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Abstract:

This study investigates the requirement for the exchange rate to be a shock absorber in Indonesia and Thailand from 1986 to 2007. In general, we find that the economic shocks have predominantly been asymmetric relative to the US and the Japanese economies. Yet, the weights attached to the US dollar remain respectably high in the exchange rate management of the rupiah and the baht, in particular for the latter currency, during the post-1997 crisis. Hence, relinquishing the role of exchange rate as a shock absorber has been costly during both the pre-and the post-1997 crisis periods for these Southeast Asian countries. Furthermore, it is arguably more costly for Thailand during the post-1997, and for Indonesia during the pre-1997 crisis.

JEL Classification: C32, E42 and F31

Key Words: Economic Shocks; Shock Absorber; Exchange Rate; Structural Vector Autoregression; Indonesia; Thailand

1. Introduction

Among a number of perennial macroeconomic policy debates, the contention on finding the appropriate exchange rate regime continues to attract a large number of studies. In general, these early works prescribe a more flexible exchange rate for any country moving to liberalize its domestic economy. Eichengreen (1994), Diaz-Alejandro (1985), Chang and Valesco (2000) and Wyplosz (2001) for instance contend that it is crucial to realize *ex ante* that liberalization rocks foreign exchange markets, and building some form of exchange rate flexibility (either by floating or by being prepared to realign pegs) into the liberalization program is, therefore, essential.

The argument linking a more flexible exchange rate to economic liberalization does not however advance without rebukes and caveats. The source of financing and the degree of financial openness also matter. Goldfajn and Olivares (2001) conclude that flexible regimes are viable in financially open economies, provided that external financing is not based on very volatile capital. In the absence of full international financial markets, Devereux (2004) demonstrates theoretically that although a flexible exchange rate acts perfectly as a shock absorber of global demand shocks, in welfare terms it may in fact be better off to prevent the exchange rate from moving at all (pg.360).

Moreover, the characteristics and features of real economic shocks, i.e. demand and supply shocks, have also been identified as another influential determinants of a country's exchange rate regime. When these shocks are largely symmetric relative to the major trading partners , the common view in the literature is that the flexibility of the exchange rate policy should therefore not be an issue. However, if they are primarily asymmetrical, then the role of exchange rate as a shock absorber is desirable.

Despite the importance of the issue, particularly for designing effective monetary and exchange rate policies, and the numerous works on the developed economies, still very little works have been carried out on the emerging markets, particularly on the major Southeast Asian economies that had experienced severe financial crisis about a decade ago.[1] Yet, a similar set of monetary and exchange rate policy challenges resurfaced with the global outbreak of the sub-prime crisis starting 2007. In the midst of the global financial market uncertainties, major Southeast Asian economies, such as Indonesia, Malaysia, Philipines, Thailand and Singapore, have been forced to reassess and adjust their monetary and exchange rate priorities.

To help fill in the gap in the literature, the primary objective of our paper is to examine the experiences of two most-severely affected economies by the 1997 East Asian crisis, namely Indonesia and Thailand, during the past two decades. In particular, we wish to address the following two questions:

a) Have the economic shocks that Indonesia and Thailand had to face relative to their two key trading partners, namely Japan and the US, during the previous two decades have predominantly been symmetrical or asymmetrical ones?

b) Has there been any necessity for the exchange rate to be a shock absorber in these two Southeast Asian economies since the mid-1980s? Has this requirement become more pertinent during the post-1997 financial crisis?

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[1] We will review works being done on these issues in Section two of the paper.

To achieve our objectives, we would employ a structural VAR framework with long-run and short-run restrictions of Artis and Ehrmann (2006). This approach incorporates a methodology introduced by Smets (1997) to identify domestic monetary policy shocks, especially on the weights that the monetary authorities attached to exchange rate. These approaches enable us to disentangle the role and contribution of exchange rate and interest rate in monetary policy shocks. At the final stage, the impulse response analyses will be employed to explore the characteristics of the economic shocks and the requirement for the exchange rate to be a shock absorber in Indonesia and Thailand during the past two decades.

This paper proceeds as follows. Next section briefly reviews the literature. Section three introduces the empirical approaches of Artis and Ehrmann (2006) and Smets (1997). The following section discusses the data sets and the unit root properties. Section four on test results extensively analyzes the empirical findings and addresses the set of questions posted earlier. The conclusion section ends the paper.

2. Literature Review

Numerous efforts have been extended to identify the types of economic shocks and their impacts on the local economies in the past two decades. Most of these studies adopted a structural VAR framework with long-run identifying restrictions, introduced by the seminal work of Blanchard and Quah (1989), as the basic framework to their empirical works. Lastrapes (1992) for instance finds that the real and nominal exchange rate fluctuations during the floating exchange rate period are due primarily to real shocks in six developed economies, namely the United States, the United Kingdom, Germany, Italy, Japan and

Canada. The study however fails to distinguish whether the real shocks were originated from the demand or the supply shocks.

Extending the bivariate VAR model of Lastrapes (1992), Clarida and Gali (1994) estimate a three-equation open macroeconomic model to identify three structural shocks, i.e. two real shocks (demand and supply) and monetary (nominal) shocks, to examine the sources of real exchange rate fluctuations in Japan, Germany, Britain and Canada during the post Bretton Woods period. The trivariate VAR model consists of the relative output growth, the first difference in real exchange rate and the relative rate of inflation, in which all of the three variables under consideration are specified as relative to the corresponding variables of the large neighbours. Based on their findings, Clarida and Gali (1994) argue that for Germany and Japan, nominal shocks as well as demand shocks explain a substantial amount of the variance in the dollar-Deutsch mark and the dollar-yen real exchange rates. However, nominal shocks explain very little of the variance in the real exchange rate for Canada and Britain. Similarly, supply shocks in all cases account for very little variance of the real exchange rate relative to the dollar.

Applying the long run identification scheme of Clarida and Gali (1994), Chadha and Prasad (1996) and Thomas (1997) examine the relationship between the real exchange rate and the business cycle in Japan and Sweden respectively after the collapse of Bretton Woods system. In addition, both studies specify the variables in their VAR systems in relative terms to Japan's and Sweden's foreign counterparts. From their structural decomposition, Chadha and Prasad (1996) find that the variation in Japan's output growth was largely due to supply shocks while demand shocks played an important but only secondary role. The real exchange rate change, on the other hand, was driven equally by demand and nominal shocks with supply shocks performed a minor role. Moreover, the variation in the rate of inflation was mainly influenced by supply and nominal shocks with the latter shocks became increasingly significant at longer horizons.

On the other hand, Thomas (1997) probes the relative importance of real and nominal shocks in explaining the fluctuations of the real exchange rate in Sweden. The policy objective of the study is to assess the potential cost of giving up exchange rate as the instrument of the macroeconomic policy adjustment in Sweden, i.e. as a shock absorber, required for participating in the Economic and Monetary Union (EMU). The study finds that real shocks (demand and supply shocks) account for over 60 percent of the forecast error variance of real exchange rate. Moreover, demand shocks account for a significantly higher fraction of the real shocks in Sweden as compared to other core EMU countries. The study contends that the cost of abandoning the exchange rate as an instrument of monetary policy is no higher and may be lower for Sweden than for most of the main EMU countries.

An interesting work by Smets (1997) appraises the role of the European Currency Unit (ECU) exchange rate in the monetary policy strategy of France, Germany and Italy. The principal contribution of this study is in its attempt to distinguish between interest rate and exchange rate innovations that are due to domestic monetary policy shocks and those that are due to monetary authorities' response to exchange rate movements. The study proposes an approach whereby the first empirical step is to estimate the weight of exchange rate in the short run reaction function of the domestic monetary authority using instrument variable technique, and then employs the estimated weights of exchange rate to identify the domestic monetary policy shock and its effects on output, prices, interest rate and exchange rate. The study claims that the responses of output, prices, interest rate and exchange rate to monetary policy shocks in these three major European economies are consistent with the standard open economy model. In particular, taking into account the role of exchange rate in the monetary policy formulation explicitly, the study is able to solve the exchange rate puzzle, i.e. exchange rate depreciates instead of appreciating, following a monetary policy tightening.

In their recent works, Artis and Ehrmann (2006) explore the following important policy question: Was the exchange rate a shock absorber or a source of its own destabilising shocks in the United Kingdom, Canada, Sweden and Denmark? Their study applies a structural VAR framework with the mixed of long run and short run identification restrictions pioneered by Gali (1992). They claim that exchange rate can only act as a shock absorber if the domestic economy is hit by an asymmetric shock as compared to its foreign counterparts. Most of early works however failed to determine if real shocks that hit domestic economy are symmetric or idiosyncratic in nature, largely due to the fact that the key variables in their VAR systems are constructed in the relative term to the corresponding variables of the neighbouring countries (Smets, 1997; Thomas, 1997). Under this type of construction, it becomes difficult to separate whether shocks were originated from the domestic economy or trading partners' economies.

To overcome this shortcoming, Artis and Ehrmann (2006) include the foreign interest rate variables into their VAR systems that are not formulated in relative term. Moreover, Artis and Ehrmann (2006) apply the Smets (1997) approach to disentangle domestic monetary policy shocks from exchange rate shocks using the calculated weights which central banks attached to exchange rate development when setting their domestic monetary policies. Their study concludes that real shocks are predominantly symmetric relative to the neighbours in all countries of focused except for the United Kingdom. Hence, there is little need for the exchange rate to act as a shock absorber in Canada, Sweden and Denmark. In addition, shocks that are generated from the exchange rate market appear to play a more important role in Denmark than other countries. They, therefore, argue that monetary union is easier to recommend for Denmark and Sweden than it is for Canada and the United Kingdom.

Despite those numerous efforts, to our knowledge only few works have looked into these important monetary policy issues for the East Asian economies. Hataiseree (1998) examines the role of exchange rate in Thailand's Monetary Condition Index (MCI)[2], and claims that during the period from 1990 to 1998, the weight of exchange rate in Thailand's MCI is 0.33 for the baht nominal effective exchange rate, and that exchange rate plays an increasing role in transmitting the effects of monetary policy to real economy.

Using a simple VAR framework, Fung (2002) examines the effects of monetary policy shocks in seven East Asian economies, including Indonesia and Thailand during 1985 to 2001, the pre-1997 and the post-1997 Asian financial crisis. The study employs the Bernanke and Mihov (1998) methodology to calculate the weight of exchange rate in the MCI for nominal effective exchange rate to capture explicitly the importance of exchange rate in the domestic monetary policy measures. The author further assumes that domestic interest rate is the policy instrument and domestic monetary policy shocks do not affect the exchange rate contemporaneously. The results however were not conclusive, especially for

2 The monetary condition index (MCI) is a weighted average of short term interest rate and exchange rate, and is often used to measure the stance of monetary policy in open economies.

the estimated weights of the exchange rate and eventually had to be replaced with weights of the exchange rate based on the openness of the economy.

As stated earlier, our study aims at extending and enriching the current literature on the role of exchange rate in the developing countries by specifically examining the cases of Indonesia and Thailand during the period from 1986 to 2007. Applying the structural VAR identification scheme with short run and long run identifying restrictions of Artis and Ehrmann (2006), we hope to investigate the requirement for the exchange rate to be a shock absorber in these economies during the last two decades. Furthermore, by harnessing the approach introduced by Smets (1997) to estimate the role of exchange rate when identifying the domestic monetary policy shocks, we can resolve the endogeneity problem between exchange rate and domestic interest rate in the Hataiseree (1998) and Fung (2002) studies.

3. Empirical Methodologies

Turning into the empirical approaches, this section would first summarize the structural VAR framework with the long run and short run restrictions of Artis and Ehrmann (2006) to identify five structural shocks, i.e., the supply and demand shocks, the foreign and domestic monetary policy shocks and the exchange rate shocks. We would then briefly introduce the basic frameworks of Smets (1997) methodology for estimating the weights of exchange rate when the monetary authorities in Indonesia and Thailand set their domestic monetary policy measures. Once the structural VAR model has been identified, the impulse response functions and the forecast error variance decompositions can then be estimated.

3.1 The Structure of the VAR Model of Artis and Ehrmann (2006)

Following Artis and Ehrmann (2006), the structural VAR model in this study can be represented by $\mathbf{x} \equiv [\Delta y_t, i_t^*, i_t, \Delta p_t, \Delta e_t]'$, where all variables except interest rates are in natural log. Δy_t denotes the domestic output growth, i_t^* is the foreign short-term nominal interest rate, i_t is the domestic short-term nominal interest rate, Δp_t denotes the domestic rate of inflation, and Δe_t denotes the rate of appreciation of the nominal exchange rate of home currency against its foreign currencies. The domestic economy is subject to 5 structural shocks $\boldsymbol{\varepsilon} \equiv [\varepsilon_t^S, \varepsilon_t^d, \varepsilon_t^{m*}, \varepsilon_t^m, \varepsilon_t^e]'$. Here, we have two real shocks, namely the supply shocks (ε_t^s) and the demand shocks (ε_t^d), and three nominal shocks, including the foreign monetary policy shocks (ε_t^{m*}), the domestic monetary policy shocks (ε_t^m), and the exchange rate shocks (ε_t^e).

As in Gali (1992) and Artis and Ehrmann (2006), our structural VAR model utilizes a combination of long run and short run identifying restrictions. To start with, the following five sets of restrictions are to be imposed in our VAR system to recover the structural model.[3]

a) First, we impose an orthogonality condition among the five structural shocks, which implies that the structural shocks are mutually uncorrelated. This restriction implies that the channels through which each structural shock will affect the economy are left unconstrained.

[3] The detail implementation of the identifying restrictions imposed to recover the structural model will be fully elaborated in the next sub-section.

b) The second set of restrictions will differentiate the supply shocks from the four remaining shocks by assuming that only supply shocks have long run effect on output following Blanchard and Quah (1989).

c) The third set of restrictions will distinguish the demand shocks from the remaining three nominal shocks by assuming that demand shock is the only shock that can influence output contemporaneously.

d) The fourth set of restrictions will sort out the foreign monetary policy shocks from the domestic monetary policy shocks and the exchange rate shocks. Our study assumes that foreign interest rate does not respond contemporaneously to domestic monetary policy shocks or to exchange rate shocks. This restriction is reasonable for the purpose of this study since Indonesia and Thailand are arguably small open economies relative to their major trading partners, such as the US and Japan.

e) Finally, to disentangle the two types of domestic nominal shocks (i.e. domestic monetary policy shocks and exchange rate shocks), we would first calculate the weight, α, which central banks attach to exchange rate development when setting monetary policy as introduced by Smets (1997) .

Once all the effects of supply, demand and foreign monetary policy shocks on the domestic interest rate and the exchange rate have been removed, the unexplained components of the interest rate and the exchange rate can therefore be attributed entirely to domestic monetary policy and exchange rate shocks. The reduced-form empirical model of monetary policy behaviour and the foreign exchange market can then be presented as follows:

$$u_t^i = \alpha_1 \varepsilon_t^m + \alpha_2 \varepsilon_t^e \quad (1)$$

$$u_t^e = \beta_1 \varepsilon_t^m + \beta_2 \varepsilon_t^e \quad (2)$$

Where: the left-hand side variables, u_t^i and u_t^e, are the reduced-form residuals for domestic interest rate and exchange rate respectively.

Equation 1 denotes that the central bank controls domestic short-term interest rate and adjusts this instrument either to changes in the stance of domestic monetary policy (ε_t^m) or in response to foreign exchange market disturbances (ε_t^e). Similarly, the current exchange rate also depends on domestic monetary policy shocks and exchange rate shocks (Equation 2). Solving Equations (1 and 2) for domestic monetary policy shocks, ε_t^m, in terms of the reduced-form interest rate and exchange rate residuals yields:

$$\varepsilon_t^m = \frac{\beta_2}{\alpha_1 \beta_2 - \alpha_2 \beta_1} u_t^i - \frac{\alpha_2}{\alpha_1 \beta_2 - \alpha_2 \beta_1} u_t^e \quad (3)$$

Normalising ($\alpha_1 = 1, \beta_1 = 1$) and the sum of the weights on the domestic interest rate and exchange rate residuals to one, result in the following expression:

$$\varepsilon_t^m = (1 - \omega) u_t^i + \omega u_t^e \quad (4)$$

Equation 4 can be interpreted as short run monetary condition index (MCI). The relative weight of exchange rate in the MCI is given by $\omega = -\alpha_2 / (\beta_2 - \alpha_2)$. In a successful identification scheme, one would expect α_2, which captures the effect of exchange rate shocks on domestic interest rate, to be non-positive since an appreciation of exchange rate should lead to a fall in interest rate; and β_2, which captures the effect of exchange rate shocks on exchange rate itself, to be positive. Therefore, the relative weight of exchange rate in MCI, ω, should lie between zero and one.

If the value of ω is known, the remaining identification problem is solved since one can define the domestic monetary policy shocks according to Equation 4. One of the main advantages of focusing on this weight to identify domestic monetary policy shocks is that it encompasses not only two extreme cases of interest rate and exchange rate targeting but also the intermediate cases, which is very much related to the experience of Indonesia and Thailand. In a pure interest rate targeting regime, the relative weight of exchange rate on the MCI will be equal to zero ($\omega = 0$) since the monetary authorities ignore the effect of exchange rate when setting domestic interest rate ($\alpha_2 = 0$).

On the other hand, in a pure exchange rate targeting regime ($\omega = 1$), there will be a one-to-one relationship between domestic monetary policy shocks and exchange rate innovations since the central bank will not allow the foreign exchange market disturbances to affect the exchange rate ($\beta_2 = 0$). For the case of Indonesia and Thailand, one would expect that the relative weight of exchange rate in domestic monetary policy measure to be some positive value, since the monetary authorities in these countries actively manage their exchange rate.

Smets (1997) and Artis and Ehrmann (2006) suggest that ω can be estimated by transforming Equation 4 into the following regression model:

$$u_t^i = -\frac{\omega}{1-\omega}u_t^e + \frac{1}{1-\omega}\varepsilon_t^m \qquad (5)$$

Equation 5 implies that the observed reduced-form residuals for interest rate (u_t^i) is explained by the observable reduced-form residuals for exchange rate (u_t^e) and a random shock, $\frac{1}{1-\omega}\varepsilon_t^m$. We estimate Equation 5 by adopting Shapiro and Watson (1988) sequential instrument variable technique, using shocks to the Australia RBA's cash rate and the exchange rate of deutschemark against the Australian dollar as instruments.[4] The shocks to the instruments are obtained by regressing each of the instrument variables on its own lags, the lags of the endogenous variables in the VAR systems, and the estimated supply, demand and foreign monetary policy shocks.[5]

3.1.1 The Specification and Implementation of Identifying Restrictions

As introduced earlier, $\mathbf{x} \equiv [\Delta y_t, i_t^*, i_t, \Delta p_t, \Delta e_t]'$ is a (5×1) vector. It is assumed that $\mathbf{x}$ is a covariance stationary vector process, and it has the following vector moving average representation form:

$$\mathbf{x} = C(L)\boldsymbol{\varepsilon} \tag{6}$$

[4] For instrument variables, we need to adopt the policy rate and the exchange rate of the major trading partners of Indonesia and Thailand. Since relevant key economic indicators from the Japanese and the US economy are already considered explicitly in our structural VAR system, we opt to use the Australia RBA's cash rate and the Australian dollar against deutschemark to be the instrumental variables for Equation 5. The Australian dollar is chosen based on two criteria. First, the country is one of the major economic partners of Indonesia and Thailand (refer to Bowman (2005)). Second, the Australian exchange rate policy is considered among the most flexible regime in the world.

[5] The lag length chosen to estimate ω is reported in Table 2 and these lags are chosen to minimise the AIC criteria and to ensure that the residuals are well specified.

where $\boldsymbol{\varepsilon} \equiv [\varepsilon_t^S, \varepsilon_t^d, \varepsilon_t^{m*}, \varepsilon_t^m, \varepsilon_t^e]'$ is the 5 by 1 vector of serially uncorrelated structural disturbances (i.e. the supply shocks, demand shocks, foreign monetary policy shocks, domestic monetary policy shocks and exchange rate shocks respectively). The 5×5 matrix of polynomial lags $C(L) \equiv [C_{ij}(L)]$, for $i, j = 1,...,5$ is the object to be estimated. Once matrix $C(L)$ has been estimated, the expressions for the levels of different variables in terms of the current and lagged values of the structural disturbances can be recovered.

The reduced-form Wold moving average representation of $\mathbf{x}$ is:

$$\mathbf{x} = R(L)\mathbf{u} \tag{7}$$

where $\mathbf{u}$ is a 5 by 1 vector of reduced-form disturbance, and $R(L) \equiv [R_{ij}(L)]$, for $i, j = 1,...,5$, $R(0) = I$ and $R(L)$ is invertible. Moreover, let Σ denotes the symmetric variance-covariance matrix of the reduced-form innovations $\mathbf{u}$, that is, $\Sigma = E\mathbf{uu}'$.

The reduced-form autoregressive representation of Equation 7 is given by:

$$B(L)\mathbf{x} = \mathbf{u} \tag{8}$$

where $B(L) \equiv [B_{ij}(L)]$ for $i, j = 1,...,5$, $B(0) = I$ and $B(L) = R(L)^{-1}$.

We assume that there exists a non-singular matrix S such that the reduced-form innovations in $\mathbf{u}$ are to be the linear combinations of the structural disturbances in $\boldsymbol{\varepsilon}$:

$$\mathbf{u} = S\boldsymbol{\varepsilon} \tag{9}$$

Therefore from Equations (6, 7 and 9):

$$C(L) = R(L)S \tag{10}$$

Pre-multiplying both sides of Equation 8 by S^{-1}, the vector autoregressive representation of $\mathbf{x}$ in terms of the structural disturbances $\boldsymbol{\varepsilon}$ can be derived:

$$A(L)\mathbf{x} = \boldsymbol{\varepsilon} \tag{11}$$

where $A(L) \equiv [A_{ij}(L)]$, for $i, j = 1,...,5$ and $A(0) \equiv S^{-1}$.

The structural model, i.e. the coefficients of $A(L)$ and $C(L)$, can be identified once enough restrictions are imposed to determine all components of the matrix S.[6]

Turning into the detail operation of the identification scheme, the assumption of mutually uncorrelated shocks, together with a convenient normalisation that each structural shock has a unit variance, imply that $E\boldsymbol{\varepsilon\varepsilon}' = I$. Thus from Equation 9,

$$SS' = \Sigma \tag{12}$$

Equation 12 represents fifteen restrictions on matrix *S*, given Σ. Therefore, ten additional restrictions need to be imposed to just-identify the structural model (Table 1).

The long run identifying restrictions of R1 to R4, imply that $C_{12}(1) = C_{13}(1) = C_{14}(1) = C_{15}(1) = 0$. Thus given Equation 10, the following linear restrictions on matrix *S* can be derived, respectively:

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[6] Consistent estimates of the coefficients in matrix $B(L)$ can be obtained from Equation 8 using the ordinary least square (OLS) technique. The estimate of matrix $R(L)$ can then be obtained by inverting matrix $B(L)$. A consistent estimate of the symmetric variance-covariance matrix of the reduced form disturbances, Σ, can be computed using the residuals of the OLS regression. From Equation 10, given the matrix S, the matrix $C(L)$ can be recovered by post-multiplying matrix $R(L)$ by matrix S; while from Equations (8, 9 and 11), matrix $A(L)$ can be recovered by pre-multiplying matrix $B(L)$ by the inversion of matrix S.

$$C_{12}(1) \equiv R_{11}(1)S_{12} + R_{12}(1)S_{22} + R_{13}(1)S_{32} + R_{14}(1)S_{42} + R_{15}(1)S_{52} = 0 \quad (13)$$

$$C_{13}(1) \equiv R_{11}(1)S_{13} + R_{12}(1)S_{23} + R_{13}(1)S_{33} + R_{14}(1)S_{43} + R_{15}(1)S_{53} = 0 \quad (14)$$

$$C_{14}(1) \equiv R_{11}(1)S_{14} + R_{12}(1)S_{24} + R_{13}(1)S_{34} + R_{14}(1)S_{44} + R_{15}(1)S_{54} = 0 \quad (15)$$

$$C_{15}(1) \equiv R_{11}(1)S_{15} + R_{12}(1)S_{25} + R_{13}(1)S_{35} + R_{14}(1)S_{45} + R_{15}(1)S_{55} = 0 \quad (16)$$

Restrictions R5 to R9 imply the following five direct constraints on matrix *S*:

$$S_{13} = 0 \quad (17)$$

$$S_{14} = 0 \quad (18)$$

$$S_{15} = 0 \quad (19)$$

$$S_{24} = 0 \quad (20)$$

$$S_{25} = 0 \quad (21)$$

By construction, element S_{ij} measures the contribution of *j*th structural shock to the contemporaneous innovation in the *i*th element of vector $\mathbf{x}$, i.e. the reduced-form residuals of *i*th variables in vector $\mathbf{x}$.

Finally, restriction R10 can be implemented as a linear restriction involving some of the elements of matrix $A(0)$. From Equations 9 and 11, $A(0)\mathbf{u} = \boldsymbol{\varepsilon}$. Therefore, the fourth row in matrix $A(0)$ is associated with the domestic monetary policy shocks. Given the specification of vector $\mathbf{x}$ and Equation 4, R10 implies the following constraint on matrix $A(0)$:

$$A_{43}(0) = 1 - \omega \text{ and } A_{45}(0) = \omega \tag{22}$$

Given $S \equiv A(0)^{-1}$, Equation 22 maps into one restriction on the element of matrix *S*.

With the identifying restrictions, the structural model (Equations 6 and 11) can be recovered from the reduced-form model (Equation 8). We estimate the structural VAR model in turn for Indonesia and Thailand for the pre-crisis period (January 1986 to December 1996) and the post crisis period (January 2000 to December 2007). For Indonesia, the model is estimated using 6 lags for both the pre- and post crisis period; while for Thailand, the model is estimated using 5 lags and 4 lags respectively for the pre- and post crisis period[7]. In addition, since it has been a common practice in the monetary VAR models, the world oil price inflation and linear time trend are also included in our VAR model as exogenous variables[8].

3.2 Impulse Response Functions

Once the structural VAR model has been identified, we then move to examine the two main questions posted in the introduction of this study. For that, we generate the impulse response functions of each key variable under the presence of the five structural disturbances in the VAR systems, for both the pre- and post-1997 crisis period. Suitably transformed, the estimates of $C(L)$ in Equation 6 can express all the variables of interest, i.e., output, foreign

7 Since the structural VAR involved long run identifying restrictions, this study adopts the above mentioned lag length to ensure that the impulse response functions are well identified, although in some cases the VAR systems with 3 lags have a smaller AIC statistic.

8 The RATS program code used to estimate this chapter's structural VAR models is adapted from Artis & Ehrmann (2006).

interest rate, domestic interest rate, domestic prices and domestic exchange rate in terms of the sum of the distributed lags of the five structural disturbances. Formally,

$$\mathbf{z} = F(L)\boldsymbol{\varepsilon} \tag{23}$$

where $\mathbf{z} \equiv [y_t, i_t^*, i_t, p_t, e_t]'$ and $F(L) \equiv [F_{ij}(L)]$ for $i, j = 1,...,5$. The coefficients of the polynomial lag $F_{ij}(L)$ give the estimated dynamic response of vector **z**'s *i*th variable to a one standard deviation realisation of the *j*th structural disturbance. Note that the variables in the impulse response function are now presented in levels for output, prices and exchange rate rather than in their growth rates.

As discussed, the need for exchange rate to be a shock absorber arises only when the real economic shocks are asymmetrical relative to the country's trading partners. Shocks that are predominantly asymmetric require opposed responses of foreign and domestic monetary policy. Accordingly, the trends of the short-run impulse response functions of output, foreign interest rate, domestic interest rate, prices and exchange rate to the five structural shocks should reveal information needed to address our research queries.

4. Data Description and Unit-Root properties

The monthly data sets from January 1986 to December 2007 are obtained from the International Financial Statistics of the International Monetary Fund and the DataStream. Since this study is interested in examining the changes in the role of exchange rate during the post-crisis period compared to the pre-crisis period, the observation set will be grouped into the pre-crisis period from January 1986 to December 1996[9], and the post crisis period from January 2000 to December 2007. In addition, the unit root properties for each variable will also be discussed. In this study, we employ three different unit root tests, namely the Augmented Dickey-Fuller (ADF) test, the Philip Perron (PP) test, and the Kwiatkowski, Philips, Schmidt and Shin (KPSS) test for robustness.[10]

4.1.1 Domestic Output

Since the gross domestic product (GDP) data is only available quarterly, the industrial production or manufacturing production index are used as a proxy for domestic output (y). The output level is expressed in natural log. From the unit root tests, it can be concluded that in most cases output variable is first-differenced stationary for Indonesia and Thailand for both sample periods.

4.1.2 Nominal Exchange Rate

To examine the importance of the shocks relative to the two major trading partners (the US and Japan), our study employs two definitions of nominal exchange rate (e), namely the bilateral nominal exchange rate against the US dollar and the bilateral nominal exchange rate against the Japanese yen. The nominal exchange rates are expressed as units of foreign currency for one unit of domestic currency. Thus, an increase in exchange rate implies a domestic currency appreciation. Both nominal exchange rate variables are expressed in

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[9] Due to data availability, the pre-crisis period for Thailand only starts in January 1988.

[10] For the sake of brevity, the unit-root test results will not be reported. But they can be made available upon request.

natural log. The unit root tests indicate that the nominal exchange rates are first-differenced stationary for both Southeast Asian economies during both sample periods.

4.1.3. Foreign Short-term Interest Rate

The foreign short-term interest rate is the US federal funds rate when the estimation involves nominal exchange rate against the US dollar and Japan's overnight call rate if it involves the Japanese yen. The foreign interest rate variables are expressed in percentage. Based on the unit-roots testing, we conclude that foreign interest rates are stationary. The findings are also supported by the estimated impulse responses, showing that foreign interest rate returns to the baseline quickly with converging error bounds, which is generally not the case if the variables are integrated (Artis and Ehrmann, 2000).

4.1.4. Domestic Short-term Interest Rate

As in recent studies on monetary policy for Indonesia and Thailand, this study uses the 90-day Certificates of Bank Indonesia (SBI) rate and the Bank of Thailand 14-day repurchase (Repo) rate as the proxies of short-term interest rate controlled by the central banks of these two economies (Berg et al., 2003; Fane, 2005; Fung, 2002).[11] The domestic interest rate variables are expressed in percentage. In general, the unit root tests reveal that the domestic interest rate is stationary for both countries for both sub-periods. This finding is once again supported by the impulse response test results.

4.1.5. Domestic Price

[11] Since the data for the Bank of Thailand 14-day repurchase rate is only available from January 1997, the call money rate is used for the period before the first data is available. We did not see any significant jump or drop at the date when the two rates are combined.

The domestic price (p) is measured by the consumer price index (CPI) with year 2000 as the base year for Indonesia and Thailand. The domestic price is expressed in natural log. Most of the unit root tests indicate that domestic price variables of both economies are first-differenced stationary for both sub-periods.

5. Test Results

5.1. Estimates for ω

The results for the weights the central banks attach to exchange rate (ω) for various periods are reported in Table 2. All weights for both the rupiah and the baht are found to be significant. Turning first to the Indonesian rupiah, our results provide evidence of less rigid exchange rate policy against the US dollar during the post-1997 crisis period. The size of the (ω) for the period of 1986-1996 is reported to be around (0.39), and drops to (0.28) for the post-1997 crisis period. In contrast, the Japanese yen continued to receive much less, but relatively unchanged weight, sitting within a narrow range of (0.04-0.06). These results seem to support the more flexible official (*de-jure*) regime of exchange rate adopted by Bank Indonesia since 1999. Nevertheless, the monetary authority in Indonesia continues to assign relatively large weight to the US dollar, suggesting a managed float regime of exchange rate against the US dollar.

In addition, our results seem to suggest that the Bank of Thailand has basically pursued the same exchange rate regime in the past two decades. The weight against the US dollar during the post-crisis has very much equalled to its pre-crisis level at around 0.33. Very much the same analyses can be said as well for the weight of the baht against the yen, albeit a slight drop in (α) during the post-crisis period. These findings are consistent with those of Baig (2001) and McKinnon and Schnabl (2004).

5.2. Have the rupiah and baht exchange rates been shock absorbers?

5.2.1. The Case of the Indonesian Rupiah

Turning first to the case of the Indonesian rupiah, the role of exchange rate as a shock absorber appears to be much more vital during the pre-1997 financial crisis than during the post-crisis period. As shown in Figures 1 and 2, demand shocks during the period of 1986-1996 were predominantly asymmetric relative to Japan and the US, and therefore requiring opposed monetary policy responses. In contrast, demand shocks during the post-1997 period triggered similar monetary policy responses by the domestic monetary authority (via its certificate of Bank Indonesia (SBI) rate) and its counterparts in the US (the US federal fund rate) and Japan (the overnight call rate) (Figures 3 and 4). As for the supply shocks, there were largely symmetrical relative to the US economy, but asymmetrical relative to the Japanese economy during the pre-crisis period. The reverse is however true for the post-crisis period.

In summary, whereas three out of four real shocks taken place before 1997 were asymmetric, the majority of these shocks since 2000 require parallel responses of the domestic and foreign monetary policies (Table 3). Given the nature of the shocks, the cost of relinquishing the role of exchange rate as a shock absorber should therefore be more expensive during the pre-1997 crisis relative to the post-crisis period. More importantly, the commitment of Bank Indonesia to introduce more flexibility in its exchange rate policy, particularly against the US dollar as indicated by the lesser weight in Table 2, is appropriate to address the asymmetrical supply shocks relative to the US economy in recent years. Nevertheless, we do not find the necessity for the shock absorbing capacity of the rupiah against the yen during the post-crisis.

5.2.2. The Case of the Thailand Baht

Based on the natures of the shocks, the necessity to introduce more flexibility in the management of the Thailand baht during the post-1997 crisis is arguably more profound than during the pre-1997 crisis (Figures 5-8 and Table 3). During the pre-crisis period, real shocks were mainly symmetrical relative to the Japanese economy. Hence, the role of exchange rate as a shock absorber here was not required. But relative to the US economy, the shocks were predominantly asymmetrical, suggesting a respectably high cost of maintaining the soft-US dollar peg policy during the pre-1997 crisis.

Since 2000, however, the two types of real shocks have largely been asymmetric, both relative to the US and the Japanese economies. This implies that there is a rising urgency to have a more credible and independent domestic monetary policy to generate opposite responses to the real shocks, and thus allowing exchange rate to be a more efficient shock absorber. Yet, as reported earlier, the Bank of Thailand continued to maintain relatively high weights for the US dollar and only moderately introduced more flexibility of the baht against the Japanese yen in its overall management of exchange rate policy. In short, given the nature of real shocks since 2000, the persistently rigid management of the Thai baht is an example of inconsistent macroeconomic policy response to economic shocks.

6. Concluding Remarks

With the liberalization of both current and capital account, the requirement for exchange rate to be an instrument of the macroeconomic policy adjustment, i.e. a shock absorber, in Indonesia and Thailand has been well documented. Most of these early works examined the rigidities of the baht and the rupiah, particularly against the US dollar, and their roles in explaining the current account deficits facing these economies prior to the collapse of the soft-US dollar peg exchange rate regimes.[12] However, hardly any has examined the nature of real shocks in the domestic economies of these Southeast Asian nations relative to the countries' major trading partners and the necessity for the exchange rate to be a shock absorber domestically.

Our study finds that real shocks in Indonesia and Thailand relative to its trading partners, namely the US and Japan, have been predominantly asymmetrical during both the pre- and post-1997 financial crisis. More importantly, we come to a conclusion that the cost for relinquishing the role of exchange rate as a shock absorber is relatively greater during the pre-crisis period for Indonesia, and during the post-crisis period for Thailand. Yet, we hardly observe any firm commitment by the monetary authorities of these two countries to move substantially away from the US dollar peg policy, especially by the Bank of Thailand. The weights of the US dollar remain respectably high in the overall management of the exchange rate of the rupiah and the baht, particular for the latter currency. The still relatively rigid exchange rate regimes against the US dollar are prevailing despite the official announcements by the monetary authorities to adopt the inflation targeting policy in Thailand since May 2000 and in Indonesia since July 2005.

[12] See for instance Siregar and Rajan (2005) and Rahmatsyah, et.al. (2002).

References:

Artis, M., Ehrmann, M.,2000. The exchange rate – A shock absorber of source of shocks? A study of four open economies. *European University Institute Working Papers RSC No. 2000/38*.

Artis, M., Ehrmann, M., 2006. The exchange rate - A shock-absorber or source of shocks? A study of four open economies. *Journal of International Money and Finance 25(6)*, 874-893.

Baig, T., 2001. Characterizing exchange rate regimes in post-crisis East Asia. *IMF Working Paper WP/01/152*.

Berg, A. G., Jarvis, C. J., Stone, M. R., Zanello, A., 2003. Re-establishing credible nominal anchors after a financial crisis: A review of recent experience. *IMF Working Paper WP/03/76.*

Bernanke, B. S., Mihov, I., 1998. Measuring monetary policy. *Quarterly Journal of Economics 113(3)*, 869-902.

Blanchard, O., Quah, D., 1989. The dynamic effects of aggregate demand and supply disturbances. *American Economic Review 79(4)*, 655-673.

Bowman, C., 2005, Yen bloc or koala bloc? Currency relationships after the East Asian crisis, *Japan and the World Economy 17*, pp.83-96.

Chang, R., Valesco, A., 2000. Exchange rate policy for developing countries. American Economic Review 90(2), Papers and Proceedings of the 112th Annual Meeting of the American Economic Association, May, 71-75.

Chadha, B., Prasad, E., 1996. Real exchange rate fluctuations and the business cycle: Evidence from Japan. *IMF Working Paper WP/96/132*.

Clarida, R., Gali, J., 1994. Sources of real exchange rate fluctuations: How important are nominal shocks? Carnegie-Rochester Conference Series on Public Policy 41, 1-56.

Devereux, M.B., 2004. Should the exchange rate be a shock absorber? *Journal of International Economics 62,* 359-377.

Diaz-Alejandro, C., 1985. Good-bye financial repression, hello financial crash. *Journal of Development Economics 19*, 1-24.

Eichengreen, B., 1994. International Monetary Arrangements for the 21st Century. The Brookings Institution, Washington DC.

Fane, G., 2005. Post-crisis monetary and exchange rate policies in Indonesia, Malaysia and Thailand. *Bulletin of Indonesian Economic Studies 41(2),* 175-195.

Fung, B. S. C., 2002. A VAR analysis of the effects of monetary policy in East Asia. *BIS Working Papers No.119.*

Gali, J., 1992. How well does the IS-LM model fit postwar US data? *Quarterly Journal of Economics 107(2), 709-738.*

Goldfajn, I., Olivares, G., 2001. Can flexible exchange rates still "work" in financially open economies? G-24 Discussion Paper Series No. 8, United Nations Conference on Trade and Development, January.

Hataiseree, R., 1998. Monetary conditions and monetary policy in small open economies: Empirical results for Thailand under the floating rate regime. Paper presented at the 22nd International Conference on a Macroeconomic Core of an Open Economy for Progressive Industrialisation and Development in Asia in the New Millennium, Bangkok, Thailand.

Lastrapes, W. D., 1992. Sources of fluctuations in real and nominal exchange rates. *Review of Economics and Statistics 74(3)*, 530-539.

McKinnon, R. I., Schnabl, G., 2004. The East Asian dollar standard, fear of floating, and original sin. *Review of Development Economics 8(3)*, 331-360.

Rahmatsyah, T., Rajaguru, G., Siregar, R., 2002. Exchange rate volatility, trade & "fixing for life" in Thailand. *Japan and the World Economy 14 (4)*, 445-470.

Shapiro, M. D., Watson, M. W., 1988. Source of business cycle fluctuations. *NBER Macroeconomics Annual 3,* 111-148.

Siregar, R., Rajaguru, G., 2005. Sources of variation between the inflation rates of Korea, Thailand and Indonesia during the post-1997 crisis. *Journal of Policy Modelling 27(7),* 867-884.

Smets, F., 1997. Measuring monetary policy shocks in France, Germany and Italy: The role of the exchange rate. *BIS Working Papers No. 42.*

Thomas, A., 1997. Is the exchange rate a shock absorber? The case of Sweden. *IMF Working Paper WP/97/176.*

Wyplosz, C., 2001. How risky is financial liberalization in the developing countries? G-24 Discussion Paper Series No. 14, United Nations Conference on Trade and Development, September.

Table 1: Structural VAR Identifying Restrictions

Long run restrictions:

R1: no long run effect of aggregate demand shocks on output

R2: no long run effect of foreign monetary policy shocks on output

R3: no long run effect of domestic monetary policy shocks on output

R4: no long run effect of exchange rate shocks on output

Short run restrictions:

R5: no contemporaneous effect of foreign monetary policy shocks on output

R6: no contemporaneous effect of domestic monetary policy shocks on output

R7: no contemporaneous effect of exchange rate shocks on output

R8: no contemporaneous effect of domestic monetary policy shocks on foreign interest rate

R9: no contemporaneous effect of exchange rate shocks on foreign interest rate

R10: the contemporaneous weight, ω, which central banks attached to exchange rate development when setting domestic monetary policy, that is,

$$\varepsilon_t^m = (1-\omega)u_t^i + \omega u_t^e$$

Table 2: The estimates of the Weight Attached to Exchange Rate Management (α)

	Indonesia		Thailand	
	RP-USD[1]	**RP-YEN**[2]	**BAHT-USD**[3]	**BAHT-YEN**[4]
Pre-Crisis:	0.39	0.04	0.33	0.22
(1986:1-1996:12)	(3.23)***	(1.88)*	(3.72)***	(6.24)***
Post-Crisis:	0.28	0.06	0.33	0.18
(2000:1-2007:12)	(4.43)***	(2.82)***	(2.22)**	(6.24)***

The t-statistics are in brackets. ***, **, * indicate significance at 1%, 5% and 10%

Notes:

1). The (α) for RP-USD is estimated using 11 lags, excluding the crisis period observation (1997:1-1999:12);
2). The (α) for RP-YEN is estimated using 10 lags, excluding the crisis period observation (1997:1-1999:12);
3). The (α) for BAHT-USD is estimated using 7 lags, excluding the crisis period observation (1997:1-1999:12);
4). The (α) for BAHT-YEN is estimated using 10 lags, excluding the crisis period observation (1997:1-1999:12);

Table 3: Summary of Key Findings on the Role of Exchange Rate as a Shock Absorber

	Indonesia		**Thailand**	
	Pre-crisis	**Post Crisis**	**Pre-crisis**	**Post Crisis**
a) Against the US$				
▪ Supply shocks	Symmetric	Asymmetric	Asymmetric	Asymmetric
▪ Demand Shocks	Asymmetric	Symmetric	Asymmetric	Asymmetric
b) Against the Japanese Yen				
▪ Supply shocks	Asymmetric	Symmetric	Symmetric	Asymmetric
▪ Demand Shocks	Asymmetric	Symmetric	Symmetric	Asymmetric
Main Conclusion	The cost of relinquishing the role of exchange rate as a shock absorber has arguably been more costly in Indonesia during the pre-1997 crisis relative to post-crisis period.		The cost of relinquishing the role of exchange rate as a shock absorber should definitely be more costly in Thailand during the post-1997 crisis period relative to pre-crisis period.	

Figure 1: Impulse Response Functions for Indonesian Rupiah against US dollar during the Pre-crisis Period

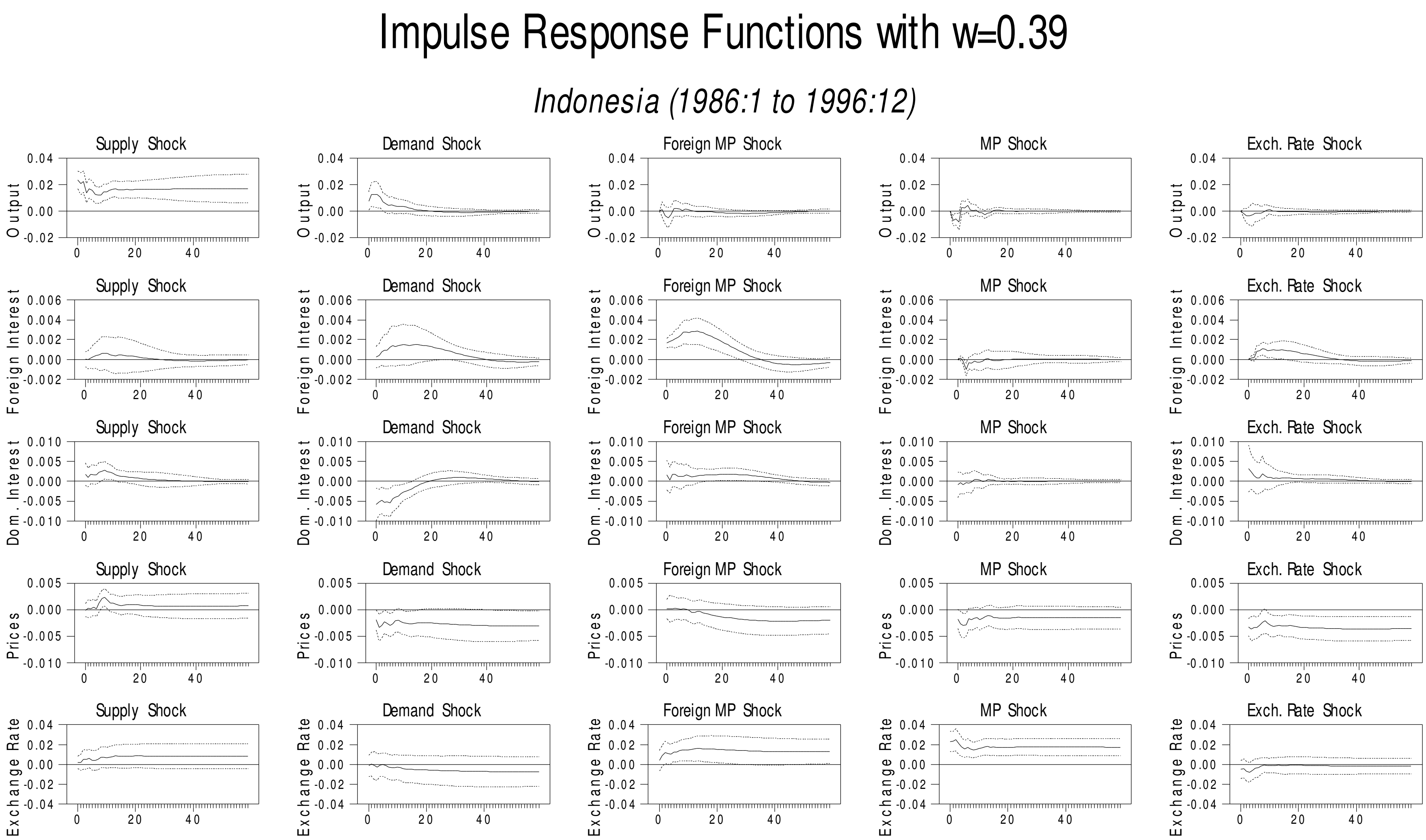

Figure 2: Impulse Response Functions for Indonesian Rupiah against Japanese Yen during the Pre-crisis Period

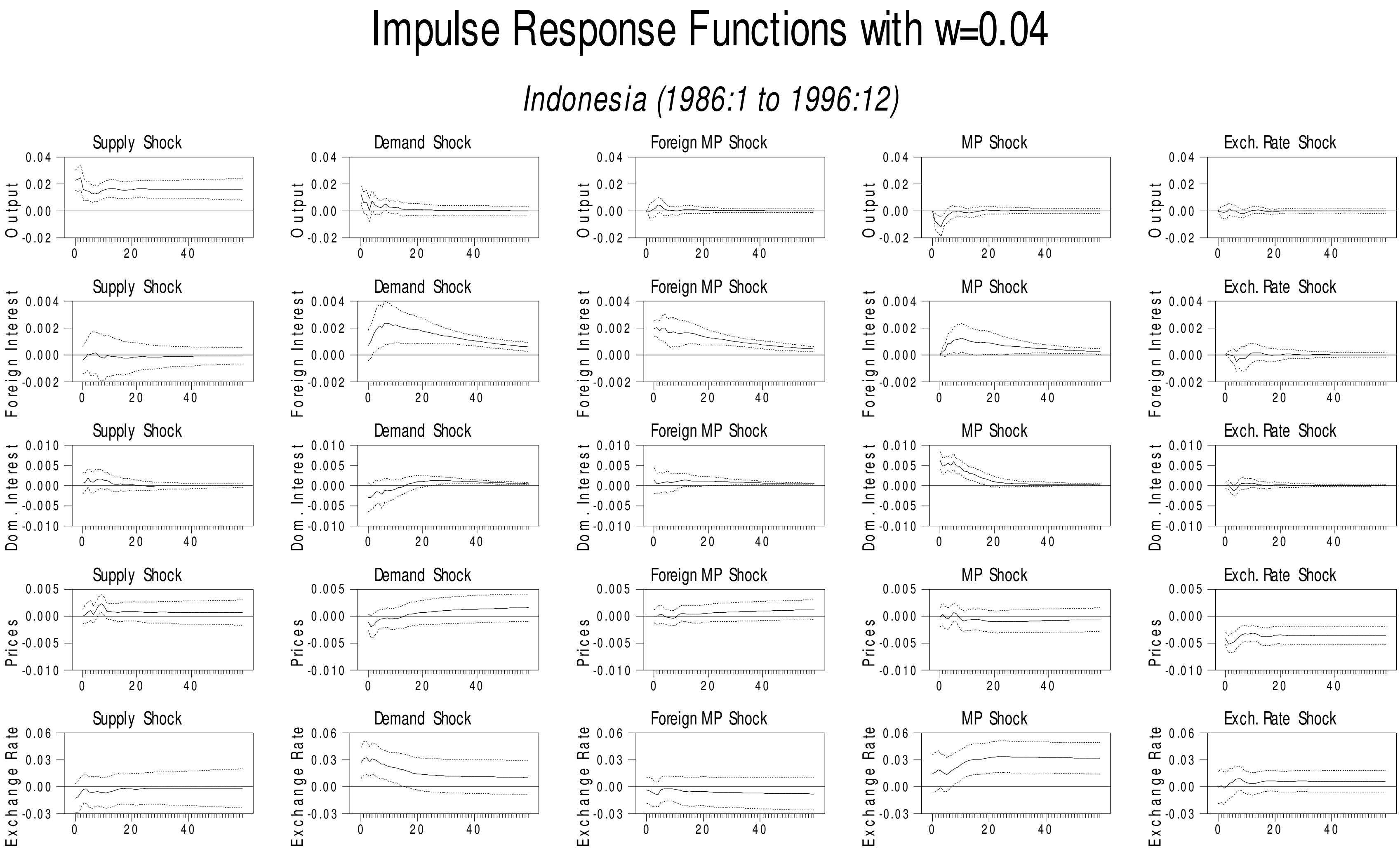

Figure 3: Impulse Response Functions for Indonesian Rupiah against US dollar during the Post-crisis Period

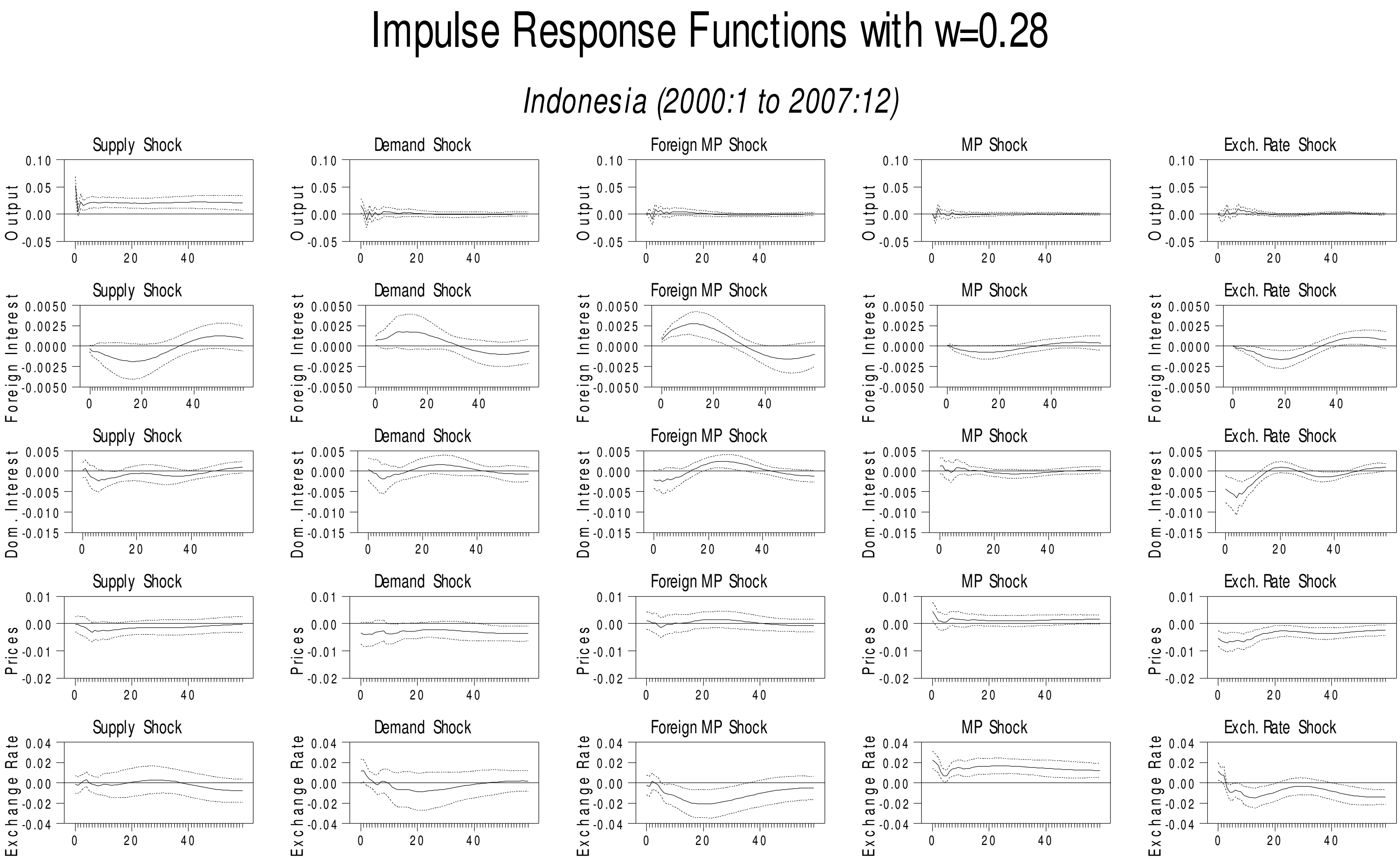

Figure 4: Impulse Response Functions for Indonesian Rupiah against the Japanese Yen during the Post-crisis Period

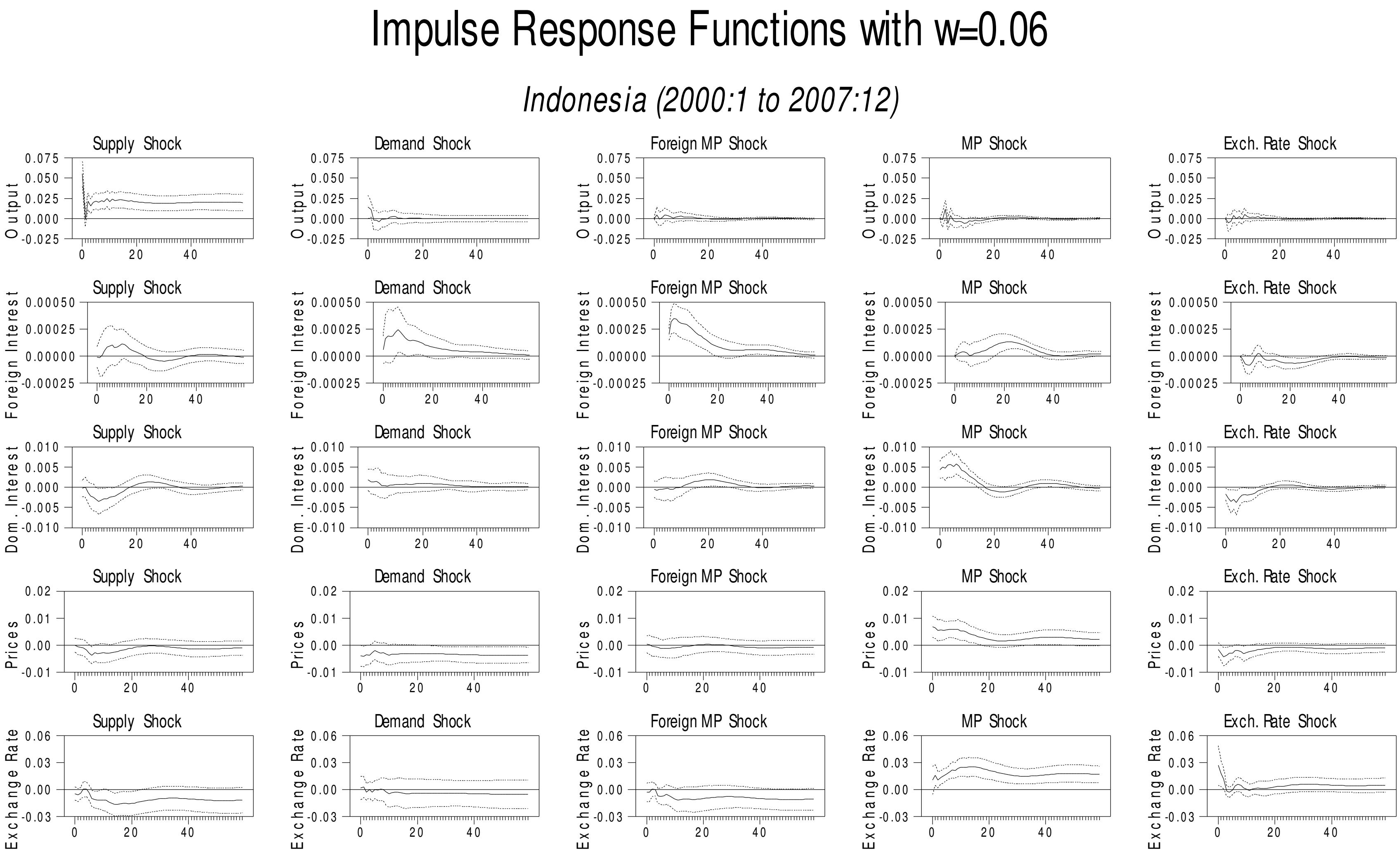

Figure 5: Impulse Response Functions for the Thai baht against the US dollar during the Pre-crisis Period

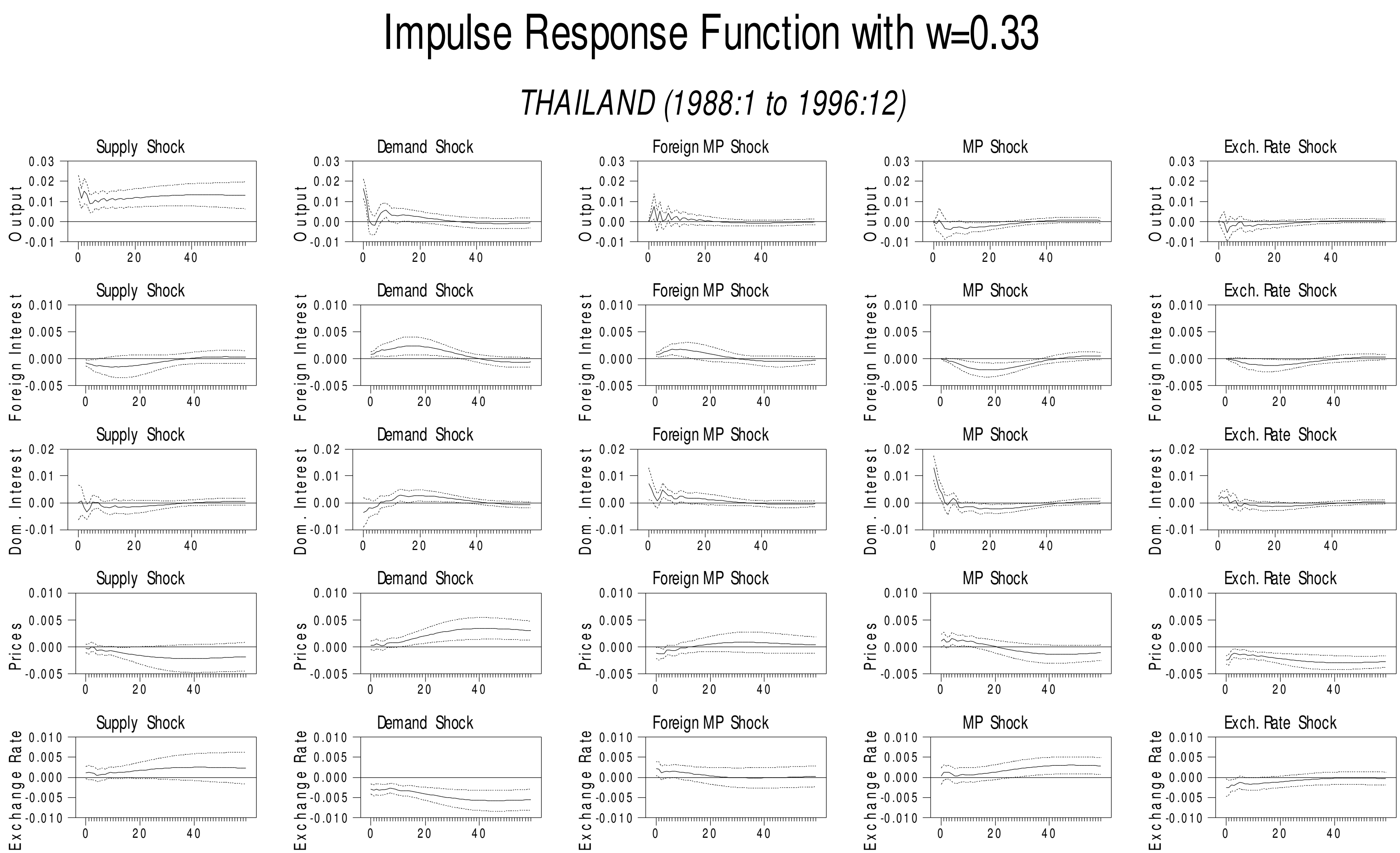

Figure 6: Impulse Response Functions for the Thai baht against the Japanese Yen during the Pre-crisis Period

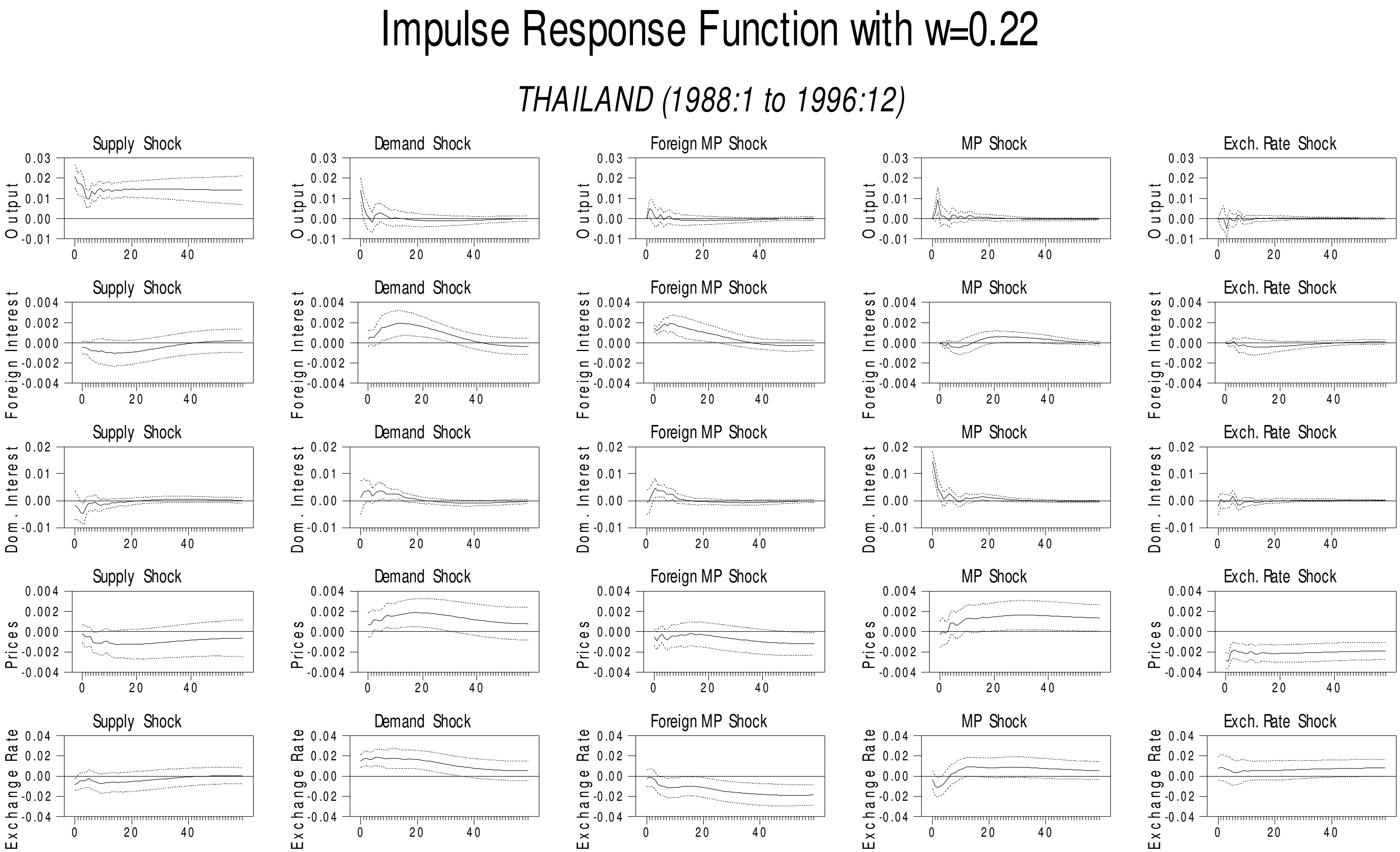

Figure 7: Impulse Response Functions for the Thai baht against the US dollar during the Post Crisis Period

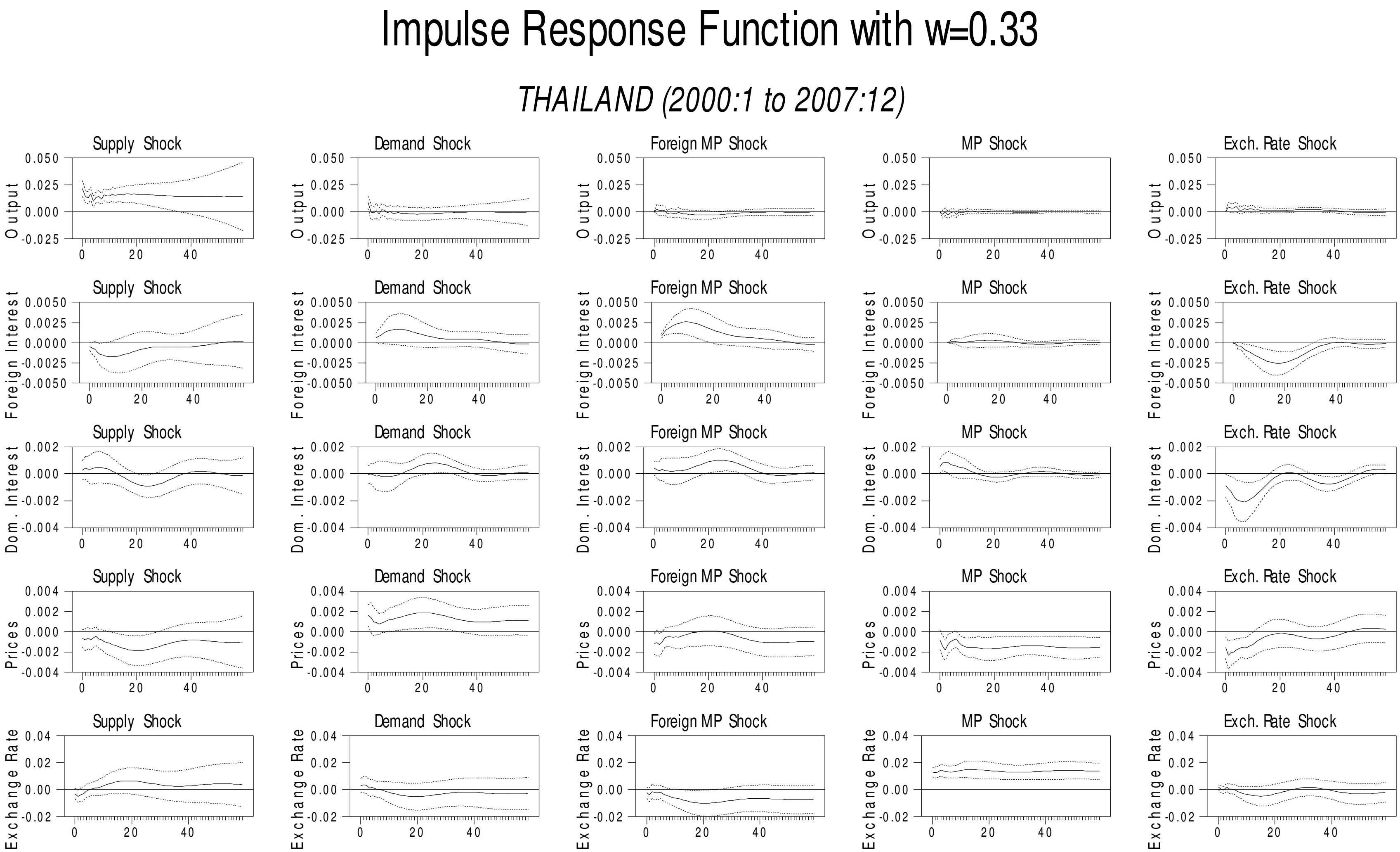

Figure 8: Impulse Response Function for the Thai baht against the Japanese Yen during the post-crisis period