Explaining the Real Exchange Rate during Sudden Stops and Tranquil Periods

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Abstract: This paper untangles the causes behind real exchange rate devaluation events with particular attention paid to the Sudden Stop of capital flows. By utilizing cumulative impulse response function and variance decomposition analysis, we argue that there is the asymmetric response across Sudden Stop and tranquil times. Further comparison across the Sudden Stop in the 80s ("debt crisis") and 90s ("Sudden Stop crisis"), however, reveals that the Sudden Stop disturbance has become more prominent in explaining the real exchange rate disturbance in Sudden Stop crisis of the 1990s rather than debt crisis of the 1980s.

Key word: Exchange rate depreciation, Capital flows, Sudden Stop, Asia, and Latin America
JEL classification: F31, F32, F41

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1 Introduction

The violent Sudden Stop of capital inflows during the Asian crisis and the macroeconomic turmoil following the event strongly suggest that these phenomena cannot simply be explained in terms of conventional factors. Sudden Stops are typically accompanied by large contractions in international reserves and declines in the relative price of non-tradables with respect to tradables, i.e., real currency depreciation. Figure 1 demonstrates this graphically. In the case of the Asian financial crisis, the contagious withdrawal of liquidity from the region was followed by real depreciations of more than 30% in the affected countries. However, events such as these—the sudden drying up of liquidity and real depreciation—are not new. It is well documented that many Latin American economies and some economies in other regions in the 1980s suffered from debt crises characterized by the loss of access to international capital markets and the depreciation of domestic currencies.

One way to understand the sharp devaluations associated with the sudden stop of capital inflows is by looking at risk premium movements. To support the previous argument, Caballero and Krishnamurthy (2001)[1] argue that to the extent that the reversals of capital flows require additional risk premium, the country becomes more credit-constrained. Under this circumstance, agents are forced to sell more domestic assets, leading to a lower demand and the fire sales of domestic assets, which consequently lead to a lower price of the domestic assets. This chain reaction causes the real exchange rate to depreciate.[2] We can therefore expect that the effects on the real exchange rate are different between the Sudden Stop period and the tranquil period; one would lead to a larger depreciation in the real exchange rate than the other in the short run.

In addition to the Sudden Stop factor, Corsetti et. al. (1998) argue that the key to understanding the sharp devaluations of these currencies is the conduct of monetary policies before the crisis and after the first round of depreciations in the case of the Asian financial crisis. The first reaction by monetary authorities to speculative pressures in the foreign exchange market was to prevent a significant monetary contraction and a significant increase in domestic interest rates. A relatively loose monetary policy with the goal of preventing further financial problems for firms and banks was of course a very risky strategy. As it turned out, it eventually induced a continuous spiral of currency depreciations as the countries fell into credit crunches.

[1] Caballero and Krishnamurthy (2001) argue that the currency would depreciate more in countries with external liabilities.

The Sudden Stops of the 1980s, on the other hand, are given slightly different explanations. The arguments tend to focus on the prolonged debt and domestic demand managements as well as external factors, i.e., deciles in commodity prices and world interest rate. Edwards (1989) argues that the adjustment package of 1982-1987 was impressive in some areas such as the turnarounds of the current account. He says, however, that the costs arising from the demand management were also high. Not only did real income decline but real wages also declined in most of the affected countries. Unemployment also soared, which subsequently contributed to further real devaluations of currencies. Oil prices and the world money market rate were also the variables of interest in many countries particularly from the late 1970s to the early 1980s. In Brazil, the increase in the oil bill in 1978-1979 was automatically financed through the budget and current account by borrowing in the world capital market. The increase in world interest rates in 1979-1981 added to the interest bill. These two factors contributed to an increase in the external debt burden of many countries, which eventually led to debt defaults.[3]

Keeping this background in mind, this paper attempts to assess the importance of the exogenous nature of capital flow movements, namely "Sudden Stop" shocks. In other words, this paper asks if the unexpected movements of the capital flows—such as the one triggered by contagious withdrawal of cross-boarder bank lending—significantly explain the movements of the real exchange rates. Based on the existing discussions on the factors affecting the real exchange rates, we interpret the fluctuations in the real exchange rate as due to six types of shocks. They are the external and internal disturbances that arise from (1) world interest rate, (2) terms of trade, (3) monetary, (4) productivity, (5) demand, and (6) current account.[4] We define the "Sudden Stop shock" as a shock arising from the current account, which is not associated with the interest rate differential but is associated with market sentiments. We pay particular attention to the dynamic response of the real exchange rate at the time of Sudden Stop shocks to examine whether the responses are different between Sudden Stop times and inflow times as Calvo (1998) and others suggest.

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[2] See Edison, Luangaram, and Miller (1998), and Calvo and Reinhart (2000).

[3] Some countries suffered from deterioration of terms of trade. Being a net exporter of commodities, Brazil was hurt by a decline in real commodity prices, for example.

[4] Notice that we do not account for a factor such as international productivity difference, namely Balassa-Samuelson effect, due to limited availability of sectoral data at quarterly frequency. Menzie (1997), however, discusses that the effect is rather of long-run nature even if significant, and other factors such as those we examine can move the exchange rate in the short run. Since our primary purpose is to explain the short-run deviations possibly by the sudden stop type of disturbance, this missing factor should not affect our interpretation of findings significantly.

Our sample includes eight emerging markets from Latin America and Asia: Argentina, Brazil, Chile, Mexico, Indonesia, Korea, the Philippines, and Thailand.[5] Data analysis reveals that the eight countries suffered from a large real depreciation both in the 1980s and 1990s. By utilizing impulse response function and variance decomposition analysis, our results suggest the following. For the comparison across Sudden Stop and tranquil times, the cumulative impulse response functions reveal that the most significant impact comes from Sudden Stop shocks during the Sudden Stop period—it accounts for nearly 40% of the real exchange rate variance while it is only around 5% during tranquil times. Another important factor is the demand shock, which accounts for about 40% of the real exchange rate variance during the Sudden Stop time while it doubles to around 80% during the tranquil period. This suggests the importance of demand policy affecting real exchange rates.

The comparison across two major crises — "Debt crisis (1980s)" and "Sudden Stop crisis during Tequila and Asian flu (1990s)" — allows us to examine different factors affecting the real exchange rate during the two crises. We find by looking at the variance decomposition that the Sudden Stop shock accounts for about 18% of the real exchange rate variance during the debt crisis while it becomes significantly larger with 48% (maximum) during the Sudden Stop crisis. The comparison across the two crises reveals that the terms of trade and the demand shocks explain more in the 1980s than in the 1990s. Meanwhile, the demand shock accounts for more than 60% of the real exchange rate variance during the "debt crisis" time though it only explains around 30% of the variance during the Sudden Stop period.

Section 2 provides a brief literature review and empirical prediction. Section 3 describes our data set and empirical methodology. Section 4 reports the results of the VAR estimation. Section 5 concludes.

2 A Review of Sudden Stop Literature

"Large" and "unexpected" are the two defining characteristics of what the literature calls Sudden Stop (Calvo, 2000). The existent literature deals in great detail with the causes of the capital market crisis in general. However, a more time-series approach evaluating particularly the response of real exchange rates to the Sudden Stops has been very limited. This paper aims to shed some light in this direction by factoring other aspects that are generally

[5] For Latin America, Colombia, Peru and Venezuela are not used due to their short sample periods. In Asia, the capital flow series is not available for Malaysia in IFS.

perceived to be important to the real exchange rate movement. Our goal is to assess the importance of the exogenous nature of capital flow movements, namely the "Sudden Stop" shock.

In theoretical literature, "Sudden Stop shock" is explained in the context of imperfect capital markets.[6] Caballero and Krishnamurthy (2001), for example, argue that to the extent that the reversals of capital flows require additional guarantee per unit of credit raised, the country becomes more credit-constrained and runs out of dollar-denominated assets. Under this scenario, agents are forced to sell domestic assets, leading to a lower demand and the fire sales of domestic assets, which in turn lead to a lower price of the domestic assets. This reaction causes the real exchange rate to depreciate, and possibly depreciate more in countries with external liabilities. This temporary reaction of the real exchange rate could lead to financial collapse as suggested by Edison, Luangaram, and Miller (1998).[7]

The theoretical literature focuses on characteristics of the imperfect capital markets, such as higher risk premium and/or higher collateral requirements at the onset of the Sudden Stop of capital inflows. Details differ, but most of the papers seem to agree on the mechanism of the real exchange rate depreciation following Sudden Stop. Despite the abundant theoretical literature, empirical literature evaluating the importance of sudden stop shocks or risk premium arising from the shock has been only partially explored.

Calvo and Reinhart (2000) conduct a cross-country analysis of Sudden Stops. In examining the reversals per se, they find that the impact effects of the reversals in the 1990s are much larger than those corresponding to average crises data for the period 1970-1994. By documenting 15 recent episodes of large reversals in net private capital inflows, 12 of which took place in the 1990s,[8] they show that Sudden Stop crises produce larger adjustments in real exchange rates than those produced by previous BOP crises.[9]

Furthermore, Calvo, Izquierdo, and Talvi (2002) argue that the nature of sudden stops has typically been large and far from temporary by examining the events around the Russian crisis[10] for five Latin American countries. The study points out that the key to understand the impacts is the unexpected component of the sudden stop and its duration. Since the expectations prevailing before the Russian crisis had not factored in the widespread effects on

[6] .See Calvo (1998), Caballero and Krishnamurthy (2001), Mendoza (2001), among others.
[7] See Calvo and Reinhart (2000).
[8] The remaining three episodes are in Argentina, Chile, and Mexico during the period of debt crisis in early 1980s.
[9] Hutchison and Noy (2002) conduct an analysis of Sudden Stops but only look at their impacts on output and not on real exchange rate.

the emerging countries, so the unexpected element needed to be met, resulting in large real devaluation. Despite the descriptive nature of the analysis, these two studies make us believe that the sudden stop shock might have more significance in explaining the real exchange rate movements in the 1990s, and also motivates us to investigate the events in detail.

Without paying particular attention to the sudden stop events, Agénor and Hoffmaister (1998) conduct an empirical investigation on the short-run relationship between the real exchange rate and capital flows using near-VAR[11] methodology for four emerging markets. Although no attention was given to sudden stop shocks in the study, the result would be a relevant one since the sudden stop shocks are perceived to have only temporary impacts. This study extracts temporary component of the real exchange rate,[12] and decomposes it into five variables: temporary components of real exchange rates, capital inflows / GDP, money-base velocity, government expenditure / GDP, and interest rate differential. They find only weak association between temporary components of the shocks to capital flows and real exchange rate movements.[13] This study, however, does not assume asymmetric responses across positive and negative shocks, and thus the resulting relationship is an average one over time and countries. It therefore demands further investigation across the different types of shocks, specifically the response to the effects of Sudden Stop or large negative flows—our attempt in this study.

Our empirical approach is similar to that of Lee and Chinn (1998), which performs a structural VAR analysis of the current account and real exchange rate utilizing Blanchard and Quah (1989) decomposition.[14] Though the analysis does not particularly concern Sudden Stop events, it utilizes the decomposition method so as to minimize assumptions for identification. This strategy relies on long-run economic restrictions and allows us to avoid the contemporaneous ordering restrictions of standard VAR analysis. In other words, it also allows us to investigate the short-run real exchange rate movements without imposing explicit restrictions while having the long-run structural framework. The next section presents an analytical framework identifying the long-run structure.

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[10] Massive capital inflows that set sail to Latin America in the early 1990s, financing high growth rates and large current account deficits, came to a sudden standstill following Russia's partial foreign debt repudiation in August 1998.
[11] A "Near-VAR" model allows the use of different sets of variables in each equation.
[12] They use the Beveridge-Nelson approach to extract the nonstationary components of the series.
[13] See also Agénor, Hoffmaister, and Medeiros (1997).
[14] Their paper examines seven industrialized countries.

3. Empirical Methodology

a. The identification of the Shocks

We employ the time series approach to gauge the differential effects of the sudden stop shocks on the real exchange rate movements.[15] The structural VAR model that is used to obtain the main empirical results of this paper summarizes both the extrinsic dynamics of the exogenous variables as well as the intrinsic dynamics—propagation mechanisms—of the model. We follow Hoffmaister and Roldos (1997) to determine the long-run real exchange rate while the short-run dynamics are left to be determined by the data. In addition to the five factors that Hoffmaister and Roldos (1997) look at—foreign interest rate, terms of trade, supply, demand, and monetary shocks—we incorporate current account shock as it explicitly accounts for the effect of Sudden Stop shock.

This system does not rely on a specific exchange rate model, such as the purchasing power parity, sticky price monetary, productivity differential model (or Balassa-Samuelson effect), or uncovered interest rate parity.[16] It is a composite model that incorporates a number of familiar relationships (see Cheung, Chinn, and Pascual, 2004).[17] This economic model motivates the long-run identifying restrictions that, together with the usual assumption of orthogonality of structural innovations, identify the structural innovations and helps to interpret the empirical results. We consider the following system.

$$AX_t = A(L)X_{t-1} + C\varepsilon_t, \quad V(\varepsilon_t) = \Sigma, \tag{1}$$

where X is a vector the first difference of variables [i_t*, tot_t, m_t, y_t, q_t, ca_t], where i_t*, tot_t, m_t, y_t, q_t, ca_t are the world interest rate, the terms of trade, monetary policy, productivity, demand, and current account (or Sudden Stop shock). The variables are assumed to have an MA representation. ε_t is the vector of the structural shocks, [ε_{i*}, ε_{tot}, ε_m, ε_y, ε_d, ε_{ca}]. The demand shock is interpreted as a combination of shocks that affect the domestic demand. Fiscal policy, such as government spending, is one of the major factors.[18] We pay particular attention to $\varepsilon_{ca,t}$, which represents a current account shock—a negative shock is a Sudden Stop shock. We interpret it as being a shock arising from market sentiments, and this disturbance is meant to capture the "unexpected" nature of the Sudden Stops.

[15] Although sudden stop episodes are discrete events, time series analysis is conducted so that lagged variables do not include the observations of the non-sudden stop episodes.
[16] Though this is not a model; rather, it is an arbitrage relationship.
[17] Cheung, Chinn, and Pascual (2004) find that none of the models can be successfully used by looking at five mature markets' currencies. Thus, we believe that the composite model approach is more appropriate in our study to capture relatively new phenomena, such as the Sudden Stop shock.

In matrix, they are:

$$\begin{bmatrix} i* \\ tot \\ m \\ y \\ q \\ ca \end{bmatrix} = A(L) * \begin{bmatrix} \varepsilon_{i*} \\ \varepsilon_{tot} \\ \varepsilon_{m} \\ \varepsilon_{y} \\ \varepsilon_{d} \\ \varepsilon_{ca} \end{bmatrix} \tag{2}$$

The reduced form VAR representation can be obtained by multiplying both sides of equation 5 by A^{-1}:

$$X_t = B(L)X_{t-1} + \mu_t, \tag{3}$$

where μ_t is the vector of reduced-form innovations, [μ_{i*}, μ_{tot}, μ_m, μ_y, μ_d, μ_{ca}]. The left-hand side of equation 2 contains the endogenous variables and B(L) is a square matrix of lag polynomials. The typical element of A(L), $a_{ij}(L)$ denotes the response of the ith endogenous variable to the jth structural innovation lagged L periods.

The estimation strategy used in this study to recover the structural innovations is an extension of Blanchard-Quah (1989).[19] This strategy relies on long-run economic restrictions and avoids the contemporaneous ordering restrictions of standard VAR analysis. Blanchard and Quah show that the structural innovations are a linear transformation of the reduced-form innovations and this linear transformation requires the matrix of contemporaneous effects of the structural innovations, A(0). We apply this approach not only because we can avoid the ordering problem, but also because we can avoid assuming a particular macroeconomic paradigm so that the empirical methodology allows the data to determine the short-run dynamics implied by A(L). The short-run movements of the endogenous variables can then depend both on the dynamics of the exogenous variables and the unspecified intrinsic dynamics of the model.

The analytical framework of section III provides guidelines for imposing zero restrictions on the elements of A(1)—sum of the coefficients. We use it to discuss the justification of this interpretation. The small open economy assumption for the foreign interest rate and terms of trade implies to impose $A_{ik}(L) = 0$ for i=1, 2 and k=3, 4, 5, 6 for L=0, 1, 2, …, ∞, for example. For nominal variable, following the common practice in the literature on the sources of business fluctuations, we assume long-run neutrality of money and/or the nominal

[18] See Hoffmaister and Roldós (1997) for treatment of demand shock.
[19] See Enders (1995) for detailed explanation of the decomposition.

exchange rate. We further assume that this temporary shock arising from the current account has no long-run impacts on real variables, such as real exchange rate and output.[20] Also notice that we assume the demand shock can have long-run effects on the real exchange rate but not on the output, $A_{45}(L) = 0$. If we ignore the intercept terms, the moving average representation of the six variables, as implied by the analysis of the previous section, will have the compact form:

$$\begin{bmatrix} i* \\ tot \\ m \\ y \\ q \\ ca \end{bmatrix} = \begin{bmatrix} A_{11}(L) & 0 & 0 & 0 & 0 & 0 \\ 0 & A_{22}(L) & 0 & 0 & 0 & 0 \\ 0 & 0 & A_{33}(L) & 0 & 0 & 0 \\ A_{41}(L) & A_{42}(L) & 0 & A_{44}(L) & 0 & 0 \\ A_{51}(L) & A_{52}(L) & 0 & A_{54}(L) & A_{55}(L) & 0 \\ A_{61}(L) & A_{62}(L) & 0 & A_{64}(L) & A_{65}(L) & A_{66}(L) \end{bmatrix} * \begin{bmatrix} \mu_{i*} \\ \mu_{tot} \\ \mu_m \\ \mu_y \\ \mu_d \\ \mu_{ca} \end{bmatrix}^{21} \qquad (4)$$

where $A_{ij}(L) = \sum_{k=0}^{\infty} a_{ij}(k)$ and $A_{ij}(L)$ are polynomials in the lag operator L such that the individual coefficients of $A_{ij}(L)$ are denoted by $a_{ij}(k)$.

b. Interpretation of the Shocks

This system, thus, includes two external, three domestic, and sudden stop shocks. A conventional relationship suggests that a positive supply shock, due either to technological progress in the tradable sector as well as a terms-of-trade improvement, leads to real exchange rate appreciation. This is due to the fact that positive wealth effects of these shocks lead to a higher demand for nontradables that is met by a reallocation of labor to the nontraded goods sector induced by the increase in the relative price of the nontradable good. Meanwhile, positive supply shock in the nontradable sector leads to depreciation. This may be because an increase in wage associated with the productivity growth leads to lose competitiveness. In contrast, an increase in the world interest rate, or marginal productivity of capital in the long run, leads to depreciation of real exchange rate.

An impact arising from a demand factor can be interpreted as one that arises from government spending. Hoffmaister and Roldos (1997) argue that the fiscal expansion leads to a decline in the capital stock that has an

[20] See Lee and Chinn (1998), for the similar treatment.
[21] We thus have an over-identified model.

effect on the real exchange rate, but a negligible effect on the level of total GDP.[22] An increase in government spending leads to a real exchange rate appreciation since the government spending is biased towards nontradable goods and requires an increase in the relative price of the nontraded good to reach a new equilibrium despite having a negative wealth effect from the appreciation.

c. Defining the Sudden Stop Period

The Sudden Stop of capital inflows is defined as "unexpected severe stops in capital flows of a persistent nature" by Calvo et al. (2002). We interpret this as a period of loss of access to the international capital market. In other words, the Sudden Stop is a period of no capital inflows or a period of capital outflows. Figure 2 plots the development of capital flow[23] for eight countries. All of the countries in our sample experienced large reversals of capital flow in the 1980s and 1990s. The reversals have been particularly severe during the Asian crisis starting in 1997, and in Latin America during the debt crisis (early to mid-1980s) as well as Mexican crisis (1994).[24] In the case of Thailand, for example, this most affected country was forced by the reversal of capital flows to go from a deficit of some 3% of GDP in 1996 to a surplus of 11% in 1998.

There are several ways of defining the Sudden Stop period. Calvo et. al. (2002), for example, look at Emerging Market Sovereign Bond Spread (EMBI). The EMBI would capture uncertainty in international markets[25] and cost of sovereign bond issuance, which can be a proxy for a loss of access to the international capital market.[26],[27] On the other hand, Milesi-Ferretti and Razin (1997) focus on current account imbalances net of official transfers. They set two requirements to be satisfied: (1) the average reduction in the current account deficit of at least 3 (5) % of GDP over a period of three years before the event, and (2) the maximum current account deficit after the reversal must be no larger than the minimum deficit in the three years preceding the reversal. Hutchison and Noy (2002), on the

[22] Hoffmaister and Roldos (1997) also show that under general parameter assumptions, the response of the real exchange rate to the demand shock is more than twice that of GDP.
[23] Capital flow is defined as a net sum of net errors and omissions, capital account, and financial account.
[24] The period of 1973-1981 witnessed massive capital flows to countries in many parts of the developing world, largely in a form of private syndicated bank loans directed to the public sector. Such lending effectively dried up for many (but not all) developing countries during the period of the debt crisis, 1982-1989.
[25] See also Global Financial Stability Report of the IMF (2003).
[26] To be more precise, developments of new bond issuance is a better proxy for the accessibility of funds.
[27] We do not use this variable for two reasons. First, capital flow consists of different components including financial flows as well as bank flows, for example, and thus the EMBI would only capture a part of the Sudden Stop story, namely the financial flow, but not the bank flows, which was the major part of the Sudden Stop during the Asian financial crisis. Second, the EMBI is available only after 1995 from DataStream while our sample includes

other hand, define a Sudden Stop crisis as one in which there is the contemporaneous occurrence of a currency crisis, and capital account reversal. Calvo and Reinhart (2000) select events with reversals in net private capital flows of more than 4% of GDP.

The Sudden Stop crisis in the 1990s tend to be identified solely by looking at capital flows or current account movements lasting for a relatively short period of one or two years. In contrast, the events of the 1980s can be seen as a prolonged period of loss of access to international capital market because of the long debt restructuring process. Table 2 compares several papers identifying the Sudden Stop crises events both in the 1980s and 1990s that we would like to examine. Details differ, however, it seems that there are core years that are always identified as Sudden Stop period. We can also find in Table 2 that the debt crisis literature identifies the events to last for about five years starting from 1982 to 1987 including the period of restructuring. Meanwhile, Sudden Stop crisis literature only refers to the onset of events, which is the period of 1981-1983. In order to reconcile these different definitions of events, we use two ways of defining the Sudden Stop episodes: (1) period as defined by looking at capital flow movements, which we name as "Sudden Stop period" and (2) two crises periods: "Debt crisis in the 1980s" and "Sudden Stop crisis in the 1990s" as defined based on the existing crisis literature.

For the period defined by capital flows, we use several criteria to be satisfied. Our dummy variable of Sudden Stop takes 1 if (1) a change in net capital flow as percentage of GDP is less than the sample mean, and also it continues for the following two quarters, and (2) a change in net capital flow is larger than the sample's one standard deviation, 1.6% (see Table 3).[28] The first definition ensures that the episode is of a sustained duration of capital outflows, while the second definition ensures to include one-time sharp reversal. The defined Sudden Stop episodes are shown in Figure 1 along with the real exchange rate development. They include a period of Mexican debt and Tequila crises (1982 and 1994), hyperinflation episodes in Argentina (1990) and in Brazil (1990 and 1994), and Asian Crisis (1997 and 1998)[29] among others—some with large real depreciation. This can be seen as a period without an access to international capital market or a Sudden Stop period.

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the events during the 1980s. The variable, therefore, does not allow us to identify the Sudden Stop period consistently throughout our sample.

[28] Milesi-Ferretti and Razin (1997) used 3% or 5% (y-o-y) as a threshold, while our criterion was to use 1.6% (q-o-q) or more than 6% at annualized rate.

[29] Note that there was an episode in Chile with current account reversals in early 1980s. The current account deficit declined from 15% of GDP in 1981 to 5% of GDP in 1983, however, the event is not captured by our data since there are no quarterly current account data available during episode.

We use these criteria to compare across the Sudden Stop versus tranquil times.[30] Table 1 shows that except for the Philippines, seven out of eight countries in our sample experienced their most severe depreciation events during our definition of Sudden Stop periods. In the Philippines, the most severe depreciation, which was captured by the Sudden Stop period, took place during the debt crisis. The Philippines was one of the few countries in Asia that was affected severely by the debt crisis. During the Asian crisis, on the other hand, the country was forced to depreciate its currency in 1997Q3 by 23% after Thailand collapsed while large capital flow reversal started only later in 1999.

As for the period defined based on the existing crisis literature, we define the period between 1982 and 1987 as being debt crisis time. For Sudden Stop crisis, we take 1994 and 1995 for Latin American countries and 1997 and 1998 for Asian countries. This exercise enables us to compare across "debt crisis" versus "Sudden Stop crisis" to see if there is any difference in factors affecting the two episodes, in other words, capital market crises in the 1980s versus in the 1990s (see the shaded area of Figure 3 for the two periods).

d. Data

The variables in the empirical analysis are quarterly data spanning from 1980Q1 to 2000Q4 where data is available.[31] Our sample includes eight emerging countries from Asia and Latin America. They are Argentina, Brazil, Chile, Mexico, Indonesia, Korea, Philippines, and Thailand. To the extent that the Sudden Stop events contain a large unexpected component associated with investors' sentiment and risk premium of the country, such events are more relevant to emerging markets. Therefore, we focus our attention on emerging markets.[32] The six variables of interest to us are US interest rate,[33] terms of trade, M2, industrial production (see Table 4 for the data statistics),[34] current account as percent of GDP,[35] and real exchange rate.[36] We examine the real exchange rates relative to US dollar. Terms of trade, M2, production, and real exchange rate are used in natural logs.

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[30] The period where the dummy variables tales zero,
[31] The data starts in 1984 in Brazil, 1991 in Chile, and 1981 in the Philippines and Indonesia.
[32] See also Arellano and Mendoza (2002) for why Sudden Stop phenomena are unique to emerging markets.
[33] As a robustness test, we examine another definition of the world interest rate created by taking the average of the US, Japan, and German interest rates. The impulse response is not significantly different from the one of the regional foreign interest rate that we present in the paper. The explanatory power of the regional foreign rate, however, is slightly higher by about 5%.
[34] Annual GDP data is interpolated to create quarterly GDP for Thailand from 1980 to 1992, where the quarterly industrial production is not available.
[35] The sign of current account is transformed in a way that its negative change represents sudden stop of capital inflows. We also estimate the VAR system by using capital flows instead. The result is consistent with the one of current account. This may be due to the fact that the change in reserves explains significantly less, and the current account movements almost mirror that of capital flows.

Apart from the capital flow developments in Figure 2 that we have looked at, there are two external macroeconomic developments that warrant a closer look. The first is the US interest rate. Figure 3 plots the development of US money market rate showing drastic change in the early 1980s. After the "Volcker Shock[37]" of rising US short-term rate by 6.5%, the US treasury bills again dropped below 12% by 1982. The consequent sharp rise in real interest rates paid by oil-importing developing countries raised the cost of servicing external debts. The US rate, on the other hand, has been relatively stable in the 1990s except for the expansionary development in the early 1990s.

The second external factor is the decline in commodity prices. The widespread recession in industrial countries in 1981-1982 severely weakened the markets for developing country exports. Figure 4 plots terms of trade developments in eight countries in our sample. The terms of trade deteriorated dramatically in most of the countries during the first half of the 1980s, except perhaps in Korea, which did not experience the decline in the terms of trade during the debt crisis. It, however, deteriorated sharply preceding the Asian financial crisis.

As a preparation for the estimation, we first transfer the variables to a zero mean one standard deviation series to correct for the scale effects, i.e., any one country does not dominate the estimation results. We then perform unit root tests on the time series variables using the Dickey-Fuller test. In order to use the Blanchard and Quah technique, the variables must be in a stationary form.[38] Appendix 2 shows the test results for all the series and countries. The Dickey-Fuller tests failed to reject the unit root hypothesis for most of the variables except for the current account series in a couple of countries. As suggested by Enders (1995), we take the first difference of those series to make them stationary.

Secondly, we perform a lag-length test. Akaike information criterion (AIC) and Schwartz Bayesian criterion (SBC) are calculated to find a reasonable approximation to the infinite-order VAR. The results suggest including 1

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[36] Despite the fact that Asian economies have increasingly being connected to Japan in the 1990s particularly in financial flows, the four countries obviously tried to maintain currency stability to US$. Thus, we believe the real exchange rates relative to US dollar would be the most appropriate one. Nonetheless, when we look at the exchange rate against Japanese yen, we can notice some deviations from the one vis-à-vis US$ during the first half of 1995 when Asian currencies real depreciated due to nominal appreciation of yen. Otherwise, there do not significant deviations between the two exchange rates in our sample.

[37] The Federal Reserve chairman who set out to reverse the inflationary excesses of the preceding years after his appointment in 1979.

[38] See Enders (1995) for a detailed discussion on the decomposition technique.

lag by AIC and including 2 lags by SBC. We used 1 lag for each estimation, and did not use long lags suggested by AIC given the limited number of observation as AIC is biased toward selecting an over parameterized model. [39]

4. Estimation Results

This section presents the main empirical evidence of the macroeconomic disturbances (world interest rate, terms of trade, monetary, supply, demand, and current account) on the real exchange rate by discussing the relative importance of each disturbance and of the negative and positive capital flow shock in particular. The results are summarized by variance decompositions and impulse response functions. The estimation result with the pooled sample refers to a typical economy as described by the pooled time series data in the previous section.

a. "Sudden Stop" and tranquil time

Figure 5 and Table 5 present the estimation results comparing the "Sudden Stop" and the "tranquil" times. The impulse response functions and variance decomposition are reported. The cumulative impulse response functions of real exchange rate to different shocks are presented in a way that an increase (decrease) is real appreciation (depreciation). By looking at the impulse response functions, we can see that the most significant impact comes from the sudden stop or current account shock during the Sudden Stop period accounting for nearly 40% of the real exchange rate variance. On the other hand, the explanatory power is only around 5% during the tranquil time. The impulse response functions show significant difference across two periods during the first two quarters. The real exchange rate depreciates sharply in responding to the capital outflows during the Sudden Stop while it remains minimal during the tranquil time. By the fourth quarter, the real exchange rate returns to zero suggesting that the impact is rather temporary.[40] This result validates our earlier argument that this unexpected Sudden Stop shock could lead to asymmetric responses of real exchange rate in the short-run as discussed in Calvo et. al. (2002). [41]

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[39] See Enders (1995) for details.

[40] Despite the temporary impulse response to the Sudden Stop shock, the variance decomposition suggests a persistent contribution of the shock till 12th horizon (3 years). Blanchard and Quah (1989) report the similar results in their paper: the demand shock affects output only temporarily in the impulse response while contributing about 50% in the variance decomposition at 40th quarter horizon. Among the several reasons they give, one possible explanation for this to happen in our case is that the identifying restriction only impose that (in our case) the contributions of foreign rate, terms of trade, demand and sudden stop disturbances to the real exchange rate sum to unity as the horizon increases (in the long-run). And other aspects such as the short-run behaviors from disturbances with temporary effects are unconstrained. Therefore, the results e.g., large contribution from the sudden stop shock

We now turn to look at other factors affecting the real exchange rate. During the Sudden Stop period, a positive disturbance in the terms of trade leads to the real exchange rate appreciation. However, the impact lasts only in the short-run for two quarters while it has long-run impact during the tranquil time. The terms of trade shock accounts for the variance of the real exchange rate slightly more but merely about 7% during the Sudden Stop time than during the tranquil time (4%).

A positive shock in monetary policy (expansionary) has a negative impact leading to real depreciation in the short run during both periods. This result validates our analytical framework that nominal shocks have only short-run impacts. The monetary policy disturbance accounts for around 8% to 10% of the real exchange rate variance explaining slightly more during Sudden Stop period.

Our results suggest that both supply and foreign rate shocks have minimal impacts on the real exchange rate during both periods. While both shocks are expected to have long-run impacts on the real exchange rate, the impulse response functions are not significantly different from zero both in the short run and long run in our sample countries and periods.

Despite dramatic development of the external factors (world interest rate and terms of trade, in particular) in the 1980s, we find that their explanatory powers are rather small. Hausman and Gavin (1995) also find a small correlation between external shocks and real exchange rate volatility for Latin America. In contrast, Calvo, Leiderman, and Reinhart (1994) find a large impact of external factors on the real exchange rate by looking at 18 countries in Latin America and Asia. Dornbusch (1989) argues that the impacts of the world interest rates significantly differ across countries by looking at the period of debt crisis. For the debtor countries such as our sample countries, the magnitude of the impact largely depends on their share of floating rate debt. While countries such as Mexico and Brazil borrowed at the interest rates that are linked to market rates, other poorer countries borrowed at concessional rates, which would not directly be affected by the world interest rate movements.[42] This

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in the 12th quarter (short-run), do not contradict with our identifying scheme. See further discussion in Blanchard and Quah (1989) for a limit to the decomposition technique when multiple permanent and temporary disturbances exit, for example.

[41] Forbes and Rigobon (2002) argue, by examining stock market co-movements that an increase in correlations is due to an increase in market volatilities, which biases the correlations upward. In other words, a caveat that we should keep in mind is that the difference between the sudden stop and tranquil times that we find may have this bias as well. Correction for the "Rigobon effect" is worth considering in future research.

[42] In order to test for the robustness of the results, we examined taking into account the regional difference using the Japanese money market rate for Asian countries. Nonetheless, the result remains to be the same.

contrasting result may also be due to the sample period used, the frequency of the data,[43] and the fact that domestic policy and supply shocks are not explicitly accounted for.

Finally, we look at the demand shock, which, in fact, explains a significant portion of the real exchange rate variance. The demand shock accounts for about 40% of the real exchange rate variance during the Sudden Stop time while the explanatory power doubles to around 80% during the tranquil period. This suggests that the demand disturbance is the main factor driving the real exchange rate development in general, and it is particularly significant during the tranquil time.[44] Hoffmaister and Roldós (1997) also find the real exchange rate to be mostly determined by demand shock particularly in Latin America and explain that the demand factor is driven by fiscal policy. They argue that a positive shock in the fiscal policy would lead to real appreciation since the fiscal policy mostly falls on non-tradable sector leading to real appreciation. While this argument appears to be valid in general or particularly during the tranquil period, the demand disturbance during the crisis times needs more attention as the demand management is usually a result of complex policy choices. Therefore, we will discuss the different factors affecting the demand disturbance when examining the crisis periods in the next section.

b. "Debt crisis" and "Sudden Stop crisis during Tequila and Asian flu" time

We now compare across Sudden Stop crises in the 1980s (debt crisis) and 1990s (Sudden Stop crisis) to examine if there are differences in factors explaining the real exchange rate during these two crises events that we identify.[45] Figure 6 and Table 6 report the estimation results comparing the "debt crisis" and "Sudden Stop crisis." The cumulative impulse response functions and the variance decomposition analysis are presented.

When examining the Sudden Stop shock, the cumulative impulse response functions reveal similarities across the two crisis periods. A positive Sudden Stop shock leads to real appreciation for two to three quarters both during the debt crisis and Sudden Stop crisis times. The responses are largest in magnitudes in the first quarter, and then decreases overtime. However, the variance decomposition reveals a distinct explanatory power of the shock across the two crises. The Sudden Stop shock accounts for about 18% of the real exchange rate variance during the debt crisis. On the other hand, the impact becomes significantly larger explaining 48% (maximum in the second quarter)

[43] External factors tend to explain more with higher frequency data (monthly or higher) while our data is of quarterly frequency.
[44] Our result is consistent with what Hoffmaister and Roldós (1997) find. Their VAR analysis concludes that the real exchange rate is mainly driven by its own past history with more than 90%.

during the Sudden Stop crisis. This result suggests that the capital flow shock—a shock caused by unexpected market sentiment—is more significant during the 1990s crisis than during the 1980s crisis. This result is consistent with the financial liberalization literature arguing that the globalization of financial flows in the 1990s brought instability to the emerging markets. The surge in hot money resulted in contagious withdrawal of financial flows during the Tequila and Asian financial crises, and had a detrimental effect on real exchange rate crises in some countries. [46]

We now turn to look at the terms of trade shock. As we examined in the previous section, the terms of trade deteriorated sharply during the early 1980s in most of our sample countries. Therefore, we would like to examine if the terms of trade disturbance played a significant role on the real exchange rate during the debt crisis period. The cumulative impulse response functions show that the disturbance has long-run impacts on the real exchange rates during the debt crisis while it is not significantly different from zero during the Sudden Stop period. The variance decomposition analysis reveals that about 6% of the real exchange rate variance is due to the terms of trade disturbance during the debt crisis while it is only about 3% during the Sudden Stop crisis period. Despite its small explanatory power, this result is consistent with our data analysis early on. [47]

As for the domestic shocks, the cumulative impulse response functions reveal that the monetary policy and supply shocks seem to affect the real exchange rate only in the short run during the Sudden Stop crisis, accounting for about 10% and 8% of the variance respectively. A positive (or expansionary) monetary disturbance leads to real depreciation for about two quarters, and then goes back to zero response. And a positive supply shock leads to real appreciation in the second quarter, and then goes back to zero response. While the short-run impact of monetary policy is consistent with our analytical framework, the short-run impact of supply shocks is surprising. It, however, may reflect the fact that the real sector faces severe financial constraint during the Sudden Stop crisis, but of a temporary nature. This type of shock arising from the supply side would also have temporary effects on the real exchange rate (see Izquierdo, 1998, for example). The two domestic factors, monetary and supply disturbances, on

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[45] We have also estimated using the two sub-samples of the Sudden Stop periods in the 1980s and 1990s. The estimation, unfortunately, is not feasible due to the small sample size.

[46] See Calvo (1998), for example.

[47] The terms of trade deterioration severely affected all of the sample countries except for Korea during the debt crisis while there was no major development during the Sudden Stop crisis period (see Figure 4). The terms of trade shock during the debt crisis was mainly driven by collapses both in oil and commodity prices. Countries such as Mexico and Indonesia were the hardest-hit since they export both oil and commodities, leading to the real exchange depreciation at the same time. Korea, on the other hand, suffered least since the country was a net importer of commodities.

the other hand, have much smaller impacts on the real exchange rate during the debt crisis time. This result demonstrates the fact that the major factors at work during the debt crisis were of an external nature and also of demand.

Finally, the demand factor is found to account for a major portion of the real exchange rate variance. The shock accounts for more than 60% of the real exchange rate variance during the "debt crisis" time while the explanatory power halves to around 30% during the Sudden Stop crisis period. This result may be due to the fact that the demand management was the key issue explaining the real exchange rate during the debt crisis. Because of the prolonged period of the crisis, various external, domestic, and political factors affected the countries' demand managements. Latin American countries particularly experienced a collapse in demand as a result of difficult policy choices for coping with the crisis. The next section discusses some of the factors affected the demand development during the period.

c. Determinants of the Demand Disturbance

Given the importance of the demand shock explaining the disturbance of the real exchange rate, it is crucial to understand the factors driving it.[48] Using available data for the countries in Asia and in Latin America included in this study, we examine the factors essential to the demand. The adjustment period during the debt crisis interests us particularly due to its large explanatory power of greater than 60%.

During the debt crisis, most countries needed to reverse the direction of the net transfers by combining expenditure-switching policies, including devaluation, imposition of capital controls, and import quotas during the crisis (see Edwards, 1989, for example). The adjustment required a significant increase in real interest rates as well as major relative price changes or real devaluation. As the expenditure-reducing policies center on two major areas—the reduction of public investment and government employees' wages—we examine how public spending developed during the crisis.[49]

First, we examine the development of government spending as a percent of GDP during the crisis periods to assess the impact of the fiscal factor as Hoffmaister and Roldós (1997) argue. Table 7 presents the annual growth rate of government spending and the real exchange rate. Although the data are available for only three countries at

[48] See Kamin and Bobson's (1999) explanation of the devaluation crisis in Latin America. They argue that the macroeconomic volatility was mainly due to domestic policy and economic imbalances, with exogenous external factors playing only a secondary role.

quarterly frequency during the debt crisis, we can see that government spending registered negative growth rates during the crisis. The fiscal tightening was particularly severe in the early years reaching -26% in the Philippines (1984) and -23% in Mexico (1983)[50]. Concurrently, the real exchange rates depreciated sharply by 22% and 36%, respectively. This declining government expenditure was largely due to restrictions on the aggregate demand implemented immediately after the crisis.

A similar trend can be found by looking at gross investment as percent of GDP. Table 8 contains data on investment ratios for the sample countries. Investment declined throughout the crisis until 1987 when the growth of investment finally turned positive. Mexico and the Philippines were particularly the hardest-hit countries where the investment was declining by almost 30%. Public and construction investments were the components more severely curtailed. In the case of public investment, this was again the result of restrictive aggregate demand policies implemented immediately after the crisis started. Naturally, this decline in investment has serious consequences for the prospects of renewed growth, and hence the real exchange rate.

Meanwhile, the demand shock explains the relatively small portion of real exchange rate variance during the Sudden Stop crisis despite some countries such as Argentina, Mexico and Indonesia having experienced sharp decline in government spending. Though Table 8 shows that investment declined during the Sudden Stop crisis, the decline was seen as caused by the liquidity constraint arising from the "Sudden Stop" shock. Distinction between the two periods can be found in the level of real interest rates. While experiencing the fiscal tightening, the real interest rates were kept relatively low in the 1990s crisis in contrast to the 1980s. This policy aimed to aid the already weak financial sector (see Corsetti, Pesenti, and Roubini 1998). Despite low real interest rates and the relatively sound fiscal balance in the 1990s, economic activity was severely affected by the lack of liquidity caused

[49] The government employees' wages cannot be assessed because of the limited data availability.

[50] Annual data for the growth rate of government spending as percent of GDP is presented below except for Argentina. The figures reveal that the government spending experienced sharp decline in most of our sample countries during the debt crisis.

	Brazil	Chile	Indonesia	Korea	Philippines	Thailand	Mexico
1982	8%	15%	4%	-1%	4%	3%	-2%
1983	-2%	-8%	-11%	-7%	-10%	-2%	-18%
1984	-14%	2%	-3%	-8%	-16%	2%	5%
1985	12%	-8%	10%	2%	8%	3%	0%
1986	8%	-6%	-2%	-1%	4%	-6%	-1%
1987	13%	-15%	-15%	-3%	5%	-12%	-4%

by the Sudden Stop of capital inflows. While the demand management was also a major factor for real exchange rate movements during the 1990s crisis, its relative importance was apparently much smaller than in the debt crisis[51].

5. Conclusion

This paper has tried to untangle the causes behind the severe real exchange rate depreciation events with particular attention paid to the Sudden Stop of capital flows. We have examined whether the Sudden Stop of capital inflows led to asymmetric behavior in real exchange rate movements as suggested by Calvo (1999) among others.

By utilizing cumulative impulse response function and variance decomposition analysis, we have argued that there is asymmetric response across Sudden Stop and tranquil times. This appears to be true when we compare across Sudden Stop and tranquil times. Further comparison across the "debt crisis in the 1980s" and the "Sudden Stop crisis in the 1990s", however, reveals that the Sudden Stop disturbance has become more prominent in explaining the real exchange rate disturbance in the Sudden Stop crisis of the 1990s rather than the debt crisis of the 1980s.

[51] One could argue that this demand component might include other impacts such as those arising from different degrees of exchange rate pass-through over time. Factors such as a shift in trade policies, cost of price adjustment, oligopolistic price-setting, and a change in composition of a country's import bundle (see Campa and Golberg, 2002) have been discussed as significant elements affecting the pass-through coefficients. However, there appears no compelling evidence supporting why those coefficients might be different across sudden stops and tranquil times.

Appendix 1: Data Source

a) World interest rate: US, Japanese, and German money market rates are taken from International Financial Statistics (line 60B)

b) Terms of trade: International Financial Statistics (line 74 and 75) and various sources[52]. The missing terms of trade are calculated using the countries main exports price divided by the OECD's import price index.

c) M2: International Financial Statistics (line 34 and 35)

d) Industrial production index is taken from International Financial Statistics (line 66) except for three countries listed below.

Argentina: "Indicadores De Coyuntura," Fundacion de Investigaciones Economicas Latinoamericanas, various issues.

Brazil: "Boletim Do Banco Central Do Brazil," Central Bank of Brazil, various issues.

e) Current account is taken from International Financial Statistics. We look at the aggregate capital flow, which consists of the net errors and omissions, capital account, and financial account. See below for details of each component.

Capital Flows: CA + RES = -(EO + KA + FINA) Where the left hand side is CA: Current account (line 78ald), and RES: Reserves and Related items (line 79dad, Reserve assets + Exceptional financing + Fund credit and loans). The right hand side is EO: Net Errors and Omissions (line 78cad, unrecorded capital flows / trade transactions), KA: Capital account (line 78bcd, Capital transfers associated with migrants, debt forgiveness, or other government transfers), and FINA: Financial account (line 78bjd, Direct I + Portfolio I + other I)

f) Real exchange rate is taken from International Financial Statistics (line AE) for nominal exchange rate, and multiplied by CPI US / CPI domestic for real exchange rate.

g) Government spending is taken from International Financial Statistics (line 80), and divided by GDP (line 99b).

h) Gross capital formation is taken from International Financial Statistics (line 93), and divided by GDP (line 99b).

Appendix 2: Dickey-Fuller test for unit roots on variables

	Argentina	Brazil	Chile	Mexico	Indonesia	Korea	Philippines	Thailand
	Test Statistics							
TOT	-2.67	-2.48	-2.89	-1.16	-1.39	-0.29	-2.12	-1.90
D.TOT	-8.16**	-13.80**	-8.19**	-6.73**	-9.51**	-8.25**	-6.95**	-6.95**
M2	-2.79	-0.14	-3.55**	-1.70	0.07	-0.58	-0.26	-2.50
D.M2	-4.45**	-3.19*	--	-6.38**	-8.95**	-9.91**	-11.15**	-7.32**
Production	-3.98**	-3.96**	-0.88	0.04	-0.95	-0.52	-1.08	-1.55
D.Production	--	--	-13.32**	-10.00**	-9.56**	-9.49**	-10.22**	-7.08**
REX	-2.06	-1.78	-1.55	-1.78	-1.50	-2.24	-1.92	-2.26
D.REX	-13.00**	-8.60**	-8.93***	-9.81**	-7.92**	-12.04**	-10.37**	-9.41**
Capital Flow	-5.00 ***	-3.44*	-4.38***	-3.69*	-4.57***	-4.08***	-6.41***	-2.33
D.CapFlow	--	--	--	--	---	--	--	-7.38***
Current Acct	-5.69**	-3.33*	-4.11**	-2.38	-2.43	-2.48	-1.77	-2.14
D.CA	--	--	--	-8.01**	-12.62**	-9.25**	-12.45**	-10.28**

Note: US RMMKT: -2.01 and D.US RMMKT: -8.73**. D.X stands for the first difference of the variable X. TOT: Terms of trade, REX: Real exchange rate, CA: Current account

** stands for that the test statistics reject the hypothesis that there is a unit root in the time series at the interpolated Dickey-Fuller critical value at 1%.

* stands for that the test statistics reject the hypothesis that there is a unit root in the time series at the interpolated Dickey-Fuller critical value at 5%.

[52] I benefited from Graciela Kaminsky's database for some countries.

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Table 1: Real Exchange Rate Depreciation during "Sudden Stop Period" and Entire Sample

	Sudden Stop period 1/			During 1980-2000 (Entire Sample)			
	Average Depreciation/Appreciation	Maximum depreciation rate	Year of most severe depreciation	Average Depreciation/Appreciation	Standard Deviation	Maximum depreciation	Year of most severe depreciation if not SS period
Argentina	-2.9%	-161.2%	1989q2	0.2%	26.5%	-161.2%	--
Brazil	0.1%	-34.6%	1990q4	0.1%	12.4%	-34.6%	--
Chile	0.3%	-7.5%	1999q2	0.8%	3.3%	-7.5%	--
Mexico	-0.3%	-47.1%	1982q4	0.4%	11.0%	-47.1%	--
Indonesia	-1.8%	-41.3%	1998q2	-1.2%	12.4%	-41.3%	--
Korea	0.4%	-60.4%	1997q4	-0.2%	8.1%	-60.4%	--
Philippines	-2.1%	-18.9%	1984q2	-0.3%	6.6%	-23.2%	1997q3
Thailand	-1.4%	-32.0%	1997q3	-0.3%	6.2%	-32.0%	--

1/ As defined in the paper.

Table 2: Defined Sudden Stop Period and Crisis Period

	Argentina	Brazil	Chile	Mexico	Indonesia	Korea	Philippines	Thailand
Sudden Stop Literature								
Calvo and Reinhart (2000)	1982-83 1994-95	none	1990-91	1981-83 1993-95	1996-97	1996-97	1996-97	1996-97
Hutchison and Noy (2002)	1989	1987	none	1982, 1994	1983, 1986	none	1983, 1986	1981, 1997
Crisis Literature								
Caprio (2003)	1980-82 1989-90 1995	1990 1994-1999	(1981-86)*	1981-91 1994-1997	1997-present		1981-87 1998-present	1983-87 1997-present
"Silent Revolution, IMF 1979-1989" (2001)	1982-86	1982-86	(1983-86)*	1982-86			1983-84	

* Out of sample period.

Table 3: Capital Flow as % of GDP

A. Capital Flow as % of GDP

	Number of Observation	Mean	Standard Deviation	Minimum	Maximum
8 countries	613	0.51	1.59	-13.80	4.95
Argentina	84	0.22	1.85	-13.80	4.08
Brazil	84	0.17	0.94	-2.01	2.80
Chile	37	1.26	1.23	-1.64	3.92
Mexico	82	0.47	1.31	-5.10	2.12
Indonesia	77	0.50	1.25	-5.57	2.34
Korea	82	0.21	1.50	-9.50	3.20
Philippines	83	0.75	1.56	-4.42	4.14
Thailand	84	0.88	2.30	-8.59	4.95

B. Change in Capital Flow (As % of GDP, quarter on quarter)

	Number of Observation	Mean	Standard Deviation	Minimum	Maximum
8 countries	611	-0.02	1.56	-14.33	12.43
Argentina	84	-0.01	2.38	-14.33	12.43
Brazil	84	0.00	0.87	-3.21	2.75
Chile	36	-0.05	1.62	-4.57	2.99
Mexico	82	-0.01	1.12	-4.40	3.50
Indonesia	76	0.00	1.30	-5.62	5.82
Korea	82	-0.01	1.72	-9.40	7.76
Philippines	83	-0.08	1.63	-4.46	4.25
Thailand	84	-0.04	1.45	-4.45	3.79

Table 4: Data Summary

	Number of Observation	Mean	Standard Deviation	Minimum	Maximum
US Money Market Rate	672	7.49	3.39	2.99	17.78
Terms of Trade	655	1.12	0.40	0.40	2.47
Annual Production Growth Rate	653	5%	9%	-27%	51%
Annual M2 Growth Rate	616	-35%	68%	-479%	59%

Table 5: Decomposition of Variance for Real Exchange Rate: Sudden Stop Period vs Tranquil Period

A. No Access to Capital Market Time

Step	Foreign Rate	Terms of Trade	Monetary Policy	Supply	Demand	Sudden Stop
1	1.11	7.09	9.04	1.01	47.36	34.41
2	1.03	6.40	10.36	0.92	42.36	38.94
3	1.07	6.32	10.46	0.98	41.51	39.67
4	1.09	6.31	10.51	1.00	41.22	39.88
5	1.09	6.32	10.53	1.00	41.14	39.92
6	1.09	6.32	10.54	1.00	41.12	39.93
7	1.09	6.32	10.54	1.00	41.11	39.94
8	1.09	6.32	10.54	1.00	41.11	39.93
9	1.09	6.32	10.54	1.00	41.11	39.93
10	1.09	6.32	10.54	1.00	41.11	39.93
11	1.09	6.32	10.55	1.00	41.11	39.93
12	1.09	6.32	10.55	1.00	41.11	39.93

B. Tranquil Time

Step	Foreign Rate	Terms of Trade	Monetary Policy	Supply	Demand	Sudden Stop
1	0.05	3.91	7.74	1.13	81.96	5.21
2	0.14	4.62	8.41	2.96	78.87	5.00
3	0.22	4.58	8.35	3.11	78.45	5.29
4	0.23	4.58	8.38	3.12	78.31	5.37
5	0.24	4.57	8.40	3.12	78.24	5.43
6	0.25	4.57	8.42	3.12	78.19	5.46
7	0.25	4.57	8.43	3.12	78.17	5.47
8	0.25	4.57	8.44	3.12	78.15	5.48
9	0.25	4.57	8.44	3.12	78.14	5.48
10	0.25	4.57	8.44	3.11	78.14	5.49
11	0.25	4.57	8.45	3.11	78.14	5.49
12	0.25	4.57	8.45	3.11	78.13	5.49

Table 6: Decomposition of Variance for Real Exchange Rate: Debt Crisis Period vs. Sudden Stop Crisis Period

A. Debt Crisis Period

Step	Foreign Rate	Terms of Trade	Monetary Policy	Supply	Demand	Sudden Stop
1	1.82	6.31	6.46	0.03	67.08	18.31
2	5.49	6.12	5.82	3.12	62.23	17.22
3	5.42	6.21	5.73	3.11	61.86	17.66
4	5.49	6.18	5.71	3.10	61.63	17.89
5	5.52	6.17	5.70	3.10	61.51	18.01
6	5.54	6.16	5.71	3.09	61.43	18.07
7	5.55	6.17	5.73	3.09	61.36	18.10
8	5.56	6.17	5.76	3.08	61.31	18.11
9	5.56	6.18	5.79	3.08	61.28	18.12
10	5.56	6.18	5.82	3.08	61.25	18.11
11	5.56	6.18	5.84	3.08	61.23	18.11
12	5.56	6.19	5.85	3.08	61.22	18.11

B. Sudden Stop Period

Step	Foreign Rate	Terms of Trade	Monetary Policy	Supply	Demand	Sudden Stop
1	0.77	3.60	12.52	1.53	39.67	41.91
2	1.12	3.12	9.54	7.99	30.12	48.11
3	2.72	3.41	10.07	7.99	29.04	46.76
4	3.60	3.40	10.11	8.14	28.58	46.18
5	3.98	3.39	10.15	8.18	28.38	45.92
6	4.15	3.39	10.17	8.20	28.30	45.80
7	4.22	3.38	10.18	8.20	28.27	45.75
8	4.25	3.38	10.18	8.20	28.25	45.73
9	4.26	3.38	10.19	8.20	28.25	45.72
10	4.27	3.38	10.19	8.20	28.24	45.72
11	4.27	3.38	10.19	8.20	28.24	45.72
12	4.27	3.38	10.19	8.20	28.24	45.72

Table 7: Growth Rate of Government Spending as % of GDP

Debt Crisis Period				
Country	Crisis Period Average	Most Severe Decline	Year	Real Exchange Depreciation
Korea	-3%	-13%	1984q4	-5%
Mexico	-4%	-23%	1983q3	-30%
Philippines	0%	-26%	1984q2 and q3	-36%

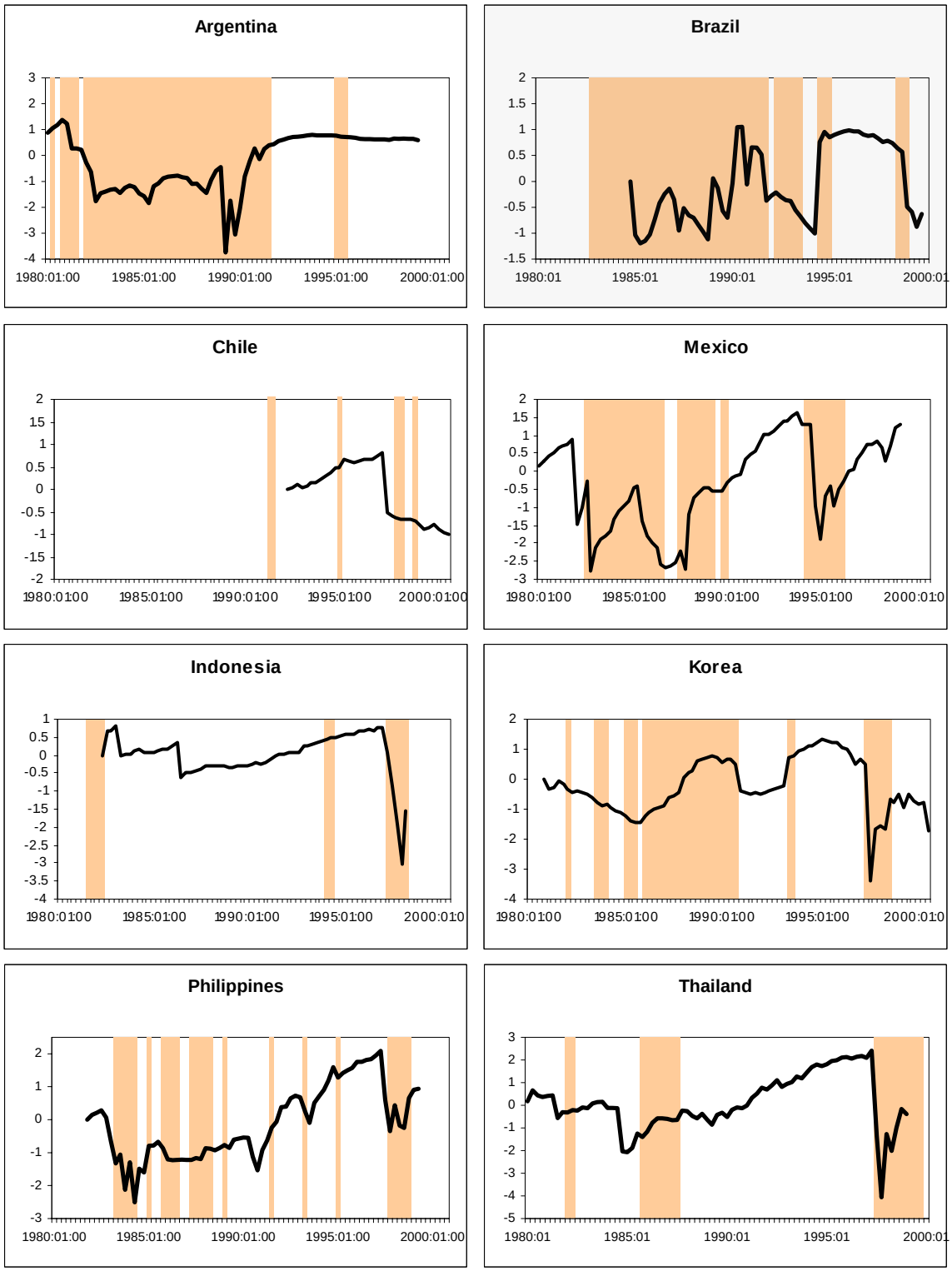
Sudden Stop crisis period				
Country	Crisis Period Average	Most Severe Decline	Year	Real Exchange Depreciation
Argentina	-1%	-8%	1995q1	2%
Brazil	6%	-8%	1995q1	60%
Mexico	-3%	-20%	1995q2	-36%
Indonesia	-16%	-32%	1998q1	-101%
Korea	4%	-3%	1997q4	-67%
Philippines	5%	-1%	1998q1	-22%
Thailand	4%	-8%	1997q4	-56%

Table 8: Growth Rate of Investment as % of GDP

Crisis	Year	Argentina	Brazil	Chile	Mexico	Indonesia	Korea	Philippines	Thailand
Debt Crisis	1982	-4%	-6%	-24%	-14%	4%	1%	-1%	-4%
	1983	-4%	-16%	-20%	-27%	-1%	4%	8%	5%
	1984	-5%	-12%	3%	2%	-11%	-1%	-26%	0%
	1985	-13%	15%	31%	6%	3%	-2%	-34%	-5%
	1986	-1%	0%	2%	2%	5%	-1%	-3%	-5%
	1987	11%	15%	12%	-6%	3%	3%	3%	7%
Sudden Stop Crisis	94,97 1/	5%	8%	-8%	4%	-4%	-5%	4%	-18%
	95,98	-10%	-1%	6%	-17%	-10%	-15%	-13%	-34%
Tranquil Period		-1%	-5%	1%	3%	0%	2%	4%	4%
Sample Average		-2%	-3%	1%	-1%	-1%	0%	-1%	-1%

1/ Sudden Stop crisis is defined to be 1994 and 95 for Latin America, and 1997 and 98 for Asia.

Figure 1: Real Exchange Rate and Sudden Stop Period (Shaded Area)



1/ Real exchange rate is normalized to zero mean and one standard deviation for all countries. The shaded area is the "Sudden Stop" period that we define in the paper.

Figure 2: Sudden Stop (Capital Flow in Millions of US$) by country

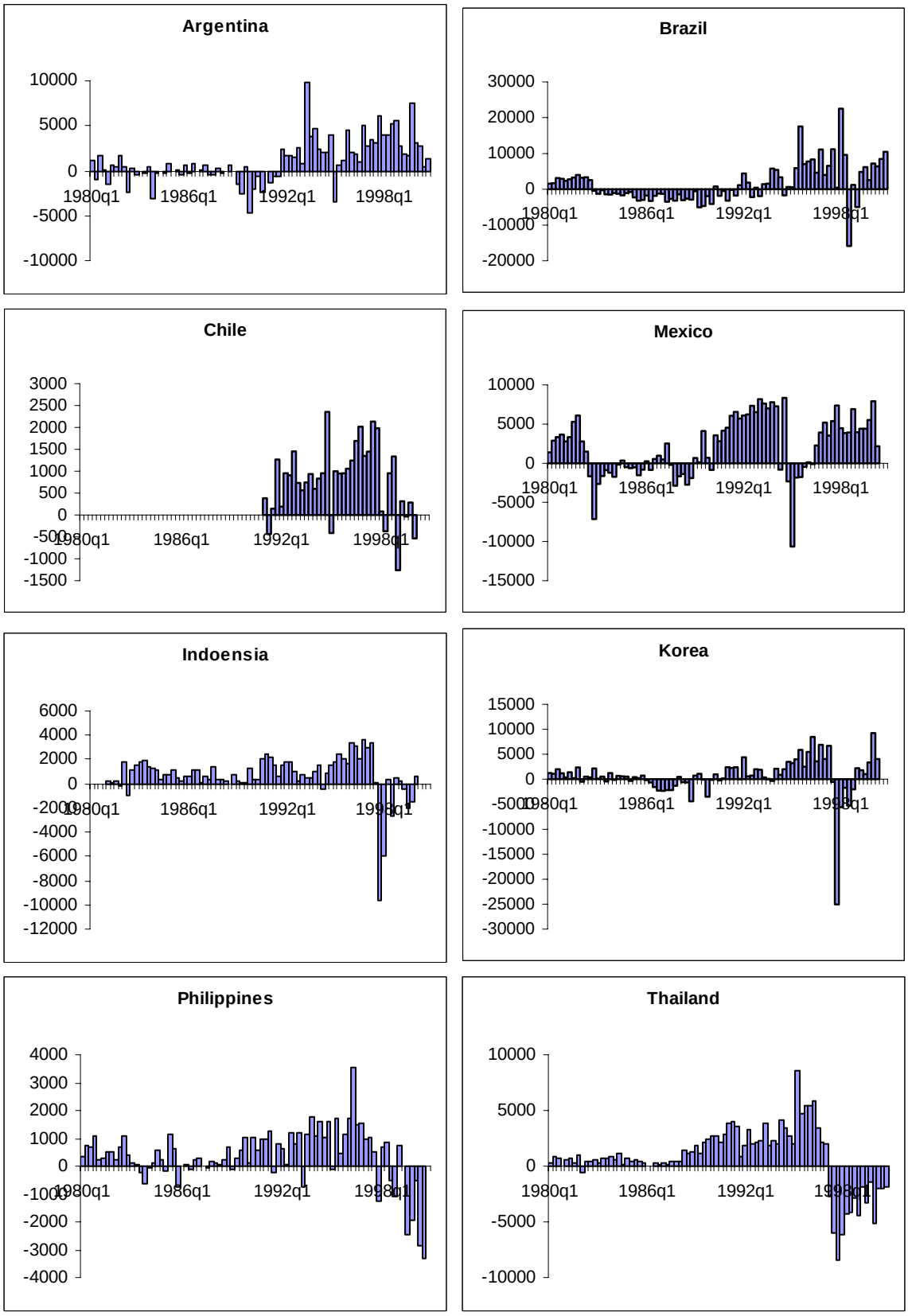


Figure 3: Money Market Rate of USA during the Debt Crisis and Sudden Stop Crisis (Shaded Area)

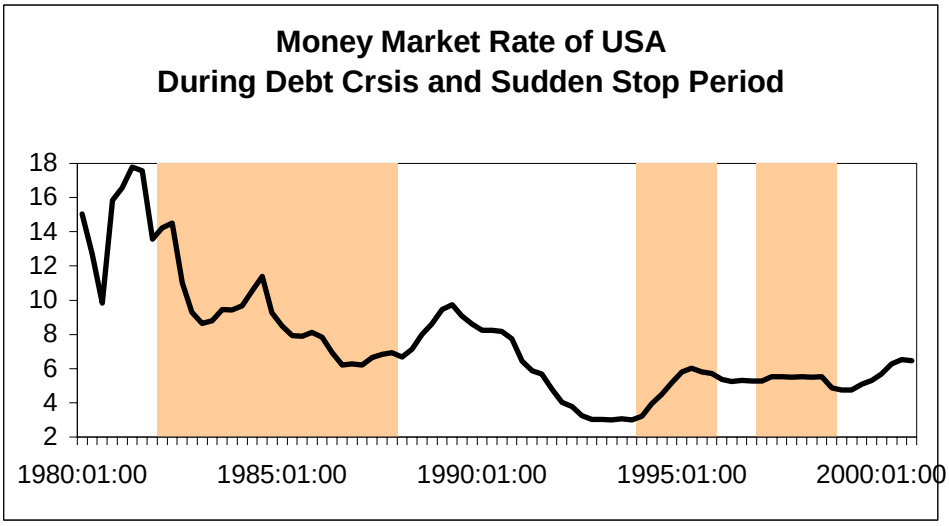


Figure 4: Terms of Trade Developments in the 8 countries during the Debt Crisis and Sudden Stop Crisis (Shaded Area)

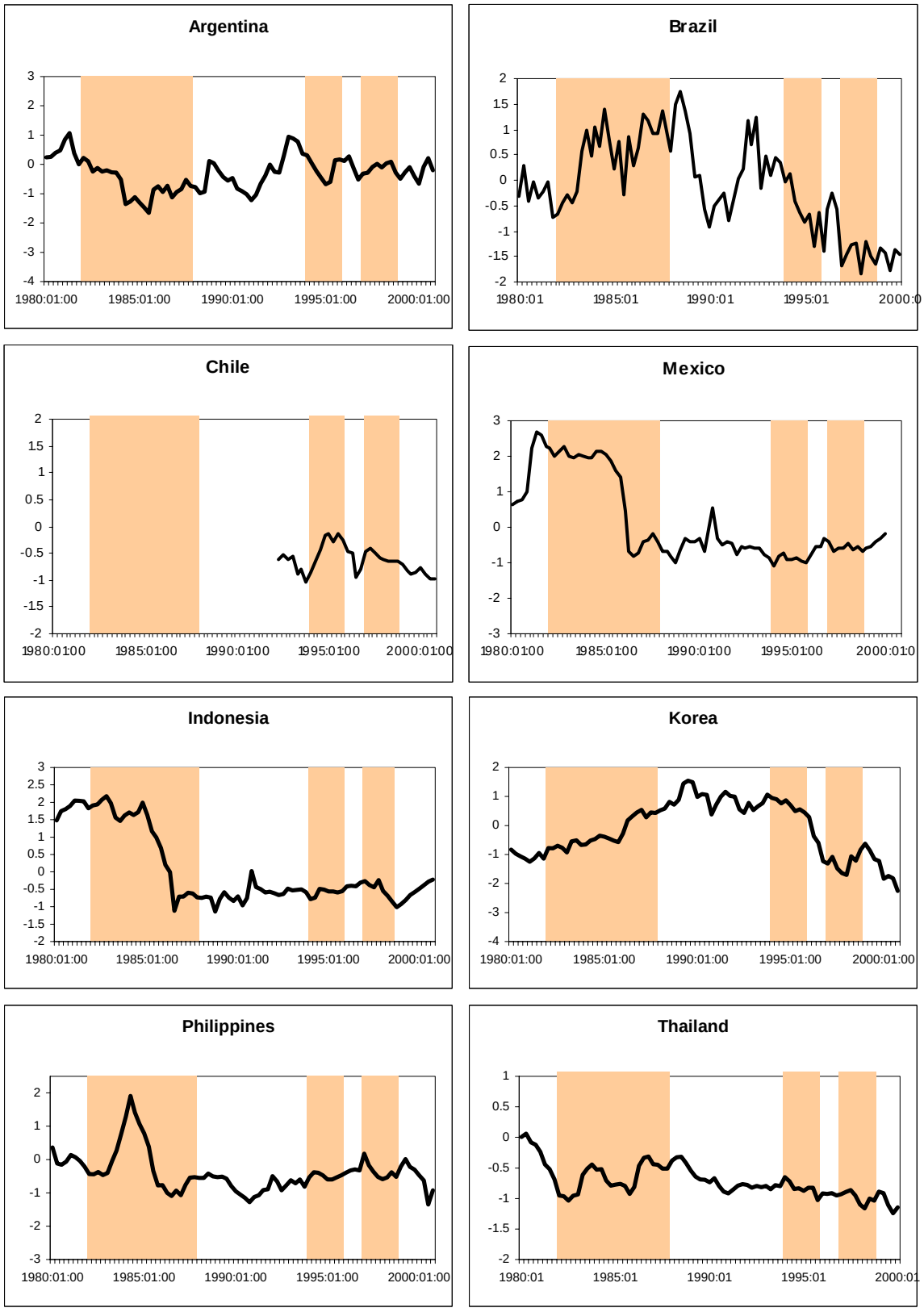


Figure 5: Cumulative Impulse Response Functions of Real Exchange Rate (Solid line for Tranquil period and ▲ for Sudden Stop period)

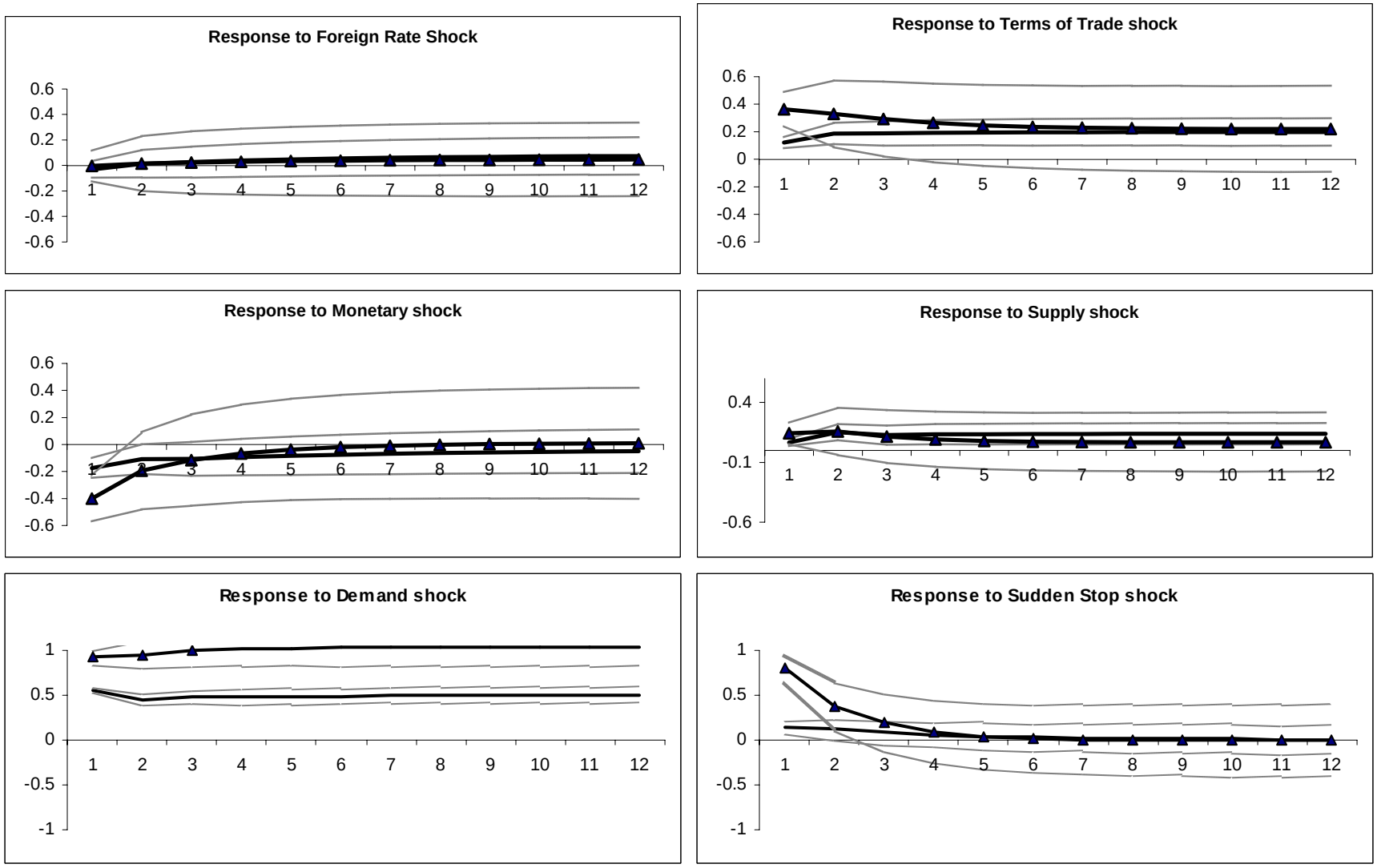


Figure 6: Cumulative Impulse Response Functions of Real Exchange Rate (Solid line for Sudden Stop Crisis period and ▲ for Debt Crisis)