Surges and Sudden Stops of Capital Flows to Emerging Markets

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Abstract

A characteristic of many of the recent emerging market currency crises is a preceding surge in capital inflows and their reversals or 'sudden stops' during the crises. The empirical investigation of 38 emerging market economies between 1990 and 2003 reveals that a surge in capital inflows significantly increases the probability of a sudden stop. In addition, a surge accompanied by a high current account deficit or an appreciated real exchange rate is more likely to be associated with a sudden stop. The paper also finds that a surge that is dominated by private loans and portfolio flows rather than direct investment has a higher probability to end with a sudden stop.

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Keywords: Capital flows; Sudden stops; Surges in capital flows; Emerging Markets; private loans; portfolio flows; foreign direct investment.

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1. Introduction

The rash of major emerging market currency crises over the past decade has led to a good deal of fundamental rethinking about what we thought we knew about international financial flows. Most of these crises have been characterized by a reversal or 'sudden stop' (Calvo, 1998) of capital flows followed by sizeable output loss. Often there has been a preceding surge of private capital flows partly fueled by such factors as economic reforms and reductions in capital controls. Recent episodes in Mexico in 1994, and in Asia in 1997 are well-known examples of the speed and magnitude of capital inflows and their reversals accompanied by severe currency crises.

The possible detrimental effects of "excessive" capital inflows have often been discussed, but hardly any empirical studies exclusively investigate this issue. For example, out of 56 empirical cross country currency crisis studies that have been surveyed in Kaminsky, Lizondo and Reinhart (1998) and Abiad (2003) only six of them include a measure for a component of preceding capital inflows in their model. Among this six only one of them has a variable to capture the effect of total preceding capital inflows (Sachs, Tornell and Velasco, 1996).

This paper fills this gap by investigating the effects of surges in capital inflows on the probability of their sudden stops. We focus on the sudden stop episodes for 38 emerging markets for the period 1990 to 2003. More specifically, we construct and test several hypotheses dealing with the following three questions:

- Do surges in capital inflows have any effect, direct or indirect, on the probability of their sudden stops?

- Do weak economic fundamentals make surges more reversal prone?

- Does the composition of capital inflows during the surge have any role on the probability of a sudden stop?

Sachs, Tornell and Velasco (1996), provide the only study that empirically investigates all of these issues and they find that neither high capital inflows nor their composition has any significant effect on currency crises. However, their study focuses on 20 emerging market economies only during the 1994 Mexican crisis and it does not include the second half of the 1990s. As a result it leaves out many recent emerging market crises. This study is the first to specifically investigate the connection between large capital inflows and a sudden stop crisis in a cross country panel setting.

Our empirical findings support the view that surges in capital inflows are strong predictors of sudden stop crises. After controlling for several important determinants of sudden stops, the probit regression results show that surges still have significant effect on the probability of sudden stops. In addition, this effect tends to be stronger if there is a large current account deficit or if the real exchange rate has appreciated. We also find that the composition of the surge matters. While portfolio flows and private loans increase the probability of a sudden stop, foreign direct investment does not.

The paper is organized as follows: Section 2 lays out the theoretical linkages of surges in capital flows and their effect on the probability of a sudden stop and presents four testable hypotheses on the surge and sudden stop association. Section 3 briefly summarizes the findings of previous empirical studies on our hypotheses. Section 4 describes the data and methodology. Section 5 presents the empirical results and Section 6 concludes.

2. Linkages between Surges and Sudden Stops

Why would a large increase in capital inflows increase the likelihood of its reversal? Theoretically, surges in capital inflows and the probability of a sudden stop can be connected through two channels. The first is the indirect effect of high capital inflows on the likelihood of currency crises, which is through the effects of inflows in causing deteriorating economic fundamentals of the recipient country. The second is the direct effect. If a rapid and large increase in capital inflows is not warranted by the economic fundamentals, then inflows may eventually have to adjust downward.

2.1. Do surges have any effect on the probability of a sudden stop?

Under a flexible exchange rate system, large capital inflows may cause both the nominal and the real exchange rate to appreciate. Under a fixed exchange rate system, central banks will intervene in the foreign exchange market to prevent the domestic currency from appreciating. This means an increased supply of domestic currency and accumulation of international reserves by the central bank. Unless sterilized, this type of intervention will push the domestic prices up, and cause the real exchange rate to appreciate. While, under both exchange rate regimes, large capital inflows cause real exchange rate appreciation whether through prices or the nominal exchange rate, under the fixed exchange rate regimes the economy becomes particularly vulnerable to currency crisis. Real exchange rate appreciation increases the probability of an exchange rate adjustment, which may in turn trigger a speculative attack on the currency. In addition,

real exchange rate appreciation worsens the competitiveness of the export sector.[1] Loss of competitiveness would lead to a sizeable widening of the current account deficit and increase in the likelihood of a default on external debt.

Large capital inflows may also cause rapid expansion of domestic credit. Banks, by borrowing at shorter maturities abroad and by financing long-term projects domestically, increase the liquidity risks in the financial sector. Credit expansion may also increase the share of non-performing loans and therefore put the financial system in a vulnerable situation. The abundance and ease of obtaining credit will attract all types of investment projects including highly risky ones (adverse selection).

Finally, large capital inflows may have effects on the budget balance and national debt as well. One hypothesis is that large capital inflows make it easier for sovereign governments to borrow from abroad and therefore finance budget deficits (Kaminsky, Reinhart and Vegh, 2003). Without any credit constraints, high capital mobility basically creates incentives for politicians to engage in expansionary fiscal policies. Another problem arises if the central bank sterilizes these inflows by selling treasury bills. Since the interest rates are higher domestically, the central bank sells high-yielding treasury bills and accumulates low-yielding international reserves. Since sterilization maintains the interest rates at their high levels, continuation of the intervention by the central bank means accumulating national debt and an increase in budget deficits due to the interest costs (Calvo, Leiderman and Reinhart, 1996).

The direct effect of surges on the probability of sudden stops is based on the likely instability of surges if they exceed levels justified by economic fundamentals. While it is extremely difficult to determine the "justified levels," one can assess a

[1] See Edwards (1998) for empirical evidence.

probability whether the level of capital inflows are moving away or moving to justified levels. For example, if the current account deficit is widening and the surge in capital inflows is continuing, then it is likely that the inflows are not justified. In this case, the probability of a slow down or a reversal will increase as well.[2] The important issue is whether this adjustment would be smooth or sudden.

In a world with perfect information, a large increase in capital inflows could be caused by unexpected favorable news about the emerging markets' economic prospects. This would increase the expected returns and decrease the perceived riskiness of investment, which in turn would cause foreign investors to increase their portfolio shares towards these countries. This is a stock adjustment process and may require large flow adjustments in the short-run causing the surges in capital inflows (Bacchetta and Vincoop, 1998; Edwards, 1998). One circumstance that would turn these inflows into a sudden stop is unexpected news that would change portfolio allocation decisions in the opposite direction. Otherwise a gradual adjustment towards the justified levels is expected in the long run.

If the assumption of perfect information is relaxed, then surges may be associated with a 'bubble' like behavior for capital inflows. Informational problems may be a major source of instability (Calvo and Mendoza, 2000; Bacchetta and Vincoop, 1998). If investors do not have full information about the risk and returns in emerging markets, they will use imperfect decision rules, which lead them to over or under investment in the emerging market asset. Once the true information is revealed, a fast reaction may cause the sudden stop and reversal of flows.

[2] It is worth noting that our analysis excludes the US and other developed nations.

In addition, surges in bank lending can be explained by moral hazard, the expectation that the international governments will bail out the foreign investors in the event of a crisis (Krugman, 1998; Corsetti, Pesenti and Roubini, 1998). Surges may also be due to psychological biases in perceptions of risk and decision-making, short-time horizon, or herding behavior.[3] These types of behavioral explanations imply that capital inflows can be very unstable; international investors do not adequately foresee problems, and they overreact once the problems occur.[4]

All of these arguments imply that foreign investors' portfolio decisions are not purely based on economic fundamentals or may be influenced by informational problems and psychology. It is evident that international investors neither always behave according to the farsighted rational expectations view, nor only generate unwarranted reversals of investment. The existing explanations of the surges in capital inflows are sufficient to justify an empirical study of their effect on the probability of large reversals or sudden stops. The first and the central hypothesis that will be investigated in this study is:

Hypothesis 1: A surge in capital inflows directly and indirectly increases the probability of a sudden stop.

The first hypothesis is simple and restrictive. A surge in capital inflows may increase the probability of a sudden stop, but what are the other factors that would make a surge more likely to turn into a sudden stop?

[3] For biases in risk perception see Guttentag and Herring (1984). For a survey on herding behavior see Bikhchandani (2000).
[4] See Griffith-Jones (2001) and Willett (2000) for discussions of different forms of such hypotheses.

2.2. Do weak economic fundamentals make surges more reversal prone?

Besides the effects of high capital inflows on economic fundamentals, their coexistence with weak economic fundamentals may increase the probability of a sudden stop. During periods of high and persistent capital inflows, worsening economic fundamentals will increase the gap between the justified levels and the actual levels of these capital inflows. As a result, both the size of the capital flow bubble and the probability of it bursting will increase. For example, the large capital inflows to Mexico at the end of the 1980s were seen as natural and justified by the stabilization programs and structural reforms. However, towards the end of 1993, only months before the crisis, the economic fundamentals that brought these high inflows were no longer favorable. Mexico had a large current account deficit, and a big external debt, yet the levels of capital inflows remained high.

Any factor that would cause investors to re-evaluate their investment strategies will also increase the likelihood of the bubble bursting. This may lead to an abrupt change rather than a smooth adjustment in portfolio allocations. For instance, a large current account deficit may not be perceived as dangerous until another emerging market with a similar current account deficit gets hit.[5] The spread of currency crisis from one country to another, i.e., contagion, is more likely to occur when countries witness surges in capital inflows just before the crisis (Kaminsky, Reinhart and Vegh, 2003).

Another reason why weak economic fundamentals and high capital inflows can be a dangerous cocktail is due to the possible existence of multiple equilibria. According to the second generation crisis models, countries that have neither good nor bad economic fundamentals could be prone to speculative attacks if they are in a vulnerable zone, where

[5] This is also known as the "wake-up call hypothesis."

a potential attack on the currency has the power to cause crisis (Obstfeld, 1995). Likewise, a combination of high current account deficits and high capital inflows can push the country into a vulnerable zone of this kind (Calvo, 2000). If investors suddenly decide not to finance the deficit, this would create severe adjustments to the current account, and a very high possibility for default on external debt. A current account mainly financed by capital inflows would cause a higher probability of crisis and since the investors would recognize this, it leads to the possibility of multiple equilibriums and may cause a self-fulfilling crisis. If economic fundamentals are sound, then capital inflows, even if not justified, would be more likely to adjust down smoothly, and if the economic fundamentals are bad, the attack is inevitable anyway. Therefore, the second hypothesis is:

Hypothesis 2: A surge accompanied by deteriorating economic fundamentals is more likely to turn into a sudden stop.

2.3. Does the composition of capital inflows during the surge matter?

Some types of capital flows may have a larger potential for sharp reversals than others. The recent crisis episodes in Mexico, Asia, Russia and Turkey show that portfolio flows and private loans have larger reversals and FDI is very stable during crises (Table 1). This may also imply that not every surge in capital inflows is the same; composition of capital inflows may play a crucial role. The reversibility, how much the capital flows out during a crisis or because of a shock, is an important determinant of the probability of a sudden stop. The emerging markets during the 1990s were primarily subject to three

major types of private capital inflows: Foreign Direct Investment (FDI), portfolio flows and private loans.

Foreign direct investment is widely considered to be the most stable form of capital flows, both during normal times and crisis periods. It mainly consists of fixed assets, highly illiquid, and very difficult to sell during crises. FDI is also typically influenced more by long-term profitability expectations related to a country's economic fundamentals, rather than short-run speculative forces. Stability of FDI is a stylized fact; nevertheless, this may be misleading. Several studies emphasized that FDI may cause instability by allowing other types of flows to mask themselves (Sarno and Taylor, 1997; Bird and Rajan, 2002). Other types of flows may enter the country under the title of FDI and leave under another title. FDI may be stable during crises but surges of FDI may still have an effect on the probability of crisis. We propose the following testable hypothesis to clarify these issues:

Hypothesis 3: Larger inflows of FDI do not increase the likelihood of a sudden stop.

The second component of private capital, portfolio flows, is expected to be more volatile than FDI. Portfolio investors can sell their stocks or bonds more easily, quickly and with smaller losses than FDI. The third component, private loans, is mainly constituted by bank loans. Despite the illiquid nature of bank loans, banks may have higher incentives to pull out in order to cut their losses during a crisis (Bailey et al., 2000; Willett et al., 2004; Williamson, 2001). Since the prices of loans do not adjust automatically, banks adjust the quantity of lending instead. Both the portfolio flows and private loans have had high reversals during the recent currency crises in emerging

markets (Table 1); therefore, our fourth and final hypothesis to test is:

Hypothesis 4: Larger inflows of portfolio flows and private loans increase the likelihood of a sudden stop.

3. Previous Studies

Sachs, Tornell and Velasco (1996) investigate all of the hypotheses that were laid out in the previous section in the context of currency crises.[6] They find evidence against the first, second and the fourth hypothesis. The average ratios of capital inflows to GDP and the percentage change in this variable do not help explain why some countries experienced greater crises than others in the aftermath of the Mexican crisis in 1994. Sachs et al. argue that any explanatory power the capital inflow variable does have is through its effect on the real exchange rate and credit to private sector; therefore the effect of high capital inflows is an indirect one. They apply the same measures to short-term capital inflows and find only weak evidence that short-term inflows have an effect on crises.[7] They conclude that the composition of capital inflows is not an important factor. The authors also partially test the second hypothesis. They look whether current account deficits cause currency crises during the period of inflows, and find that the effects are not significant. Their study focuses on the Mexican crisis and therefore misses out on the major crises in Asia and other emerging markets in the second half of the 1990s.

While there are no other studies that directly test for the effect of a surge in capital flows on crisis, one group of studies uses variables that partially capture this effect. For

[6] They investigate these issues in a small section of the paper.
[7] Their short-term flows include portfolio flows and other short-term investments.

example, Radelet and Sachs (1998) find a significant relationship between the ratio of previous capital inflows to GDP and the probability of a capital flow reversal in Asia. Studies that use previous FDI to GDP ratios as explanatory variables find either a negative or an insignificant effect, supporting the third hypothesis (Frankel and Rose, 1996; Aziz, Caramazza and Salgado, 2000; Kamin, Shindler, and Samuel, 2001; Kumar, Moorthy and Perraudin, 2002; Osband and Van Rijckeghem, 1998; Cavallo and Frankel, 2004; Calvo, Izquierdo and Meija, 2004). Regarding the fourth hypothesis, Kumar et al. (2002) find that portfolio flows increase the probability of a sudden stop, but Aziz et al. (2000) show that short-term capital flows played a very small role.

Most of the other empirical crisis models include a measure for short-term foreign debt, which could be interpreted as an imperfect proxy for surges in short-term capital flows, since it might represent capital inflow accumulation. These studies generally support the fourth hypothesis that short-term debt increases the probability of a sudden stop.[8]

Another group of studies focus on the volatility and persistence of different types of capital flows and therefore indirectly test the third and fourth hypothesis. If a certain type of flow exhibits high volatility and less persistence then it is considered "hot" and has a higher potential to flow out with the first sign of trouble. This conclusion naturally leads to the assumption that high inflows of the "hot money" flow would increase the probability of a sudden stop.

Recent empirical studies on these issues find conflicting results. For example, Claessens et al. (1995) find that foreign direct investment is as volatile as the other types of flow. The same study finds no distinction between long-term and short-term flows.

[8] See Kaminsky et al. (1998) and Abiad (2003) for a detailed survey.

However, Chuhan et al. (1996) reach the opposite conclusion. Sarno and Taylor (1997) find portfolio flows to be the most volatile type of capital. Yet, the largest outflows during the Asian crisis were in bank loans (Willett et al., 2004). Gabriele et al. (2000) conclude that all types of capital flows including the foreign direct investment contributed to the instability during the 1990s. The common drawback in these studies is the limited time periods over which capital flow volatility has been studied. Most of the previous studies focus on time periods dominated by inflows and they leave out the recent major currency crises in emerging economies.[9]

4. Empirical Methodology

Research on sudden stops is fairly new. The concept is also called "capital account reversal" and has been used as a way to identify financial crisis (Radelet and Sachs, 1998; Rodrik and Velasco, 1999). With the increased occurrence of this type of crises in the second half of 1990s, the phrase "sudden stop" typically replaced this term (Calvo, 1998). Usually sudden stops are defined as large and abrupt falls in capital inflows (Calvo et al., 2004; Edwards, 2005), or the simultaneous occurrence of currency crises and capital account reversals (Calvo, 1998; Hutchison and Noy, 2002).

The studies up to now have not adopted a common statistical identification method. In this study, we follow Radelet and Sachs (1998) and Rodrik and Velasco (1999) and construct a sudden stop dummy variable ($Stop_t$) that takes the value of 1 if:

$$\frac{K_{t-1} - K_t}{GDP_{t-1}} > \tau \quad \text{and} \quad K_{t-1} > 0 \tag{1}$$

[9] Only Gabriele et al. (2000) includes Asian crises in their sample.

where t is the year, K is total capital flows excluding foreign direct investment and τ is an arbitrary threshold.

The first condition is to identify large falls in capital inflows.[10] The second condition prevents picking observations preceded by net capital outflows. Furthermore, the year following a sudden stop episode is dropped from the sample. The key feature that differentiates our measure from the previous ones is the exclusion of FDI in the definition of capital flows. Because FDI flows are usually very stable during crises, excluding these flows from the total capital flows should give a more precise measure of sudden stops (Table 1). Later on, this will also aid us in interpreting the effects of FDI on the probability of sudden stops in other types of capital flows.

In order to build an indicator for surges in capital flows we constructed a similar dummy variable. A surge is a large and abrupt increase in capital inflows. The surge dummy takes the value of one if the behavior of capital flows meets all of the following criteria in a given year:

$$\frac{K_{t-k} - K_t}{GDP_{t-k}} < -\eta \quad ; \quad \frac{K_t}{GDP_t} > \mu \quad \text{and} \quad \text{Stop}_t = 0 \qquad (2)$$

where K is total capital flows.

The first criterion identifies abrupt and large increases in capital inflows over a k-year period. The rationale for not using a single year lag is that the capital inflows may increase suddenly in one year and continue to be very high for consecutive years without

[10] Measurement also varies across different studies. When capital flows data are monthly or quarterly, studies identify the sudden stop by comparing the observations with the country specific mean. When only annual data is available, usually arbitrary thresholds are used to decide whether the fall in capital inflows are large enough to be defined as a sudden stop.

another abrupt increase. In such a case, if the surge is defined as a one-year difference in capital inflows, the measure will only detect the beginning of the surge but will miss the end. The second criterion ensures that the size of inflows is large enough relative to GDP. This condition allows us to filter episodes of sudden increases from large outflows to small inflows. Finally, we set the surge dummy to one if we identify a sudden stop episode in the same year. This is possible if there are large inflows of FDI and large outflows of other types of capital in the same year.

We search for surge and sudden stop episodes in 38 emerging market economies for the period between 1989 and 2003.[11] The main results presented are based on four percent thresholds for both the sudden stop and the surge dummy ($\tau = \eta = \mu = 0.04$) but, our regression analysis results are not sensitive to the numerical values used for the sudden stop and surge indicators.[12]

To detect surges we looked at three-year changes in capital inflows (k=3). Table 2 presents frequencies of surges and sudden stops based on these criteria. Out of 44 sudden stop episodes, 27 of them are preceded by a surge in capital inflows (61 percent). Out of 83 surge episodes, 27 of them ended up with a sudden stop (33 percent). If the consecutive surge episodes are taken as one extended surge, then there are a total of 49 such episodes, 27 of them ending up with a sudden stop (55 percent).

Figure 1 spots both the surge and sudden stop episodes for all of the emerging markets in our sample. A casual inspection of these figures shows the close relationship

[11] Countries are included if they are contained in the Emerging Markets Bond Index (EMBI+) or the Morgan Stanley Country Index (MSCI) following Fischer (2001). In addition Bangladesh, Botswana, Croatia, Hong Kong, Romania, Syria, Uruguay and Zimbabwe are added to the sample due to their large capital inflows during the 1990s.

[12] We have checked to see if the coefficient of the surge dummy in the regressions is sensitive to different sizes of the thresholds (three, four or five percent), different number of year changes (one to five), and inclusion of the FDI flows in sudden stop dummy indicator. Out of 270 possible combinations of criteria, none of them result with an insignificant or an opposite-sign coefficient.

with surges and sudden stops. However, it is also evident that some of the surge and sudden stop episodes are not identified by our measures. Instead of relying on qualitative judgment to include the left out surge or sudden stop episodes, we choose to strictly follow the arbitrary rules.

We use a probit model to test the four hypotheses discussed in section II.[13] The dependent variable is the sudden stop dummy and the key independent variable is the surge dummy. We assume that any factor that would increase the probability of a currency crisis would also increase the probability of a sudden stop. To control for the other possible causes of sudden stops and include measures for economic fundamentals, we follow the related literature on determinants of currency crises and included a set of control variables. These variables are: current account balance/GDP ratio, real exchange rate appreciation (a positive value represents real exchange rate appreciation), budget balance/GDP ratio, domestic credit growth (relative to GDP) and short-term debt/reserves ratio.[14] These are also considered to be the potential channels of the indirect effects of surges. Therefore, controlling for them enables us to measure the direct effect of surges on sudden stops. In addition, the non-linear nature of the probit estimation makes it possible to observe the effects of a surge at different levels of these control variables.

Variables to test the effect of the composition of capital flows are also added to the regressions. We test the effects of two types of capital flow: foreign direct investment (FDI) and hot money flows (HOT) that are the sum of portfolio flows and private loans. These measures are the size of the type of capital flow (FDI or HOT) relative to GDP.

[13] Relatively small number of sudden stops in the sample for each individual country precluded the use of fixed effect models in which the constants vary across countries. Yet, standard errors are robust and clustered (on country).
[14] See Appendix A for a description of the dataset.

5. Empirical Results

Table 3 presents results for a benchmark model without the surge dummy. We run the sudden stop indicator on five control variables. Both current account deficits and real exchange rate appreciation significantly increase the probability of a sudden stop. There is a fall in the current account balance coefficient with the inclusion of real exchange rate appreciation. This is expected since high deficits are a reflection of real exchange rate appreciation and these two variables are highly correlated.

The other variables do not have statistically significant effects. Coefficient for credit growth has the expected sign (except in the third regression credit growth has a negative effect). Budget deficit; on the other hand seem to decrease the probability of a sudden stop. Previous studies also failed to mark budget deficits as robust predictors of currency crises.[15] [16] These results are used as a base to evaluate the contribution of surges on the probability of a sudden stop. Since there is no control for capital inflows in these regressions, the implicit assumption is that the effects of surges are reflected on the other variables' coefficients.

5.1 Surges Increase the Probability of a Sudden Stop

Table 4 provides support for hypothesis 1: surges directly and indirectly increase the probability of a sudden stop. The surge dummy has a positive sign and is highly significant. Furthermore, these results withstand the inclusion of the control variables.

[15] Case studies, on the other hand, show that budget deficits were important warning signs for the Brazilian (1999), Argentinean (2002) and Turkish (1994) currency crises.
[16] Calvo et al. (2004) also find a insignificant positive sign coefficient for the budget balance variable using a similar probit model.

We observe two interesting changes in the coefficients of the control variables. First is the overall decrease in the effect of current account deficits on the probability of sudden stops. It seems likely that the high coefficient of this variable in the benchmark model was due in part to the hidden effects of surges in capital inflows. Once we control for this, the effect weakens in magnitude. The second change is the sign reversal of the budget balance coefficient. While it is still insignificant, the peculiar effect in the benchmark model turns around and now a larger budget deficit increases the probability of a sudden stop. The other control variables' effects are similar to their effects in the benchmark model. These results suggest that the primary indirect effect of surges in capital inflows is generally reflected in current account balance, and direct effect is stronger that the indirect ones.

5.2 Weak Economic Fundamentals Make Surges more Reversal Prone

Figures 2 and 3 provide support for hypothesis 2: surges accompanied by weak economic fundamentals increase the probability of a sudden stop. To evaluate the effects of surges on the sudden stop probabilities, the marginal effects of the surge variable are computed for different levels of the control variables.

Figure 2 depicts the probability of a sudden stop for different levels of the current account balance variable and the surge dummy. The real exchange rate appreciation variable is evaluated at its mean. The marginal effect of the surge dummy (which is the difference between the probability of a sudden stop with and without a surge) is also included in the graph. The probability of a sudden stop with a current account deficit of five percent is around five percent, but if the deficit is accompanied by a surge in capital

inflows then the probability rises to 26 percent. At the other extreme, if there is a five percent current account surplus, the probability of a sudden stop is close to zero and an accompanying surge increases this probability only to seven percent. Figure 3 shows these relationships for the real exchange rate appreciation variable. The results are similar.

We reach to two conclusions from these results. First the current account deficit and the real exchange rate appreciation by themselves are not good predictors for sudden stops; in fact, it can be argued that the previous prediction success of these variables in the other studies could be due to at least in part to their reflection of surges in capital inflows. Second, the weaker the economic fundamentals of the emerging markets, the stronger the effect of surges on the probability of sudden stops. If the current account deficit is high or the real exchange rate is appreciated, then the country is in the vulnerable zone and it is likely just a matter of time before the surge will reverse.

5.3 Composition of Capital Inflows during the Surge Matters

Next, the role of the components of capital inflows is investigated. Tables 5 and 6 present evidence for Hypotheses 3 and 4: the composition of capital flows matters. Larger inflows of FDI do not have a significant impact on the probability of a sudden stop and larger inflows of private loans and portfolio flows do increase the probability.

In Table 5, two additional variables are added to the model. The coefficient for the FDI/GDP ratio has a negative sign, but is insignificant. On the other hand the HOT/GDP ratio has a significant positive coefficient.

Table 6 introduces interaction variables. Since we focus on surges of different types of capital flows, we included two interaction variables that capture the joint effect of a surge and the magnitude of a certain capital flow type. In a non-linear model, the interpretation of the coefficient of the interaction term is not clear (Ai and Norton 2003). Given that one of the interaction terms is a binary variable, the size of the coefficients of HOT/GDP and FDI/GDP ratios should be evaluated and compared at two possible states of the surge dummy. Consider the following probit equation:

$$prob[Stop_t = 1] = \Phi[\beta_0 + \beta_1 Surge_{t-1} + \beta_2 FDI_{t-1} + \beta_3 HOT_{t-1} + \beta_4 (Surge_{t-1} \cdot FDI_{t-1}) + \beta_5 (Surge_{t-1} \cdot HOT_{t-1}) + \beta_6 X_{t-1}] \quad (3)$$

When the surge dummy takes the value of zero, the coefficients, β_2 and β_3 represent the effect of FDI/GDP and HOT/GDP ratios, respectively. Results presented in Table 6 indicate that both of these coefficients are significant. When there is no surge, high levels of FDI decrease the probability of a sudden stop, and high levels of hot money flows increase the probability of a sudden stop.

If the surge dummy takes the value of one, then the sum of β_2 and β_4 will be the effect of FDI/GDP ratio, and the sum of β_3 and β_5 will be the effect of HOT/GDP ratio. Both of these sums are positive. In the bottom panel of Table 6, we present the test results and p-values. HOT/GDP ratio has a significant effect on the probability of sudden stops yet we cannot the reject the hypothesis that FDI/GDP ratio's effect is zero during surges. In Tables 5 and Table 6, we also see that the results withstand the inclusion of other control variables.

One hypothesis about FDI is that flows may enter as FDI but may leave under the title of other flows (Sarno and Taylor, 1997, World Bank, 2000, Bird and Rajan, 2002).

While we don't test particularly for this hypothesis, results in Table 5 and Table 6 suggest that this is not a relevant contributor of sudden stops. By our statistical definition, the sudden stop dummy measures the sudden stops in total capital flows excluding FDI. The insignificant coefficient of the FDI/GDP variable indicates that FDI is not causing sudden stops in other flows; it is not leaving the emerging market disguised as other flows, or even if it does, the magnitude is not dramatic.

6. Conclusion

This paper investigates the effects of surges in capital inflows on the likelihood of their sudden stops. We find that surges in capital inflows have both indirect and direct effects on the probability of a sudden stop. Our results indicate that the direct effects are stronger than the indirect effects. In addition, a surge accompanied by weak economic fundamentals, such as a high current account deficit or an appreciated real exchange rate, is more likely to cause a sudden stop. Finally, a surge that is dominated by private loans and portfolio flows is more likely to cause a sudden stop. FDI is more stable and it does not cause other flows to suddenly stop during a crisis.

These results strongly suggest that surges of capital inflows should be included in empirical crises models as primary explanatory variables and they should be taken as important warning signals by policy officials and financial market participants alike. The best strategies for dealing with such surges both to make them less likely and to reduce vulnerability to their occurrence will likely depend on developing a better understanding of the causes of these surges. While many ideas have been presented that may help

explain such behavior, there is little consensus as yet about their relative importance. This is clearly an important topic for research.

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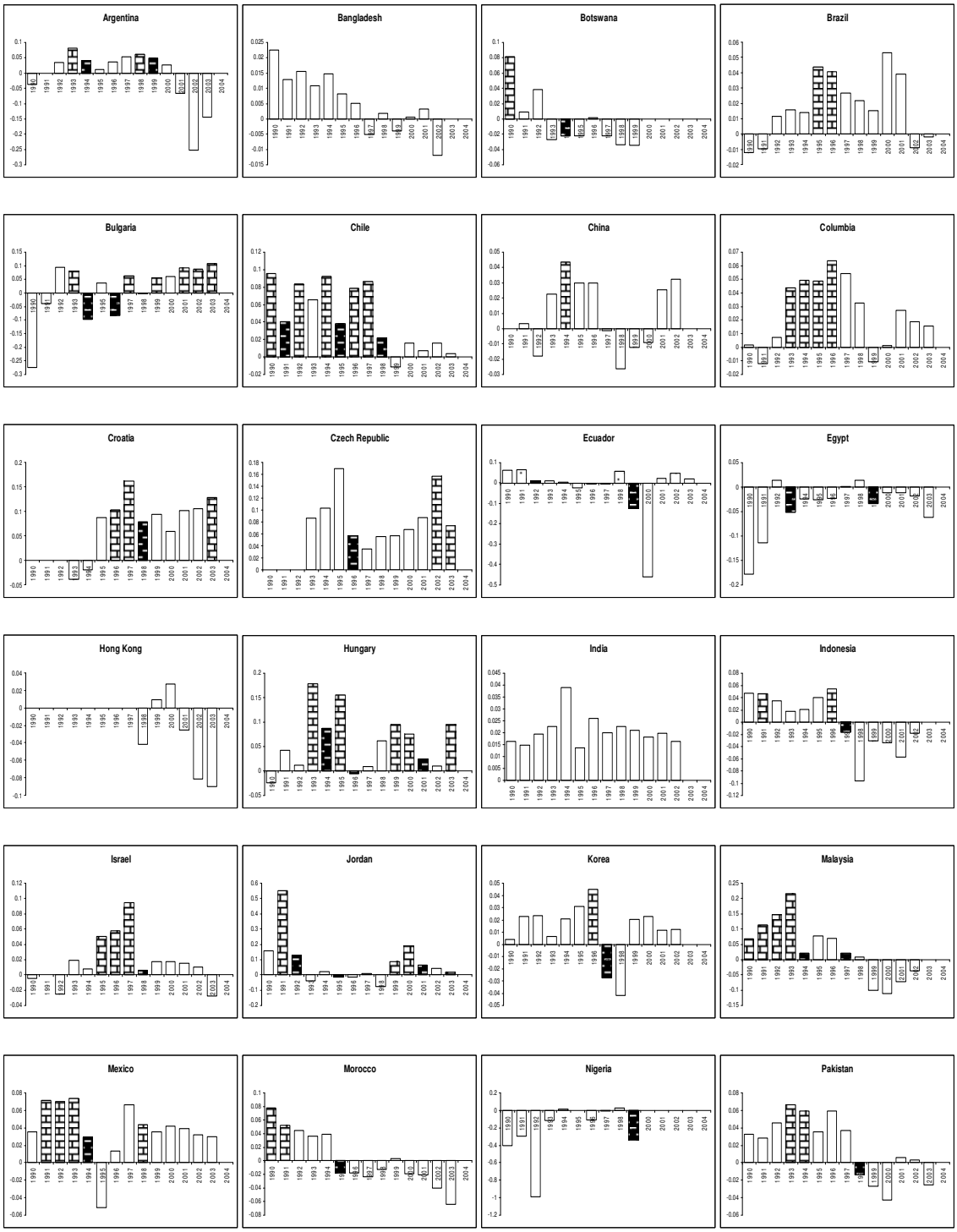
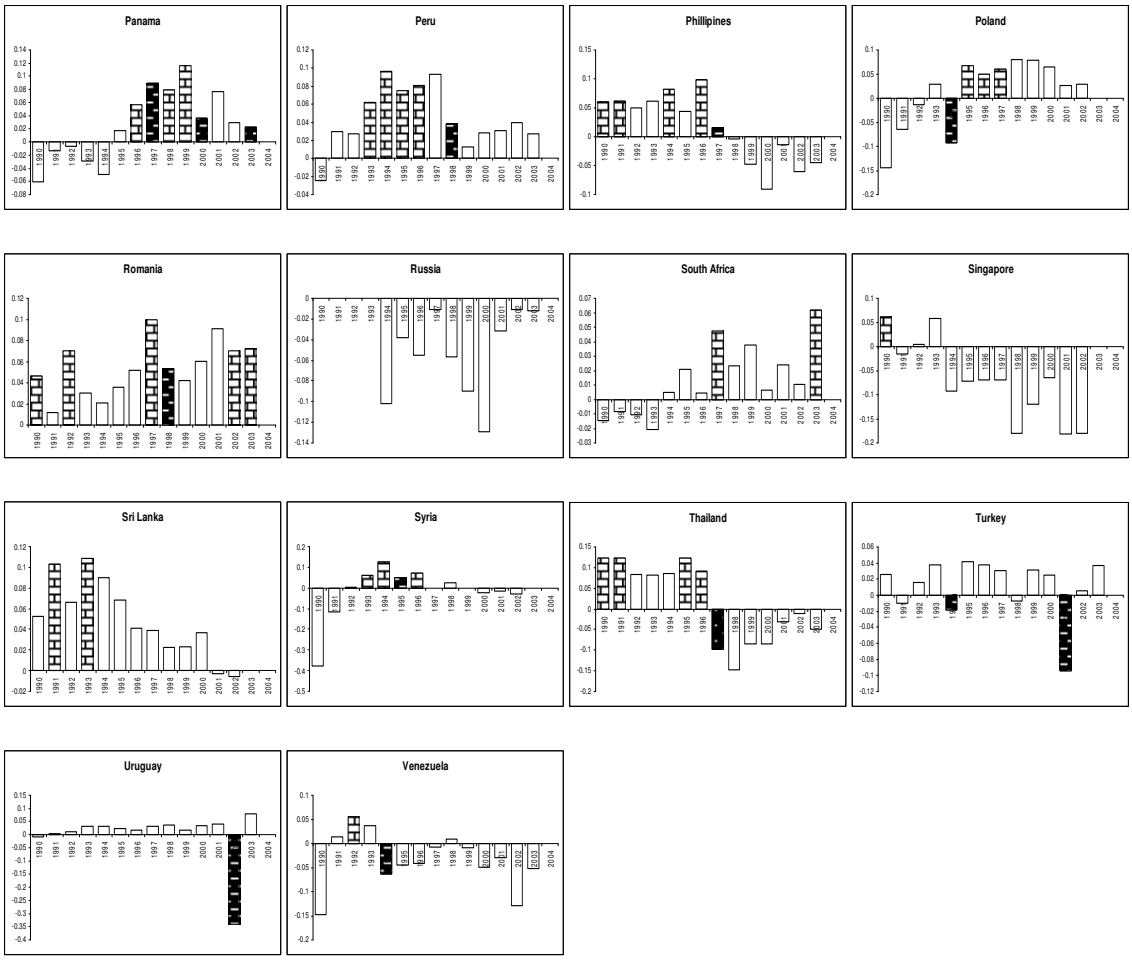
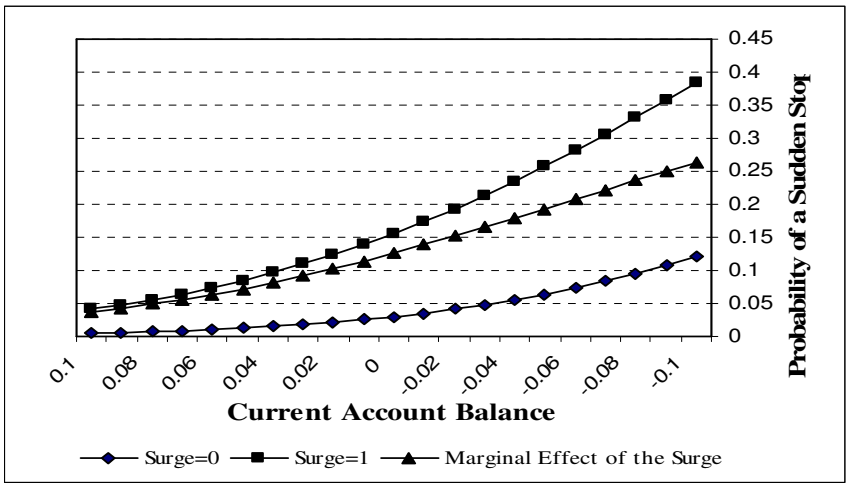
Figure 1: Total Capital Flows, Surges and Sudden Stops





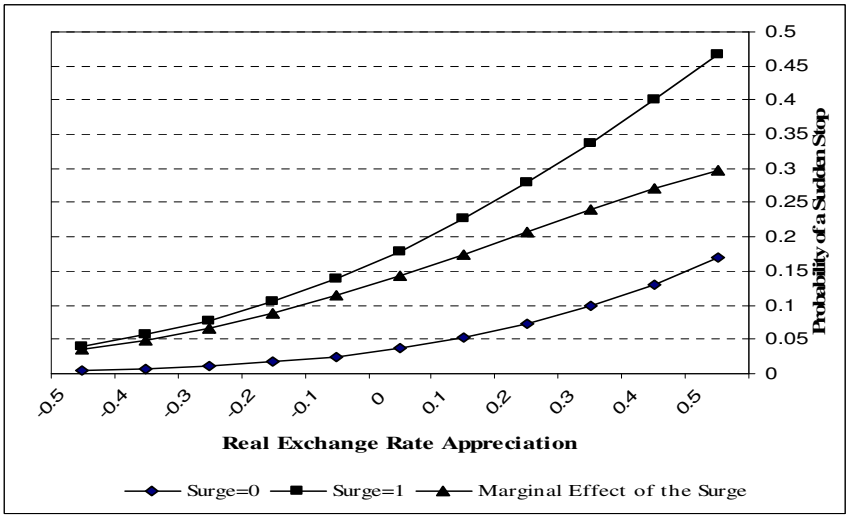
Notes: White bars indicate total capital flows as a percentage of GDP, white brick bars indicate surges and black brick bars indicate sudden stop episodes.

Figure 2: Predicted Probabilities of Sudden Stops and the Current Account Balance



Note: The figure is based on Regression 8 in the Table 4.

Figure 3: Predicted Probabilities of Sudden Stops and the Real Exchange Rate Appreciation



Note: The figure is based on Regression 8 in the Table 4.

Figure Captions

Figure 1. Presents total capital flows, surges and sudden stops. White bars indicate total capital flows divided by GDP, white brick bars indicate surges and black brick bars indicate sudden stop episodes.

Figure 2. Illustrates the predicted probabilities of sudden stops and the marginal effect of surges on the probability of sudden stops at different values of current account balance. The figure is based on Regression 8 in the Table 4.

Figure 3. Illustrates the predicted probabilities of sudden stops and the marginal effect of surges on the probability of sudden stops at different values of current account balance. The figure is based on Regression 8 in the Table 4.

Table 1: Capital Flow Reversals during Crises as Percentage of GDP

	Total Flows	FDI	Private Loans	Portfolio
Asian Crises (5 Country's Average)	8.2%	0%	6.4%	1.7%
Indonesia 97	5.1	0.7	1.4	3.4
Korea 97	5.9	-0.1	6.9	0.1
Malaysia 97	7.2	-0.1	7.5	0
Philippines 97	5.7	0.4	0.1	5.6
Thailand 97	17	-0.8	16.2	-0.5
Mexico 94	4.3	-1.6	0.6	5
Russia 98	2.8	0.4	0.4	2.2
Turkey 94	7.3	0	5.6	1.5
Turkey 01	9.8	-1	8.1	2.3

* Reversal measure is the ratio of difference of crisis year net capital inflows and previous year net capital inflow divided by the previous year's GDP. A negative value represents an increase in inflows during crises.
** An exchange market pressure index is used to identify the crisis years.

Table 2: Frequencies of Surges and Sudden Stops

	No Surge	Surge	Total
No Sudden Stop	343	56	399
Sudden Stop	17	27	44
Total	360	83	443

Table 3: Determinants of Sudden Stops – Without the Surge Dummy

	(1)	(2)	(3)	(4)	(5)
Current Account /GDP	-8.88***	-13.02***	-12.64***	-12.38***	-11.89***
	(2.22)	(3.15)	(3.22)	(3.24)	(3.6)
Real Exchange Rate Appreciation		1.53***	1.77***	1.63***	1.46**
		(0.49)	(0.57)	(0.62)	(0.6)
Credit Growth			-0.04	0.22	0.19
			(0.08)	(0.24)	(0.27)
Budget Balance / GDP				2.91	1.58
				(2.38)	(2.14)
Short-term Debt / Reserves					-0.11
					(0.11)
Constant	-1.46***	-1.73***	-1.72***	-1.67***	-1.56***
	(0.12)	(0.14)	(0.14)	(0.14)	(0.2)
# of Observations	455	376	344	300	255
Log-Likelihood	-134.2	-96.8	-87.9	-81.4	-75.0
Pseudo R^2	0.09	0.17	0.17	0.17	0.15

Robust and clustered (on country) standard errors are in parenthesis. All independent variables are lagged one year unless specified otherwise.
* Significant at 10%; ** significant at 5%; ***significant at 1%

Table 4: Determinants of Sudden Stops - With the Surge Dummy

	(6)	(7)	(8)	(9)	(10)	(11)
Surge Dummy	1.22***	1.02***	0.84***	0.83***	0.97***	0.87***
	(0.18)	(0.19)	(0.24)	(0.24)	(0.29)	(0.3)
Current Account /GDP		-4.87**	-9.13***	-8.49***	-7.16**	-7.21**
		(1.99)	(2.89)	(2.78)	(3.08)	(3.43)
Real Exchange Rate Appreciation			1.70***	1.88***	1.81***	1.67***
			(0.53)	(0.58)	(0.66)	(0.63)
Credit Growth				-0.02	0.25	0.23
				(0.08)	(0.25)	(0.27)
Budget Balance / GDP					-1.25	-1.74
					(1.98)	(1.78)
Short-term Debt / Reserves						-0.08
						(0.11)
Constant	-1.67***	-1.70***	-1.94***	-1.92***	-1.99***	-1.86***
	(0.11)	(0.12)	(0.15)	(0.14)	(0.16)	(0.19)
# of Observations	443	443	369	341	300	255
Log-Likelihood	-120.8	-117.9	-87.0	-81.5	-74.5	-69.9
Pseudo R^2	0.16	0.18	0.23	0.23	0.24	0.21

Robust and clustered (on country) standard errors are in parenthesis. All independent variables are lagged one year unless specified otherwise.
* Significant at 10%; ** significant at 5%; ***significant at 1%

Table 5: Determinants of Sudden Stops – Components of Capital Inflows Included

	(12)	(13)	(14)	(15)	(16)	(17)
Surge Dummy	0.82***	0.70***	0.66***	0.63**	0.77**	0.69**
	(0.23)	(0.21)	(0.25)	(0.26)	(0.31)	(0.32)
Current Account /GDP		-3.87	-6.69**	-5.80*	-5.26	-5.88
		(2.88)	(3.23)	(3.33)	(3.76)	(4.13)
Real Exchange Rate Appreciation			1.74**	1.97***	2.23***	2.01**
			(0.73)	(0.76)	(0.81)	(0.79)
Credit Growth				0.23	0.22	0.21
				(0.28)	(0.29)	(0.29)
Budget Balance / GDP					-2.25	-3.12*
					(2.22)	(1.94)
Short-term Debt / Reserves						-0.12
						(0.16)
FDI / GDP	0.15	-0.51	-4.01	-3.77	-4.21	-5.01
	(2.87)	(3.22)	(4.44)	(4.54)	(4.56)	(5.15)
HOT / GDP	8.38***	8.50***	8.45***	8.37***	9.23***	8.68***
	(3.)	(2.56)	(2.57)	(2.47)	(2.36)	(2.36)
Constant	-1.77***	-1.81***	-1.92***	-1.94***	-2.07***	-1.89***
	(0.16)	(0.18)	(0.19)	(0.18)	(0.18)	(0.25)
# of Observations	398	398	349	326	293	248
Log-Likelihood	-95.3	-94.0	-78.7	-73.2	-67.5	-63.3
Pseudo R^2	0.21	0.22	0.26	0.27	0.29	0.26

Robust and clustered (on country) standard errors are in parenthesis. All independent variables are lagged one year unless specified otherwise.
* Significant at 10%; ** significant at 5%; ***significant at 1%

Table 6: Determinants of Sudden Stops – Components of the Surge Included

		(18)	(19)	(20)	(21)	(22)	(23)
B_1	*Surge Dummy*	0.02	-0.09	-0.06	-0.25	0.00	-0.26
		(0.42)	(0.44)	(0.48)	(0.52)	(0.54)	(0.57)
B_2	*FDI / GDP*	-7.25	-9.90	-14.50*	-15.20*	-15.09	-17.43*
		(5.52)	(6.39)	(8.96)	(8.67)	(9.93)	(10.46)
B_3	*HOT / GDP*	6.67**	7.35***	7.92***	7.27***	8.76***	8.39***
		(2.79)	(2.27)	(2.58)	(2.39)	(1.99)	(2.11)
B_4	*FDI/GDP x Surge*	14.88*	17.40**	18.17*	19.92**	19.14*	23.36**
		(7.99)	(8.57)	(10.34)	(10.16)	(11.58)	(11.74)
B_5	*HOT/GDP x Surge*	9.00*	7.02	4.74	6.76	5.62	5.88
		(5.54)	(5.2)	(5.7)	(5.79)	(5.59)	(5.7)
B_6	*Current Account /GDP*		-4.16	-7.41**	-6.47*	-5.76	-6.06
			(3.05)	(3.73)	(3.74)	(4.12)	(4.81)
B_7	*Real Exchange Rate Appreciation*			1.83**	2.17***	2.37***	2.20***
				(0.73)	(0.75)	(0.79)	(0.79)
B_8	*Credit Growth*				0.24	0.28	0.29*
					(0.27)	(0.28)	(0.28)
B_9	*Budget Balance / GDP*					-4.01	-4.85*
						(2.97)	(2.92)
B_{10}	*Short-term Debt / Reserves*						-0.07
							(0.1)
B_0	*Constant*	-1.61***	-1.63***	-1.74***	-1.72***	-1.92***	-1.75***
		(0.17)	(0.18)	(0.19)	(0.19)	(0.16)	(0.21)
	# of Observations	398	398	349	326	293	248
	Log-Likelihood	-92.7	-91.5	-76.8	-70.9	-65.5	-60.8
	Pseudo R^2	0.23	0.24	0.28	0.29	0.31	0.29
	Null Hypothesis				**P-Values**		
	Ho: $B_2+B_4=0$	0.10	0.11	0.48	0.37	0.45	0.33
	Ho: $B_3+B_5=0$	0.00	0.01	0.02	0.01	0.01	0.01

Robust and clustered (on country) standard errors are in parenthesis. All independent variables are lagged one year unless specified otherwise.
* Significant at 10%; ** significant at 5%; ***significant at 1%

Appendix A: Data Sources

Sources: *International Financial Statistics (IFS),* International Monetary Fund; *World Development Indicators (WDI),* The World Bank; JP Morgan Real Exchange Rate Indices. Unless otherwise noted, the frequency of the data is annual.

Net Capital Flows: The sum of the financial account of balance of payments excluding reserves (IFS line 78BJDZF) and net errors and omissions balance (IFS line 78CADZF).

FDI: Foreign Direct Investment, defined as direct investment in reporting economy IFS line 78BEDZF.

Private Loans: Defined as the sum of other investment assets and liabilities for banks and other sectors. IFS lines 78BQDZF + 78BRDZF + 78BUDZF + 78BVDZF.

Portfolio Flows: Defined as the sum of portfolio assets and liabilities IFS lines 78BFDZF + 78BGDZF.

Hot Flows: Private loans + Portfolio Flows.

GDP: Main series is from WDI. Missing observations are filled with data from IFS (line 99B..ZF). GDP from IFS is converted into dollars whenever necessary using nominal exchange rate (divided by IFS line ..AE.ZF).

Current Account Balance: IFS line 78ALDZF.

Budget Balance: IFS line 80…ZF.

Credit Growth: Defined as the three year change in the banking sector credit to non-government sector divided by the GDP. IFS line 32D..ZF divided by the Dollar GDP

Short-term Debt: Short-term debt is taken from Global Development Finance database and it is defined as external debt that has an original maturity of one year or less.

Reserves: Reserves excluding gold: IFS line .1..SZF.

Real Exchange Rate Appreciation: Defined as the three year percentage change in the real exchange rate. Main real exchange rate series is from IFS. Missing observations are filled with data from JP Morgan Real Exchange Rate index.