the reserve demand rather than the reserve volatilities.

On the empirical front, there is still a lack of empirical evidence analyzing the joint cost of holding reserves. The first empirical analysis to investigate the joint cost of holding reserves and debt was conducted by Yeyati (2008). The argument put forward by Yeyati (2008) suggests that self-insurance is costly and should be considered a second-best solution in the context of an imperfect international financial market. Yeyati (2008) also argues that the results should be refined by taking into account other potential factors such as country-specific effect characteristics despite highlighting that the results are possibly overstated. Meanwhile, in the case of developing countries, Daud and Podivinsky (2011) found that the positive effect of accumulating reserves which aims to improve sovereign ratings has been crowded-out by the negative effect of accumulating external debt which resulted in a net negative effect. The analysis also suggested that countries should reduce their sovereign debt in order to maintain a good credit risk position while holding international reserves at the optimal level of 3.67 in a month of imports.

3. Methodology and Data

The methodology adopts the simple model of Yeyati (2006, 2008) who analyzes the impact of the decision to jointly hold international reserves and sovereign debt on sovereign spread. This paper examines the following basic model given by

$$SSP_t = \alpha + \alpha_1 RESV_{t-1} + \alpha_2 EDEBT_{t-1} + \alpha_3 REER_t + \varepsilon_t \quad (1)$$

where (for country *i*, at time *t*), SSP is sovereign spread as a proxy of the opportunity cost, RESV is international reserves, EDEBT is sovereign debt and REER is real exchange rate. To examine the opportunity cost of holding reserves for the emerging markets, following Gonzalez-Rozada and Yeyati (2008), the Emerging Market Bond Index by JP Morgan (EMBI) is used as the dependent variable.[7]

This paper has been inspired by the work of Gonzalez-Rozada and Yeyati (2005) to use Emerging Market Bond Index (EMBI) as the dependent variable to represent the opportunity cost of holding reserves for the emerging markets. The opportunity cost of reserves could be explained as the difference between cost and benefits incurred or yielded by the government. Yeyati (2006) defines the opportunity cost as the return that the government has to pay in excess of the return on the liquid foreign assets to finance the purchase of reserves. In addition, Rodrik (2006) and Jeanne and Ranciere (2008) postulate opportunity cost of reserves as the difference between the interest rate paid on the country's liabilities and the lower return received on the reserves. An increase in international reserves reduces the probability of costly crises in the case of default and also reduces the spread paid on the stock of sovereign debt, which tends to reduce the marginal cost of reserves accumulation. The opportunity cost of self-insurance could also relate to a risk premium rate, while the risk premium also explains the probability of a country defaulting. Therefore, Jeanne and Ranciere (2008) suggest that the cost of self-insurance be measured by the pure risk premium (interest rate spread) rather than incorporating the default risk premium in the model since adding both risks could overestimate the true opportunity costs of reserves. To examine whether a linear cointegrating relationship exists for the estimated equation, the Autoregressive Distributed Lag (ARDL) bounds test developed by Pesaran et al. (2001) is utilized. As the sample size in this paper is relatively small, the Pesaran et al. (2001) bounds test procedure will be an appropriate technique (Pattichis 1999, Mah 2000, Tang and Nair 2002). Basically, the bounds test developed by Pesaran et al. (2001) is the Wald test (F-

[7] EMBI Global is an emerging market debt benchmark index to measure the total return performance of international government bonds issued by emerging market countries that are considered sovereign (issued in something other than local currency) and that meet specific liquidity and structural requirements. In addition, EMBI Global identifies emerging markets countries with a combination of World Bank-defined per capita income brackets and each country's debt-restructuring history.

statistic version of the bound testing approaches) for the lagged level variables in the right-hand side of an Unrestricted Error Correction Model (UECM). The asymptotic distribution of the F-statistic is non-standard under the null hypothesis of no cointegrating relationship between the examined variables, irrespective of whether the explanatory variables are purely I(0) or I(1).

Under the conventionally used levels of significance such as 10 percent, 5 percent and 1 percent, if the statistic from a Wald test falls outside the critical bounds value (lower and upper values) a conclusive inference can be made without considering the order of integration of the explanatory variables. If the F-statistic exceeds the upper critical bound, the null hypothesis of no cointegrating relationship can be rejected. However, if the test statistic (F-statistic) falls below the lower critical bound, then the null of non-cointegration cannot be rejected. If the F-statistic falls between the upper and lower bounds, a conclusive inference cannot be made. The second stage of the ARDL approach is to estimate the coefficients of the long-run cointegrating relationship and the corresponding error correction model.

To enhance the credence of the analysis, this paper also employs the test proposed by Hansen (2000) to estimate the existence of non-linearity on the cost of reserves-holding as well as the optimal amount of international reserves-holding with respect to its opportunity cost. With a slight modification of Hansen (2000), this paper proceeds with the thresholds model of

$$SSP_t = \beta_1' x_t + \mu_t \qquad q_t \leq \gamma \tag{3}$$

$$SSP_t = \beta_2' x_t + \mu_{ti} \qquad q_t > \gamma \tag{4}$$

where q_t is the threshold variable, signifies for RESV variable. In addition, the threshold variable could be part of the regressors and it is used to split the sample into two regimes. Meanwhile SSP_t is the opportunity cost measured by EMBI and x is $p \times 1$ vector of independent variables and μ_t is a regression error. Models (3) and (4) can be written in a single equation form as

$$SSP_t = \beta' x_t + \theta x_t(\gamma) + \mu_t \quad (5)$$

where $d_t = I(q_t \leq \gamma)$. $I(.)$ denotes the indicator function and sets the variable $x_t(\gamma) = x_t d_t(\gamma)$. Furthermore, the null hypothesis of linearity against a threshold specification can be expressed as:

$$H_0 : \beta_1 = \beta_2 \quad (6)$$

Equation (5) allows all the regression parameters to differ between the two regimes depending on the value of q_t. The threshold model developed by the Hansen (2000) estimator considered the least squares estimations test of the null of linearity against the alternative of a threshold. In addition, by providing an asymptotic simulation this method also computed a confidence interval by inverting the likelihood ratio statistics. Hansen (2000) also proposes an F-test bootstrap (heteroscedasticity-consistent) procedure to test the null of linearity. Since the threshold value γ is not identified under the null, the p-values are computed by a fixed bootstrap method. The independent variables are supposed to be fixed and the dependent variable is generated by a bootstrap from distribution $N(0, \hat{\mu})_i$, where $\hat{\mu}_i$ is the OLS residual from the estimated thresholds model. Hansen (2000) shows that this procedure yields asymptotically correct p-values. If the null hypothesis of linearity is rejected, one can split up the original sample according to the estimated thresholds value and perform the same analysis on each subsample. The distribution of the threshold estimator is non-standard while it only allows one threshold relationship and one threshold variable.

Data are collected from various sources for the period of 2002Q1 to 2010Q4 from World Development Indicator (WDI) and Global Development Financial (GDF) indicator by the World Bank (WB) database, International Financial Statistics (IMF/IFS) by the International Monetary Fund (IMF) and Datastream by Thomson. The international reserves variables, external debt, GDP and real exchange rate are gathered from IMF/IFS and GDF databases. In addition, data on spread represented by the Global Emerging Market Bond Index (EMBI) are taken from Datastream as a proxy of opportunity cost. Data on

sovereign debt as a percentage of GDP which represents the sovereign debt are gathered from GDF/World Bank database.

4. Empirical Findings

Table 2 presents the results estimated by Ordinary Least Squares (OLS) on the cost of holding international reserves function. The results show that EDEBT, RESV and REER variables are significant at 5 percent significance level in explaining the sovereign spread for Malaysia. As presented in Model 2 which incorporates a risk factor, an increase of 1 percent of RESV reduces the sovereign spread for about 0.46 percent, while a 1 percent increase in EDEBT is associated with an increase of about 0.24 percent in sovereign spread. As a result, with the increase in international reserves and sovereign debt, the cost of holding reserves is lower than the cost of holding debt. From another point of view, if a country reduces the international reserves-holding, the cost would incurred about 0.46 percent, whereas by reducing the external debt by 1 percent, the cost is only reduced by 0.24 percent. This indicates that holding reserves is a better option than reducing the external debt.

Table 2: The ordinary least squares estimation of cost of holding reserves

Sovereign spread	**Model 1 SSP(ED, RESV)**	**Model 2 SSP(ED, RESV, REER)**
EDEBT	0.564 (0.052)*	0.2416 (0.099)*
RESV	-0.968 (0.046)*	-0.464 (0.048)*
REER	-	-0.833 (0.0875)*
Intercept	9.561 (0.412)*	17.398 (1.006)*
R-Squared	0.921	0.973

*Notes: * and ** denotes significant at 5 and 10 percent significance level. Numbers in brackets represent the standard error. All variables are expressed in natural logarithms.*

This paper proceeds to establish the long-run linear relationship between the variables and the sovereign spread. The results of the F-statistic for testing the long-run relationship between EDEBT, RESV, REER and sovereign spread are shown in Table 3. With a maximum number lag of 4 imposed, the computed F-statistic's values of 0.867 and 0.276 could not exceed the critical bounds of 3.793 to 4.855 and 3.219 to 4.378 at the 5 percent significance level for Model 1 and Model 2 respectively. This implies that the null hypothesis of no cointegrating long-run relationship could not be rejected. In addition, the computed F-statistics were also compared with the critical values provided by Narayan (2004, 2005).[8] The results also fail to find evidence of a linear long-run relationship between the EDEBT, RESV, REER and sovereign spread for the period 2002Q1 to 2010Q4.

Since no evidence has been found to confirm the existence of a long-run linear relationship in the estimated cost function, this paper continues the analysis by employing a non-linearity test of Hansen (2000). Table 4 shows the results of the non-linearity test on the threshold estimates of the cost of international reserves-holding function with respect to its sovereign spread.[9] By using 10,000 bootstrap replications, the F-statistics and the bootstrap p-values suggest a rejection of the null of no thresholds effect (at 5 percent significance level), suggesting evidence of the non-linearity relationship for Model 1 and Model 2. In addition, the results also reveal the intervals which propose a minimum and maximum level of international reserves assets that a county should hold. The results shows that, in Model 1, where the estimation is only taking into account the international reserves and sovereign debt, the interval of international reserves-holding ranges from 4.736 to 4.832 by months of imports. Meanwhile, taking into consideration the REER variable, the interval of international reserves-holding is around 4.687 to 4.956 months of imports. As the threshold variable represented by the international reserves as a month of imports, it provides information on the optimal level of international reserves with respect to the sovereign spread. The international reserves and sovereign debt are found to have

[8] Based on the analysis by Narayan (2004) the existing critical value reported in Pesaran et al. (2001) is not suitable for use in small sample sizes. Furthermore, Narayan (2004) provides a set of critical values, specifically for small sample sizes ranging from 30 to 80 observations.

[9] Traditional "rules of thumb" that have been used to guide reserve adequacy suggest that countries should hold reserves covering or the equivalent of 3 months of retained imports. However, this traditional measure of reserve adequacy appears to have limited relevance today with the notion of no one size fits all.

a significant impact on the sovereign spread (at 5 percent significance level) for both models.

The threshold estimates are found to account for about 4.83 and 4.96 for Models 1 and 2 respectively. In Model 1, which only incorporates the international reserves and sovereign debt as the independent variables, the optimal level of international reserves is found to account for about 4.83 months of imports, implying that a country should hold international reserves at 4.83 months of imports to protect itself from sudden shock. However, with a consideration of additional variable real exchange rate, the results indicated a slightly higher level of 4.96 months of imports as optimal reserves-holding. In the era of financial liberalization, where countries are highly exposed to risk of shocks, a model for the cost of holding reserves that includes other risk factors would provide a better prediction of the optimal level of international reserves that a country should hold with respect to its cost. The results show that, in the first regime, a 1 percent increase in international reserves is associated with a reduction in sovereign spread of 1.3 percent in Model 1. In other words, an increase in international reserves below the 4.83 months of imports is associated with a reduction in the opportunity cost.[10] However, above the threshold level, an increase in international reserves is associated with an increase in sovereign spread, which suggests an increase in the cost of holding reserves in the second regime. In other words, an increase in international reserves is associated with a reduction opportunity cost up to the threshold level. In addition, continuing to increase the international reserves above the adequate level is associated with increased opportunity cost. On the other hand, holding sovereign debt is associated with an increase in opportunity cost in the first and second regimes with 0.81 percent and 0.44 percent respectively. In summary, increasing the international reserves and sovereign debt in the first regime is associated with a net negative effect implying a decline in the opportunity cost whilst, above the threshold level, an increase in the international reserves and sovereign debt is associated with an increase in the opportunity cost.

[10] The real exchange rate is also significant (at 5 percent significance level), implying that this factor is also important and needs to be considered in estimating the opportunity cost.

The impact of an increase in the holding of international reserves is consistent even with consideration of other external variables as in Model 2. The results show that the threshold estimates of the international reserves is at 4.96 months of imports, implying that a country has to save at least 4.96 months of imports in order to protect itself. In addition, the results also reveal that an increase in international reserves below the 4.96 months of imports is associated with a reduction in sovereign spread of about 0.70 percent.[11] Meanwhile, above the threshold level, any increase in international reserves is associated with an increase in sovereign spread, suggesting an increase in the cost of holding reserves. In addition, holding sovereign debt is associated with an increase in opportunity cost in the first regimes. However, the sovereign debt variable is insignificant (at 5 percent significance level) in the second regime even though it indicates that accumulating sovereign debt in the second regimes is associated with a decline in opportunity cost.

Thus, it is suggested optimal level for Malaysia to stock its international reserves up to 4.96 since above the optimal level country would incur cost at higher rate. In this case, there is less advantage to Malaysia if it continues to accumulate international reserves above the optimal level, since this is associated with higher opportunity costs. Furthermore, by continuing to increase the international reserves in the second regime, Malaysia is lowering her ability to repay the sovereign debt, which also increases the probability of the country falling into default.

Intuitively these results, which represent the period following the financial crisis, explain that, at this point of the period, the optimal level of international reserves that Malaysia should hold is higher than the conventional rules (3 months of imports) would recommend. With the hoarding of international reserves during the post-crisis period, a country could possibly learn a lesson to protect itself from any sudden shock. Although the optimal level of international reserves was found to be slightly higher than the conventional rule of three months of imports, Malaysia is holding too many international reserves, which could burden the country with excessive costs. This fact is also supported by

[11] The results are slightly higher than the threshold estimates found by Daud and Podivinsky (2011) for the case of developing countries.

Ramachandran (2004) that the rapid accumulation of reserves during the recent years does not reflect the optimal behaviour in the sense of the buffer stock model.

5. Conclusions and discussion

The objective of the present study is to analyze the impact of holding international reserves and sovereign debt with regard to its opportunity cost. Furthermore, this paper analyzes the cost of Malaysia's decision to jointly hold international reserves and sovereign indebtedness after the 1997 financial crisis. This paper also contributes to the literature by identifying the optimal level of international reserves that Malaysia should hold over the period of analysis from 2002Q1 to 2010Q4, thus evaluating the current position of international reserves hold by Malaysia. The important empirical findings show that an increase in international reserves is associated with a reduction in sovereign spread up to its optimal level. Furthermore, this paper also provides evidence that Malaysia should hold international reserves at an optimal level of 4.96 months of imports, which is higher from the conventional rule of thumb of 3 months of imports. In other words, Malaysia incurred an increase in the opportunity cost with an increase of international reserves above the threshold level. In this case, there is less advantage to Malaysia if it continues to accumulate international reserves above the optimal level, since this is associated with higher opportunity costs. Meanwhile, by continuing to increase the international reserves, Malaysia is lowering her ability to repay the sovereign debt, which also increases the probability of the country falling into a default problem. The best decision for Malaysia is to hold the international reserves at the optimal level when the opportunity costs are at a minimal level. Holding fewer reserves than the optimal level might expose a country to a high risk of uncertainty and sudden shock. However, too high a level of international reserves (savings) is associated with a high cost as well as a reduction in the probability of a country repaying its sovereign debt

Current development shows that Malaysia could finance about 9.3 months of retained imports, this leads has led to the issue of the reason for the increase in the stock of international reserves. This in turn points to the concern over whether the increase in the international reserves as months of imports is a reflection of the central bank behaviour of

continuing to increase the international reserves or whether it is due to the declining pattern in retained imports which is the denominator of the ratio. The pattern of Malaysia's international reserves during the period of 1990 to 2010 shows that, after the 1997 financial crisis, Malaysia started to increase the stock of international reserves. In addition, with the announcement of losses due to the United States sub-prime mortgage crisis, Malaysia drastically increased the international reserves as indicated by a steeper curve as compared to the period before the news (see Figure 2). This development signifies the fear of the contagion effect which has been translated to the accumulation of international reserves. However, it shows that, during July 2008, the total international reserves-holding started to exhibit a declining pattern before the trend was reversed to show an increase in reserves in August 2010, albeit at a lower rate. Thus could be due to the utilization of the international reserves during the late 2008 crisis. In contrast, the growth rate of retained imports shows a gradual increase from the period of 2004 before reversing to record a declining pattern during the period of 2005 to 2009. Thus, the increasing of the international reserves as a month of retained imports is also due to the decline in the growth rate of the retained imports being higher than the decline in the total international reserves-holding thus resulting in the higher ratio of international reserves as a month of imports. As such, looking blindly at the ratio of international reserves as a month of imports could lead to the misinterpretation of the central bank behavior in promoting monetary and financial system stability and fostering a sound and progressive financial sector.

On the other hand, the uncertainty condition in the economies of the Asian crisis-hit countries would indicates the countries' behavior in saving too many of international reserves in the late 2000s (Daud and Ahmad, 2013). Furthermore, China that holds the highest stock of international reserves also aims for a self-insurance motive. Persistent trade surplus as well as rising private capital inflows could be the best explanation of this phenomena. It is notable that China's large holding of international reserves is associated with some unavoidably high cost such as quasi-fiscal cost, opportunity cost, financial repression cost and economic distortion cost (Yongzhong and Freeman, 2013). Current development shows that government of China is struggling to restore balance to the economy with strict capital control since the economy has

experienced the inflationary effect of the high capital inflows. A short-term capital inflows through the banking system provide an excessive domestic credit, thus push-up the inflation rate. The risk of sudden shock in the event of speculative capital flows as well as the interdependency on the trade balance would also become a worries by the economist and China's policy maker. As such, the episode of high level of international reserves has shown the negative cost to the economy with China started experience the heat of the effect.

Apart from the fundamental economic conditions, political risks of the domestic economy could possibly contribute to an explanation of a country's decision on holding international reserves. Since the political risk factor could be a potential indicator to measure a country's economic health as well as unstable condition in the economy, the association of the political risk factor and demand for international reserves would provide an important and interesting avenue for future research.

Table 3: The bounds test for the existence of linear relationship

Model	**F statistics**	**Significance level**	**Pesaran et al. (2001) critical values**		**Narayan (2004) critical values**	
			I(0)	I(1)	I(0)	I(1)
Model 1 SSP (EDEBT, RESV, intercept)	0.867	5 percent	3.793	4.855	3.458	4.343
		10 percent	3.182	4.126	2.863	3.610
Model 2 SSP (EDEBT, RESV, REER, intercept)	0.276	5 percent	3.219	4.378	3.170	4.160
		10 percent	2.711	3.800	2.618	3.502

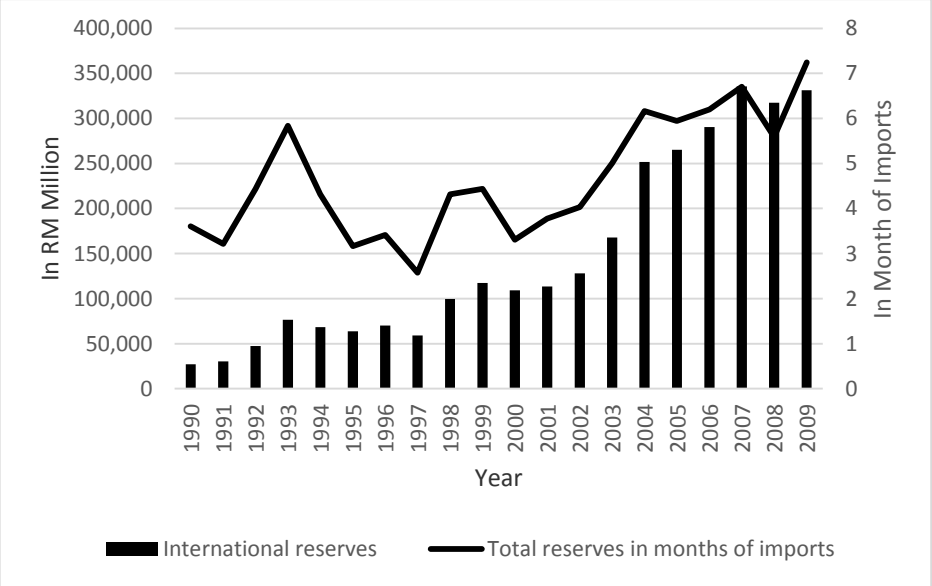
*Notes: * and ** denotes significant at 5 and 10 percent significance level. Numbers in brackets represent the standard error. The null hypothesis is no long-run relationship.*

Table 4: Results of threshold regression

Sovereign spread	**Model 1** **SSP (ED, RESV)**	**Model 2** **SSP (ED, RESV, REER)**
F-test statistics	617.61*	269.84*
Bootstrap p-value	0.000	0.000
95 percent confidence interval	[4.736,4.832]	[4.687,4.956]
	First regime	
EDEBT	0.806 (0.016)*	0.295 (0.134)*
RESV	-1.312 (0.052)*	-0.695 (0.139)*
REER		-0.432 (0.123)*
Intercept	9.451 (0.232)*	12.78 (1.070)*
R-Squared	0.99	0.99
Threshold estimates	$q_i \leq 4.83$	$q_i \leq 4.96$
	Second regime	
EDEBT	0.438 (0.017)*	-0.059 (0.176)
RESV	0.205 (0.070)*	0.201 (0.075)*
REER		-0.571 (0.218)*
Intercept	-2.863 (0.927)*	5.921 (3.139)*
R-Squared	0.99	0.98

*Notes: * and ** denotes significant at 5 and 10 percent significance level. The null hypothesis is no threshold relationship. Numbers in brackets represent the standard error. All variables are expressed in natural logarithms.*

Figure 2: The pattern of total international reserves and reserves in month of imports



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