THE CAPITAL INFLOWS PROBLEM IN SELECTED ASIAN ECONOMIES IN THE 1990s REVISITED

by

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General discussions on the topic with Alice Ouyang and Tom Willett have been helpful in organizing some of our thoughts in this paper. The usual disclaimer applies.

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Abstract

This paper develops a simple model to examine the extent to which monetary sterilization policies helped to prolong the capital inflow surges into selected Asian economies in the 1990s prior to the financial crisis. The model predicts that the level of capital mobility plays an important role in the effectiveness of sterilization and how it impacts the interest premium. Using the model as an organizing framework, the paper undertakes a simple empirical analysis of the dynamic links between international capital flows and uncovered interest rate differentials (UIDs) in the five crisis-hit economies (Indonesia, Korea, Malaysia, the Philippines and Thailand) over the period 1990:1 to 1997:5.

Key words: *capital flows, East Asia, interest rates, monetary sterilization, reserves*

JEL Classification: *F30, F32, F41*

1. Introduction

In a nutshell, the East Asian financial crisis was due in no small part to an initial surge in international capital flows in the early 1990s which halted abruptly and in fact reversed direction in 1997-98. While the causes and consequences of the "sudden stop" of capital flows have been discussed elsewhere (for instance, see Rajan and Siregar, 2002), less well understood are the factors motivating the pre-crisis capital inflow boom in the 1990s prior to the bust.

Referring to IMF data in Table 1, it is apparent that the bulk of capital inflows into the region in the years just preceding the crisis was under the category of "other investments", comprising a range of short and long-term credits (including the use of IMF credit) and currency transactions. This category constituted about 75 percent of the private capital inflows on average in the case of Thailand, and it was also the single largest component of capital flows in the cases of Indonesia and the Philippines. Recognizing the interest sensitive nature of these bank flows, attention can be narrowed to the issue of interest rate differentials between those offered in East Asia precrisis and comparable international (US) ones.

Figure 1 highlights the uncovered interest rate differentials (UIDs) for Korea, Thailand, Malaysia, Indonesia and the Philippines, measured as the domestic money market rate minus the US Treasury Bond rate and the *ex post* change in the (log) exchange rate.[1] This was a period in which these countries underwent a significant degree of financial liberalization. Eye-balling the data, Figure 1 indicates a general non-divergence in the cases of Thailand and Indonesia, while the Philippines and Korea

[1] Expected exchange rate change is given by the actual three-month change. It might be argued that money market rates (90-day) tend to exhibit noise that do not necessarily reflect fundamental deviations from the US T-Bill rates (which are typically smoother). In addition, as noted, capital flows into the region were largely processed by the banking system. As such, it would appear appropriate on that basis to use deposit rates, as these rates are determined within that system and not by interbank trading. On the other hand, these rates tend to be under a degree of government control -- despite the financial system deregulation efforts of most of these economies during the late 1980s.

reveal a very gradual convergence, Malaysia's UID can be broadly split into two sub-samples; there is a higher UID for the first half and a much lower one in the second.

Table 3 presents unit root tests (ADF) of the UIDs of respective money market rates vis-à-vis the US T-Bill for the East Asian countries in question. A rejection of a unit root would suggest that the differential that is present at the start of the sample persisted. In other words, stationarity can be broadly interpreted as implying non-convergence. From Table 2, it can be seen that a unit root can be rejected for all cases (weakly in Korea) except Malaysia where there is some evidence of a downward trend and additional non-stationarity. This is in line with the tentative conclusion drawn from eyeballing the data. It is also logically consistent with the fact that, unlike Thailand and the other countries, inflows to Malaysia predominantly took the form of relatively more durable and interest-insensitive direct investment (70 percent of total capital flows on average).

Motivated by this, Section 2 develops a simple analytical model to highlight the links between international capital flows and uncovered differentials (UIDs). The model is based predominantly on the one used by Edwards and Khan (1985) and subsequently modified by Haque and Montiel (1991), Dooley and Mathieson (1994) and Willett et al. (2002).[2] To preview the main implication of the model, we find that (a) the presence of high capital mobility; (b) significant sluggishness of interest rates to changes in domestic monetary conditions; or (c) complete sterilization of capital inflows, neutralizes the effects of the capital inflows on the UIDs.

Using the model as an organizing framework, Section 3 undertakes a simple empirical analysis of the dynamic links between international capital flows and UIDs in the five crisis hit economies under investigation over the period 1990:1 to 1997:5. The empirics confirm that international capital inflows have not always generated declines in the UIDs, which in turn explains some of the persistence in capital inflows pre-crisis. But

[2] The foregoing papers originally employed the model to investigate the level of capital mobility in developing countries.

is complete or near complete sterilization of capital flows by these countries the reason? This issue is explored empirically in Section 4. Section 5 offers some concluding remarks with a particular focus on the role of banks in intermediating capital flows.

2. Interest Rate Determination in a Small and Semi-Open Economy

The starting point of our analysis is the workhorse model by Edwards and Khan (1985) to assess how the interest differential is determined in a small, semi-open economy for alternative degrees of openness of the capital account.

2.1 Basic Framework of Model

We begin with the following basic equation:

$$i_t = \psi i^*_t + (1-\psi)\tau_t, \qquad 0 \leq \psi \leq 1 \qquad (1)$$

Eq. 1 states that the domestic interest rate is a weighted average of the international rate (i^*_t) and autarky rate (τ_t). ψ is a parameter representing the degree of capital mobility. As capital mobility decreases, the more the economy's interest rate is determined by domestic monetary conditions. As capital mobility increases, the domestic interest rate is determined increasingly by i^*_t.. This in turn is based on the uncovered interest parity (UIP) condition and is expressed in the usual manner:

$$i_t^* = i_t^f + (e^e_{t+1} - e_t) \qquad (2)$$

where i^f_t is a foreign interest rate with which to base UIP; e_t is the log of the current exchange rate expressed as the domestic price of foreign currency; and e^e_{t+1} is the expectation at t of the (log) exchange rate at $t+1$.

In the context of the model, τ_t is a "shadow" interest rate. It captures conditions of disequilibrium arising from excess demand or supply of money. This shadow rate can be calculated in the following way (Edwards and Khan, 1985):

$$\tau_t = \rho + \pi^e{}_{t+1} + \gamma(m^d{}_t - m_t) \qquad (3)$$

Eq. 3 derives the domestically determined or autarkic nominal interest rate as comprising ρ, which is the long run equilibrium or neutral real interest rate, the expected inflation rate (π^e_{t+1}), and a wedge term capturing monetary disequilibrium. Thus, any excess (shortfall) of money demand relative to its supply will result in an increase (decrease) in the domestically determined interest rate. γ captures the degree of sluggish adjustment of interest rates to domestic monetary conditions which we discuss further in Section 3.2.

We are left with having to formalize the demand and supply for money in this economy. The demand for money is modeled in the standard way with the addition of a stock adjustment term. Specifically, money demand is assumed to depend on the equilibrium interest rate, expected inflation and income. It can be expressed in log form:

$$m^d{}_t - p_t = -\alpha_1(\rho + \pi^e_{t+1}) + \alpha_2 y_t + \alpha_3 m_{t-1} \qquad (4)$$

Eq. 5 below is a simple identity stating that the change in the base money (m) is due either to a change in domestic assets (d) or a change in foreign assets (f), or both.

$$\Delta M_t = \Delta D_t + \Delta F \qquad (5)$$

In applying the model, previous authors assume money supply is completely exogenously determined. Few allowed for the possibility of sterilized intervention by the monetary authority and its effect on domestic money supply (Willett et al, 2002 is an

exception). Sterilization of international capital flows by the monetary authority can be simply stated as follows. First express Eq. 5 as:

$$\Delta m_t = \Delta d_t + \Delta f_t \qquad (6)$$

where $\Delta m_t = \Delta M_t/M_{t-1}$, $\Delta d_t = \Delta D_t/M_{t-1}$ and $\Delta f_t = \Delta F_t/M_{t-1}$. For complete sterilization, $\Delta m_t = 0$ and, as such:

$$\Delta d_t = \lambda \Delta f_t \qquad (7)$$

where: λ is the degree of sterilization. If there is complete sterilization, λ = -1. As such, using Eq. 7, Eq. 6 becomes:

$$\Delta m_t = (1+\lambda)\Delta f_t \qquad (8)$$

With the incorporation of sterilization, the supply of money (monetary base) is the familiar identity in logs given by Eq. 9.[3]

$$m_t = (1+\lambda)\Delta f_t + m_{t-1} \qquad (9)$$

The domestic interest rate (i_t) can now be calculated by substituting Eqs. 4 and 9 into Eq. 3 to find τ_t and this and Eq. 2 can be substituted into Eq. 1 to derive:[4]

$$i_t - i^*_t = (1-\psi)[\,(1-\gamma\alpha_1)\rho - i^*_t - \gamma(1+\lambda)\,\Delta f_t - (\gamma-\gamma\alpha_3)\,m_{t-1} + (1-\gamma\alpha_1)\pi^e_{t+1} - \gamma p_t + (\gamma\alpha_2)y_t\,] \qquad (10)$$

[3] We ignore the money multiplier, implicitly assuming it is a constant and normalized to one. See Kwack (2003) for a discussion of sterilization in the context of a varying multiplier.

[4] This paper examines similar relationships to the work of Takagi and Esaka (1999). This paper differs in that the model provides additional theoretical underpinnings of the relationship between sterilization and interest rates and the UID.

2.2 Implications of Model

What does the simple model imply about the behaviour of sterilization? The parameters of interest are those in front of the reserve inflow **(Δf_t): $[(1 - \psi)\ \gamma\ (1 + \lambda)]$.** The degree to which the sterilization of capital inflows is successful in maintaining an upward pressure on uncovered interest differential (UID) is driven by three factors: (a) the extent of sterilization undertaken by the central bank (λ); (b) the degree of capital mobility (ψ); and (c) the adjustment parameter that determines the speed with which domestic interest rates adjust to domestic monetary disequilibrium (γ).

The first factor influencing the effect of Δf on the (UID) is the extent of sterilization. Recall that $\lambda = -1$ implies complete sterilization of capital inflows. If this is the case, capital flows have no impact on the interest rate, as full sterilization offsets any monetary impact of a reserve flow. Alternatively, if the central bank does not engage in sterilization ($\lambda = 0$), capital inflows and the consequent reserve build-up inevitably puts downward pressure on domestic interest rates.

The second factor affecting the nexus between Δf_t and $(i_t - i^*_t)$ is the degree of *de facto* capital mobility (ψ). For a given λ, if the level of capital mobility increases, the effect of a capital inflow on the UID diminishes. For levels of capital mobility that are extremely high ($\psi \rightarrow 1$), the effect of capital inflows on the interest rate tends to zero regardless of the extent of sterilization activity (i.e. perfectly elastic supply of funds). This is consistent with the so-called "impossible trilogy" which states that with perfect capital mobility and a fixed exchange rate, a country loses monetary policy autonomy (Frankel, 1999 and Rajan, 2002). Note that for the impossible trilogy to hold strictly -- and therefore for sterilization to be ineffective -- financial assets across countries might be perfectly substitutable. In the context of this (monetary style) model that has no portfolio balance type features, the capital mobility parameter may also capture characteristics more typically associated with imperfect asset substitution (such as a risk premium term).

Hence, the capital mobility parameter should be viewed as having a more general interpretation.[5]

The third factor is the adjustment parameter (γ) which denotes the extent to which monetary disequilibrium affects the domestic interest rate. As noted, a higher γ indicates that interest rates are more sensitive to domestic monetary conditions. To be sure, if there are no institutional or other hindrances, and the domestic money market functions effectively then $\gamma \rightarrow 1$.[6] As above, its interaction with the other parameters is important. If capital mobility is near perfect, the value of γ is irrelevant because domestic factors have no influence on i_t. Similarly, if $\lambda = -1$, capital inflows have no monetary effects (given our assumption that there are no other independent effects of domestic credit changes); consequently they ought not to have any impact on domestic interest rates or UIDs.

3. Empirics

The empirical assessment in this paper centers on the examination of the effects of international capital flows on the domestic interest rate and whether this might be responsible for the non-convergence of the UIDs in the crisis-hit economies in Asia. Ideally one would like to directly estimate Eq. 10. However, the endogeneity of a number of variables (such as capital flows, income, etc) makes this a rather overly-ambitious proposition. Instead, a more parsimonious way forward would be to ascertain the dynamic links between UIDs and capital flows.

In keeping with the literature on sterilization, and to remove the possibility of simultaneity of reserve flows and the UID, Eq. 10 is augmented by an expression for Δf. The model takes the form of a two-equation VAR as follows:

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[5] Hutchison (2002) notes that capital mobility (more strictly interpreted) is a stronger factor in determining the effectiveness of sterilization than imperfect asset substitution. For imperfect asset substitution to have any meaningful effect the relative asset quantities being moved must be enormous.

[6] One possible institutional barrier causing the sluggishness in developing countries could be the role played by banks. We touch on this theme in Section 5.

$$\begin{bmatrix} 0 & a_{12} \\ a_{21} & 0 \end{bmatrix} \begin{bmatrix} UID_t \\ \Delta f_t \end{bmatrix} = \begin{bmatrix} b_{01} \\ b_{02} \end{bmatrix} + \begin{bmatrix} B_{11}(L) & B_{12}(L) \\ B_{21}(L) & B_{22}(L) \end{bmatrix} \begin{bmatrix} UID_{t-1} \\ \Delta f_{t-1} \end{bmatrix} + \begin{bmatrix} c_1 \\ c_2 \end{bmatrix} X_t + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \tag{11a}$$

or: $A_1 Y_t = B_0 + B_1(L) Y_{t-1} + CX_t + \xi_t$ (11b)

where: X_t is a vector of exogenous variable that relate to both the UID and Δf expressions and c_1 and c_2 are vectors of parameters (Kouri and Porter, 1974, Frankel and Okwongu, 1996, Bond, 1999 and Mark, 2001). For the UID equation, the variables include the exogenous variables from Eq. (10). For the reserve equation, the variables include the change in net domestic assets, and the trade balance as a proxy for the current account balance.

3.1 Data and Estimation

The data are primarily from the International Monetary Fund's (IMF's) International Financial Statistics (IFS) CD database and supplemented by the Asian Development Bank's, Asia Recovery Information Centre (ARIC) databases. Monthly observations are used from 1990:1 to 1997:5 as the sample period.[7] The selection of 1990:1 as the starting point is dictated mainly by the fact that many of the countries in this sample made substantial efforts to deregulate their financial systems during the 1980s. The sample excludes any effects of the financial crisis which began in Thailand in 1997:6. Data on exchange rates, net foreign assets and money bases are taken from lines *RF, (11-16c)* and *14*, respectively of the IFS. Interest rates, prices and output are taken from *60b*, *64* and *66*, respectively of the IFS. First differences are used for net domestic assets and net

[7] For the calaulation of the sterilization coefficients in Section 4, the sample ends at 1997:3 so as to avoid the rapid depletion of reserves at the onset of the East Asian crisis.

foreign assets for the sterilization equation (Eq. 11a). Δf is measured as [ΔFA/MB(-1)]*100 as defined above. Expected inflation is measured as [log(CPI(12))-log(CPI)]*100, m_{t-1} is log(MB(-1)), and output and CPI are both measured in logs.

3.2 Granger Causality

As a start, simple Granger causality tests are conducted to ascertain the lagged effects of capital inflow changes (through foreign reserves, Δf) on *UID*.[8] Three lag structures are considered, viz. 3, 6 and 12 months. Only the null hypothesis of Δf Granger causes the UIDs is considered. The results of the Granger causality tests (Table 3) reveal that, with the exception of Korea, there is some evidence to suggest the possibility of reserve changes causing UIDs. For Indonesia and the Philippines, the effect seems to be present over longer lag lengths (12 and 6 months for Indonesia and 12 months for the Philippines). The effect for Thailand is at its strongest for shorter lag lengths (3 and 6 months). The relationship appears to be significant across all reported lag lengths for Malaysia.

3.3 VARs and Impulse Responses

This section assesses the effects of capital inflow changes (Δf_t) on the UIDs by deriving impulse response functions. In order to identify the model and to provide an ordering for the impulse responses, a Cholesky decomposition is employed.[9]

In keeping with the results for the causality tests, three lag structures (12, 6 and 3 months) are examined. Figure 3 contains impulse response functions for the model for

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[8] The Granger Tests are based on a reduced form of eq. (11b) and is given by: $A_1Y_t = A_1^{-1}B_0 + A_1^{-1}B1(L)Y_{t-1} + A_1^{-1}CX_t + A_1^{-1}\xi_t$

[9] A potential problem arises as theory would dictate that both the contemporaneous coefficients, a_{12} and a_{21}, be present in the estimating the model. The problem is addressed by presenting the results for both Choleski orderings. The ordering employed here is (UID, Δf), which is equivalent to restricting $a_{12} = 0$. The results are quite robust to the alternative ordering. This is suggestive of two things. One, the contemporaneous coefficients are not statistically significant. Two, the residuals to the reduced form model are not likely to be highly correlated (Enders, 1995).

Ordering 1 and 2, respectively. As with the Granger causality results, only the effect of capital inflow changes (Δf_t) on the UIDs are examined. In other words, of relevance are the dotted lines in Figure 3 as they indicate the effect of a shock to Δf on subsequent values of the UIDs. The forecast horizon provided is 24 months. The impulse responses tend to confirm and fortify the results of the causality tests by providing the direction of the effect of Δf on the UIDs.

Consider Thailand in the first instance. The causality tests indicate a stronger relationship for shorter lag lengths. The responses show an initial reduction in the UIDs in the event of a Δf shock, but the effect converges quite quickly. Recall the Granger causality results for Indonesia where it is suggested that the effects of Δf on the UIDs are stronger at longer lag lengths. This appears to be reinforced both by its presence in the impulse responses for the models with longer lags and its absence in those for models with shorter lags. The longer-lag models reveal little effect of Δf on the UIDs for about 6 months but with a negative effect taking place thereafter. The Granger causality results for Malaysia are strong for all reported lag lengths, but the impulse responses reveal an ambiguous relationship, as they do for the impulse responses in the case of the Philippines. The impulse responses for Korea show a general tendency for the UIDs to decrease in the event a Δf shock. Nonetheless, given the lack of statistical significance of the Granger causality results, these impulse responses should be interpreted with some caution.

4. Monetary Sterilization in the Crisis-Hit Economies

Overall, the preceding analysis suggests that, except for Indonesia, it is not apparent that persistent international capital inflows have led to declines in the UIDs. As suggested by Eq. 10, the lack of impact of capital flows on the UIDs may possibly be indicative of complete sterilization, low capital mobility, or low / lagged responsiveness of interest rates to domestic monetary disequilibrium. Given the difficulties in measuring the

latter two directly, this section attempts to ascertain the importance of sterilization in the crisis-hit economies. If we find that sterilization is close to being complete, this may help rationalize the ambiguity in the dynamic relationship between capital flows and UIDs, and the consequent persistence of both them.

In practice, central banks in Indonesia, Korea, Malaysia, the Philippines, and Thailand all sterilized inflows in different ways. For instance, the Bank Indonesia (BI) employed Open Market Operations (OMOs) by issuing its own CDs called SBIs. The Indonesian government also managed its budgetary operations in a way that built up large deposits with the Bank Indonesia (McLeod, 1998). Bank of Thailand (BOT) conducted OMOs to sterilize its inflows (Warr, 1998). OMOs were not used extensively by the Bank of Korea (BOK) which instead made use of quantitative controls and discounting policies to dampen domestic credit (Kwack, 2003). Bank Negara Malaysia (BNM) historically deployed government and other deposits with the central bank to impact monetary liquidity (Reisen, 1993).

Figure 3 presents the (quarterly) changes in net foreign assets (NFA) and domestic (NDA) for Korea, Thailand, Malaysia, Indonesia and Philippines for 1990-97. It reveals the extent to which foreign assets are offset by domestic credit. This is especially pronounced for Thailand, Malaysia and Indonesia where there appears to be quite a sustained accumulation of reserves throughout the sample period. All countries presented show the same pattern of an increase in NDA in one period and an almost corresponding reduction in domestic credit in the next. This is strongly suggestive of the central bank's desire to undertake sterilization to offset the domestic monetary impact of their foreign exchange operations.

More formally, the extent of sterilization (λ) can be ascertained from the following equation:

$$\Delta d_t = \theta + \lambda \Delta f_t + \varepsilon_t \qquad (12a)$$

For full sterilization, λ would be expected to be equal to -1. However, Eq. 11 only reveals information about contemporaneous sterilization. It does not allow for the possibility that the monetary authority may adjust reserve changes more gradually (Glick and Hutchison, 2000). As such, a lagged term for foreign reserves is included into the regression equation. A positive sign might be taken to mean that the central bank is correcting a perceived over-sterilization; a negative sign may imply that the central bank is attempting to gradually sterilize a reserve inflow rather over two periods. As such, we estimate: [10]

$$\Delta d_t = \lambda_0 + \lambda_1 \Delta f_t + \lambda_2 \Delta f_{t-1} + \varepsilon_t \qquad (12b)$$

The OLS results from estimating Eq. 12b are summarized in Table 4. It is clear that there is a moderate-to-high degree of sterilization among the countries considered, and that the λ_1 parameter is generally statistically significant. Indonesia's sterilization coefficient is around -0.78 over the sample period, while the coefficient for the Philippines was -0.92. The sterilization coefficient for Korea is less than -1. This indicates that there may have been "over-sterilized" throughout the sample period. Taken by itself, this might reveal a desire to use sterilization as a contractionary -- rather than a neutralizing -- device in the context of capital inflows. Incorporation of a lagged term for foreign reserves reveals evidence of a possible correction to the over-sterilization in the second period. The sterilization coefficient for Thailand is also fairly high at -0.91. Interestingly, for both Indonesia and Thailand, the lagged effect (λ_2) is also economically and statistically significant (-0.56 and -0.39, respectively), suggesting a possible scenario of sterilization "smoothing".

[10] Estimation of Eq. 12a and 12b is consistent most studies attempting to empirically investigate sterilization. For instance, Glick and Hutchison (1994) and Kwack (1994) have estimated various versions of Eq. (12) for Japan and Korea respectively. Also see Fane (2000) for a list of sterilization coefficients for a selection of emerging market economies. In addition, see Kwack (2003).

The sterilization coefficients reported above are constant over the sample period averages. It may be interesting to examine how sterilization might change over time throughout the sample. Figure 4 presents the value of λ_1 for some rolling regressions *a la* Sasaki et al. (1999) and De Koning and Straetmans (1997). The sample was split into a 48-month sub-sample, and an OLS regression for ΔDA was performed for a 48-month sub-sample every 3 months. In other words, the first sub-sample is 1990:1 to 1993.12, the second, 1990:4 to 1994:3, and so on. Figure 4 shows that, for the most part, reserve inflow sterilization was fairly constant for Thailand, Philippines and Malaysia. Indonesia's sterilization policy seemed to ease from about 1993 when the coefficient shifted from around -0.8 to about -0.6. The rolling coefficients for Korea are quite variable; there were times of significant under and over sterilization. This might suggest that it was an active and possibly discretionary policy in Korea, whereas it might have been a more automatic or rules-based activity for the others.

5. Concluding Remarks

The first set of empirical results in this paper suggests that the large-scale capital inflows into Korea, Malaysia and the Philippines before the crisis had no discernible impact on domestic interest rates, thus leading to persistent uncovered interest differentials, which in turn motivated further capital inflows. The simple analytical model presented in this paper finds that the reason for this may be complete sterilization, perfect capital mobility, high sluggish response of interest rates to domestic monetary disequilibrium, or some combination of all three. The second set of empirical results in this paper reveals that sterilization was incomplete / partial in Indonesia, this being consistent with the finding that the foreign capital flows did have gradual downward pressure on the countries UIDs. Initial regression results indicated that there may have been complete or almost complete sterilization on average in the other Asian economies (Korea, Malaysia, Thailand and the Philippines). Nonetheless, careful examination of

rolling regressions reveals that sterilization had eased up considerably for Thailand, Philippines and Malaysia since 1993. This in turn implies that one may need to look elsewhere for the reason behind the seeming lack of impact of capital flows on UIDs in some of these countries.

Accordingly, a full explanation of the interest rate premium puzzle probably lies elsewhere. But where? Imperfect capital mobility (including imperfect asset substitutability) is no doubt part of the reason. But there is also the other element of imperfect or rigid adjustment of interest rates to domestic monetary disequilibrium. Standard macroeconomic theory has, by and large, either completely ignored the role of banks in the intermediation process (Calvo, 1996), or implicitly assumed it to be efficient and frictionless (Bird and Rajan, 2002). Neither alternative is all that satisfactory, particularly with regard to emerging economies. In their -- now prescient -- review of capital flows and the domestic financial sectors East Asia, Folkerts-Landau and Associates (1995) drew the following conclusion:

> The ability of banks to accumulate foreign liabilities or domestic liabilities denominated in foreign currency was improved as part of the early deregulation process. Capital inflows were…encouraged by the relatively high interest rates that prevailed in the region. Although specific causes differed among countries, high interest rates were a direct result of such factors as monetary tightening, interest rate deregulation, the encouragement of competition among financial institutions, and the relatively high costs of intermediation (p.41).

Clearly there is a need to pay greater heed to domestic banking structures in emerging economies and the manner in which capital flows is intermediated via the banking system.

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Table 1
Capital Inflows as a percentage of GDP

	Indonesia	Malaysia	Philippines	Thailand
FDI flows	1.7	7.2	1.8	1.6
Portfolio flows	0.5	0.0	0.2	1.4
Other	3.0	2.9	2.1	8.5
Total	5.1	10.2	4.1	11.5
Δ Reserves*	-1.7	-5.1	-1.8	-4.3

Source: Rajan and Siregar (2002) and IMF
Note: Negative sign means increase in reserves

Table 2
Augmented Dickey-Fuller Tests

	ADF with Trend	ADF with no Trend
Korea	-3.26 *	-2.86 *
Thailand	-4.70 †	-4.73 †
Indonesia	-3.70 **	-3.73 †
Malaysia	-2.36	-2.25
Philippines	-6.77 †	-6.59 †

Note: *(**)(†), 10% (5%)(1%) significant levels, respectively

Table 3
Granger Causality Tests
Null Hypothesis: Reserve changes, Δf, does not Granger Cause UID.

Country	Lags	F-stat	Prob
Korea	12	1.12	0.37
	6	0.74	0.62
	3	0.69	0.56
Thailand	12	1.15	0.34
	6	2.22	0.05
	3	4.34	0.01
Indonesia	12	2.05	0.04
	6	0.72	0.63
	3	0.29	0.83
Malaysia	12	2.90	0.00
	6	5.17	0.00
	3	4.15	0.01
Philippines	12	1.55	0.14
	6	1.12	0.36
	3	0.06	0.98

Table 4
Extent of Monetary Sterilization

Dependent Variable: Change in Net Domestic Assets, *ΔNDA*

	Korea	Thailand	Indonesia	Malaysia	Philippines
Constant	9.62 (0.56)	1.05 (3.15)†	35.22 (3.21)†	65.82 (2.25)**	0.61 (2.55)**
Net Foreign Assets (t)	-1.11 (-3.80)†	-0.91 (-8.65)†	-0.77 (-7.19)†	-0.94 (-13.52)†	-0.98 (-11.06)†
Net Foreign Assets (t-1)	0.07 (0.28)	-0.56 (-4.95)†	-0.40 (-2.92)†	-0.06 (-0.43)	-0.33 (-2.52)**
Adj R^2	0.25	0.57	0.61	0.38	0.49
DW	2.21	1.98	2.02	1.98	2.00
Obs	86	85	85	86	86

Note: *(**)(†), 10% (5%)(1%) significant levels, respectively

Figure 1
Uncovered Interest Differentials

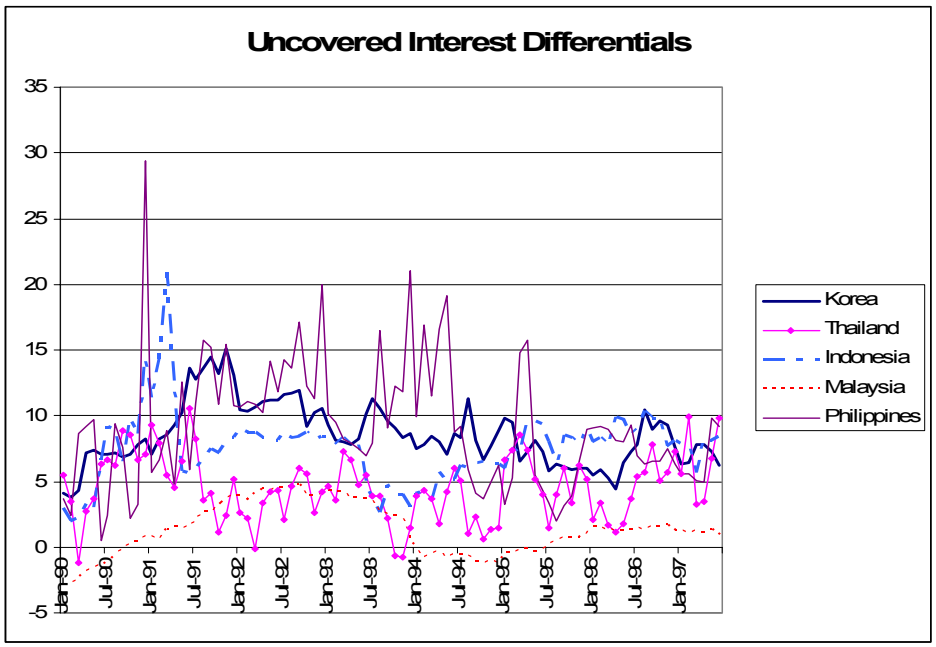
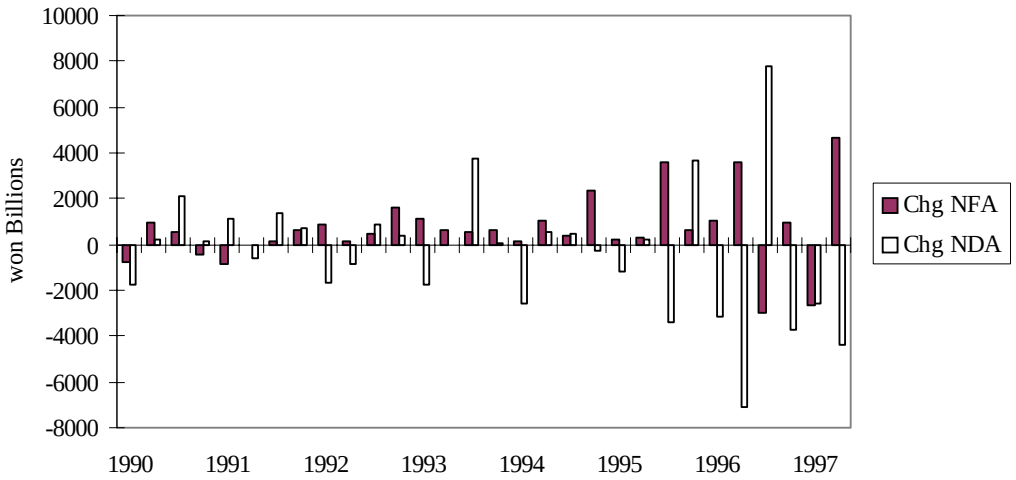
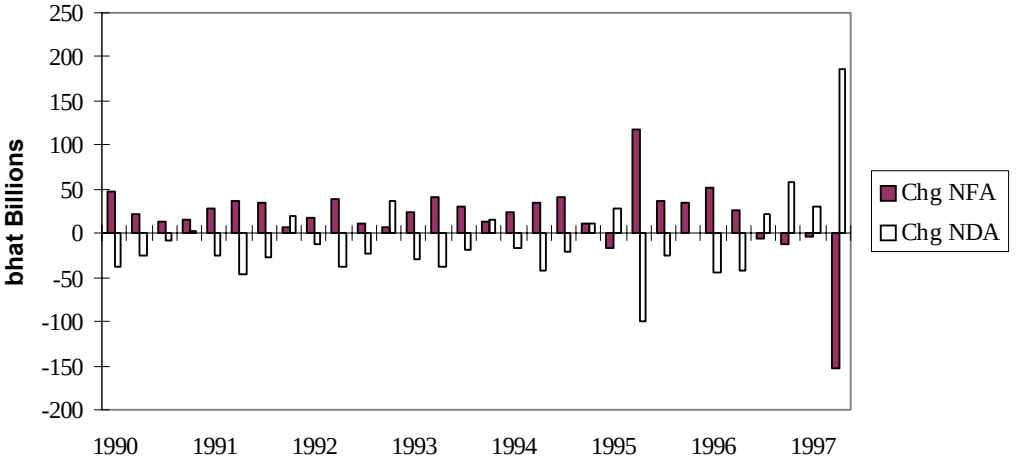


Figure 2
Reserve Sterilization

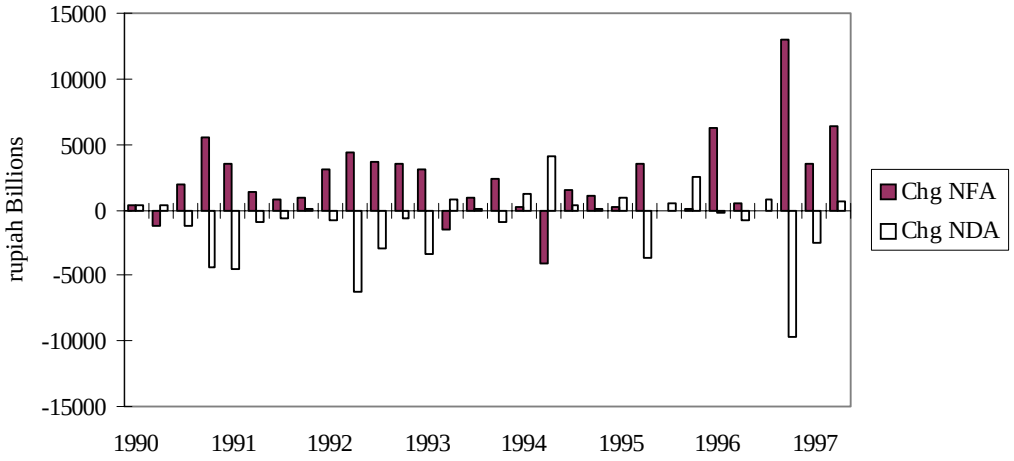
Korea



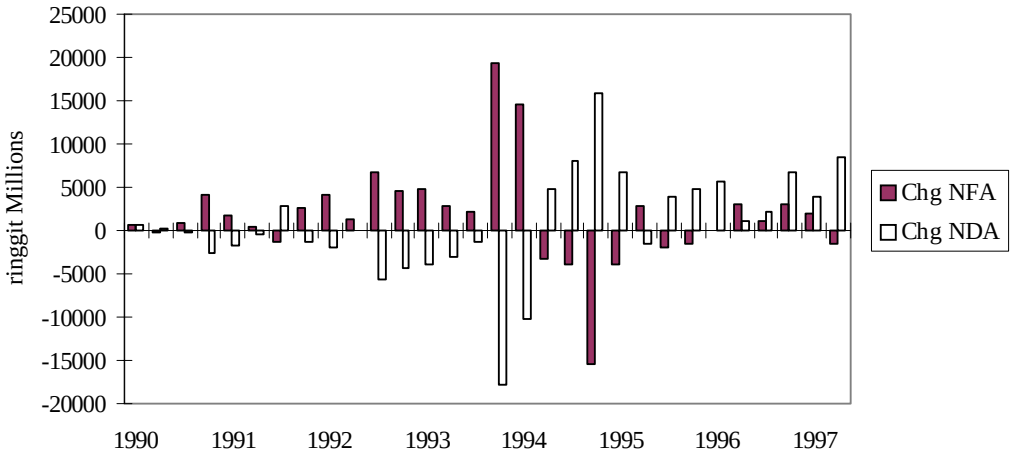
Thailand



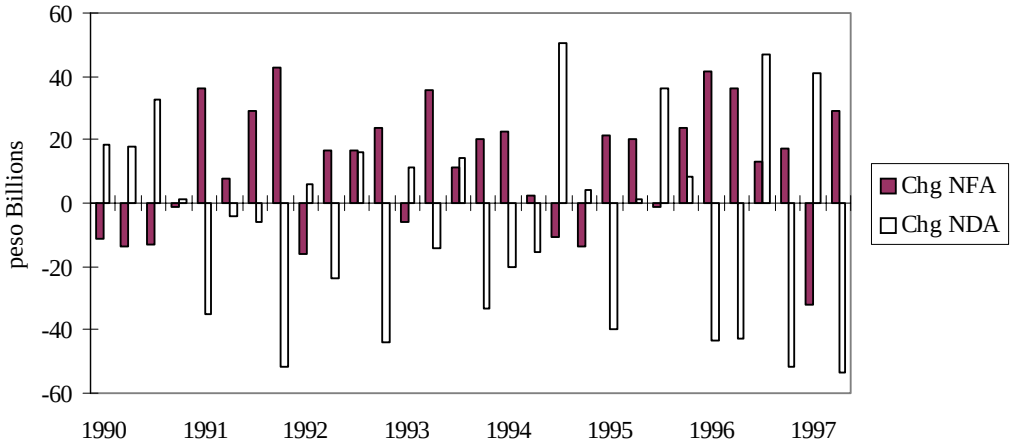
Indonesia



Malaysia



Philippines



Source; IFS

Figure 3
Impulse Responses

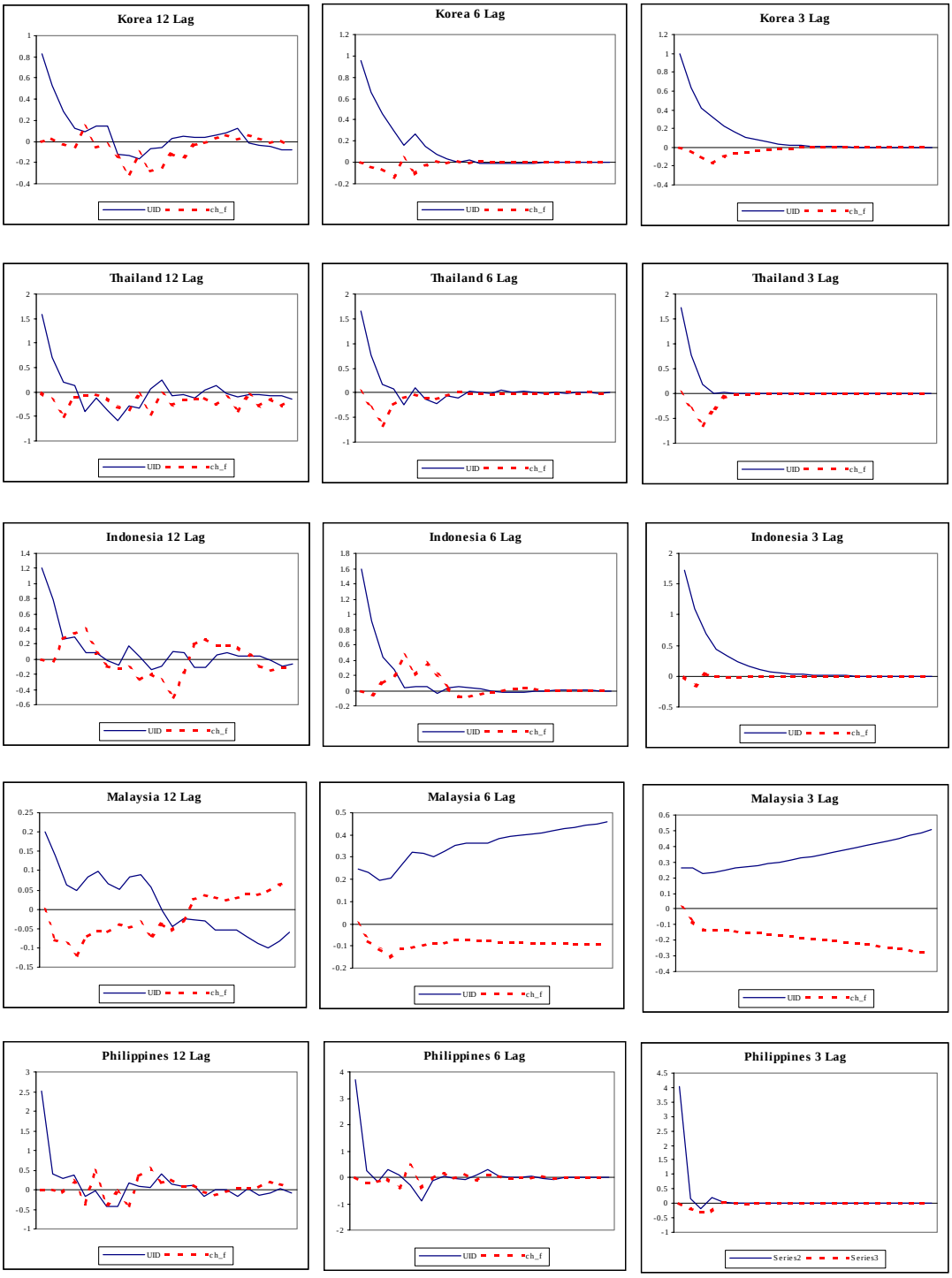
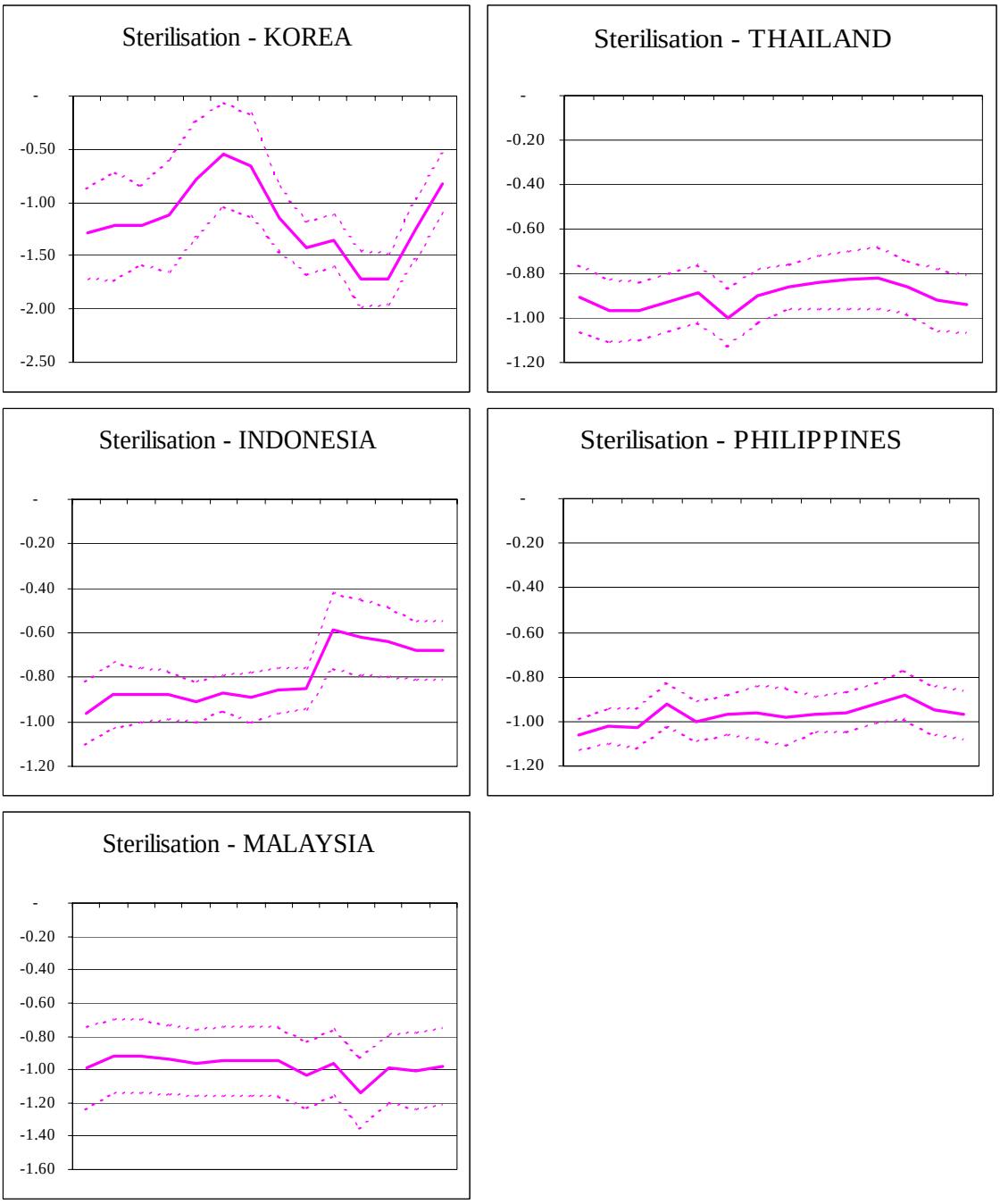



Figure 4
Rolling Regressions – Sterilization