Overreaction in Capital Flows to Emerging Markets: Booms and Sudden Stops

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Abstract

This paper applies the overreaction hypothesis of De Bondt and Thaler (1985), developed for stock price behaviour, to capital flows to emerging markets. We find that a surge in capital flows, or what we call a *capital boom*, can predict future sharp contractions in capital flows, or *sudden stops*. We use a large list of possible economic fundamentals as control variables, and the results show that the best predictor of a sudden stop is a preceding capital boom. Moreover, the probability of a country undergoing a sudden stop increases considerably with the length of the boom: this probability more than doubles when the boom is three years old, and rises by three to four times when the boom lasts for four years. These results are interesting for two reasons. In the first place, they contradict previous studies that emphasize worsening fundamentals as the ultimate cause of a sudden stop. Second, they are of policy interest because of the enormous negative impacts that sudden stops have on the real economy.

JEL Classification: F30, F32, F39

Key Words: Capital flows, Emerging Markets, Sudden Stops, Overreaction

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1. Introduction

Informal claims of overreaction in financial markets arise more frequently than they are admitted by economists and analysts, who feel more comfortable anchoring stock price movements to informed expectations about future fundamentals. However, in a seminal work De Bondt and Thaler (1985) evaluate what they call "overreaction" in the stock market and prove that, as is the case with many other human activities, financial markets show an excessive reaction to new information or unexpected events. One of their main conclusions is that a pronounced reversion in prices (negative returns) can be predicted by the observation of extreme preceding positive returns; in other words, an upward overreaction subsequently calls forth a dramatic downward adjustment.

An important aspect of this literature is the identification of an overreaction, which is related to psychological factors that push a price much beyond what would be determined by fundamental factors. Consequently, examples of markets with frequent overreaction behaviour are those showing excess volatility. Such is the case of capital flows to emerging markets, where an unexplained volatility has been found. In a recent paper, Broner and Rigobon (2006) showed that capital flows to emerging markets are more volatile than those to developed countries. Using GDP per capita, inflation rates, real depreciation of exchange rates, terms of trade and interest rates for a set of emerging countries, the standard deviation of the error from panel estimations was greater than the error from a panel using data for developed countries by more than 60 percent. This standard deviation was significantly reduced using own lags of capital flows and contagion variables.

Our approach is different. We focus on the predictive power of a capital flow bonanza on subsequent and sharp reversions of capital flows, labelled *sudden stops* in recent literature, and consider this pattern as an example of overreaction. We define

episodes of large capital flows to emerging markets, which we call *capital booms*, as those that are larger than a standard deviation above the historical mean and represent at least five percentage points of GDP. Using the definition of sudden stops by Guidotti et al (2004), we define periods of abrupt reversions, or sudden stops, as those when capital flows decline by more than a standard deviation of their average variation during the sample period and when that decline is at least five percentage points of GDP. Similarly to the findings for stock prices, our results indicate that a capital boom period is a good predictor of a subsequent sudden stop. Moreover, we find that the probability of a sudden stop increases dramatically the longer the preceding capital boom.

In our approach, emerging markets should be seen as an asset class for financial markets.[1] This view has been confirmed by Leijonhufvud (2007), who shows that financial institutions have separate business units that manage profit and loss targets for their investments in emerging markets. Leijonhufvud stresses that this organizational form is responsible for the concentration of risk in emerging markets and the consequent formation of bubbles in asset prices. In addition, compensation systems "which link annual bonus payments to the amount of net income an employee has generated for the firm or its clients in a given year directly encourage employees to focus on short-term income opportunities" (Leijonhufvud, 2007). These ideas are lent credence by Kaminsky et al (2004). Using monthly and quarterly data, they showed the existence of chartist strategies (buy winners and sell losers) and contagion trading in mutual funds dedicated to Latin American assets. These strategies proved stronger during crises.

In this paper, we use the financial account of the balance of payments (excluding reserve movements) as our closest measure of net capital flows. With a multivariate

[1] This is an application of Kindleberger's (2005) model of financial crises, where agents are prone to manias, which eventually give way to panics, in markets for specific asset classes.

analysis of the probability of suffering a sudden stop, we test the relevance of prior capital booms. A capital boom year is a period dominated by short run chartist strategies, as described previously. We find that the probability of the capital boom continuing one extra year is significant in countries that have experienced a capital boom the year before, and that this probability is very similar to the probability of suffering a sudden stop. However, as the capital boom lengthens, the probability of a subsequent sudden stop rises markedly, while the probability that the capital boom will continue drops to zero.

In contrast to other studies such as those by Edwards (2007), Calvo at al (2004) or Cavallo and Frankel (2004), who attribute to domestic variables the cause of sudden stops, our results indicate that sudden stops are downward overreactions to sharp preceding overreaction periods. This does not mean that fundamentals are unimportant in preventing a sudden stop episode. In fact, we postulate that large capital inflows can bring about an endogenous change in some macroeconomic variables – e. g., a deterioration of the current account deficit, a sharp appreciation of the real exchange rate, an excessive rise in bank credit to the private non-bank sector, or a progressive mismatch in the balance sheets of firms and banks that borrow in foreign currency. This deterioration of fundamentals caused by large capital booms that cannot be easily absorbed by economies with small financial sectors is what eventually trigger a massive withdrawal of capital.[2] Many of these variables reflecting domestic fundamentals turn out not to be robust in their predictive power and are indeed rendered insignificant when measures of preceding capital booms are incorporated into the econometric analysis.

[2] A recent discussion of capital flow bonanzas and financial crises can be found in Reinhart and Reinhart (2008), who arrive at similar conclusions as those of this paper. However, they use the current account as a measure of capital movements, while we use the net financial account. These two measures differ, of course, as capital inflows, for example, could be partly absorbed as reserves and not only go to finance the current account. In contrast to Reinhart and Reinhart, who use mostly descriptive statistics, we try to test our hypothesis with a multivariate econometric model of sudden stops.

This leads us to posit that large capital inflows are the best predictor of sudden stops in emerging economies.

The rest of the paper is organized as follows. The next section sets forth the definitions of capital boom and sudden stop episodes. Section 3 describes the methodological analysis. Section 4 and Section 5 present our main results and some robustness exercises, respectively. Finally, Section 6 provides some discussion and concluding remarks.

2. Definition of Boom and Sudden Stop Periods

We use annual data for 42 emerging economies in the period 1976-2003, which includes all of the boom and sudden stop years in recent economic history (with the exception of the booms leading to the current world financial crisis). Thus the 1976-82 period corresponds to the boom years identified with the recycling of the oil producers' surpluses; 1983-89 coincides with the Latin American debt crisis; 1990-97 is another period of capital boom and financial innovation in lending to and investing in emerging economies; and 1998-2003 is the period after the Asian and Russian financial crises struck. The complete list of countries is shown in the appendix.

2.1 Boom Episodes

We define a year of capital boom when the financial account of the balance of payments is a standard deviation above its mean and is at least 5% of the GDP. Thus, there is a capital boom in the year t when FF_{it} = 1 according to the following rule:

$$FF_{it} = \begin{cases} 1 \; if \; F_{it} > \overline{F}_i + \sigma_{F_i} \; and \frac{F_{it}}{GDP_{it}} > 5\% \\ \\ 0 \text{ otherwise} \end{cases} \tag{1}$$

where F_{it} is the value of the financial account of country i in year t (current US dollars deflated by the US consumer price index), $\overline{F_i}$ is its mean for the entire period and σ_{F_i} is its standard deviation. By using as our definition of capital boom the requirement that capital inflows be one standard deviation above the mean we ensure the unusual character of this episode. The normalization by GDP is used in order to detect surges that represent a large deviation with respect to the country's economic size. We prefer to use the level of capital flows rather than their annual change because our objective is to test for the impact of large levels, not large changes in capital flows. In the 1976-2003 period, there are 152 capital booms (so defined) in the 42 countries in the sample. The appendix lists these episodes.

2.2 Sudden Stop Episodes

Following Guidotti et al (2004), we identify a sudden stop of capital flows when the annual *change* in the financial account is one standard deviation below its mean and is larger than 5% of GDP. Concretely, a country will suffer a sudden stop when $SS_{it} = 1$ according to the following rule:

$$SS_{it} \begin{cases} 1 \; if \;\; \Delta F_{it} < \overline{\Delta F_i} - \sigma_{\Delta F_i} \;\; and \;\; \left| \dfrac{\Delta F_{it}}{GDP_{it}} \right| \geq 5\%, \; whenever \; F_{it-1} > 0 \; and \; FF_{it} = 0 \\ 0 \text{ otherwise} \end{cases} \tag{2}$$

where ΔF_{it} is the change in the financial account of country i in year t, $\overline{\Delta F_i}$ is the average change in the financial account of country i over the sample period and $\sigma_{\Delta F_i}$ is its standard deviation. In the case of sudden stops, we are interested not in the absolute value of capital flows but in a significant decline from the preceding year. Again, as with capital booms, the joint condition applied to classify an event as a sudden stop

works in the same fashion. Thus, countries with little volatility in capital flows can experience episodes with falling capital inflows (or with capital outflows) which do not have major impacts on their economies; by requiring that the contraction be a certain percentage of GDP, we attempt to guarantee that they are important for the countries experiencing it.

Since our interest is to identify the start of a contraction in capital inflow, whenever a sudden stop in a particular year is followed by another sudden stop the following year, only the first contraction will be considered to be a sudden stop. As noted in definition (2), we discard episodes which are both sudden stops and capital booms, as per definition (1). In our sample, we found 74 episodes that qualify for sudden stops (7% of the sample). The annual distribution of sudden stops is shown in the appendix.

A view of these episodes is shown in Figure 1. The three horizontal lines represent mean capital flows (the broken line) and flows that are one standard deviation above and below the mean. The shadowed region shows the drop in capital flows that corresponds to a sudden stop. These examples suggest that sudden stops are sharp adjustments after periods of consecutive booms.

[Insert Figure 1]

In Table 1 we show the average contraction of capital flows as a share of GDP occurring two years after a three-year period of capital boom. This contraction is always higher than after a three-year period of positive capital inflows in tranquil times[3] and significantly different from zero for all the geographical regions considered with the exception of emerging Europe. Another relevant characteristic is that the average growth rate of GDP two years after a three-year boom is considerably lower than in

[3] Observations of "tranquil" periods for countries experiencing a prior sudden stop are excluded.

countries with positive capital inflows for three years but without a boom. Again, this difference is significantly different from zero for all regional groups of countries with the exception of emerging Europe.

[Insert Table 1]

3. Multivariate Probit Analysis

Letting Φ be the standard normal distribution, we estimate a panel probit with heterogeneous unobserved effects. For the boom episodes we estimate the following equation:

$$\begin{aligned}\Pr(FF_{it} = 1 / FF_{it-1}, ContFF_{it}, NonFDI_{it-1}, \mathbf{X}_{it-1}, c_i) = \\ \Phi(\gamma_f FF_{it-1} + \gamma_c ContFF_{it} + \gamma_{nf} NonFDI_{it-1} + \mathbf{X}_{it-1}\beta + c_i)\end{aligned} \quad (3)$$

ContFF (boom contagion) is a binary contagion variable taking value 1 when the number of boom episodes in a particular year and the year before in other countries of the sample exceeds twice the average annual number of booms. *NonFDI* is non-FDI flows in the financial account as a share of GDP, ***X*** is a matrix of control variables and *c* is an unobserved country specific effect.

The variable *FF* lagged one period describes the overreaction (or feedback) effect in euphoric phases. According to Kindleberger (2005), the optimism of investors strengthens during periods of bonanza because of the knowledge that investors have of what other investors are doing. Thus large investments tend to be contagious and attract other investments, which generate a boom that can be self-sustaining for some time. The inclusion of this variable is meant to reflect the chartist strategies that are used by institutional and other investors when capital flows to a particular country or group of countries are large. The inclusion of *NonFDI* is congruent with our theoretical support because these kinds of flows generally have a shorter horizon than FDI and are

susceptible to reversal as investors acquire new information. FDI is much less prone to chartist strategies, has longer time horizons, and is not so easily reversed. As can be seen in Figure 2, non-FDI flows show an increasing trend in years prior to a sudden stop and drop sharply during these events.[4] By contrast, FDI flows exhibit neither surges nor sudden stops around the years identified as being characterized by a sudden stop.

[Insert Figure 2]

Matrix X includes variables that could be interpreted as determinants of capital flows.[5] These are the rate of GDP growth (*RGDP*), the change in the terms of trade (*TT*), the ratio of external debt to exports (*ED/X*), and the current account deficit as a share of GDP (*CAD*). Other variables included refer to domestic or external conditions. The real foreign interest rate (*Rf*) and the rate of growth of G7 countries (*G7gdp*) reflect external conditions affecting capital flows, and the real domestic interest rate (*Rd*) and the fiscal deficit (*Gov_Def*) are domestic fundamentals.

We follow a similar strategy to estimate the probability of suffering a sudden stop:

$$\begin{aligned}\Pr(SS_{it} = 1 / FF_{it-1}, ContSS_{it}, NonFDI_{it-1}, \mathbf{X}_{it-1}, c_i) = \\ \Phi(\gamma_f FF_{it-1} + \gamma_c ContSS_{it} + \gamma_{nf} NonFDI_{it-1} + \mathbf{X}_{it-1}\beta + c_i)\end{aligned} \quad (4)$$

This time FF_{t-1} is a proxy for an overreaction that is in need of correction: a period of bonanza is not going to persist forever. In a financial market with many heterogeneous agents, some of them are aware that the high levels of capital inflows are related more to feedbacks from other investors than to economic fundamentals. New information can arise (such as an endogenous worsening of one or more fundamentals), provoking a

[4] This is consistent with findings of Levchenko and Mauro (2006), who decompose the flows around sudden stop episodes and show that the most volatile are non-FDI flows.
[5] All variables are from International Monetary Fund, *International Financial Statistics*; and World Bank, *World Development Indicators*. Exact variable definitions are given in the appendix.

sharp adjustment. These periods are typically dominated by non-FDI flows; therefore we include this variable in the empirical analysis. As in equation (3), *ContSS* is a binary variable taking value 1 when the number of sudden stops in a particular year and the year before in other countries of the sample exceeds twice the average annual number of sudden stops.[6] As shown in the next section, contagion can raise the probability of experiencing a sudden stop.

In matrix ***X*** there are variables that have been used in the literature on balance-of-payment crises and determinants of sudden stops. The most frequently used and most successful variable has been the current account deficit, *CAD*. Furthermore, we use an indicator of banking crises (*bankcrises*) with data from Caprio and Kinglebiel (2003) and another of exchange rate rigidity (*EXR*) from Levy-Yeyati and Sturzenegger (2005) in order to test the hypothesis that sudden stops are more likely in countries with fixed rather than flexible exchange rate regimes. Large levels of external debt to exports (*ED/X*) may also raise the probability of a sudden stop. Other variables found significant in other studies are liability dollarization (*dollarization*) and economic openness (*openness*). Both are used in our estimations. In addition, in some specifications we use real exchange rate depreciation (*RER*), the ratio of M2 to GDP (*M2/GDP*), the change in the terms of trade (*TT*) and the change of reserves (*Reserves*) to control for possible signals that may generate a stampede by investors. As in the model of capital booms, external variables (*Rf, G7gr*) and domestic fundamentals (*Rd, Gov_Def*) are also included.

To estimate (3) and (4) we use random effects and, following Wooldridge (2002), we report the average marginal effect given by:

[6] For this variable we consider the total number of sudden stop without eliminating a second year of sudden stop as in equation (2). For example, we consider a sudden stop in 1994 and 1995 in Mexico.

$$\frac{\partial E\left[P(y=1/\mathbf{X},c)/c\right]}{\partial X_j}=\frac{\partial\Phi(\mathbf{X}\beta/\sigma)}{\partial X_j}=(\beta_j/\sigma)\phi(\mathbf{X}\beta/\sigma) \tag{5}$$

where for notational simplicity we have suppressed both cross-section and time-series indicators; y indicates the endogenous variable (*FF* or *SS*) and matrix $\boldsymbol{X}$ includes all variables in the right hand side of (3) and (4). Variable c has a conditional distribution $c/\mathbf{X} \sim N(0,\tau^2)$ so that $\sigma=(1+\tau^2)^{1/2}$. ϕ represents the standard normal density.

Since the model of equation (3) is a dynamic panel, we require additional assumptions. In order to report consistent estimators, we cannot use the first difference of the dependent variable – a very popular procedure in linear models – because the standard normal distribution is a highly nonlinear function. We follow Wooldridge (2000 and 2002) and propose the following distribution for c_i:

$$h(c_i/y_{i0}, \mathbf{X}_i, \delta) = \psi + \xi_0 y_{i0} + \overline{\mathbf{X}}_i\,\xi + a_i \quad \text{with} \quad a_i \sim N(0,\sigma_a^2) \tag{6}$$

where i indicates cross-section units, y_{i0} is the initial value of the dependent variable, and $\overline{\mathbf{X}}_i$ is a matrix with the average value for each explanatory variable. Including assumption (6) in the estimation of equation (3) implies adding to the estimating equation the average value of the explanatory variables and the initial value of the dependent variable.[7]

4. Main Results

Table 2 shows the results for the estimation of equation (3). In column (1) all the variables employed are significant at least at the 5% level and have the expected signs. Our lagged variable of capital booms is very significant and shows the highest marginal effect. If the previous year the economy was undergoing a boom episode the probability that this boom will persist the next year increases by 13%. This result is congruent with

[7] In the results, we do not report the values of the coefficients attached to these variables.

the feedback forces identified by Kindleberger and the strategies and transmission mechanisms described in the behavioral finance literature.[8]

Contagion from other countries is another relevant variable, raising the probability of a boom episode by 6%. Furthermore, large non-FDI flows, a high growth rate of GDP and a positive terms-of-trade shock raise the probability of a capital boom episode the next year, although their marginal effects are small. The external debt to exports ratio emerges as an important variable discouraging booms and, unexpectedly, the current account deficit has a positive sign. This result seems to indicate that the current account deficit works as a proxy for capital flows to the country.

In column (2) of Table 2 we add external and domestic variables. As expected, falls in external interest rate and in the growth rate of G7 countries increase the probability of a capital boom, whereas wider fiscal deficits reduce it. Changes in the terms of trade and the ratio of non-FDI flows to GDP are not robust to the inclusion of other relevant variables.

[Insert Table 2]

Table 3 shows the results for the estimation of equation (4). We progressively include variables in succeeding columns and exclude others to avoid inference problems from irrelevant variables. A capital boom in the preceding period is a strong predictor of a sudden stop, its effect is the highest (increasing the probability of a sudden stop of around 9%), and it is robust to the inclusion of other variables. This result is interesting because it is achieved conditioning to the effects of other variables or fundamentals that can be in turn affected by the capital flow bonanzas. Therefore, it appears to be a good

[8] See Shiller (2003) or Barberis and Thaler (2003) for a review of this literature.

test of the hypothesis of adjustment caused by a previous upward overreaction in capital flows to emerging markets.

Other variables that turn out to be significant and robust are: contagion, the ratio of non-FDI flows to GDP, the current account deficit as a share of GDP, and the external-debt-to-exports ratio. International contagion raises the probability of a sudden stop by about 3%. All significant variables have the expected signs.

[Insert Table 3]

4.1 A longer capital-boom period

The probability of a capital boom does not rise significantly as the boom lengthens; however, the probability of suffering a sudden stop increases dramatically with the length of the preceding boom. Table 4 summarizes the marginal effects that are significant for similar specifications as those in Table 3, but lengthening the boom period by one year from one column to the next. Thus columns (1) and (4) show the results of estimating equation (3) and (4), respectively, with a two-year boom period; in columns (2) and (5) the boom is lengthened to three years; and columns (3) and (6) shows the results for a four-year boom period. The results support the hypothesis that corrections to overreactions will become increasingly likely the longer the overreaction has been going on. If a capital boom has continued for a period of four years, the probability of a sudden stop rises to a very large 27%.

[Insert Table 4]

4.2 Sub-sample 1990-2003

As can be seen in the appendix, after 1982 and before 1991 there were very few years of large capital inflows in the emerging world. In 1991, capital surges begin to take place in Asia and Latin America. Table 5 shows estimations for a sub-sample including only

the period 1990-2003 in a subset of countries: Argentina, Bolivia, Brazil, Chile, China, Colombia, Ecuador, India, Indonesia, Korea, Malaysia, Mexico, Pakistan, Paraguay, Peru, Philippines, Thailand and Uruguay.

[Insert Table 5]

The probit estimations for capital boom episodes show that the only relevant domestic variables that raise their probability are *RGDP* and *CAD*. On the other hand, the results for sudden stop determinants confirm the evidence of Table 4. When the boom period lengthens, the probability of a country undergoing a sudden stop rises. Limiting the sample to these countries and this latter period also raises the importance of contagion. The probability of a sudden stop as a result of contagion rises from the original 3% shown in Table 4 to the 6-15% estimated in the runs reported in Table 5.

5. Some Robustness Tests

In order to test the robustness of the results, we change the threshold of 5% of GDP in equations (1) and (2) to 3% and 7%, respectively. Furthermore, following Faucette et al (2005) and Rothenberg and Warnock (2006), we use only gross flows (liabilities) instead of net flows to construct the capital boom and sudden stop variables. The results are reported in Tables 6 and 7. Finally, Table 7 shows an additional definition for sudden stops. We name this definition SSgdp and it requires, in addition to the conditions specified in equation (2), a fall in GDP during the year of the sudden stop or a year later. SSgdp reflects capital flight episodes that have had a large effect on the real sector.

Table 6 reports the marginal effects of probit estimations for capital boom episodes. The effect of a prior capital boom is similar to that shown in Table 2 and very significant; therefore, our prior conclusions regarding the sources of a capital boom still

hold. Some variables such as *Rf*, *G7gdp* and *Rd* are not relevant when we define a more extreme capital boom episode; by contrast, the fiscal deficit, *Gov_Def*, becomes significant only when the threshold for booms is raised. As shown in the last column of Table 6, contagion and non-FDI flows are not significant determinants in extreme boom episodes, but they are significant when we use gross rather than net flows. Gross flows seem to be affected by overall growth in developed countries as well: a drop in the rate of growth in the G7 countries raises the probability of a capital boom in emerging markets.

[Insert Table 6]

Table 7 shows that our main variables are still significant using different definitions of sudden stops, supporting our conclusions described in the previous section. The prior boom of capital flows and its composition are very important in predicting a sudden stop. International contagion helps to account for a sudden stop episode, although it loses its relevance when a more extreme fall is required or when gross flows are used instead of net flows. The domestic variable that is important in every case is the current account deficit (CAD), supporting previous studies on the subject.

[Insert Table 7]

New variables appear to be significant in a sudden stop with a sharper decline in capital flows. These include liability dollarization, the change in reserves, and the exchange rate regime. With the exception of the exchange rate regime, all show the expected sign.[9] A previous capital boom, international contagion, and non-FDI flows

[9] The negative sign of *EXR* in Table 7 indicates that a more rigid regime reduces the probability of suffering an extreme sudden stop, which is contrary to the conventional view. However, this can be an ambiguous result. We use the 1-5 classification of regimes of Levy-Yeyati and Sturzennegger (2005), where 1 is totally flexible and 5 totally fixed. In this classification, a floating regime is associated with the

are robust in predicting a sudden stop with negative real effects on GDP growth, *SSgdp*. An increase in the external-debt-to-exports ratio, and not just in the current account deficit, also appears to be a signal that could generate a reversion in capital flows. In one run, rising liability dollarization and increases in the foreign real interest rate significantly raise the probability of *SSgdp*. Unexpectedly, rather than moderating capital outflows (or dampening the fall in inflows), increases in domestic real interest rates have a positive impact on *SSgdp*. This result could be indicating that investors, faced with very adverse domestic conditions, view higher domestic interest rates as a symptom of further trouble down the road.

As a capital boom lengthens, the likelihood of a sudden stop rises even more sharply when the sudden stop is defined to be accompanied by a fall in GDP. As shown in Table 8, the probability of a sudden stop with a fall in GDP increases to 35% when a boom has gone on for a period of four years.

[Insert Table 8]

Another robustness test was undertaken using the early-warning-signal literature, as in Kaminsky et al (1998). The capital boom indicator may work as a signal, and the fact that it is a binary variable may enhance its importance in the probit estimations as compared to other explanatory variables, which are measured in a continuous way. For this reason, we take the current account deficit (the most robust domestic variable in previous estimations) and create a signal akin to the binary capital boom variable of equation (1), naming it *S1CAD*. In addition, we create another indicator based on the percentile of the current account deficit that minimizes the noise-to-signal ratio, as calculated in Kaminsky et al (1998). This optimal threshold is the highest fifth

lowest number of sudden stops. However, their number is not very different from those of other regimes, and the maximum number of sudden stops is not associated with fixed exchange rate regimes.

percentile; in other words, the largest fifth-percentile current account deficit minimizes this noise-signal ratio.[10] We name this variable S2CAD.

Tables 9 and 10 show the results of probit estimations for both indicators of the current account deficit. We use three definitions of sudden stop: *SS*, *SSgdp*, and *SSgross*. Tables 9 and 10 indicate that including these indicators does not add relevant information to the one yielded by the capital boom variable, contagion, nonFDI flows, the current account deficit as a share of GDP measured in a continuous way, and the external debt to exports ratio. In some cases when these indicators replace the continuous current account deficit variable, they show significant marginal effects, but these effects are lower than those associated with the capital boom variable.

[Insert Table 9]

[Insert Table 10]

Finally, we use the two-step procedure of Rivers and Vuong (1988) to discard any endogeneity problems that may remain between capital booms and subsequent sudden stops, even in spite of the fact that the capital boom variable is lagged one period in the equations explaining sudden stops. This test consists in including the errors of the estimation of the equation for capital booms in the estimation of the equation for sudden stops and testing for their significance. Table 11 shows the results obtained by including the errors of the estimation of the equation reported in Table 2 in the specifications of the equations reported in Table 3. The results show that it is not

[10] This threshold looks for balancing the risk of having a wrong signal when a crisis does not take place with the risk of having no signal when a crisis does occur. The threshold is chosen to minimize B/(A+B)/D/(C+D), according to the following chart:

		Signal$_{t-1}$	
		No	Yes
SS$_t$	No	A	B
	Yes	C	D

possible to reject the null that the errors are equal to zero; in other words, there is no evidence that both capital surges and sudden stops are determined simultaneously.

[Insert Table 11]

6. Discussion and Concluding Remarks

There is a large and growing literature on what triggers a sharp contraction in capital flows to emerging markets. The current account deficit, liability dollarization, or excessive credit expansion are some of the variables that figure prominently in this literature. However, sudden stops have not been seen as a consequence of a previous period of overreaction in international financial markets. Capital booms are episodes of excessive enthusiasm that are unwarranted by fundamentals. They also show in a very graphic way that chartist strategies rather than strategies based on future expectations of fundamentals dominate financial markets. In this sense, a capital boom will almost inevitably lead eventually to a sharp and sudden contraction. This means that deteriorating fundamentals are not always necessary to trigger a reversion of positive expectations; rather, it can be a rumor that disheartens the apparent optimism in a particular country, or international contagion that has little or no relationship with domestic conditions. An alternative explanation is that large capital inflows that are not easily (and productively) absorbed into the domestic economy induce a deterioration in one or more fundamentals, which functions as a negative signal to investors. Recent studies of herd behavior in financial markets show that periods of overoptimism are fragile and can be suddenly reversed when participants face new information. Our application to capital flows to emerging markets confirms the overreaction hypothesis and its predictive power.

Using other arguments of behavioral finance, one can predict that the reversion of capital flows will be sharper and shorter than the preceding bonanza. One example of

such analyses is the loss-aversion hypothesis of Kahneman and Tversky (1979): faced with possible losses, investors will unload emerging market assets more quickly than they accumulated them during the boom. Unambiguously, if the recipient country faces a deterioration of its fundamentals, the probability of a quick reversion in capital flows can be very high.

What are the policy implications of our analysis? Clearly, emerging countries contemplating integration into international financial markets should take into account that they may face a new source of volatility and should tread carefully in this new world.

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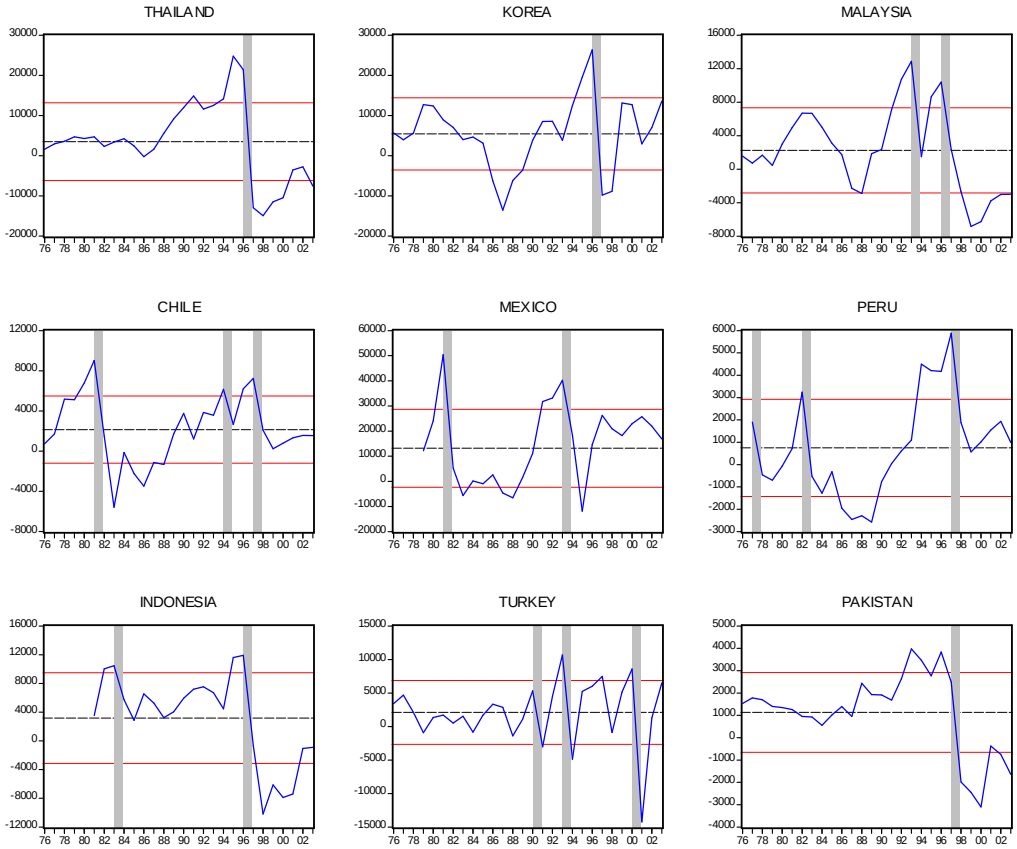
Figure 1: Booms and sudden stops in capital flows



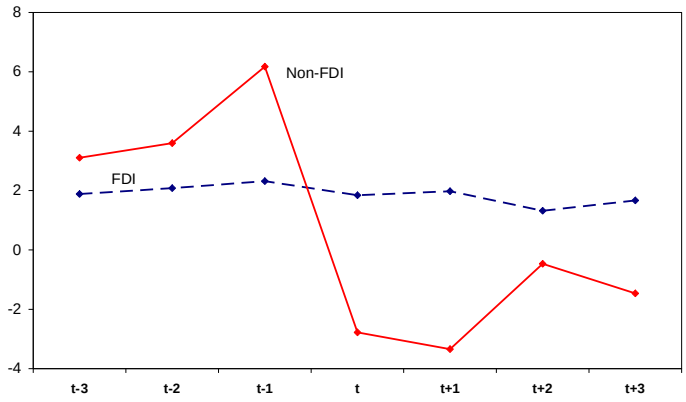
Note: millions of 2000 US dollars.

Table 1: Average change in the financial account (% of GDP) and GDP growth two years after a period of three-year capital boom, compared with the same variables in countries that did not experience a capital boom

	Three years with boom		Three years without boom[a]	
Emerging country region	ΔF/GDP	ΔGDP/GDP	ΔF/GDP	ΔGDP/GDP
South America and Mexico	-3.9* (11)	-1.6* (11)	-1.0 (68)	2.2 (68)
Central America	-5.0* (6)	-0.4* (6)	0.6 (56)	3.6 (56)
Asia	-7.7* (5)	1.6* (5)	-0.0 (131)	5.7 (132)
Africa	-9.4* (7)	1.9* (7)	-0.5 (56)	4.0 (56)
Europe	-2.0 (2)	2.5 (2)	-0.9 (16)	1.1 (18)

[a] Excluding three years after sudden stops. Number of episodes shown in parenthesis. *Difference is significant at 5%.

Figure 2: FDI and non-FDI flows around sudden stops
(Average flows to GDP ratios)



Note: Sudden Stops occur at t

Table 2: Probability of occurrence of a Capital Boom

Dependent Variable FF

	(1)	(2)
FF_{t-1}	12.514	11.913
	(4.29)***	(3.74)***
CONTFF	5.617	4.282
	(3.15)***	(2.22)**
NonFDI	0.393	0.162
	(2.08)**	(0.83)
RGDP	0.976	0.655
	(4.05)***	(2.51)**
CAD	1.091	1.185
	(4.20)***	(3.85)***
TT	0.167	0.154
	(3.56)***	(1.52)
ED/X	-6.440	-5.225
	(4.81)***	(3.60)***
Rf		-0.629
		(1.93)*
G7gdp		-1.773
		(2.04)**
Gov_Def		-0.498
		(1.74)*
Rd		0.029
		(1.09)
Observations	941	726

Average marginal effects (times 100) are reported for all regressors. Constants omitted. Figures in parenthesis are z statistics with robust standard errors. All regressors are lagged one period, with the exception of CONTFF.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 3: Probability of occurrence of a Sudden Stop

Dependent Variable SS

	(1)	(2)	(3)	(4)	(5)
FF_{t-1}	9.148	5.663	9.333	8.638	9.595
	(4.25)***	(2.90)***	(3.89)***	(3.89)***	(4.07)***
CONTSS	2.798	2.990	3.051	2.611	2.340
	(2.33)**	(2.30)**	(2.26)**	(2.02)**	(1.70)*
NonFDI	0.369	0.594	0.491	0.553	0.627
	(3.18)***	(4.54)***	(3.45)***	(3.71)***	(4.31)***
CAD	0.472	0.361	0.355	0.287	0.192
	(3.60)***	(2.39)**	(2.26)**	(1.77)*	(1.24)
EXR		-0.250			
		(0.61)			
bankcrises		0.318			
		(0.14)			
ED/X		0.822	0.943	0.967	0.867
		(1.97)**	(2.21)**	(2.16)**	(2.05)**
TT			0.055		
			(1.48)		
dollarization			0.000		
			(0.26)		
openness				0.017	
				(0.82)	
Reserves				-0.008	
				(0.96)	
M2/GDP				-0.022	
				(0.69)	
Rf					0.011
					(0.06)
G7gdp					-0.704
					(1.19)
Gov_Def					0.061
					(0.47)
Rd					0.004
					(0.47)
Observations	1070	893	875	958	856

Average marginal effects (times 100) are reported for all regressors. Constants omitted. Figures in parenthesis are z statistics with robust standard errors. All regressors are lagged one period, with the exception of CONTSS.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4: Probit estimations with an extended period of capital boom

Explanatory Variables	FF (1)	FF (2)	FF (3)	SS (4)	SS (5)	SS (6)
FF_{t-1} and FF_{t-2}	2.2			7.0*** - 9.3***		
FF_{t-1} to FF_{t-3}		-4.3**			11.6*** - 18.9***	
FF_{t-1} to FF_{t-4}			-2.3			14.5* - 26.7*
CONT[a]	4.9***	4.8***	5.1***	2.1* - 2.9**	2.4* - 2.8**	2.5** - 2.9**
$NonFDI_{t-1}$	0.4**	0.4**	0.5***	0.6*** - 0.8***	0.7*** - 0.8***	0.7** - 0.8***
CAD_{t-1}	1.3***	1.2***	1.1***	0.3** - 0.5***	0.3* - 0.5***	0.3** - 0.5***
ED/X_{t-1}	-5.4***	-4.9***	-5.3***	0.7* - 0.8*		
$RGDP_{t-1}$	0.6**	0.6**	0.8***			
$G7gdp_{t-1}$	-1.7**	-1.5**				
Rf_{t-1}	-0.6**	-0.5*	-0.9***			
Gov_Def_{t-1}	0.5**	0.7***				
Rd_{t-1}		0.0**				

Table reports significant marginal effects (times 100) only. * significant at 10%; ** significant at 5%; *** significant at 1%.

[a] The contagion variable is defined for FF when the results are for capital booms and for SS when the results are for sudden stops.

Table 5: Probit estimations with an extended period of capital boom,. 1990-2003

Explanatory Variables	FF	SS (1)	SS (2)	SS (3)
FF_{t-1}	6.6**	11.3*** - 12.8***		
FF_{t-1} and FF_{t-2}			14.6** - 20.8***	
FF_{t-1} - FF_{t-3}				25.5* - 28.1*
CONT	5.8**	6.0* - 15.1**	6.7** - 14.2***	7.5** - 14.0**
$NonFDI_{t-1}$		0.6** - 0.7**	0.8*** - 0.9***	0.8** - 1.1***
CAD_{t-1}[a]	1.3***			
$RGDP_{t-1}$	1.2***			
$dollarization_{t-1}$		0.02**		

Table reports significant marginal effects (times 100) only. [a] CAD was used in the boom equation only. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 6: Some Robustness Exercises for Capital Boom Estimations

Explanatory Variables	3%	7%	FFgross[a]
FF_{t-1}	10.5***	11.9***	10.5***
CONTFF	5.7**		4.1*
$NonFDI_{t-1}$			0.4**
CAD_{t-1}	1.1***	1.1***	1.1***
$RGDP_{t-1}$	0.7**	0.5**	
ED/X_{t-1}	-5.9***	-4.5***	-5.6***
Rf_{t-1}	-0.9**		
$G7gdp_{t-1}$	-2.7***		-2.1**
Gov_Def		-0.5**	
Rd_{t-1}	0.05*		

Table reports significant marginal effects (times 100) only. [a] Indicators of capital boom, contagion and non-FDI flows are created using gross flows only. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 7: Some Robustness Exercises for Sudden Stop Estimations

Explanatory Variables	3%	7%	SSgross[a]	SSgdp
FF_{t-1}	10.5*** - 12.9***	5.2*** - 7.5***	11.7*** - 14.8***	5.1*** – 6.2***
CONTSS	3.1** - 4.0***			1.6* - 2.6***
$NonFDI_{t-1}$	0.4*** - 0.7***	0.3*** - 0.3***	0.1** - 0.3***	0.1* - 0.2***
CAD_{t-1}[a]	0.3* - 0.4***	0.2*** - 0.3**	0.5*** - 0.6***	0.2** - 0.3***
ED/X_{t-1}	0.9* - 1.0**	0.5** - 0.7**		0.5* - 0.8***
EXR_{t-1}		-0.4* - -0.6**		
$Dollarization_{t-1}$		0.0** - 0.0***		0.0**
$Reserves_{t-1}$		-0.02** - -0.02***		
Rf_{t-1}				0.3**
Rd_{t-1}				0.0* - 0.0**

Table reports significant marginal effects (times 100) only. [a] Indicators of sudden stop, capital boom, nonFDI flows and contagion are created using gross flows only. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 8: Probit Estimations on SSgdp with an extended period of Capital Boom.

Explanatory Variables	SSgdp (1)	SSgdp (2)	SSgdp (3)
FF_{t-1} and FF_{t-2}	5.5*** - 9.4***		
FF_{t-1} - FF_{t-3}		8.0*** - 18.9***	
FF_{t-1} - FF_{t-4}			20.1*** - 34.5***
CONTSS	1.6* - 2.3**	1.6* - 2.7**	1.6* - 2.5***
$NonFDI_{t-1}$	0.2***- 0.3***	0.3*** - 0.7***	2.8** - 3.2**
CAD_{t-1}	0.2* - 0.3***	0.2** - 0.4**	0.2* - 0.4**
ED/X_{t-1}	0.5* - 0.8**	0.6** - 0.7***	0.5** - 0.6*
Rd_{t-1}			0.0**

Table reports significant marginal effects (times 100) only. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 9: Probability of occurrence of a Sudden Stop including a "signal" of the Current Account Deficit

	(1) SS	(2) SSgdp	(3)[a] SSgross	(4) SS	(5) SSgdp	(6)[a] SSgross
$S1CAD_{t-1}$	1.867	0.946	4.868	4.070	2.359	8.930
	(0.96)	(0.73)	(1.88)*	(2.17)**	(1.81)*	(3.70)***
FF_{t-1}	8.204	4.880	14.699	8.716	5.538	15.873
	(3.80)***	(3.15)***	(5.57)***	(3.92)***	(3.31)***	(5.91)***
CONTSS	3.137	2.184	0.132	3.321	2.307	0.182
	(2.42)**	(2.42)**	(0.10)	(2.51)**	(2.47)**	(0.13)
$NonFDI_{t-1}$	0.493	0.189	0.098	0.596	0.227	0.113
	(3.77)***	(2.10)**	(2.14)**	(4.32)***	(2.31)**	(2.26)**
CAD_{t-1}	0.268	0.155	0.310			
	(1.62)	(1.42)	(1.72)*			
ED/X_{t-1}	0.819	0.726		0.989	0.842	
	(2.12)**	(3.16)***		(2.59)***	(3.64)***	
Observations	1006	1007	1067	1006	1007	1067

Average marginal effects (times 100) are reported for all regressors. Constants omitted. Figures in parenthesis are z statistics with robust standard errors. All regressors are lagged one period, with the exception of CONTSS. [a] Indicators of sudden stop, capital boom, contagion and nonFDI flows are created using gross flows only. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 10: Probability of occurrence of a Sudden Stop including a "signal" of the Current Account Deficit

	(1) SS	(2) SSgdp	(3)[a] SSgross	(4) SS	(5) SSgdp	(6)[a] SSgross
$S2CAD_{t-1}$	0.661	1.169	4.080	2.636	2.480	6.923
	(0.34)	(0.79)	(1.45)	(1.20)	(1.53)	(2.45)**
FF_{t-1}	8.292	4.880	14.783	9.409	5.821	15.107
	(3.87)***	(3.16)***	(5.59)***	(4.17)***	(3.41)***	(5.44)***
CONTSS	3.094	2.192	0.160	3.381	2.342	0.683
	(2.41)**	(2.43)**	(0.12)	(2.54)**	(2.49)**	(0.49)
$NonFDI_{t-1}$	0.484	0.189	0.093	0.644	0.245	0.388
	(3.77)***	(2.20)**	(2.03)**	(4.54)***	(2.54)**	(2.94)***
CAD_{t-1}	0.351	0.168	0.420			
	(2.31)**	(1.64)*	(2.47)**			
ED/X_{t-1}	0.783	0.717		1.033	0.858	
	(2.07)**	(3.22)***		(2.70)***	(3.67)***	
Observations	1006	1007	1067	1006	1007	1067

Average marginal effects (times 100) are reported for all regressors. Constants omitted. Figures in parenthesis are z statistics with robust standard errors. All regressors are lagged one period, with the exception of CONTSS. [a] Indicators of sudden stop, capital boom, contagion and nonFDI flows are created using gross flows only. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 11: Rivers and Vuong (1988) test for the null hypothesis that capital boom and sudden stop errors are not correlated in expression (4)

	(1) SS	(2) SS	(3) SS	(4) SS	(5) SS
Residuals FF_{t-1}	0.457 (0.98)	-0.153 (0.31)	0.196 (0.40)	0.219 (0.44)	0.083 (0.17)

z statistics are in parenthesis. The estimations of Table 3 are repeated including the residuals of capital boom equation (2) in Table 2.

Appendix

List of emerging countries

Argentina, Bangladesh, Barbados, Belize, Bolivia, Brazil, Chile, China, Colombia, Cote d'Ivoire, Costa Rica, Ecuador, Egypt, El Salvador, Philippines, Guatemala, Hungary, India, Indonesia, Iran, Jamaica, Jordan, Kenya, Korea, Mali, Malaysia, Malta, Morocco, Mauritius, Mexico, Nigeria, Peru, Pakistan, Panama, Paraguay, Poland, Dominican Republic, South Africa, Thailand, Tunisia, Turkey, and Uruguay.

Capital Booms (FF) 1976-2003[a]

1976	BRA	POL	MAR	TUN								
1977	CRI	MAR	TUN									
1978	BOL	BRA	CRI	CIV	PAK	PRY	BGD	SLV	JOR	KEN	MAR	TUN
1979	CRI	CIV	NGA	PRY	URY	KEN	MLI	PAN	EGY			
1980	CHI	CRI	CIV	ECU	PRY	URY	BGD	DOM	KEN	MLI		
1981	BOL	CHI	CIV	MEX	NGA	PRY	URY	BGD	BRB	EGY		
1982	CRI	IDN	NGA	PER	URY	EGY						
1983	IDN	NGA										
1984	JAM											
1985												
1986												
1987												
1988	MUS											
1989	KEN											
1990	MUS											
1991	IRN	MEX	THA	JOR								
1992	IRN	MYS	MEX									
1993	ARG	HUN	IRN	MYS	MEX	PAK	TUR	TUN				
1994	ARG	CHL	CHN	PAR	PAK	PHL	THL	MLT	TUN			
1995	BRA	CHN	COL	HUN	IDN	MYS	PER	PHL	POL	THA		
1996	BRA	CHI	CHN	COL	IDN	KOR	MYS	PAK	PER	PHL	THA	
1997	ARG	BOL	CHI	COL	PER	PHL	SLV	PAN	ZAF			
1998	ARG	BOL	HUN	POL	SLV	GTM	MLT	PAN				
1999	ARG	BOL	HUN	POL	DOM	MLT	PAN					
2000	HUN	POL	BRB	DOM	GTM	JAM	MLI	MUS				
2001	BRB	BLZ	DOM	GTM	JAM	PAN						
2002	BLZ	GTM	JAM									
2003	HUN	BRB	BLZ	SLV	MLI							

[a] We use country abbreviations from World Development Indicator.

Sudden Stops (SS) 1977-2003[a]

1977							
1978	PER						
1979	SLV	MAR	TUN				
1980	BOL	GTM	PAN				
1981	CRI	KEN	POL				
1982	BOL	CHL	MEX	BRB	MLI		
1983	BRA	CIV	ECU	PER	PHL	URY	TUN
1984	IDN	NGA	BRB	GTM			
1985	BOL	PRY	JAM				
1986							
1987	MLI						
1988	PRY						
1989	ARG	MLI					
1990	KEN	EGY					
1991	TUR						
1992	BRB	JOR	KEN				
1993							
1994	HUN	MYS	MEX	POL	TUR	BLZ	
1995	CHL	MLT	MAR				
1996	HUN						
1997	IDN	KOR	MYS	THA	MLI		
1998	CHL	PAK	PER	PHL			
1999	COL	ECU	IRN	NGA			
2000	CRI	MLT	PAN				
2001	ARG	TUR	MUS				
2002	URY	BRB	DOM	PAN			
2003	BOL	JAM					

[a] We use country abbreviations from World Development Indicator

Definition of Variables

Variable	Definition	Source
Capital Flows	Financial account deflated by the US consumer price index, 2000=100	International Financial Statistics (IFS)
GDP	Gross domestic product	World Development Indicators (WDI)
Current Account to GDP, *CAD*	Measured as deficit	WDI
Non-FDI flows to GDP, *NonFDI*	Sum of portfolio flows, other investment and financial derivatives, as share of GDP	IFS, WDI
External Debt to exports ratio, *ED/X*	Ratio of public and private external debt (long- and short-term) to exports of goods and services	WDI
Terms of Trade, *TT*	Ratio of export to import deflators, both obtained from real and nominal trade data.	WDI
Real Exchange Rate, *RER*	Ratio of US consumer price index multiplied by nominal exchange rate to domestic consumer price index	IFS
Foreign real interest rate, *Rf*	three-month US-dollar LIBOR, deflated by US consumer prices	IFS

Domestic real interest rate, *Rd*	deposit money market rate adjusted for consumer price inflation	IFS
GDP growth of G7 countries, *G7gr*	Simple average of annual growth rate of real GDP of G7 countries	WDI
Fiscal deficit, *Gov_Def*	Measured as deficit	IFS
Banking Crises, *bankcrises*	Binary variable taking value 1 during a year of banking crises	Caprio and Klingebiel (2003)
Exchange Rate Regime, *EXR*	1-5 index according to exchange rate rigidity. 5 indicates a fixed regime	Levy-Yeyati and Sturzenegger (2005)
Openness	Exports plus imports as a share of GDP	WDI
Dollarization	External liabilities of financial sector as a percentage of money	IFS
Reserves	International Reserves	IFS
M2 to GDP, *M2/GDP*	M2 as a percentage of GDP	IFS