Surges

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Abstract

This paper examines when and why capital sometimes surges to emerging market economies (EMEs). We identify surges in net capital flows to EMEs over 1980–2011, differentiating between those associated mainly with changes in the country's external liabilities (reflecting the investment decisions of foreigners), and those associated with changes in its assets (reflecting the decisions of residents). We find that global factors, including US interest rates and investor risk aversion act as "gatekeepers" that determine when surges of capital to EMEs will occur. Whether a particular EME receives a surge, and the magnitude of that surge, however, are largely related to domestic factors such as its external financing needs, capital account openness, and exchange rate regime. While similar factors underlie asset- and liability-driven surges, the latter are more sensitive to global factors and contagion.

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1. Introduction

After collapsing during the 2008 global financial crisis, capital flows to emerging market economies (EMEs) surged in late 2009 and 2010, raising both macroeconomic challenges and financial-stability concerns. By the second half of 2011, however, amidst a worsening global economic outlook, capital flows receded rapidly, eliminating much of the cumulated currency gains, and leaving EMEs grappling with sharply depreciating currencies in their wake.[1] While such volatility is nothing new—historically, flows have been episodic (Figure 1)—it has rekindled questions about the nature of capital flows to EMEs. What causes these sudden surges? What determines the allocation of flows across EMEs? And do foreign and domestic investors behave differently when making cross-border investment decisions? In this paper, we take up these questions.

The literature on this subject has a long tradition of trying to identify global "push" and domestic "pull" factors in determining flows to recipient economies. Yet, in equilibrium, capital flows must reflect the confluence of supply and demand, so there must be both push (supply-side) and pull (demand-side) factors, and it is hard to attribute the observed flows to one side or the other. More meaningful, therefore, may be to consider the determinants of *changes* in capital flows, which might be associated with changes in supply factors (and declining costs of funds), or changes in demand factors (and rising costs of funds), or both (with roughly constant costs). From a policy perspective, however, it is not the normal variations in capital flows but rather the large increases in capital flows—*surges*—that are of particular interest both because of their greater impact on the exchange rate and competitiveness, and because they are more likely to overwhelm the domestic regulatory framework, raising financial-stability risks. In this paper, therefore, we focus on surges in net capital flows to EMEs, going beyond existing studies to examine both the factors associated with the occurrence of such surges, and their magnitude conditional on occurrence.[2] In doing so, we also establish that, while many of the factors underlying surges are broadly similar to those underlying more normal variations in capital flows, there are nevertheless economically and statistically significant differences.

It is common to think of net inflows being the result of foreigners pouring money into the country (thereby increasing residents' foreign *liabilities*), but they could equally result from the *asset* side—residents selling their assets abroad or simply not purchasing as many foreign assets as before. Recent literature (Milesi-Ferretti and Tille, 2011; Forbes and Warnock, 2012) stresses the need to distinguish between these cases to better understand cross-border capital movements—especially in advanced economies, where gross flows of assets and liabilities dominate the net movements. Though less true of emerging markets (where net

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[1] For example, in the two months following the U.S. sovereign debt rating downgrade in August 2011, the currencies of Brazil, Korea, Mexico, and Russia depreciated by about 10-16 percent in nominal terms, which largely offset earlier gains that had cumulated between end-2009 and mid-2011.

[2] On the determinants of capital flows to emerging markets, see, for example, Chuhan et al. (1993), Taylor and Sarno (1997), Hernandez et al. (2001), and IMF (2011). On surges in capital flows to EMEs, see Fernandez-Arias (1996), Taylor and Sarno (1997), and, more recently, Reinhart and Reinhart (2008), Cardarelli et al. (2009), and Forbes and Warnock (2012).

capital flows still largely reflect changes in external liabilities), the distinction may nevertheless be worth making, as liability-driven inflow surges might have different properties from asset-driven surges, and thus call for different policy responses. For example, it seems plausible that domestic investors would be more responsive to changes in local conditions because of informational advantages, while foreign investors may be more sensitive to global conditions. If so, and associating asset-driven surges with the investment decisions of domestic residents, and liability-driven surges with those of foreigners, there would be corresponding implications for the different types of surges.

In this paper, therefore, we also differentiate between asset- and liability-driven surges, and compare the factors associated with each. But in contrast to other studies that focus on gross capital flows, we do so by first identifying surges in *net* capital flows, and then classifying the net surge according to whether it corresponds mainly to changes in the country's foreign asset or liability position. This is because what matters for many of the issues of concern to EME policy makers (such as competitiveness, overheating of the economy, aggregate foreign currency exposure, and vulnerability to sudden stops) depends on whether the country is experiencing a surge in net (and not gross) terms.

Our empirical analysis proceeds in five steps. First, we establish that exceptionally large flows—surges—are a distinct phenomenon that behave differently from more normal flows. We then develop simple algorithms to identify surges in 56 EMEs over 1980–2011 by employing a "threshold" approach where net capital flows (in percent of GDP) that fall in the top 30th percentile of the country's own, and the entire sample's observations, are identified as surges.[3] With this method, we identify 326 surge observations (around one-fourth of the panel), roughly synchronized in the early 1980s (prior to the onset of the Latin American debt crisis); the early 1990s (as these countries emerged from the debt crisis); and the mid-2000s, as capital flows to EMEs recovered from the Asian crisis and the Russian default, and then accelerated in the run-up to the global financial crisis. Next, we identify the correlates of the occurrence of surges—using both conventional probit models and binary recursive tree analysis to flesh out interactions and threshold effects. Conditional on the occurrence of a surge, we then examine factors that help explain the magnitude of the flow during the surge. Finally, we distinguish between asset- and liability-driven surges and examine their similarities and differences.

The very synchronicity of surge episodes across countries suggests that global factors might be at play. Indeed, we find this to be the case—global factors, including US interest rates, and global risk aversion (as captured by the volatility of the S&P 500 index returns)—are key factors associated with the occurrence of inflow surges in EMEs. At the same time, whether a particular EME experiences a surge also seems to depend on its own attractiveness as an investment destination. Thus, fundamentals, including external financing needs (implied by the consumption-smoothing current account deficit), financial openness and connectedness,

[3] As a robustness check, we also employ a more novel "clustering" approach that avoids imposing ad hoc thresholds, and uses statistical clustering methods on (standardized) net flows to distinguish between surges, normal flows, and outflows. There is, however, a significant overlap between surges identified from both the threshold and clustering approaches, and the estimation results (presented below) are broadly similar.

real economic growth, and institutional quality are also associated with the likelihood that the country experiences an inflow surge. Conditional on the surge occurring, moreover, domestic "pull" factors, including the country's external financing needs, capital account openness, and exchange rate regime, are strongly related to its magnitude. Broadly speaking, therefore, global push factors seem to act as "gatekeepers" determining whether capital flows will surge toward EMEs at all, but domestic pull factors tell us where—and in what magnitude—they will end up, which explains both the synchronicity of EMEs surges and why not all countries experience a surge when, in aggregate, capital flows towards EMEs.

Our analysis also shows that inflow surges to EMEs are mostly liability-driven—only one-third of the net flow surges correspond mainly to residents' foreign asset transactions. The correlates of the two types of surges turn out to be quite similar: global factors matter for both, with lower US interest rates and greater risk appetite encouraging both foreigners to invest more in EMEs, and domestic residents to invest less abroad. Yet some differences are discernible. Foreign investors are equally attuned to local conditions as domestic investors, but tend to be more sensitive to changes in the real US interest rate and global risk, and are also more subject to regional contagion than asset-driven surges. These conclusions are reaffirmed from a binary recursive tree analysis, which shows that global factors, specifically, global risk, play a key role in driving large foreign inflows to EMEs.

These findings, which are robust to different surge definitions, estimation methodologies and specifications, as well as to the potential endogeneity of domestic macroeconomic factors to the inflow surge, hold important policy implications. First, inasmuch as surges reflect exogenous supply-side factors that could reverse abruptly, or are driven by contagion rather than by fundamentals, the case for imposing capital controls on inflow surges that may cause economic or financial disruption is correspondingly stronger. Second, to the extent that advanced economy interest rates are a key determinant of capital flow surges to EMEs, there may be need for multilateral surveillance over such policies to ensure that spillovers are taken into account. And third, if the aggregate volume of capital flows to EMEs is largely determined by supply-side factors, but the allocation of flows across countries depends on local factors (including capital account openness), there may also be a need for coordination among recipient countries to ensure that they do not pursue beggar-thy-neighbor policies in an effort to deflect unwanted surges to each other.

Our findings complement those of previous studies on inflow surges. Earlier work by Reinhart and Reinhart (2008) and Cardarelli et al. (2009) mainly cataloged stylized facts surrounding capital inflow "bonanzas" but did not undertake formal analysis of their determinants. A recent paper by Forbes and Warnock (2012) is the closest to our study, but there are some important differences in focus, methodology, findings, and policy implications. Forbes and Warnock identify surges on the basis of *gross* flows of assets or liabilities, rather than on the basis of *net* capital flows, distinguishing between what they define as inflow surges (nonresidents acquiring domestic assets) and retrenchments (residents repatriating foreign assets).[4] Therefore, many of their identified surges do not necessarily correspond to periods of exceptionally large net inflows.[5] While gross flows matter for some purposes, as mentioned above, it is the net surge that matters for issues such as competitiveness and aggregate foreign currency exposure that are of concern to many EMEs. Moreover, Forbes and Warnock pool advanced and emerging market countries in their analysis, yet capital flow dynamics in advanced economies (which borrow in their own currency) tend to be quite different from those in EMEs (which typically borrow in foreign currency and are much more susceptible to sudden stops). This pooling of advanced and emerging market samples may account for their finding (in contrast to ours) that advanced economy interest rates are unimportant for determining surges to EMEs, with the corresponding implication that there are no spillovers from the monetary policy of advanced economies. Finally, Forbes and Warnock focus on the occurrence of a surge, whereas we also look at the magnitude of the flow conditional on surge occurrence, and find that global factors act as "gatekeepers" but local factors determine where, and in what magnitude, flows end up. Our binary recursive tree analysis sheds further light on the interaction and threshold effects between push and pull factors, indicating that the former are the key correlate of large foreign inflows, whereas the latter are dominantly associated with surges driven by residents.

Our contribution to the existing literature is thus three-fold. First, we focus on *surges* of net capital flows, examining both why they occur, and their magnitude conditional on occurrence. Unlike previous studies, we also establish that it is important to study surges because large net flows behave differently from more normal fluctuations in capital flows. Second, we classify *net* inflow episodes according to whether they are predominantly asset- or liability-driven, and examine whether they react differently to changes in global and local conditions. Third, we systematically account for the plausible drivers of surges—including the return differential (adjusted for the expected exchange rate changes) and a new proxy of the country's external financing needs obtained from an intertemporal optimizing model of the current account—and complement our regression analysis with binary recursive trees. In addition, we test the robustness of our results to a range of alternate specifications and estimation methods as well as to the potential endogeneity of domestic macroeconomic factors (such as real GDP growth) to the inflow surge. To obtain instruments for the latter, we employ a unique database of IMF desk projections of key macroeconomic variables.

The rest of the paper is organized as follows. Section 2 outlines our empirical strategy for investigating the determinants of surge occurrence and magnitude. Section 3 describes how large flows differ from more normal flows, and presents our approach to identifying inflow surges, as well as documents their key features. Section 4 presents the main empirical results

[4] These are not the same as our asset- and liability-driven surges. Our surges represent exceptionally large *net* capital flows, which are then classified according to whether the net increase in flows corresponds mainly to changes in the foreign asset position of the country or its foreign liability position.

[5] For example, 49 percent of their surge observations also correspond to their "capital flight" (residents buying foreign assets) observations, so the net inflow should be small; likewise, 58 percent of their retrenchment observations are also "sudden stop" (nonresidents selling or no longer buying domestic assets) observations, again implying small net inflows.

and sensitivity analysis. Section 5 further explores the drivers of inflow surges using binary recursive trees. Section 6 concludes.

2. Empirical Strategy

Growing financial integration over the past few decades, together with the evident volatility of capital flows, has spawned a voluminous literature on the determinants of cross-border capital flows. While early empirical studies paid particular attention to the role of interest rate differentials (e.g., Branson, 1968; Kouri and Porter, 1974; and Kriecher, 1981), later studies have characterized determinants into "push" and "pull" factors, and focused more on evaluating the relative importance of each (e.g., Chuhan et al., 1993; Fernandez-Arias, 1996; Fernandez-Arias and Montiel, 1996; Taylor and Sarno, 1997). Push factors reflect external conditions (or supply-side factors) that induce investors to increase exposure to EMEs—for example, lower interest rates and weak economic performance in advanced economies, lower risk aversion, and booming commodity prices. Pull factors are recipient country characteristics (or demand-side factors) that affect risks and returns to investors, and depend on local macroeconomic fundamentals, official policies, and market imperfections (Fernandez-Arias and Montiel, 1996).

Since, in equilibrium, flows must reflect the confluence of supply and demand, it is not surprising that most studies of the level of capital flows find that both push (supply-side) and pull (demand-side) factors matter (see, e.g., Chuhan et al., 1993; Taylor and Sarno, 1997; Griffin et al., 2004; IMF, 2011; Fratzscher, 2011).[6] But those that look at the *change* in capital flows present a more mixed picture. Calvo et al. (1993) and Fernandez-Arias (1996) find a dominant role of global factors, notably US interest rates, in driving capital flows to Latin America and Asia in the early 1990s, while, for a similar sample, Taylor and Sarno (1997) find that US interest rates and domestic credit worthiness are equally important for changes in equity flows, but that US interest rates are much more important in driving the short-run dynamics of bond flows.

What about surges? The dynamics and determinants of these (exceptionally large) capital flows may be quite different from more normal variations, but existing empirical evidence—including on whether they indeed behave differently—is scant.[7] The few available studies (Reinhart and Reinhart, 2008; Cardarelli et al., 2009) mostly present some stylized facts about the association of net flow surges with global factors such as US interest rates, world output growth, and commodity prices, as well as with local characteristics, notably the

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[6] Chuhan et al. (1993) find that the importance of push and pull factors varies across regions and types of flows. For example, their results show that US flows to Latin America in 1988–92 were equally sensitive to pull and push factors, but those to Asia reacted more to pull factors; and relative to equities, bond flows are more responsive to domestic factors such as the country's credit rating. Fernandez-Arias (1996), however, argues that since domestic creditworthiness is closely tied to global interest rates, it is ultimately creditor country conditions that matter more.

[7] In contrast, the factors associated with large downward swings in net capital flows (in the context of sudden stops and current account reversals) have been well explored empirically (e.g., Milesi-Ferreti and Razin, 2000; Calvo et al., 2004; Eichengreen and Adalet, 2005).

current account deficit and real GDP growth. Looking at gross flows, Forbes and Warnock (2012) find that global risk, global liquidity, and global as well as domestic real growth matter for inflow surges, but find no role of advanced economy interest rates.[8] They show, however, that the retrenchment of residents' assets abroad is (positively) related with interest rates in advanced economies, and with global risk and contagion effects (through trade and financial channels).

Building on these various strands of the literature, we first show (using quantile regressions) that large net flows behave differently from more normal flows. We then model both the likelihood of inflow surges (as defined in Section 3 below), and their magnitude (conditional on occurrence), as functions of: (i) the return differential, r_{jt}^{d} ; (ii) global push factors, x_t; (iii) domestic pull factors, z_{jt}; and (iv) contagion, c_{jt}:

$$\Pr(S_{jt}=1)=F(r_{jt}^{d}\alpha_1+x_t'\beta_1+z_{jt}'\gamma_1+c_{jt}'\delta_1) \tag{1}$$

$$K_{jt|s_{jt}=1}=r_{jt}^{d}\alpha_2+x_t'\beta_2+z_{jt}'\gamma_2+c_{jt}'\delta_2+\varepsilon_{jt} \tag{2}$$

where S_{jt} is an indicator variable of whether a surge in net capital flows (to GDP) occurs in country j in period t; $K_{jt|s_{jt}=1}$ is the magnitude of the net capital flow (to GDP) conditional on the surge, and $F(.)$ is assumed to follow the standard normal cumulative distribution function so (1) can be estimated as a probit model, and (2) can be estimated by Ordinary Least Squares (OLS). To address the potential endogeneity concerns of the domestic pull factors in both (1) and (2), we substitute contemporaneous values of these variables by their lagged values.[9] Since many of the structural variables (e.g., capital account openness) change only slowly, and because we are interested in the effect of global factors that will be common across recipient countries (e.g., US interest rates), we do not include country or annual fixed effects, but control for region-specific effects and a range of country characteristics.[10]

Rate of return differential

Neoclassical theory predicts that capital should respond to interest rate differentials between countries—flowing from countries with low return (capital-abundant advanced economies) to

[8] Forbes and Warnock's (2012) finding that advanced economy/US interest rates are insignificant in explaining surges may, however, be the result of their sample, which includes both advanced and emerging market economies. Higher advanced economy interest rates would therefore have two offsetting effects: decreasing surges to EMEs while increasing them in advanced economies, with little or no average effect in their sample.

[9] If domestic factors are endogenous to the occurrence or magnitude of the inflow surge, then estimates from (1) and (2) will be inconsistent. We also estimate equations (1) and (2) by instrumental variables (IV) estimation methods, using lagged values as instruments. These estimates are very similar to those reported here (where lagged values are used directly in the specification). Endogeneity issues are discussed further in Section 4.4.

[10] Estimation results for (1) and (2) with country fixed effects are also reported in the sensitivity analysis. While estimating (1) and (2), we cluster standard errors at the country level to address the possibility of correlation in the error terms. The significance of the estimated coefficients remains unchanged if standard errors are clustered by year, or bootstrapped standard errors are computed.

those with high return (capital-scarce emerging economies). The nominal interest rate differential is given by the standard uncovered interest rate parity condition:

$$i_{jt}^{d} = i_{jt} - (i_t^{*} + (e_{jt+1}^{e} - e_{jt})) \quad (3)$$

where i_{jt}^{d} is the interest differential for country *j* at time *t*, i_{jt} is the domestic interest rate (money market rate or treasury bill rate, according to data availability) of the emerging economy, i_t^{*} is the advanced economy interest rate (proxied by the US 3-month treasury bill rate), and e_{jt} is the log nominal exchange rate (an increase in e_{jt} represents a deprecation). Subtracting the inflation rate from both sides of (3):

$$r_{jt}^{d} = i_{jt} - (p_{jt+1} - p_{jt}) - \{i_t^{*} - (p_{t+1}^{*} - p_t^{*}) + (p_{t+1}^{*} + e_{jt+1}^{e} - p_{jt+1}) - (p_t^{*} + e_{jt} - p_{jt})\} \quad (4)$$

or

$$r_{jt}^{d} = r_{jt} - r_t^{*} - \Delta q_{jt+1}^{e} \quad (5)$$

where r_{jt}^{d} is the real interest rate differential; p_t and p_t^{*} are the log domestic and US price levels, respectively; r_{jt} and r_t^{*} are the domestic and US real interest rates, respectively; and Δq_{jt+1}^{e} is the expected real exchange rate depreciation.[11] We proxy for the expected real depreciation by the log difference between the current real effective exchange rate (REER) and its long-term trend (i.e., the implied overvaluation), $\Delta q_{jt+1}^{e} = \tilde{q}_j - q_{jt}$, so capital flows to EMEs should respond positively to the differential (and, hence, negatively to the implied overvaluation):

$$r_{jt}^{d} = r_{jt} - (\tilde{q}_j - q_{jt}) - r_t^{*} \quad (6)$$

Using (6)—that is, working in terms of the real interest rate differential—is useful because some of the EME observations include high- or even hyperinflationary periods. In the empirical results below, we present two estimates of (1) and (2). The first variant (the "constrained" model) includes the real-interest rate differential as defined in (6), so that the coefficients on the individual terms (r_{jt}, r_t^{*} and Δq_{jt+1}^{e}) are constrained to be equal. The second variant (the "unconstrained" model) includes the terms individually so the coefficients are unrestricted, which allows to identify whether the effect of the real interest rate differential stems mainly from the push (r_t^{*}) or pull (r_{jt} and $(q_j - \tilde{q})$) factors.

Global push factors

Global push factors reflect external conditions, largely beyond the control of EMEs, which underpin the supply of global liquidity. In addition to the real US interest rate (in the unconstrained model), we include the volatility of the Standard & Poor (S&P) 500 index

[11] We compute the US and domestic real interest rates by using expected (i.e., one-period ahead actual) inflation rate, but the results remain similar if the current inflation rate is used instead.

returns, and world commodity prices as other global push factors.[12] Higher US interest rates (proxying the rate of return in advanced economies) are expected to be associated with lower capital flows to EMEs. Likewise, greater volatility of the S&P 500 index returns—as a measure of global market uncertainty—is likely to be associated with a lower surge probability for EMEs since advanced economies are traditionally considered to be safe havens in times of increased uncertainty. Higher commodity prices (measured as the log difference between the actual and trend commodity price index to capture the effect of large movements in commodity prices) are likely to be positively correlated with inflow surges inasmuch as they indicate a boom in demand for EME exports, and perhaps the recycling of income earned by commodity exporters.

Domestic pull factors

For capital to flow, there must be corresponding investment opportunities in the destination country. Early studies of private capital flows to developing countries often included the country's current account deficit as a measure of its financing needs (Kouri and Porter, 1974). But with the increasing importance of private (as opposed to official) flows to EMEs, this becomes almost tautological: abstracting from changes in reserves, the current account deficit must be (largely) financed by private capital flows, and the observed flows must correspond to the current account deficit.

To get around this problem, and to see whether capital flows to EMEs respond to "fundamentals," we turn to an intertemporal optimizing model of the current account (Ghosh, 1995). In such a model, the capital inflow corresponding to the current account deficit (CAD_t^*) can be shown to equal the present discounted value of expected changes in national cash flow—or the difference between GDP (Q_t), investment (I_t), and government consumption (G_t):[13]

$$CAD_t^* = \sum_{j=1}^{\infty} \frac{E\{\Delta(Q_{t+j} - I_{t+j} - G_{t+j})\}}{(1+r)^j} \tag{7}$$

According to the consumption-smoothing model (7), the country has an external financing need (that is, optimally, a current account deficit) when output is temporarily low, and/or government consumption and investment are temporarily high (for example, in the face of a positive productivity shock). Permanent shocks, of course, have no impact on the (consumption-smoothing component of the) current account as the country should adjust to

[12] We use the volatility of S&P 500 index returns as an alternative to the more commonly used VIX because the latter is only available from 1990 onwards. As a robustness check, however, we also use: (i) the Credit Suisse Global Risk Appetite Index (RAI), which is available from 1984 onwards, and measures excess return per unit of risk with lower (higher) values indicating periods of financial market strain (ease), and (ii) a normalized measure for VIX, which is supplemented by a normalized measure of the VXO index—the precursor of VIX—for the pre-1990 years (the VXO is available from 1986 onwards). The correlation between our S&P500 index returns volatility measure and the VIX/normalized VIX is 0.5. Table B1 in online Appendix provides a description of variables and data sources.

[13] See online Appendix A for details.

such shocks. Since surges are episodes of temporarily high capital inflows, they presumably correspond to temporary shocks to the domestic economy. Accordingly, CAD_t^* , as defined in (7), should be a good proxy for the country's external financing needs that are met by surges in net capital flows.

Even if the country does have an external financing need, it may not be met if the capital account is closed (indeed, the derivation of (7) assumes perfect capital mobility). To capture this possibility, we include a measure of (de jure) capital account openness in (1) and (2), which is taken from Chinn and Ito (2008), and is based on the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions* (AREAR). Countries that are more financially open are, in principle, more likely to experience a surge of capital inflows than relatively closed economies. Regardless of de jure openness, however, a country that is in arrears or otherwise in default on its external payments is unlikely to be an attractive destination for foreign investors and is less likely to experience an inflow surge. We therefore also include a dummy variable (based on Reinhart and Reinhart, 2008) to capture whether the sovereign is in a debt crisis such that it is unable to make its principal or interest payments by the due date.

Fast growing economies are more likely to experience large capital flows, not only because of their potentially large financing needs, but also because of their greater potential productivity and returns, as are countries with better institutional quality (Alfaro et al., 2008). Thus, we include real GDP growth rate as well as a measure of institutional quality among the pull factors. We also include the de facto exchange rate regime (taken from the IMF's AREAER) to capture the possibility that the implicit guarantee of a fixed exchange rate may encourage greater cross-border borrowing and lending. Countries that are better integrated with global financial markets may be more likely to receive inflows (e.g., as in Ghosh et al., 2011; and Hale, 2011)—perhaps because of lower informational costs for foreign investors or because of more diversified sources of external financing. Therefore, we also include a measure of the country's financial "connectedness" as proxied by its centrality in the global banking network (specifically, by the proportion of advanced economies that have banks with cross-border exposure to the recipient country; Minoiu and Rey, 2011). Finally, in the unconstrained model, we include the domestic real interest rate (which should be positively correlated with surges), and the deviation of REER from its trend (that is, the estimated overvaluation of the currency, which should be negatively correlated with surges) as separate terms based on (6).

Contagion

Another external factor, which has gained much attention in recent years, is contagion. Recent literature finds a strong effect of contagion on capital flows, particularly in the context of economic and financial crises/sudden stops (e.g., Glick and Rose, 1999; Kaminsky et al., 2001), but positive contagion leading to an increase in capital flows is also possible through financial (including greater bank lending or portfolio flows from one EME to another), and trade (that is, direct trade, competition in third markets, or changes in terms of trade) channels, or because of similar macroeconomic characteristics and investor herding behavior more generally (Forbes and Warnock, 2012).[14] To capture the impact of contagion on surge likelihood, we include in (1) a regional contagion variable defined as the proportion of other countries in the region experiencing a net capital flow surge (and, correspondingly, in the magnitude regression (2) we include the average net flow (in percent of GDP) to other countries in the region experiencing a surge).

3. Identifying Surges

3.1. Methodology

We begin our empirical analysis by establishing that large net flows indeed behave differently from more normal flows, and as such surges are worth examining as a distinct phenomenon. While existing studies (e.g., Reinhart and Reinhart, 2008; Forbes and Warnock, 2012) take this as given, we estimate quantile regressions to examine whether the behavior of net capital flows to push and pull factors varies across the distribution of the size of the net flow. To do so, we obtain data from the IMF's *Balance of Payment Statistics*, and define net capital flows as total net flows excluding "other investment liabilities of the general government" (which are typically official loans) and exceptional financing items (reserve assets and use of IMF credit), expressed in percent of GDP.[15]

The results obtained from this exercise, reported in Table 1, show that the association of several push and pull factors with net capital flows depends on the magnitude of the net flow being received. Thus, for example, among global factors, the coefficients on the real US interest rate, global risk aversion and commodity prices are significantly larger for net flows that are at the upper end of the distribution; and, among domestic factors, the coefficients of the exchange rate regime, capital account openness and institutional quality are also larger (cols. [5]-[7]). Conversely, the impact of real domestic interest rates is not statistically significant for larger flows relative to more normal flows (i.e., those at the median of the distribution).

Cols. [8]-[10] in Table 1 present estimates of the interquantile regressions—that is, difference of the coefficients between different quantiles. Testing for the statistical significance of these difference estimates (25^{th} vs. 50^{th} percentile, 50^{th} vs. 75^{th} percentile, and 75^{th} vs. 90^{th} percentile) reinforces the point that capital flows behave qualitatively differently depending on the size of the net flow. As such, OLS regressions on the full sample may not suffice, and large flows—surges—merit separate analysis, which is the focus of our work here.

How to identify such surge observations? A common approach in the literature is to use thresholds—for example, Reinhart and Reinhart (2008) select a cut-off of 20^{th} percentile across countries of total net capital flows (in percent of GDP), and Cardarelli et al. (2009)

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[14] See Claessens and Forbes (2001) for a discussion on contagion and the possible transmission mechanisms.

[15] We scale net flows by GDP to control for economic size—large inflows in absolute terms may not be a concern if the economy has a large absorptive capacity.

define a surge when net private capital flows (in percent of GDP) for a country exceed its trend by one standard deviation (or falls in the top quartile of the regional distribution). In recent work, Forbes and Warnock (2012) use quarterly data on gross capital flows, and define a surge as an annual increase in gross inflows (not scaled by GDP) that is more than one standard deviation above the (five-year rolling) average, and at least two standard deviations above the average in at least one quarter.[16]

There are pros and cons to defining surges in terms of net or gross inflows. On the one hand, some financial stability risks (such as foreign currency exposure of unhedged domestic borrowers) may depend on the country's gross external liabilities, and as argued above, the dynamics of liabilities may be quite different from those of assets. On the other hand, most macroeconomic consequences of capital flows (such as exchange rate appreciation or macroeconomic overheating) and some financial-stability risks, will be related to net, not gross, flows (for example, it is noteworthy that one of the most common prudential measures is the limit on banks open foreign currency position, which is defined in net rather than gross terms). Indeed, the problem with using gross flows is that many of the identified "surges" may not constitute periods of net flows, let alone exceptionally large net flows. In this paper, therefore, we define surges in terms of the net flow of capital (in proportion to GDP) but use gross flow data to distinguish between those that correspond mainly to changes in external liabilities and those that correspond to changes in assets.

To identify surge, we follow the existing literature and define a surge as any year in which net capital flows exceed some threshold value. Guided by our estimates of the quantile regressions, we set the threshold at the top 30th percentile for the country, provided the net flow (expressed in percent of GDP) also falls in the top 30th percentile for the entire (cross-country) sample. This ensures that only observations of net flows that are large by (country-specific) historical as well as by international standards are included as surges. Likewise, observations in the bottom 30th percentile (of the country-specific as well as the full sample's distribution) are coded as outflows; all other observations are coded as "normal" flows.[17]

While the particular choice of algorithm to identify surges inevitably involves trade-offs, our "threshold approach" has the advantage of ensuring uniform treatment across countries while still allowing significant cross-country variation in the absolute threshold of a surge.[18] As

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[16] These definitions are somewhat analogous to those adopted for identifying current account reversals and sudden stops (see Reinhart and Reinhart (2008) for a review).

[17] In the sensitivity analysis, we also identify surges using a more novel "clustering" approach that avoids imposing ad hoc thresholds. Here we focus on the results when surges are defined using the threshold approach, as these present more extreme observations that are large by both the country's own and the cross-country experience, reserving the cluster-identified surges for the robustness checks.

[18] In our approach, the country-specific cut-off for identifying surges remains constant over the sample period, ensuring that capital inflows that are exceptionally large (in percent of GDP) are always coded as surges. This is in contrast to methods that use deviations from rolling averages, which may take better account of drifts in the volatility of capital flows, but may not code large capital flow observations as a surge if the large inflows have persisted for a few years. Conversely, rolling methods may identify a capital inflow as a "surge" even though it is small in absolute terms (and therefore of little macroeconomic consequence), if flows have been low for a while but then there is a small jump in the series.

with other empirical studies, however, dating the start and the end of a surge is not always straightforward since the strict application of any algorithm to identify surges runs the risk of omitting at least some observations of relatively large net capital flows. We therefore also construct a one-year window around the identified surge observations, including the immediate pre- and post-surge years (provided the net flow is positive in these years), and check the robustness of our estimation results to these additional surge observations.

Moreover, to determine whether a surge is driven by an increase in residents' liability or asset transactions, we use data on total liabilities (gross inflows) and total assets (gross outflows) also obtained from the *Balance of Payment Statistics*. Thus, when a net capital flow surge corresponds to a larger *increase* in domestic residents' liabilities relative to the reduction in their foreign assets, it is identified as liability-driven, while it is defined as asset-driven when the converse holds.[19]

3.2. Key Features

We apply the threshold approach to a sample of 56 EMEs using annual data for the period 1980–2011.[20] Under this approach, we obtain 326 surge observations, the majority of which are in Eastern Europe and Latin America.[21] Surges tend to last, on average, for about 2 years, while the average net capital flow during the episode is around 10 percent of GDP. As a proportion of GDP, the largest surges are actually in the Middle East and African countries (around 13 percent of GDP, perhaps because of large resource extraction investment projects), followed by emerging Europe. Surges have become more frequent in recent years with the share of surge observations rising from about 10 percent in the 1980s to more than 20 percent in the 1990s, and to almost 30 percent in the last decade (Figure 2).

Classifying by the type of surge shows that the majority (more than two-thirds) correspond to an increase in residents' liabilities (liability-driven) rather than to a decline in the holdings of their assets abroad (asset-driven). Asset-driven surges outnumber liability-driven surges in only two out of the 30 years of our sample—1982 and 2008, both of which are crisis years

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[19] The identified surges could also be classified in terms of the components of capital flows, that is, FDI, portfolio equity or debt flows. Doing so, however, would result in the total number of surge observations being divided into the various categories (FDI, portfolio equity/debt, etc.), yielding too few observations under each category for meaningful empirical analysis. This problem may be mitigated by using quarterly data on capital flows, but quarterly data on net flows (and correspondingly on the relevant local pull factors) going back to the 1980s are largely unavailable for EMEs.

[20] The list of countries follows the sample of EMEs covered by the IMF's Early Warning Exercise (IMF, 2010). Tables B2 and B3 in online Appendix list the countries included in our sample, along with the surge episodes obtained from the threshold and cluster approaches, respectively.

[21] A comparison of our surge episodes with those of Reinhart and Reinhart (2008) and Cardarelli et al. (2009) suggests broad overlap, particularly for "well-known" episodes, though there are some differences in the duration of the episodes. For the countries included in our sample, the correlation between our threshold-based surge observations with those in Reinhart and Reinhart, and Cardarelli et al. is 0.3 and 0.4, respectively (while the correlation between the surge series in these two studies is around 0.3).

(Figure 3, panel a).[22] On average, liability-driven surges are also somewhat larger than asset-driven surges, though the difference is not statistically significant (Figure 3, panel b).

An initial snapshot of the occurrence and magnitude of inflow surges suggests three noteworthy points. First, surges seem to be synchronized internationally, generally corresponding to "well-established" periods of high global capital mobility—the early 1980s (just before the Latin American debt crisis), the mid-1990s (before the East Asian financial crisis and Russian default), and the mid-2000s in the run-up to the recent financial crisis—suggesting that common factors are at play. Second, even in times of such global surges, not all EMEs are affected. In fact, the proportion of EMEs experiencing an inflow surge in any given year never exceeds one-half of the sample, with some countries experiencing them repeatedly. As such, conditions in the recipient countries must also be relevant. Third, there is considerable time-series and cross-sectional variation in the magnitude of flows conditional on the occurrence of a surge. For example, Asian countries experienced the largest surges (in percent of GDP) during the 1990s wave of capital flows, whereas emerging Europe experienced the largest surges in the mid-2000s. Thus, both global and domestic factors appear to be relevant in determining surges—perhaps global factors driving the overall volume of flows to EMEs, and domestic factors influencing their allocation.[23]

What are these factors? A simple tabulation of explanatory variables during surge and nonsurge (normal and outflow) periods suggests a number of global push and domestic pull factors may be relevant (Table 2). During surges, the US real interest rate and global market uncertainty (S&P 500 index returns volatility) are lower, while commodity prices are higher, than at other (normal or outflows) times. Turning to domestic factors, when experiencing surges, recipient countries tend to have larger external financing needs, faster output growth, as well as more open current and capital accounts (with greater financial interconnectedness), and stronger institutions.

4. Estimation Results

The statistics reported in Table 2 are suggestive of the factors that might determine when and whether a country experiences an inflow surge. In what follows, we examine more formally the factors associated with the occurrence and magnitude of surges. Below, we also split surges according to whether they are asset or liability-driven and conduct various robustness checks on our results.

4.1. Occurrence of Surges

We begin by estimating the "constrained" variant of the surge occurrence probit model specified in (1), where the real interest rate differential (adjusted for the expected real exchange rate depreciation) enters as a single composite variable (Table 3, cols. [1]-[5]).

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[22] This observation is in line with the well-established drawdown on residents' foreign assets during crises (Milesi-Ferretti and Tille, 2011).

[23] Online Appendix (Figure B1) presents the occurrence of surges by region.

According to the estimates, a higher real interest rate differential is associated with greater likelihood of an inflow surge, though the coefficient only becomes statistically significant when domestic pull factors are taken into account. Times of greater global market uncertainty (volatility of the S&P 500 index returns) are associated with significantly lower probability of a surge to EMEs, presumably because—at least traditionally—these countries have not been viewed as safe havens at times of heightened uncertainty and risk aversion. Conversely, commodity price booms, which likely signal higher global demand for EME exports, are positively correlated with inflow surges, as is regional contagion (though the latter becomes statistically insignificant after controlling for the full set of domestic pull factors; col. [5]). Although individual coefficients are highly statistically significant, these global factors have limited explanatory power: the pseudo-R^2 (which compares the log likelihood of the full model with that of a constant only model) is 5 percent, and the probit sensitivity (proportion of surges correctly called) is about 4 percent.

Turning to domestic pull factors, the external financing need implied by the optimal consumption-smoothing current account is highly significant as is real GDP growth in the recipient country.[24] Countries with fewer capital account restrictions, that are better connected (in the sense of more sources of cross-border loans), or that have stronger institutions are also significantly more likely to experience inflow surges, as are countries with less flexible exchange rate regimes.[25] Countries that are in default are less likely to experience inflow surges, though the variable is not statistically significant. Adding these pull factors more than doubles the pseudo-R^2 to 18 percent and raises the sensitivity to 25 percent.

The right-hand panel of Table 3 (cols. [6]-[10]) reports the corresponding estimates when the real interest rate differential is not constrained to enter as a single term so that the US real interest rate, domestic real interest rate, and estimated real exchange rate deviation from trend (the implied overvaluation) enter separately. Doing so shows that much of the effect of the real interest rate differential is through the US real interest rate: evaluated at the mean of other explanatory variables, a 100 basis point rise in US real interest rates would be associated with a 3 percentage point lower likelihood of a surge (where the unconditional probability of a surge in the estimation sample is 22 percent). Real exchange rate overvaluation (as measured by the deviation of the REER from trend) lowers the estimated likelihood of a surge, though the coefficient is not statistically significant when other domestic factors are added. The estimated coefficient of the domestic real interest rate is

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[24] The significance of the external financing need is robust to the use of lagged current account balance to GDP ratio as an alternate proxy, as well as to the exclusion of outliers. Moreover, when the individual components of the optimal current account (output, investment, and government consumption measured as deviations from trend) are included, investment is the dominant variable, with higher investment ratio significantly raising the likelihood of a surge (through a larger current account deficit).

[25] Since the impact of capital account openness may be conditional on global factors—i.e., countries with more open capital accounts may be more likely to experience a surge when interest rates in advanced economies or global risk aversion are low—we also estimate regressions including interaction terms between the capital account openness variable and the global factors (real US interest rate, S&P 500 index returns volatility, and commodity prices). However, the estimated coefficients on the interaction terms are not robustly significant.

positive and statistically significant at the 10 percent level, indicating that a 100 basis point rise in the domestic real interest rate would be associated with a half percentage point higher likelihood of a surge (cols. [8]-[10]). The estimated coefficients of most of the other variables—for example, the external financing need, real GDP growth rate, capital account openness, financial connectedness, exchange rate regime, and institutional quality—are of similar magnitude and statistical significance to those estimated under the restricted variant. Overall, the model correctly calls some 80 percent of the observations, and almost 30 percent of the surge observations, with a pseudo-R^2 of 19 percent.

Based on the above results, the constrained model—which imposes the restriction of equal coefficients on the three variables in the real interest rate differential term—appears to be strongly rejected by the data. In what follows, we therefore focus on the results obtained from the unconstrained model, and in Figure 4, plot the implied probability of a surge (evaluated around the means of the explanatory variables) based on the estimates reported in Table 3 (col. [10]). Against an unconditional probability of 22 percent, a one standard deviation shock to the volatility of the S&P 500 index returns lowers the predicted surge probability by about 3 percentage points, while the corresponding shock to the commodity price index raises the surge probability by about 7 percentage points. Turning to domestic macroeconomic factors, a one percentage point increase in the country's real GDP growth rate, or a one percent of GDP increase in its external financing needs raises the predicted likelihood of a surge by about 1 and 3 percentage points, respectively. On capital account openness and the institutional quality index, moving from the sample median to the 75th percentile raises the predicted probability of a surge by 3 to 4 percentage points, respectively.

4.2. Magnitude of Flows in Surges

The probit estimates above give the likelihood of experiencing an inflow surge, but the magnitude of the capital flow during a surge also varies considerably (ranging from 4 percent to about 54 percent of GDP, as shown in Table 2). Is it possible to say anything about the size of the surge conditional on its occurrence? Table 4 reports the estimation results for the surge magnitude regression (2), where the dependent variable is the net capital flow (expressed as a proportion of GDP), and the sample comprises only the surge observations. We present the results of the unconstrained model here in which the US real interest rate, domestic real interest rate, and overvaluation are allowed their own coefficients, while the results of the constrained model—where the equality of coefficients is again rejected by the data—are presented in the online Appendix.

The estimation results, presented in Table 4, suggest a more limited role for global factors in determining the magnitude of the surge. A 100 basis point decline in the real US interest rate is associated with about 0.4 percent of GDP larger capital flows (Table 4, cols. [1]-[5]), and a one standard deviation decrease in S&P 500 index returns volatility increases the magnitude of the surge by 1 percent of GDP—though both effects are statistically significant at the 10 percent level only, while the estimated coefficient of commodity price booms is statistically insignificant. These results, together with the findings of the probit model above, suggest that global factors may act largely as "gatekeepers"—capital surges toward EMEs only when these global conditions permit, but once this hurdle is passed, the volume of capital that flows is largely independent of it.

Since countries that experience a surge already have the macroeconomic and structural characteristics identified above, several of the domestic pull factors are statistically insignificant in the magnitude regression conditional on surge occurrence. Nevertheless, the nominal exchange rate regime, real exchange rate overvaluation, and external financing needs of the country are all highly statistically significant. A one-percent of GDP increase in the estimated external financing need is associated with one-third of one percent of GDP higher capital inflows, while 10 percent overvaluation of the real exchange rate is associated with lower net capital flows of about 2 percent of GDP. Other factors equal, a country with a pegged exchange rate would experience 3 percent of GDP larger capital flows during a surge than if it had a more flexible exchange rate regime. Finally, countries with more open capital accounts appear to experience larger surges: moving from the 25th percentile of the sample's capital account openness index to the 75th percentile is associated with 1 percent of GDP higher capital inflows during a surge.

An interesting observation is that of a negative, but statistically insignificant, estimated coefficient of the regional contagion variable. This finding along with the positive estimated coefficient for the contagion variable in the surge likelihood regressions suggests that economic linkages (trade or financial) between EMEs, or herding behavior by investors, makes it more likely that a country will experience a surge if other countries in the region do. However, because investors allocate funds regionally, the magnitude of the resulting flow is a decreasing function of the flows to other countries in the region.

Overall, these findings are consistent with, but go beyond, the results of previous studies, and help to explain the stylized facts noted in Section 3. Specifically, the finding that the likelihood of surge occurrence is influenced strongly by global factors—notably, the US interest rates, as argued by Calvo et al. (1993) and Reinhart and Reinhart (2008), but in sharp contrast to Forbes and Warnock (2012) who do not find an impact of advanced economy interest rates on large (gross) inflows, and global risk—explains the synchronicity of surges across regions, and highlights that sudden changes in these factors could trigger large swings in capital flows. That commodity price booms raise the surge likelihood also resonates with the finding of Reinhart and Reinhart (2008). Certain macroeconomic (in particular, growth performance and the external financing need), and structural characteristics (notably, financial openness and institutional quality) are also important covariates with surge occurrence, which explains why not all countries experience a surge when, in aggregate, capital is flowing toward EMEs. Further, among the countries that experience a surge, the magnitude of the flow appears to be strongly associated with the external financing need, exchange rate regime and financial openness, with countries that have less flexible regimes, or those that are more financially open, experiencing larger surges.

4.3. Asset- vs. Liability-Driven Surges

Does the nature of the surge matter? In other words, are the global and domestic factors identified above equally important for surges that mainly correspond to changes in residents' assets (asset-driven surges) as those that correspond to changes in their liabilities (liability-driven surges)? To examine this question, we re-estimate (1) and (2), but define the surge as being either asset or liability-driven.[26] Tables 5 and 6 present the results for the unconstrained model for the two types of surges, while the results for the constrained model are presented in online Appendix.[27]

The results for the probit model show that real US interest rates matter significantly for the occurrence of both asset and liability-driven surges, though the impact is larger for the latter—a 100 basis points increase in the real US interest rate (evaluated at mean values) lowers the predicted probability of a liability-driven surge by about 2 percentage points, and that of an asset-driven surge by 1 percentage point (Table 5). Global market uncertainty is strongly related to both types of surges, such that in times of increased global market uncertainty, foreign as well as domestic investors exit EMEs (and presumably prefer to invest in safe haven countries). Nevertheless, foreign investors appear to be more sensitive to global market uncertainty: a one standard deviation shock to the S&P 500 index returns volatility reduces the estimated likelihood of a liability-driven surge by 3 percentage points compared to about 1 percentage point for asset-driven surges. Asset-driven surges, but not liability-driven surges, are more likely when commodity prices are booming. Conversely, liability-driven surges appear to be subject to regional contagion more than asset-driven surges.

Among the domestic pull factors, the external financing need, real economic growth, and institutional quality are correlated with both types of surges. Liability-driven surges, however, appear somewhat more sensitive to the recipient country's external financing need—such that a one percentage point increase (at mean values), raises the estimated likelihood of a liability-driven surge by about an additional 1 percentage point as compared to an asset-driven surge (Figure 5). Interestingly, asset-driven surges appear to react more strongly to changes in the real domestic interest rate, while liability-driven surges appear to respond more to expected changes in the exchange rate with greater real exchange rate overvaluation (and hence expected depreciation) making liability-driven surges less likely.

Financial interconnectedness and exchange rate regime have a more pronounced association with liability-driven surges—indicating that EMEs with greater financial linkages and less flexible exchange rate regimes are more likely to experience large foreign capital flows. Capital account openness is strongly associated with an asset-driven surge—moving from the 25th to 75th percentile of the capital account openness index raises the estimated asset-driven

[26] We estimate asset- and liability-driven surges as separate samples because a direct comparison of their regression coefficients would involve adding several interactive terms (between the explanatory variables and a dummy variable indicating whether the surge is asset/liability-driven) in the general specification, with limited degrees of freedom (and the potential to create multicollinearity). However, estimating a single regression including the interactive terms one-by-one presents a similar picture to that obtained below in terms of the relative importance of the push and pull factors for the two types of surges.

[27] In these estimations, the comparison of each surge type is with the nonsurge observations; hence, the observations for the other type of surge are excluded from the sample (which also means that the sample size for both asset- and liability-driven surges is different). As mentioned in Section 3, asset-driven surges constitute about 7 percent of the full sample (one-third of the surge observations); thus, results pertaining to these estimations should be treated with caution.

surge probability by about 3 percentage points.[28] The strong impact of capital account openness on asset-driven surges is intuitive because it is only when capital flows are liberalized (and can leave the national jurisdiction) in the first place that they be retrenched from abroad and invested in the domestic economy.

In terms of the magnitude of flows during surges, as before, several domestic macroeconomic and structural characteristics are statistically insignificant because by definition countries are sufficiently similar to have experienced a surge. Nevertheless, the results show that global factors are only weakly associated with both asset- and liability-driven surges. Domestic factors, by contrast, do matter. The regression predicts that the size of inflows received will be larger if the nominal exchange rate regime is less flexible and the capital account is (more) open (Table 6). Thus, a country with a pegged exchange rate experiences about 3 and 4 percent of GDP larger capital flows during asset- and liability driven surges, respectively, than if it had a more flexible regime. Likewise, moving from the 25th percentile of the capital account openness index to the 75th percentile is associated with 1-2 percent of GDP larger asset- or liability-driven surges. The external financing need is, however, more strongly associated with the magnitude of liability-driven surges.

The above results suggest that while asset- and liability-driven surges have many common factors, there are also some important differences between them. In particular, liability-driven surges seem to be more sensitive to global factors and to contagion, but are also more responsive to the external financing needs of the country and dependent on its financial interconnectedness. Inasmuch as liability-driven surges reflect the investment decisions of foreigners, who are likely to face greater informational barriers than residents in identifying local investment opportunities (and must therefore rely more on global factors), these findings make intuitive sense.

4.4. Sensitivity Analysis

To check the robustness of our estimates reported above, we conduct a range of sensitivity tests below, which pertain to the dating and coverage of surge episodes, our alternative methodology for identifying surges (cluster analysis), model specification, and the potential endogeneity of the regressors.

Extended surges

Pinning down the exact timing (start and end) of surge episodes is not always straightforward. Thus, while our surge episodes largely overlap (for at least one year) with episodes identified in other studies (e.g., Reinhart and Reinhart, 2008; and Cardarelli et al., 2009), they do not coincide completely (nor do surge episodes identified in other studies correspond exactly with each other). In general, strict application of any algorithm to identify

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[28] There is some evidence that capital account openness is significantly associated with the occurrence of liability-driven surges in the constrained model (Table B5 in online Appendix).

surges runs the risk of omitting at least some observations of relatively large net capital flows that in reality are probably part of the same episode but that do not quite meet the criteria.

To address these concerns, we construct a one-year window around the identified episode, including the year immediately before and immediately following the surge episode (provided the net private capital flow in those years is positive), and re-estimate all specifications using the extended surge variable.[29] Tables 7 and 8 (col. [1]) present the estimation results for this exercise, which largely support the findings reported in Tables 4 and 5, respectively. Specifically, for surge likelihood, the US real interest rate and global market uncertainty are significant—while domestic factors such as the external financing need, real GDP growth rate, capital account openness, exchange rate regime, financial interconnectedness, and institutional quality are also strongly significantly. The main difference with the previous results is that the implied real exchange rate overvaluation and the sovereign default dummy now become strongly significant. For surge magnitude, as before, the external financing need, a less flexible exchange rate regime, and expected real exchange rate change are significant, as are the real US interest rate, and the S&P 500 index returns volatility measure.

Cluster analysis

To check whether our estimation results are sensitive to the definition of surges, we employ a second, and more novel, "clustering" approach, which avoids imposing ad hoc thresholds. Specifically, we apply the *k-means* clustering technique to group each country's observations on (standardized) net flows into three clusters (surges; normal flows; and outflows) such that the within-cluster sum of squared differences from the mean is minimized (while the between-cluster difference in means is maximized). As a result, each observation belongs to the cluster (or group) with the nearest mean, and clusters comprise observations that are statistically similar.

With this approach, we obtain 372 surge observations, most of which coincide with those from the threshold approach, although the latter approach yields somewhat fewer (but larger) surge observations. For example, Figure B2 in online Appendix shows the identified surge observations for Colombia using the two approaches. There are 3 observations of net capital flow (to GDP) for Colombia that are in the top 30th percentile of the country-specific distribution, as well as in the top 30th percentile of the overall distribution of net capital flows (to GDP) for the full sample, and hence are coded as surges under the threshold approach. Through the cluster analysis, however, we obtain 11 surge observations, half of which are large from the country's historical (but not from a global) perspective.

Analysis of surges identified through clustering yields a broadly similar picture to that obtained from the threshold approach (Tables 7 and 8, col. 2). The impact of both global and domestic factors is generally comparable to earlier estimates in terms of statistical significance and magnitude—with the notable exception being the capital account openness

[29] The total number of surge observations increases to 496 in the extended version of the variable.

variable, which loses its statistical significance in Table 7. The weakening of the estimated impact of capital account openness, however, may simply reflect the fact that such openness matters more for extreme net flows as identified by the threshold approach (a country with a relatively closed capital account may, at times, experience larger inflows, but is unlikely to be the recipient of surges that are large by cross-country standards). The surge magnitude regressions for the cluster approach also present a similar picture to that obtained above, and show that among the domestic pull factors, the external financing need, exchange rate overvaluation, and exchange rate regime matter. A noteworthy difference with the earlier magnitude regressions is that now the estimated coefficient of the regional contagion variable is negative, and statistically significant.

Alternative specifications

While the estimations reported in Tables 2 and 3 include a range of global and domestic factors, other proxies and additional variables could also be employed. To check the sensitivity of our results to alternative variable definitions of global factors, we use the 10-year US government bond yield (instead of the 3-month US Treasury bill rate); and replace our S&P 500 index returns volatility measure with the Credit Suisse Risk Appetite Index (higher values indicating periods of financial ease, and greater investor risk appetite), and a normalized measure of VIX supplemented with a normalized measure of the VXO index for the pre-1990 years (with higher values indicating higher volatility in international markets, and lower risk appetite). The revised estimation results reported in Table 7 (cols. [3]-[5]) show that using these alternate proxies does not have much impact on the results—both lower US interest rates and greater risk appetite (as measured by the VIX index) are associated with greater likelihood of a surge occurrence, while the results of all other variables remain the same as before.[30]

Columns [6]-[11] (in Tables 7 and 8) include additional pull variables in our general specification to capture the effect of other potentially important domestic characteristics, while column [12] includes country fixed effects. For example, a country's trade openness, and financial sector development may increase its attractiveness as an investment destination, and boost the likelihood and magnitude of surges. The results show that indeed trade openness is associated with significantly greater likelihood of surge occurrence, but the proxies for financial sector development and soundness (such as stock market capitalization, private sector credit to GDP, and banks' return on equity) are statistically insignificant. We also do not find a strong impact of contagion through trade relationships—defined as in Forbes and Warnock (2012)—on surge likelihood/magnitude. The inclusion of these variables does not, however, affect much the estimated magnitude and significance of the other pull factors in the regressions.[31]

[30] In addition, we also conduct robustness checks using nominal US and domestic interest rates (instead of real rates), and compute both the US and domestic real interest rates with contemporaneous inflation (instead of expected inflation), but the results remain very similar.

[31] We also include fiscal balance and public debt to GDP ratios, and a proxy for the political regime in place, but find these variables to be statistically insignificant, while their inclusion does not alter the other results. Considering that the association between the extent of over/undervaluation of the real exchange rate and surge

(continued)

Although, as shown in Figure 1, a surge in international capital flows to the EMEs occurred in the early 1980s (as a continuation of the surge in late 1970s), surges in later years—particularly post-Latin American debt crisis—have been larger (in both absolute and relative to GDP terms), and have also involved more countries.[32] To examine whether the role of global and local factors in later years has been any different, we re-estimate our regressions for the 1990–2011 sample. The results summarized in column [13] (of Tables 7 and 8) show a largely unchanged impact of global and local factors, with the exception of the capital account openness index, which is statistically insignificant for this period (presumably because of smaller sample variation in the latter period as most EMEs had opened up their capital accounts).

Finally, the surge occurrence probit has a large number of zero observations in the dependent variable (about 80 percent of the observations in the estimated sample are zero). By construction, the probit model specifies that the distribution of $F(.)$ in eq. (1) is normal, and symmetric around zero. If however the distribution of the dependent variable is skewed, applying the complementary log-log model—which is asymmetric around zero—may be preferable.[33] Table 7 (last column) presents the estimation results for the most general specification with the complementary log-log method (with clustered standard errors at the country level). The obtained results however remain very similar to those reported above.

Endogeneity

In the analysis presented above, following earlier studies (e.g., Forbes and Warnock, 2012), we use one-year lagged values for local pull variables to mitigate potential endogeneity concerns. While using one-period lags as instruments is common, both because they are readily available and because persistence in most macro time series means that one-period lags tend to be highly correlated with the regressor), the validity of doing so rests on the assumption of a serially uncorrelated error term. If, however, there are concerns about the persistence of shocks (i.e., an AR(1) error term) in the surge likelihood and magnitude regressions, then one-period lagged values will not be valid instruments.

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likelihood/magnitude may be conditional on the exchange rate regime in place such that in countries with a fixed exchange rate regime, an undervalued exchange rate may imply a higher likelihood/magnitude of experiencing a surge (by providing international investors with incentives to speculate on an appreciation), we also include in our specification an interaction term between the exchange rate regime variable and our measure of REER overvaluation (lagged one period). The estimated coefficient of the interaction term is negative—indicating that countries with fixed exchange rate regimes and overvalued real exchange rates are less likely to experience a surge than more flexible regimes with the same overvaluation—but statistically insignificant in the surge likelihood regression. It is, however, statistically significant in the surge magnitude regression, indicating that conditional on surge occurrence, countries with fixed exchange rate regimes and overvalued real exchange rates experience smaller surges than more flexible regimes.

[32] Several studies (e.g., Chuhan et al., 1993; and Taylor and Sarno 1997) note that the composition of flows in the surge of 1990s and later years has also been different with a pronounced increased in portfolio flows.

[33] Specifically, the complementary log-log model is given as: $F(x_t^{'}\beta + z_{it}^{'}\gamma + \mu_i = 1 - \exp\{-\exp(x_t^{'}\beta + z_{it}^{'}\gamma + \mu_i)\}$.

An obvious solution to this would be to use two-period lags. But that may not work very well because macro series typically do not exhibit sufficient persistence for the *t*-2 lag to be a good (i.e., strongly correlated with the regressor) instrument. To get around this issue, we employ an alternative—and more innovative—approach. Specifically, drawing on a unique database of IMF country-team projections, we construct instruments for macroeconomic variables such as real GDP growth and real exchange rate overvaluation—for which endogeneity concerns may be the most pertinent—using *projections* made in year *t*-2 or earlier for year *t*.[34] Empirically, these projections are more strongly correlated with the regressors than the actual *t*-2 value (in other words, the IMF projections incorporate more information than is available in the *t*-2 lag of the variable), and are less likely to be correlated with the error term in the occurrence/magnitude regressions.[35] While endogeneity is of less concern using these instruments, there is of course no guarantee that endogeneity problems have been fully addressed, and the reported results need to be treated with appropriate caution.

Unfortunately, these projections are only available from 1990 onward; hence the sample size in these instrumental variable (IV) regressions is smaller (Table 9). For comparative purposes, however, we also include in cols. [1] and [3] the results for surge likelihood and magnitude regressions obtained from simple probit and OLS approaches (that is, without instrumenting), respectively, for the shorter sample. The results obtained from the IV probit model (col. [2]) echo the findings in col. [1]; for example, the estimated effect of real GDP growth rate on surge likelihood remains significantly positive, while that of implied REER overvaluation is not statistically significant.[36] For the IV regressions of surge magnitude, reported in col. [3], we do not find a strong association between implied REER overvaluation and net flows, while the association between real GDP growth and net flows in a surge is also not statistically significant. The estimated coefficients (and significance) of other variables in the regression remain largely unaffected in the IV estimations—overall, therefore, our results are robust to the potential endogeneity of the regressors.

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[34] IMF country-team projections offer several advantages. First, because of its near-universal membership, IMF's projections reflect the knowledge of individual economies, but also capture the interlinkages between them. Second, because these forecasts are produced simultaneously for all member countries, they satisfy the binding general equilibrium constraints (e.g., on current accounts and exchange rates) for the global economy. Third, IMF's projections are available from 1990 onward, giving consistent time series estimates for a large number of countries that can be readily employed in the empirical analysis. Most studies of the accuracy of these projections suggest that biases are numerically small, if extant at all (Takagi and Kucur, 2006). Berg et al. (1999) use IMF country-team projections as instruments in a study of economic growth in transition economies.

[35] For example, correlation between actual real GDP growth rate and the projected growth rate in t-2 is almost twice than that between actual growth rate and its two-year lagged value. The IMF does not project real exchange rate overvaluation but only expected movements in the exchange rate. But if the currency is expected to be overvalued (undervalued) in the future, the real exchange rate would be projected to appreciate (depreciate).

[36] Projections are not available for structural variables (such as the exchange rate regime and capital account openness), but since these are slow-moving variables, we use their two-year lagged values as instruments and find the estimated coefficients for these variables to be very similar to those obtained before.

5. What's Driving the Surges? Some Further Exploration

While the empirical analysis conducted thus far identifies the key factors that contribute to net capital flow surges in EMEs, it also highlights the possibility that both global and domestic factors may interact with each other to produce the cross-sectional and time-series pattern of surges that we observe in the data. A country may thus be more susceptible to receive capital inflows because of structural characteristics or large external financing needs, but only experience a surge when global conditions permit. In principle, the probit model estimated above—which gives the marginal effect on the probability of a surge for each of the explanatory variables (holding the other variables constant at their mean values)—could be modified to include such interactions, but in practice, this becomes extremely difficult when several explanatory variables are being considered simultaneously, and possible threshold effects are unknown.

We therefore complement our probit analysis with a decision-theoretic classification technique—known as a binary recursive tree—that readily allows for arbitrary interactions between the various explanatory variables, fleshing out any context-dependence and threshold effects in the data.[37] Formally, a binary recursive tree is a sequence of rules for predicting a binary variable, y, on the basis of a vector of explanatory variables, x_j, where $j=1...J$, such that at each level, the sample is split into two sub-branches according to some threshold value of one of the explanatory variables, $\hat{x}_j$. The splitting is repeated along the various sub-branches until a terminal node is reached.

To illustrate, let y be the occurrence of surge (equal to one if there is a surge, and zero otherwise). The binary recursive tree algorithm searches for sequential splits, each consisting of the explanatory variable, and its threshold value, which best discriminates between the groups. Suppose, for example, that low US real interest rates are associated with a surge, and it is thus a potentially useful discriminator variable. There may, however, be instances where a surge occurs with relatively high real US interest rates, and those where no surge occurs despite low real US interest rates. The algorithm searches over all observed values of real US interest rates in the sample until it finds that threshold value, $\hat{x}_j$, which best discriminates between surge and nonsurge observations based on a specific criterion.[38] The technique thus establishes orderings among explanatory variables such that a variable that appears toward the top of the tree could be considered as more important in distinguishing between the surge and nonsurge cases.

Based on the results of the probit model, we include the global factors as well as the important statistically significant domestic (macroeconomic and structural) factors to

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[37] Previously, binary recursive analysis has been employed by several studies investigating the determinants of currency crises (see, e.g., Ghosh and Ghosh, 2003).

[38] While several algorithms are available to search for the best split, for example, minimizing the sum of the type I and type II errors, or, conducting more formal hypothesis testing, we employ the Chi-squared Automatic Interaction Detector (CHAID) that relies on the chi-squared test to determine the best splits (see Kass (1980) for details). Implementation of CHAID is undertaken using the SIPINA classification tree software.

construct the binary tree (specifically, the optimal current account balance (to GDP), real GDP growth rate, real exchange rate deviation from trend, capital account openness, exchange rate regime, and institutional quality). Figure 6 presents the resulting binary recursive trees, with the conditional probabilities of a surge at each node, for asset- and liability-driven surges.[39] The first variable used for splitting the sample for asset-driven surges turns out to be the optimal current account balance (to GDP) at the threshold value of about 2 percent of GDP. The conditional probability of an asset-driven surge in countries with external financing needs larger than this threshold value (the left hand branch of the tree) is 19 percent, versus 6 percent for countries that have relatively smaller financing needs. Continuing along the left hand branch of the tree, the second node depends on the real GDP growth rate such that countries (in our sample) with a growth rate in excess of 6 percent of GDP are three times more likely to have an asset-driven surge than otherwise. Moving on to the right hand branch of the tree (that is, countries with optimal current account deficits smaller than 2 percent of GDP), we see that it is institutional quality that matters—countries with smaller financing needs, but in the top 50th percentile of the institutional quality index have a much higher likelihood of an asset-driven surge. The next important variable along the same branch if institutional quality is above the median is real GDP growth rate, with a threshold value of 5 percent, and a conditional probability of surge of about 17 percent for countries that exceed the threshold (versus 5 percent for countries below the threshold). If, however, institutional quality is below the median, then capital account openness matters, with countries in the top 60th percentile of the capital account openness index more likely to experience a surge. Note that nothing prevents the algorithm from further splitting the tree (using any of the explanatory variables); however, given the stopping rule for the algorithm, the improvement in the fit is not sufficient to justify the additional complexity of the tree.

While it is mainly the domestic factors that seem to be the key drivers of asset-driven surges, global factors—specifically, global risk—dominate in explaining the occurrence of liability-driven surges. Thus, when global market volatility is low (in the bottom 16th percentile of the S&P 500 index returns volatility), the conditional probability of a surge through an increase in residents' liabilities is 32 percent (versus 13 percent when global market volatility/risk aversion is higher). However, once low global market volatility is taken into account (the left hand side of the tree), countries with large external financing needs are almost thrice as likely to experience a surge (conditional surge probability is 67 percent with optimal current account deficit larger than 1 percent of GDP, versus 20 percent otherwise). Along the right hand side of the tree (when global market volatility is high), again the external financing need is what matters—countries with optimal current account deficits in excess of about 1 percent of GDP are four times as likely to experience a surge than those with smaller deficits.

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[39] We also estimate a binary tree for the full sample, where the dependent variable is the occurrence of a surge. The tree, presented in Figure B3 in online Appendix, turns out to be rather simple, and shows that large external financing need is often the proximate cause for receiving large net flows—countries with optimal current account deficits larger than 1 percent of GDP are more than twice as likely to experience a surge as countries with smaller deficits. However, global risk features prominently as well, and countries with large external financing needs are about 2½ times more likely to experience a surge when global market volatility (or risk aversion) is low. The tree correctly classifies about 80 percent of the sample; 18 percent of the surge observations and 97 percent of the nonsurge observations.

However, among the latter, countries with smaller real exchange rate deviation from trend are much more likely to attract foreign inflows than otherwise.

Consistent with the probit analysis, our binary tree algorithms thus indicate that global and domestic factors matter for surge occurrence. But, in addition, they show that there may be particular interactions between these factors, which could differ based on the surge type, such that liability-driven inflows are more likely to be triggered by global factors while asset-driven surges respond more to local conditions.

6. Conclusion

This paper examines the drivers of large net capital flows—or surges—to EMEs, explicitly distinguishing between their occurrence and magnitude, and differentiating between asset- and liability-driven surges. We use simple algorithms—based on thresholds and cluster analysis—to identify such episodes, which capture most "well-known" episodes, and allow us to distinguish between surges and more normal periods of net capital flows.

Our descriptive analysis based on a sample of 56 EMEs over 1980–2011 indicates that surges are synchronized internationally, and have become more frequent in recent years. Nevertheless, even when surges occur globally, they are relatively concentrated—with never more than half of the EMEs in the sample experiencing them at any one point of time, and some countries experiencing them repeatedly. The amount of capital received in a surge varies considerably across countries, with most (over two-thirds) of the surges to EMEs being driven by an increase in residents' liabilities rather than by a decline in their foreign assets.

The picture that emerges from our regression analysis is one in which global push factors, notably, the real US interest rate and global market uncertainty, determine whether there will be a surge of capital flows towards EMEs generally, which helps to explain why surges are synchronized internationally, and why they recur. Of course, a country that has no need for capital or that is an unattractive destination for investors will not receive inflows even if there is a global surge of capital to EMEs; hence pull factors such as economic performance, the external financing need, exchange rate regime, financial openness, and institutional quality help determine whether a particular country experiences an inflow surge, and explain why some countries do (and others do not) experience surges. Conditional on the surge occurring, moreover, domestic pull factors, including the exchange rate regime, are important in determining its magnitude.

Our results also indicate that domestic and foreign investors respond to both global and local factors such that lower US interest rates encourage capital to flow to EMEs, while increased global market uncertainty drives capital towards traditional safe havens. Foreign investors, however, appear to be more sensitive to global conditions than their domestic counterparts, with a change in the real US interest rate and global uncertainty raising the predicted likelihood of liability-driven surges somewhat more than for asset-driven surges. These results are reaffirmed by a binary recursive tree analysis which shows that liability-driven inflows are much more likely to be triggered by global factors, notably, global uncertainty and market conditions; but asset-driven surges respond more to local conditions.

Overall, our findings provide a better understanding of large upward swings in capital flows to EMEs, and suggest that inasmuch as surges reflect exogenous supply-side factors that could reverse abruptly, the case for EMEs to impose capital is correspondingly stronger. To the extent that advanced economy monetary policies are key drivers of inflow surges to EMEs—which our analysis suggests is the case—there may be need for multilateral surveillance over such policies to ensure that spillovers are taken into account (Ostry et al., 2012). And if local factors (including capital account openness) play a role in determining where the capital ends up—which our analysis also implies—then there may also be need for greater coordination between EMEs to ensure that they do not pursue beggar-thy-neighbor policies against each other. (Some evidence that we find on the magnitude of an inflow surge, conditional on its occurrence, depends negatively on the magnitude of flows to other countries in the region suggests that deflection of flows between EMEs is a relevant concern.) Further, while the drivers of asset and liability-driven surges may be largely similar, policy responses may need to be adjusted to the type of surge—for example, prudential measures might be more important for dealing with financial-stability risks caused by asset-driven surges, but capital controls on inflows may be an additional option for liability-driven surges.

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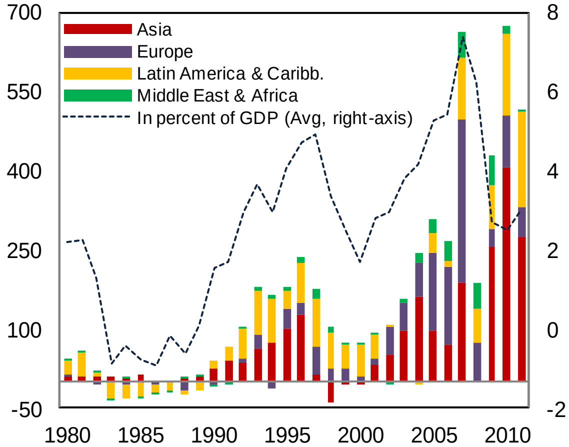
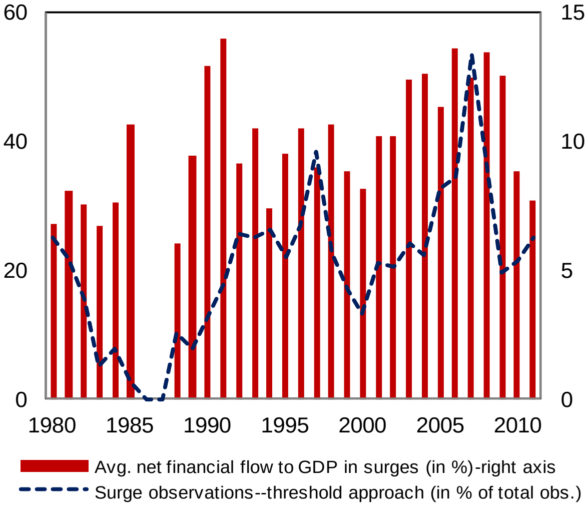
Figure 1. Net Capital Flows to EMEs, 1980-2011 (in USD billions)



Source: IMF's IFS database.
Note: Net financial flows excludes reserves and other investment liabilities of the general government.

Figure 2. Surges of Net Capital Flows to EMEs, 1980-2011

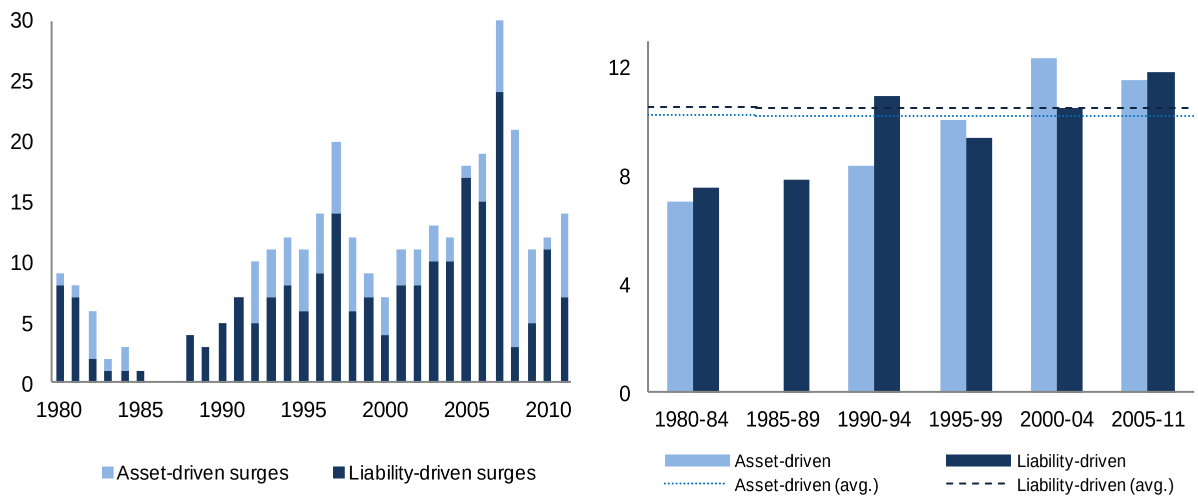


Source: Authors' estimates based on IFS.

Figure 3. Types of Surges, 1980–2011

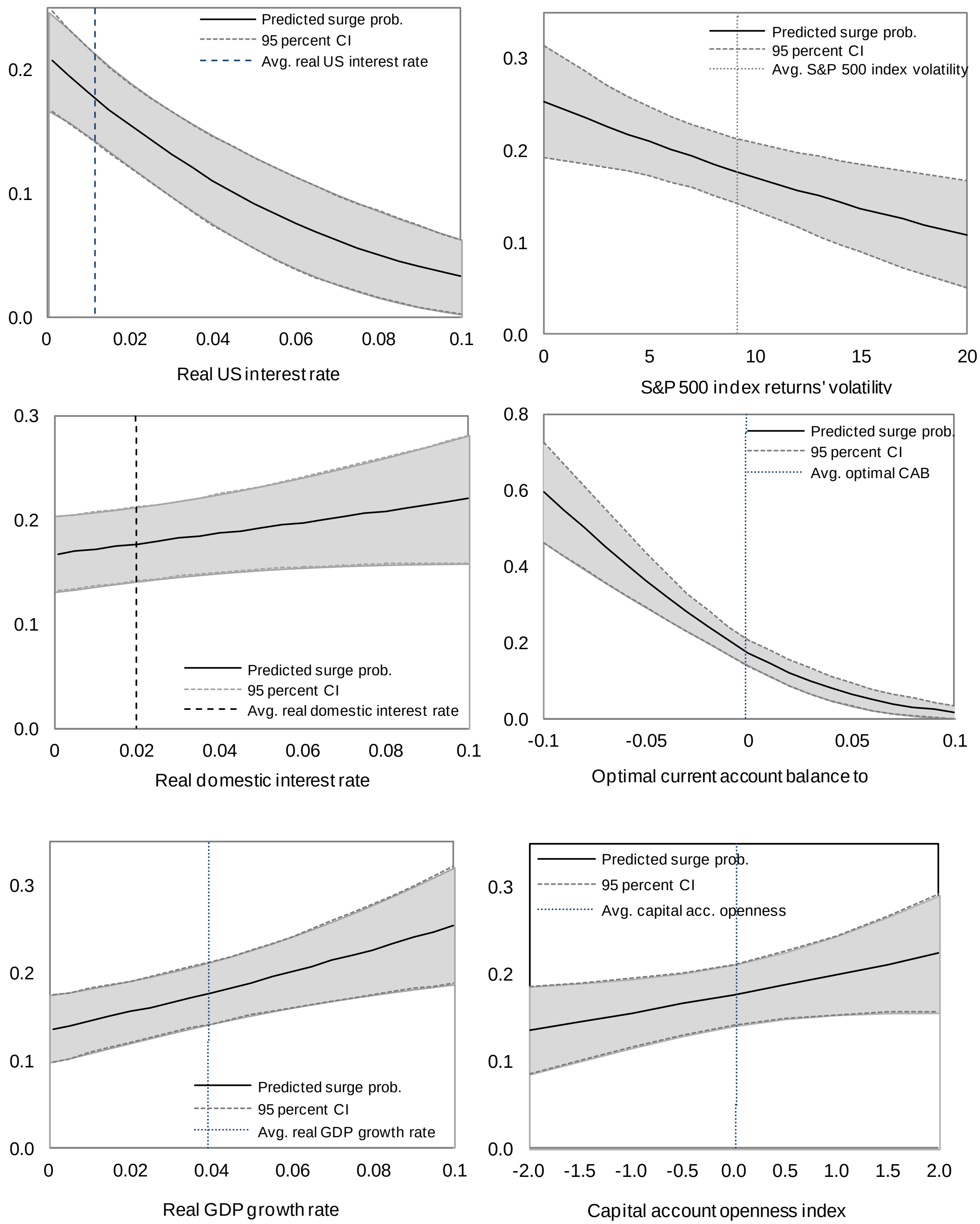
(a) Number of surges based on type

(b) Average net capital flow (% of GDP)



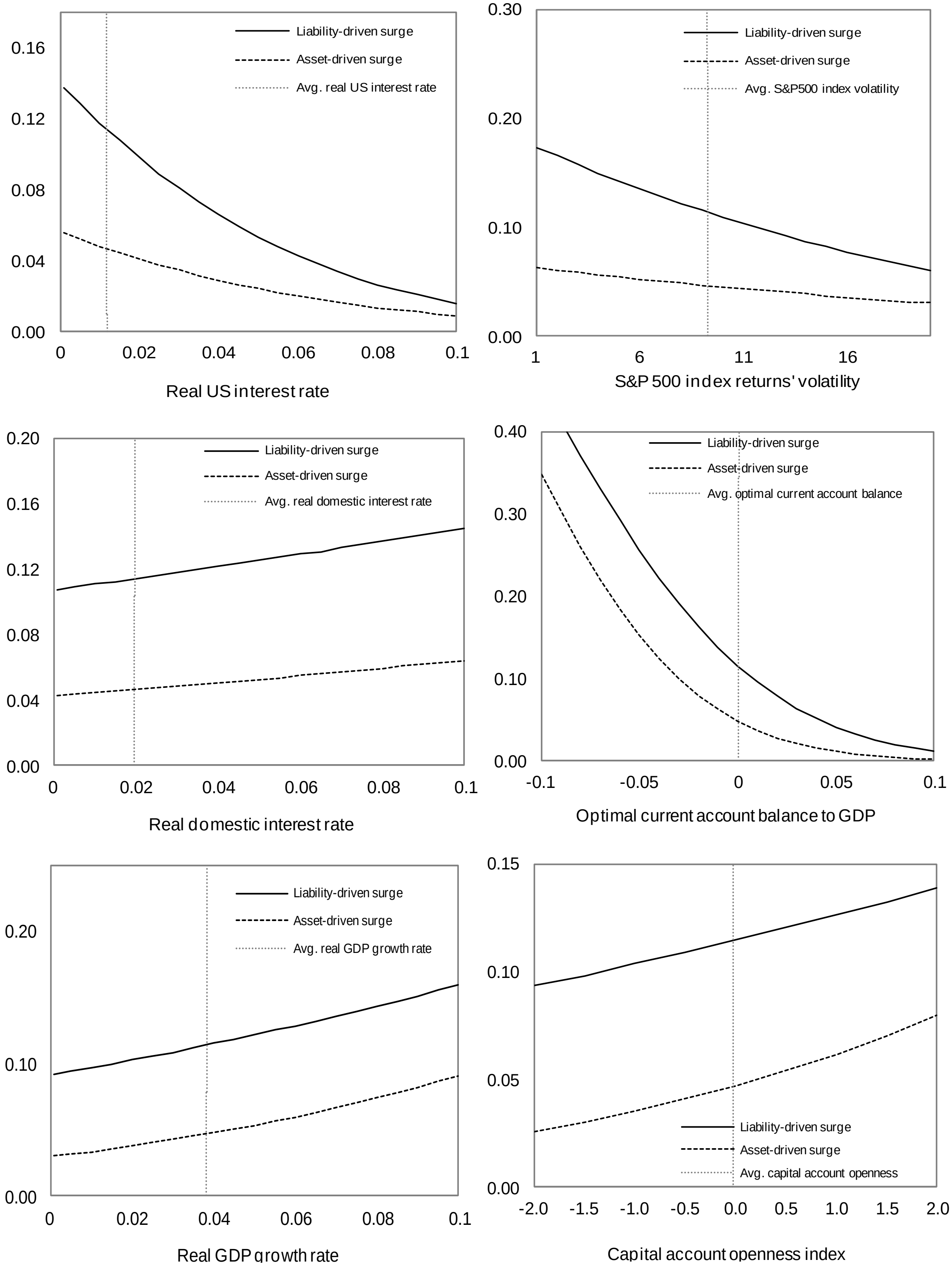
Source: Authors' estimates based on IFS.

Figure 4. Predicted Probabilities of Surge Occurrence



Source: Authors' estimates.
Notes: Predicted probabilities are based on the estimation results reported in Table 2 (col. 10) holding all other variables fixed at mean value.

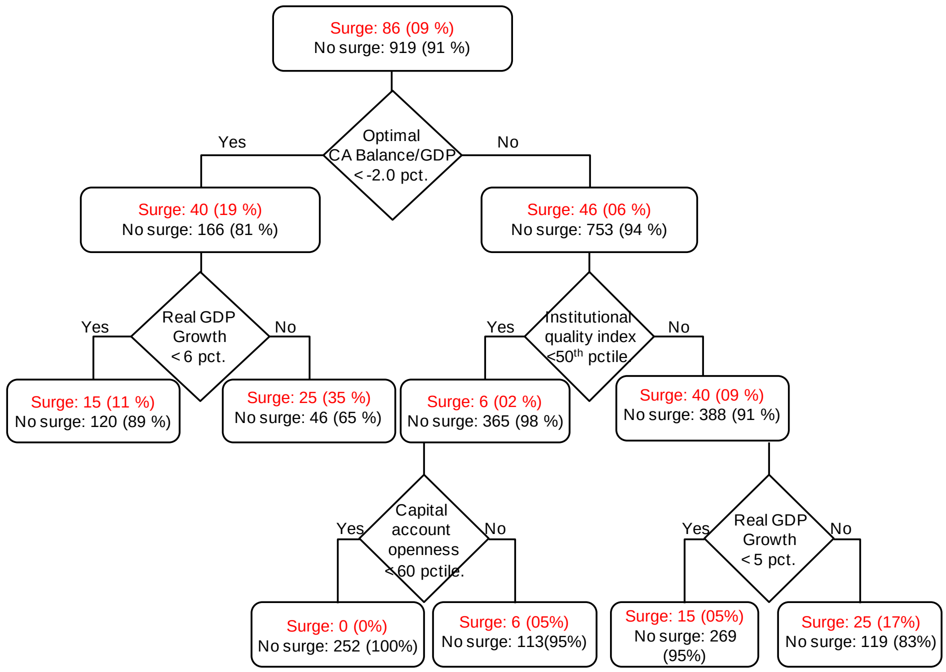
Figure 5. Predicted Probabilities of Asset- and Liability-Driven Surge Occurrence



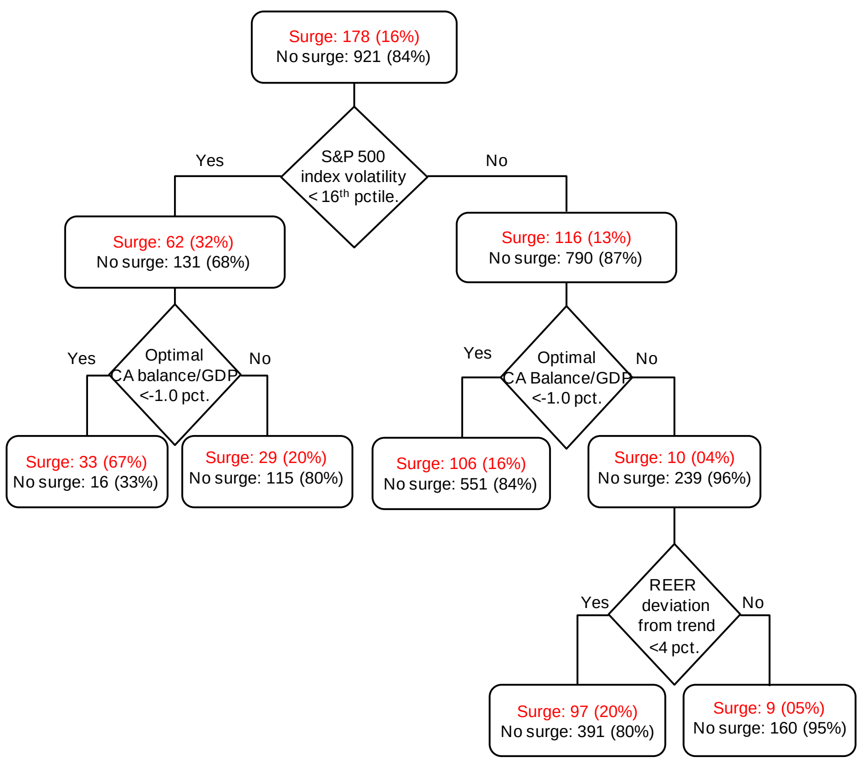
Source: Authors' estimates.
Notes: Predicted probabilities for asset- and liability-driven surges are based on estimation results in Table 4 (panel b, cols. 5 and 10, respectively) holding all other variables fixed at mean value.

Figure 6. Binary Recursive Trees for Surge Occurrence

(i) Asset-driven surges



(ii) Liability-driven surges



Source: Authors' estimates.
Notes: Binary recursive trees have been constructed using the full sample with the Improved CHAID algorithm in SIPINA software (with the minimum size of nodes to split, and leaves specified as 20 and 10 observations, respectively; and the p-level for merging and splitting nodes specified as 0.05 and 0.001, respectively). Outlier observations for (lagged) optimal current account (i.e., in the bottom and top 0.005th percentile) have been excluded.

Table 1. Quantile Regression Estimates for Net Capital Flows to GDP, 1980-2011

Estimation	OLS	Quantile regressions (percentiles)						Interquantile regressions		
		25th	30th	50th	70th	75th	90th	25th vs. 50th	50th vs. 75th	75th vs. 90th
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Real US interest rate	-0.416***	-0.264***	-0.291***	-0.263***	-0.390***	-0.396***	-0.664***	0.001	-0.133*	-0.268**
	(0.122)	(0.079)	(0.071)	(0.067)	(0.085)	(0.095)	(0.170)	(0.066)	(0.073)	(0.136)
S&P500 index volatility	-0.001***	-0.001	-0.000	-0.000	-0.001**	-0.001***	-0.002***	0.000	-0.001*	-0.001*
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Commodity price index	0.035*	0.019	0.024**	0.021**	0.029**	0.031***	0.068***	0.003	0.009	0.037*
	(0.020)	(0.012)	(0.011)	(0.009)	(0.011)	(0.011)	(0.023)	(0.010)	(0.011)	(0.020)
Regional contagion	0.022*	0.024***	0.018**	0.022***	0.022***	0.019**	0.002	-0.002	-0.003	-0.017
	(0.013)	(0.009)	(0.008)	(0.008)	(0.008)	(0.010)	(0.015)	(0.008)	(0.009)	(0.013)
Real domestic interest rate	0.121**	0.100***	0.097***	0.062***	0.051**	0.058*	0.027	-0.038*	-0.004	-0.030
	(0.046)	(0.027)	(0.027)	(0.023)	(0.024)	(0.030)	(0.059)	(0.022)	(0.027)	(0.049)
REER deviation from trend	-0.060**	0.017	0.003	-0.017	-0.029	-0.040*	-0.108***	-0.034*	-0.023	-0.067**
	(0.026)	(0.023)	(0.022)	(0.020)	(0.019)	(0.024)	(0.034)	(0.019)	(0.018)	(0.028)
Optimal current account/GDP	-0.455***	-0.284***	-0.282***	-0.314***	-0.337***	-0.348***	-0.454***	-0.030	-0.034	-0.106*
	(0.096)	(0.066)	(0.062)	(0.051)	(0.049)	(0.053)	(0.069)	(0.054)	(0.050)	(0.063)
Real GDP growth	0.126	0.200***	0.219***	0.196***	0.209***	0.163***	0.094	-0.004	-0.033	-0.069
	(0.099)	(0.059)	(0.054)	(0.036)	(0.042)	(0.056)	(0.084)	(0.043)	(0.039)	(0.073)
Exchange rate regime	0.012**	-0.001	0.001	0.004*	0.011***	0.012***	0.024***	0.005**	0.008***	0.012**
	(0.005)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.006)	(0.002)	(0.002)	(0.005)
Capital account openness	0.006***	0.004***	0.004***	0.004***	0.006***	0.007***	0.008***	0.000	0.003***	0.000
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Financial interconnectedness	0.003***	0.003***	0.003***	0.001***	0.002***	0.002***	0.001	-0.002***	0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Institutional quality index	0.067*	0.050**	0.063***	0.069***	0.097***	0.104***	0.143***	0.019	0.036**	0.038*
	(0.038)	(0.020)	(0.019)	(0.013)	(0.017)	(0.017)	(0.027)	(0.016)	(0.016)	(0.023)
Default onset	-0.025***	-0.025**	-0.027***	-0.022**	-0.016**	-0.019*	-0.020	0.004	0.003	-0.001
	(0.006)	(0.011)	(0.010)	(0.009)	(0.008)	(0.010)	(0.014)	(0.009)	(0.009)	(0.013)
Real GDP per capita (log)	-0.010	-0.013***	-0.013***	-0.009***	-0.010***	-0.010***	-0.015***	0.004*	-0.001	-0.005
	(0.007)	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)	(0.005)	(0.002)	(0.002)	(0.004)
Observations	1,199	1,199	1,199	1,199	1,199	1,199	1,199	1,199	1,199	1,199
R-squared[a]	0.246	0.146	0.146	0.166	0.197	0.209	0.239			

Notes: Dependent variable is net capital flow to GDP. Real domestic interest rate, REER deviation from trend, current account balance/GDP, capital acount openness, exchange rate regime, reserves to imports, institutional quality index, and (log) of real GDP per capita are lagged one period. Constant, and regional specific effects are included in all specifications. The interquantile regressions (reported in cols. [8]-[10]) estimates regressions of the difference in quantiles (e.g., col. [8] indicates the difference between the estimates obtained for the 25th and 50th percentiles, and whether that difference is statistically signficant). Bootstrapped standard errors (with 100 replications) reported in parentheses. ***,**,* indicate significance at 1, 5, and 10 percent levels, respectively.

a/ Pseudo-R2 reported for quantile regressions.

Table 2. Summary Statistics of Selected Variables

	Observations	Mean		Min	Max	Std dev.
	Surge					
Net capital flows to GDP (in %)	271	10.60	***	4.57	54.62	7.13
Real US interest rate (in %)	271	1.25	***	-2.93	5.20	2.03
S&P 500 index returns volatility	271	8.26	***	2.94	22.59	4.39
Real domestic interest rate (in %)	270	2.23		-18.73	41.65	5.91
REER deviation from trend (in %)	271	0.70	**	-16.65	19.98	4.65
Optimal current account (in %)	271	-2.60	***	-23.68	9.41	4.06
Real GDP growth rate	271	5.13	***	-12.40	12.55	3.39
Trade openness (in %)	271	84.69	***	15.98	191.83	36.86
Reserves to GDP (in %)	271	16.81	***	1.43	85.45	10.93
Real GDP per capita (Log)	271	7.89	**	5.87	10.00	0.73
De facto exchange rate regime	271	2.11	*	1.00	3.00	0.68
Capital account openness index	271	0.57	***	-1.86	2.46	1.48
Financial interconnectedness	271	8.16	***	1.00	15.00	3.21
Institutional quality index	271	0.66	***	0.34	0.89	0.09
	Nonsurge					
Net capital flows to GDP (in %)	928	0.84		-39.82	24.44	4.72
Real US interest rate (in %)	928	0.83		-2.93	5.20	2.19
S&P 500 index returns volatility	928	9.45		2.94	22.59	4.27
Real domestic interest rate (in %)	922	1.82		-34.22	30.31	6.26
REER deviation from trend (in %)	928	-0.40		-45.41	69.02	7.33
Optimal current account (in %)	928	0.60		-11.19	19.38	3.39
Real GDP growth (in %)	928	3.62		-15.06	25.65	4.15
Trade openness (in %)	928	68.60		13.22	220.41	37.74
Reserves to GDP (in %)	926	13.06		0.43	108.25	12.28
Real GDP per capita (Log)	928	7.76		5.47	10.04	0.90
De facto exchange rate regime	928	2.03		1.00	3.00	0.66
Capital account openness index	928	-0.08		-1.86	2.46	1.42
Financial interconnectedness	928	6.59		0.00	15.00	2.92
Institutional quality index	928	0.61		0.29	0.86	0.11

Notes: Observations restricted to the estimated sample as in Table 3. Real domestic interest rate and real GDP growth rate have been re-scaled using the formula $x/(1+x)$ if $x \geq 0$, and $x/(1-x)$ if $x<0$ to transform the outliers. ***, **, * indicate significant difference between the surge and nonsurge observations at the 1, 5, and 10 percent levels, respectively.

Table 3. Likelihood of Surge, 1980-2011

	[A] Constrained Model					[B] Unconstrained Model				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Real interest rate differential	0.494	1.467**	1.481**	1.656**	1.593**					
	(0.527)	(0.570)	(0.649)	(0.712)	(0.720)					
Real US interest rate						-6.689**	-12.260***	-9.903***	-10.534***	-10.418***
						(2.850)	(2.297)	(2.148)	(2.095)	(2.238)
S&P500 index volatility	-0.023**	-0.034***	-0.025**	-0.023**	-0.014	-0.032***	-0.051***	-0.038***	-0.037***	-0.029***
	(0.010)	(0.012)	(0.012)	(0.012)	(0.011)	(0.010)	(0.011)	(0.012)	(0.012)	(0.011)
Commodity price index	0.704*	0.542	0.570	0.358	0.690*	1.006**	1.010**	0.956**	0.787*	1.092***
	(0.387)	(0.389)	(0.387)	(0.390)	(0.391)	(0.421)	(0.423)	(0.420)	(0.420)	(0.414)
Regional contagion	0.997***	1.023***	0.632**	0.462*	0.313	0.808***	0.666***	0.410*	0.230	0.087
	(0.260)	(0.263)	(0.258)	(0.262)	(0.250)	(0.260)	(0.242)	(0.247)	(0.240)	(0.227)
Real domestic interest rate						0.846	1.453	1.704*	2.080*	1.934*
						(1.024)	(1.021)	(1.025)	(1.120)	(1.051)
REER deviation from trend						0.092	-1.058**	-0.986	-0.957	-1.098
						(0.520)	(0.538)	(0.632)	(0.726)	(0.744)
Optimal current account/GDP		-10.898***	-10.607***	-10.665***	-10.607***		-12.365***	-11.761***	-11.854***	-11.810***
		(1.750)	(1.697)	(1.798)	(1.737)		(1.793)	(1.722)	(1.830)	(1.788)
Real GDP growth			6.005***	4.880***	4.790***			5.712***	4.541***	4.406***
			(1.422)	(1.328)	(1.354)			(1.442)	(1.360)	(1.388)
Capital account openness			0.104**	0.106**	0.110**			0.077*	0.077*	0.085*
			(0.044)	(0.046)	(0.048)			(0.043)	(0.045)	(0.047)
Financial interconnectedness				0.073***	0.072***				0.074***	0.074***
				(0.015)	(0.016)				(0.015)	(0.015)
Exchange rate regime				0.172**	0.151**				0.198***	0.174**
				(0.077)	(0.075)				(0.074)	(0.074)
Institutional quality index					2.382***					2.276***
					(0.680)					(0.673)
Default onset					-0.428					-0.330
					(0.384)					(0.372)
Real GDP per capita (log)					-0.277***					-0.298***
					(0.103)					(0.101)
Observations	1,199	1,199	1,199	1,199	1,199	1,199	1,199	1,199	1,199	1,199
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-R2	0.0525	0.114	0.142	0.164	0.184	0.0597	0.131	0.152	0.176	0.194
Percent correctly predicted	77.48	78.82	79.23	79.98	80.15	78.07	78.65	79.57	79.73	79.98
Sensitivity	4.428	14.76	20.30	23.99	25.46	4.428	16.61	21.40	25.46	26.20
Specificity	98.81	97.52	96.44	96.34	96.12	99.57	96.77	96.55	95.58	95.69

Notes: Dependent variable is a binary variable equal to 1 if a surge occurs and 0 otherwise. Constrained model refers to the specification where real interest rate differential between country i and the US (real domestic interest rate-real US interest rate-REER overvaluation) is included. All regressions are estimated using a probit model, with clustered standard errors (at the country level) reported in parentheses. Constant and region-specific effects are included in all specifications. ***,**,* indicate significance at 1, 5, and 10 percent levels, respectively. Sensitivity (specificity) gives the fraction of surge (no-surge) observations that are correctly specified. All variables except for global factors (real US interest rate, S&P500 index returns volatility, and commodity price index), regional contagion, and financial interconnectedness are lagged one period.

Table 4. Magnitude of Surge, 1980-2011

	(1)	(2)	(3)	(4)	(5)
Real US interest rate	-0.425*	-0.480*	-0.387*	-0.405*	-0.410*
	(0.229)	(0.242)	(0.220)	(0.223)	(0.223)
S&P 500 index volatility	-0.002*	-0.002*	-0.002*	-0.002*	-0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Commodity price index	0.019	0.010	0.012	0.029	0.028
	(0.029)	(0.028)	(0.030)	(0.028)	(0.032)
Regional contagion	-0.050	-0.048	-0.031	-0.026	-0.023
	(0.070)	(0.070)	(0.068)	(0.071)	(0.070)
Real domestic interest rate	-0.103	-0.091	-0.114	-0.035	-0.036
	(0.081)	(0.080)	(0.083)	(0.066)	(0.071)
REER deviation from trend	-0.129*	-0.146*	-0.136*	-0.160**	-0.162**
	(0.074)	(0.077)	(0.079)	(0.076)	(0.077)
Optimal current account/GDP		-0.245*	-0.201	-0.247**	-0.249**
		(0.138)	(0.122)	(0.122)	(0.124)
Real GDP growth			-0.116	-0.152	-0.150
			(0.230)	(0.220)	(0.226)
Capital account openness			0.010***	0.008**	0.007*
			(0.003)	(0.003)	(0.003)
Financial interconnectedness				-0.001	-0.002
				(0.002)	(0.002)
Exchange rate regime				0.031***	0.031***
				(0.010)	(0.010)
Institutional quality index					0.019
					(0.090)
Default onset					-0.002
					(0.020)
Real GDP per capita (log)					0.008
					(0.019)
Observations	271	271	271	271	271
Regional dummies	Yes	Yes	Yes	Yes	Yes
R2	0.171	0.187	0.222	0.288	0.293

Notes: Dependent variable is net capital flow to GDP if a surge occurs. All regressions are estimated using pooled OLS. Constant, and regional specific effects are included in all specifications. All variables except for global factors (real US interest rate, S&P 500 index returns volatility, and commodity price index), regional contagion, and financial interconnectedness are lagged one period. Clustered standard errors (at the country level) reported in parentheses. ***,**,* indicate significance at 1, 5, and 10 percent levels, respectively.

Table 5. Likelihood of Surge: by Surge Type, 1980-2011

	Asset-driven surge					Liability-driven surge				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Real US interest rate	-5.158	-12.078***	-8.572**	-8.824**	-7.861**	-6.568**	-11.189***	-9.575***	-10.436***	-10.692***
	(3.396)	(3.162)	(3.414)	(3.462)	(3.716)	(2.797)	(2.403)	(2.248)	(2.336)	(2.411)
S&P 500 index volatility	-0.021*	-0.042***	-0.029**	-0.028**	-0.018	-0.033***	-0.051***	-0.040***	-0.038***	-0.032**
	(0.011)	(0.013)	(0.014)	(0.014)	(0.014)	(0.012)	(0.013)	(0.014)	(0.013)	(0.013)
Commodity price index	1.652***	1.849***	1.705***	1.671***	1.902***	0.566	0.524	0.514	0.210	0.512
	(0.428)	(0.496)	(0.483)	(0.491)	(0.528)	(0.470)	(0.452)	(0.457)	(0.462)	(0.437)
Regional contagion	0.581**	0.401	0.082	0.061	-0.048	0.864***	0.762***	0.553*	0.308	0.141
	(0.280)	(0.284)	(0.309)	(0.306)	(0.311)	(0.309)	(0.292)	(0.294)	(0.264)	(0.256)
Real domestic interest rate	1.119	1.999**	2.187**	2.267**	2.022**	0.508	1.057	1.370	1.912	1.834
	(0.946)	(0.969)	(1.003)	(1.024)	(0.958)	(1.069)	(1.074)	(1.077)	(1.234)	(1.186)
REER deviation from trend	1.866***	1.046*	1.497*	1.523*	1.455**	-0.982	-2.187***	-2.269***	-2.476***	-2.618***
	(0.619)	(0.611)	(0.774)	(0.802)	(0.715)	(0.599)	(0.617)	(0.674)	(0.755)	(0.836)
Optimal current account/GDP		-13.462***	-12.794***	-12.735***	-12.735***		-10.934***	-10.514***	-10.904***	-10.872***
		(2.416)	(2.386)	(2.397)	(2.377)		(1.653)	(1.637)	(1.867)	(1.817)
Real GDP growth			5.966***	5.834***	5.527***			5.122***	3.354**	3.366**
			(1.878)	(1.864)	(1.777)			(1.488)	(1.429)	(1.489)
Capital account openness			0.127**	0.125**	0.134**			0.049	0.049	0.059
			(0.054)	(0.054)	(0.055)			(0.042)	(0.047)	(0.047)
Financial interconnectedness				0.013	0.012				0.103***	0.104***
				(0.021)	(0.023)				(0.019)	(0.018)
Exchange rate regime				0.059	0.027				0.261***	0.240***
				(0.086)	(0.086)				(0.085)	(0.082)
Institutional quality index					2.569***					1.950***
					(0.866)					(0.656)
Default onset					-0.346					-0.523
					(0.389)					(0.474)
Real GDP per capita (log)					-0.237**					-0.317***
					(0.113)					(0.110)
Constant	-1.219***	-0.965***	-1.339***	-1.538***	-1.252	-0.904***	-0.674***	-0.936***	-2.101***	-0.748
	(0.161)	(0.170)	(0.208)	(0.290)	(0.850)	(0.171)	(0.177)	(0.182)	(0.344)	(0.916)
Observations	1,017	1,017	1,017	1,017	1,017	1,111	1,111	1,111	1,111	1,111
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-R2	0.0617	0.147	0.179	0.180	0.200	0.0632	0.121	0.137	0.180	0.197

Notes: Dependent variable is a binary variable (=1if a surge occurs; 0 otherwise). Asset- (liability-) driven surge is defined as the surge when change in residents' assets (liabilities) is larger than the change in their liabilities (assets). Regressions are estimated using probit model, with clustered standard errors (at the country level) reported in parentheses. All variables except for real US interest rate, S&P 500 index returns volatility, commodity price index, regional contagion and financial interconnectedness are lagged one period. Constant and region-specific effects are included in all specifications. ***,**,* indicate significance at 1, 5, and 10 percent levels, respectively.

Table 6. Magnitude of Surge: by Surge Type, 1980-2011

	Asset-driven surge					Liability-driven surge				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Real US interest rate	-0.220	-0.264	-0.237	-0.326	-0.322	-0.521*	-0.566*	-0.452	-0.396	-0.403
	(0.379)	(0.387)	(0.341)	(0.312)	(0.334)	(0.285)	(0.307)	(0.294)	(0.298)	(0.308)
S&P500 index volatility	0.000	-0.000	-0.001	-0.001	-0.001	-0.002*	-0.003*	-0.002	-0.002	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Commodity price index	0.082*	0.082*	0.073*	0.094**	0.096*	0.005	-0.011	0.001	0.012	0.015
	(0.045)	(0.044)	(0.040)	(0.044)	(0.049)	(0.042)	(0.045)	(0.044)	(0.040)	(0.047)
Regional contagion	-0.018	-0.009	-0.020	-0.065	-0.066	-0.077	-0.089	-0.057	-0.023	-0.010
	(0.075)	(0.082)	(0.096)	(0.102)	(0.127)	(0.106)	(0.106)	(0.102)	(0.105)	(0.104)
Real domestic interest rate	0.011	0.016	-0.005	0.071	0.073	-0.150	-0.131	-0.150	-0.047	-0.051
	(0.144)	(0.143)	(0.135)	(0.133)	(0.144)	(0.092)	(0.093)	(0.091)	(0.073)	(0.082)
REER deviation from trend	-0.149**	-0.146**	-0.135*	-0.140**	-0.136	-0.122	-0.158	-0.142	-0.194	-0.195
	(0.074)	(0.071)	(0.072)	(0.064)	(0.087)	(0.115)	(0.118)	(0.123)	(0.124)	(0.130)
Optimal current account/GDP		-0.124	-0.066	-0.029	-0.030		-0.287*	-0.236	-0.349**	-0.353**
		(0.174)	(0.155)	(0.160)	(0.165)		(0.167)	(0.156)	(0.157)	(0.161)
Real GDP growth			-0.193	-0.153	-0.172			-0.064	-0.180	-0.183
			(0.173)	(0.172)	(0.183)			(0.347)	(0.324)	(0.318)
Capital account openness			0.012*	0.011*	0.011*			0.009**	0.007*	0.005
			(0.006)	(0.006)	(0.006)			(0.004)	(0.004)	(0.004)
Financial interconnectedness				-0.001	-0.001				-0.001	-0.002
				(0.002)	(0.002)				(0.002)	(0.002)
Exchange rate regime				0.025**	0.025*				0.037***	0.037***
				(0.012)	(0.015)				(0.013)	(0.013)
Institutional quality index					0.013					0.039
					(0.108)					(0.105)
Default onset					-0.010					-0.001
					(0.038)					(0.028)
Real GDP per capita (log)					-0.001					0.008
					(0.027)					(0.019)
Constant	0.076***	0.075***	0.079***	0.032	0.033	0.113***	0.117***	0.107***	0.038	-0.045
	(0.017)	(0.017)	(0.020)	(0.034)	(0.155)	(0.017)	(0.018)	(0.030)	(0.035)	(0.115)
Observations	88	88	88	88	88	182	182	182	182	182
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R2	0.302	0.306	0.358	0.406	0.406	0.141	0.162	0.191	0.272	0.278

Notes: Dependent variable is net capital flow to GDP if a surge occurs. Asset- (liability-) driven surge is the surge when change in residents' assets- (liabilities-) is larger than the change in residents' liabilities (assets). All variables except for real US interest rate, S&P 500 index returns volatility, commodity price index, regional contagion and financial interconnectedness are lagged one period. Constant, and region specific effects are included. All regressions are estimated using OLS. Clustered standard errors (at the country level) reported in parentheses. ***,**,* indicate significance at 1, 5, and 10 percent levels, respectively.

Table 7. Likelihood of Surge: Sensitivity Analysis

	Surge definitions		Alternate regressors			Additional regressors							Sample	Estimation
	Extended	Cluster	Real US 10yr yield	RAI	VIX	Trade opennes	Reserves to GDP	Stock market capitalization	Return on equity	Private sector credit/GDP	Trade links	Fixed effects	1990-2009	Complementary Log-Log
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Real US interest rate	-10.701***	-12.260***	-6.342**	-5.747**	-8.725***	-9.418***	-9.316***	-13.783***	-11.758***	-12.211***	-10.354***	-16.225***	-9.255***	-14.837***
	(2.825)	(2.816)	(2.678)	(2.888)	(2.682)	(2.177)	(2.253)	(3.075)	(3.871)	(2.536)	(2.222)	(3.260)	(3.344)	(3.550)
S&P500 index/RAI/VIX	-0.023**	-0.016	-0.015	0.140	-0.092*	-0.027**	-0.029***	-0.045***	-0.034**	-0.033***	-0.029***	-0.028**	-0.029**	-0.050***
	(0.011)	(0.012)	(0.011)	(0.091)	(0.052)	(0.012)	(0.011)	(0.015)	(0.014)	(0.012)	(0.011)	(0.012)	(0.014)	(0.017)
Commodity price index	0.706	1.335***	0.851**	1.102**	0.957**	1.135***	1.044**	1.188**	1.318**	1.385***	1.088***	1.504***	0.889**	1.117*
	(0.457)	(0.400)	(0.411)	(0.428)	(0.430)	(0.414)	(0.416)	(0.560)	(0.523)	(0.452)	(0.416)	(0.469)	(0.431)	(0.577)
Regional contagion	0.503*	0.744***	0.180	0.219	0.281	0.056	0.088	-0.247	-0.371	-0.089	0.068	0.238	-0.107	0.045
	(0.290)	(0.257)	(0.232)	(0.256)	(0.255)	(0.224)	(0.225)	(0.341)	(0.360)	(0.298)	(0.236)	(0.268)	(0.262)	(0.333)
Real domestic interest rate	2.847***	2.942***	1.620	1.926	2.003	2.148**	2.012*	1.131	2.044	1.789*	1.947*	1.406	1.406	2.856*
	(1.079)	(1.030)	(1.028)	(1.216)	(1.222)	(1.034)	(1.048)	(1.328)	(1.347)	(1.053)	(1.064)	(1.139)	(1.347)	(1.522)
REER deviation from trend	-1.158**	-1.268*	-1.048	-1.210	-1.259*	-0.703	-1.034	-1.831**	-1.692*	-1.184	-1.094	-1.189	-1.914**	-1.405
	(0.471)	(0.766)	(0.751)	(0.779)	(0.712)	(0.721)	(0.754)	(0.780)	(0.903)	(0.720)	(0.741)	(0.786)	(0.893)	(1.126)
Optimal current account/GDP	-13.040***	-10.254***	-11.367***	-12.232***	-12.029***	-11.609***	-11.884***	-12.417***	-12.313***	-11.886***	-11.821***	-12.496***	-13.100**	-16.322***
	(2.340)	(2.338)	(1.813)	(1.883)	(1.823)	(1.740)	(1.797)	(2.376)	(2.057)	(1.951)	(1.783)	(2.006)	(2.012)	(2.515)
Real GDP growth	4.929***	4.225***	4.456***	4.879***	5.025***	4.062***	4.465***	3.746**	4.678**	3.943**	4.394***	4.376**	4.267***	6.630***
	(1.524)	(1.390)	(1.385)	(1.431)	(1.434)	(1.434)	(1.387)	(1.826)	(1.829)	(1.683)	(1.387)	(1.710)	(1.529)	(1.949)
Capital account openness	0.102*	0.021	0.088*	0.053	0.070	0.064	0.079*	0.062	0.041	0.098**	0.084*	0.004	0.037	0.111*
	(0.057)	(0.037)	(0.048)	(0.047)	(0.046)	(0.048)	(0.047)	(0.053)	(0.045)	(0.046)	(0.047)	(0.075)	(0.047)	(0.064)
Financial interconnectedness	0.063***	0.103***	0.074***	0.078***	0.078***	0.089***	0.075***	0.092***	0.097***	0.071***	0.074***	0.131***	0.087***	0.114***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.016)	(0.015)	(0.016)	(0.016)	(0.015)	(0.015)	(0.021)	(0.016)	(0.023)
Exchange rate regime	0.181**	0.155*	0.163**	0.207***	0.216***	0.127	0.162**	0.251***	0.243***	0.163**	0.172**	0.218*	0.249***	0.211**
	(0.089)	(0.082)	(0.074)	(0.074)	(0.074)	(0.081)	(0.074)	(0.085)	(0.079)	(0.077)	(0.075)	(0.128)	(0.076)	(0.105)
Institutional quality index	2.521***	1.375**	1.943***	2.055***	2.259***	1.681**	2.144***	2.284***	1.971**	2.441***	2.267***	2.731***	1.835**	3.741***
	(0.774)	(0.663)	(0.707)	(0.756)	(0.765)	(0.735)	(0.677)	(0.834)	(0.870)	(0.711)	(0.687)	(1.008)	(0.786)	(1.097)
Default onset	-0.660**	-0.975**	-0.366	-0.470	-0.458	-0.355	-0.313		-0.354	-0.313	-0.332	-0.247	-0.445	-0.832
	(0.326)	(0.443)	(0.386)	(0.524)	(0.513)	(0.369)	(0.373)		(0.572)	(0.378)	(0.372)	(0.361)	(0.555)	(0.688)
Real GDP per capita (log)	-0.279**	-0.204**	-0.262***	-0.325***	-0.345***	-0.319***	-0.319***	-0.261**	-0.343***	-0.292***	-0.298***	-0.951**	-0.316***	-0.489***
	(0.127)	(0.087)	(0.100)	(0.106)	(0.108)	(0.093)	(0.100)	(0.124)	(0.104)	(0.111)	(0.101)	(0.388)	(0.103)	(0.151)
Observations	1,199	1,199	1,199	1,121	1,067	1,199	1,199	879	840	1181	1,199	1,181	956	1,199
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-R2	0.217	0.203	0.188	0.199	0.194	0.202	0.195	0.212	0.199	0.191	0.194	0.277	0.188	

Notes: Dependent variable is a binary variable (=1if a surge occurs; 0 otherwise). All regressions (except for complemetary log-log regression) are estimated using probit estimation method. Clustered standard errors (at the country level) are reported in parentheses. All variables except for real US interest rate, S&P500 index returns volatility, commodity price index, regional contagion, and financial interconnectedness are lagged one period. Constant and region specific effects are included in all specifications. ***,**,* indicate significance at 1, 5, and 10 percent levels, respectively. Extended=Surges identified using a one-year window (i.e., including the year before and after the surgeif the net capital flow is positive); Cluster=Surges identified using the cluster approach; Real US 10yr yield=Including the real US 10 yr government bond yield instead of the real US 3-month T-bill rate; RAI=including the (log of) Credit Suisse global risk appetite index (RAI) instead of the S&P500 index volatility measure; VIX=Including the (normalized) VIX extended backward up to 1986 with the (normalized) VXO index; Trade openness=Including trade to GDP ratio in the specification; Reserves to GDP=Including the stock of foreign reserves to GDP ratio in the specification; Stock market capitalization=Including stock market capitalization in the specification; Return on equity=Including banks's return on equity in the specification; Private sector credit/GDP=Including private sector credit to GDP ratio in the specification; Trade links=Including trade links to measure contagion effects in the specification; Fixed effects=Including country fixed effects in the specification.

Table 8. Magnitude of Surge: Sensitivity Analysis

	Surge definitions		Alternate regressors			Additional regressors							Sample
	Extended	Cluster	Real US 10yr yield	RAI	VIX	Trade openness	Reserves to GDP	Stock market capitalization	Return on equity	Private sector credit/GDP	Trade links	Fixed effects	1990-2009
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Real US interest rate	-0.439**	-0.314	-0.242	-0.144	-0.207	-0.154	-0.009	-0.922***	-0.556*	-0.661***	-0.331	-0.202	-0.243
	(0.171)	(0.219)	(0.224)	(0.269)	(0.245)	(0.176)	(0.234)	(0.335)	(0.327)	(0.234)	(0.217)	(0.267)	(0.321)
S&P 500 index/RAI/VIX	-0.002**	-0.002**	-0.001*	0.001	-0.005	-0.001	-0.002*	-0.003***	-0.002*	-0.002*	-0.001	-0.002**	-0.002
	(0.001)	(0.001)	(0.001)	(0.009)	(0.005)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Commodity price index	0.030	0.021	0.017	0.030	0.028	0.044	0.007	0.060	0.052	0.055*	0.021	0.082***	0.020
	(0.021)	(0.027)	(0.032)	(0.039)	(0.039)	(0.030)	(0.032)	(0.045)	(0.041)	(0.031)	(0.030)	(0.027)	(0.038)
Regional contagion	-0.102	-0.208**	-0.014	-0.024	-0.042	0.022	0.019	-0.228***	-0.069	-0.063	-0.021	0.046	-0.066
	(0.063)	(0.101)	(0.072)	(0.077)	(0.082)	(0.064)	(0.065)	(0.076)	(0.100)	(0.061)	(0.070)	(0.047)	(0.090)
Real domestic interest rate	-0.007	-0.047	-0.054	-0.058	-0.052	0.033	0.005	-0.131	-0.043	-0.001	-0.024	0.015	-0.070
	(0.063)	(0.062)	(0.072)	(0.073)	(0.075)	(0.073)	(0.067)	(0.082)	(0.083)	(0.062)	(0.070)	(0.059)	(0.076)
REER deviation from trend	-0.120**	-0.235***	-0.158**	-0.167*	-0.177*	-0.076	-0.124	-0.200*	-0.162**	-0.178**	-0.155**	-0.175**	-0.171*
	(0.054)	(0.084)	(0.078)	(0.091)	(0.091)	(0.076)	(0.082)	(0.108)	(0.078)	(0.079)	(0.075)	(0.086)	(0.087)
Optimal current account/GDP	-0.294***	-0.302***	-0.248**	-0.240*	-0.260**	-0.164	-0.246*	-0.298	-0.257*	-0.303	-0.253**	-0.216	-0.268**
	(0.091)	(0.110)	(0.123)	(0.126)	(0.128)	(0.116)	(0.125)	(0.190)	(0.149)	(0.182)	(0.121)	(0.130)	(0.126)
Real GDP growth	-0.048	-0.038	-0.140	-0.114	-0.127	-0.166	-0.108	-0.244	-0.170	-0.243	-0.166	-0.294	-0.183
	(0.130)	(0.235)	(0.223)	(0.221)	(0.226)	(0.228)	(0.244)	(0.246)	(0.266)	(0.251)	(0.227)	(0.265)	(0.244)
Capital account openness	0.006**	0.006*	0.007*	0.007*	0.007*	0.003	0.004	0.005	0.006	0.005	0.006*	0.005	0.006*
	(0.002)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.006)	(0.004)
Financial interconnectedness	0.000	-0.003	-0.002	-0.002	-0.002	0.000	-0.002	-0.001	-0.001	-0.002	-0.002	-0.000	-0.002
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Exchange rate regime	0.025***	0.024**	0.031***	0.031***	0.031***	0.023***	0.025***	0.034**	0.033***	0.032***	0.029***	0.016**	0.030***
	(0.008)	(0.010)	(0.010)	(0.010)	(0.010)	(0.008)	(0.007)	(0.013)	(0.011)	(0.011)	(0.010)	(0.007)	(0.010)
Institutional quality index	0.013	0.079	0.000	0.016	0.019	-0.055	-0.039	-0.016	0.040	0.031	0.020	-0.073	-0.011
	(0.072)	(0.088)	(0.094)	(0.107)	(0.106)	(0.092)	(0.093)	(0.113)	(0.134)	(0.093)	(0.090)	(0.071)	(0.115)
Default onset	0.003	-0.002	-0.006	0.006	-0.000	-0.030	0.000		0.004	-0.013	-0.008	-0.038*	0.001
	(0.017)	(0.018)	(0.020)	(0.022)	(0.026)	(0.023)	(0.021)		(0.022)	(0.023)	(0.019)	(0.021)	(0.022)
Real GDP per capita (log)	0.002	-0.001	0.009	0.008	0.008	0.003	0.001	0.020	0.006	0.003	0.008	0.012	0.011
	(0.015)	(0.016)	(0.020)	(0.021)	(0.021)	(0.017)	(0.014)	(0.023)	(0.024)	(0.020)	(0.019)	(0.019)	(0.021)
Observations	439	316	271	260	256	271	271	216	223	253	271	271	252
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.234	0.295	0.287	0.288	0.299	0.358	0.375	0.353	0.315	0.32	0.303	0.728	0.303

Notes: Dependent variable is net capital flow to GDP conditional on surge occurrence. All regressions are estimated using OLS, with clustered standard errors (at the country level) reported in parentheses. All variables except for real US interest rate, S&P 500 index returns volatility, commodity price index, regional contagion, and financial interconnectedness are lagged one period. Constant and region specific effects are included in all specifications. ***,**,* indicate significance at 1, 5, and 10 percent levels, respectively. Extended=Surges identified using a one-year window (i.e., including the year before and after the surge if the net capital flow is positive); Cluster=Surges identified using the cluster approach; Real US 10yr yield=Including the real US 10 yr government bond yield instead of the real US 3-month T-bill rate; RAI=Including the (log of) Credit Suisse global risk appetite index (RAI) instead of the S&P 500 index volatility measure; VIX=Including the (normalized) VIX index extended backward up to 1986 with the (normalized) VXO index; Trade openness=Including trade to GDP ratio in the specification; Reserves to GDP=Including stock of foreign reserves to GDP ratio in the specification; Stock market capitalization=Including stock market capitalization in the specification; Return on equity=Including banks's return on equity in the specification; Private sector credit/GDP=Including private sector credit to GDP ratio in the specification; Trade links=Including trade links to measure contagion effects in the specification; Fixed effects=Including country fixed effects in the specification.

Table 9: Surge Likelihood and Magnitude: Sensitivity Analysis for Endogeneity

	Surge likelihood a/		Surge magnitude b/	
Estimation	Probit	IV-Probit	OLS	IV-2SLS
	(1)	(2)	(3)	(4)
Real US interest rate	-12.185***	-12.974***	-0.294	-0.370
	(3.754)	(4.323)	(0.315)	(0.307)
S&P 500 index	-0.029*	-0.028	-0.001	-0.002
	(0.017)	(0.019)	(0.001)	(0.001)
Commodity price index	0.482	0.241	0.003	-0.006
	(0.442)	(0.515)	(0.034)	(0.071)
Regional contagion	-0.310	-0.385	0.010	-0.023
	(0.356)	(0.408)	(0.108)	(0.112)
Real domestic interest rate	3.050***	3.017*	-0.005	-0.055
	(0.997)	(1.540)	(0.086)	(0.102)
REER deviation from trend	-0.395	5.047	0.003	0.377
	(0.870)	(9.775)	(0.062)	(0.726)
Optimal current account/GDP	-20.327***	-18.875***	-0.301***	-0.267*
	(3.147)	(3.222)	(0.109)	(0.140)
Real GDP growth	7.597***	12.105*	0.277*	0.126
	(2.530)	(7.281)	(0.150)	(1.402)
Capital account openness	0.061	0.062	0.008*	0.009*
	(0.058)	(0.045)	(0.005)	(0.005)
Financial interconnectedness	0.058***	0.042	-0.002	-0.002
	(0.020)	(0.028)	(0.002)	(0.003)
Exchange rate regime	0.173**	0.159*	0.025***	0.028**
	(0.078)	(0.089)	(0.009)	(0.012)
Institutional quality index	2.346**	2.040*	0.028	0.002
	(0.973)	(1.050)	(0.130)	(0.128)
Real GDP per capita (log)	-0.297**	-0.255**	-0.035***	-0.307
	(0.129)	(0.116)	(0.012)	(0.220)
Observations	758	758	209	209
Regional dummies	Yes	Yes	Yes	Yes
Variables instrumented	No	Yes	No	Yes

a/ Dependent variable is a binary variable equal to 1 if a surge occurs and 0 otherwise. Constant and region specific effects included in all specifications. Instrumental variables (IV) regressions estimated with two-step probit model. Real GDP growth rate and REER deviation from trend instrumented with real GDP growth rate and real exchange rate change projected in time periods t-2 or earlier. ***,** and * indicate signficance at 1, 5, and 10 percent levels, respectively.

b/ Dependent variable is net capital flow to GDP conditional on surge occurrence. Clustered standard errors reported in parentheses. Constant and region specific effects included in all specifications. Instrumental variables (IV) regressions estimated with 2SLS approach. Real GDP growth rate and REER deviation from trend instrumented with real GDP growth rate and real exchange rate change projected in time periods t-2 or earlier. ***,** and * indicate signficance at 1, 5, and 10 percent levels, respectively.

SURGES: ONLINE APPENDIX

A. The Intertemporal Optimizing Model of the Current Account

Capital flows to EMEs should correspond to their external financing needs; to proxy for the latter, we use an intertemporal optimizing model of the current account following Ghosh (1995). If the country can borrow (or lend) freely in the world capital markets, then consumption need not depend on the current realization of "national cash flow" (output, net of investment and government consumption) but rather on the annuity value of its entire present value:

$$c_t^* = \left(\frac{r}{\theta}\right)\left\{b_t + \frac{1}{(1+r)}\sum_{j=0}^{\infty} E_t \frac{(Q_{t+j} - I_{t+j} - G_{t+j})}{(1+r)^j}\right\} \quad \text{(A1)}$$

where θ is a constant of proportionality reflecting consumption tilting given the country's subjective discount rate and the world interest rate, $c*$ reflects consumption, Q is GDP, I is investment, and G is government consumption. The assumption that the economy is small in the world capital markets implies Fisherian separability: investment is undertaken until the marginal product of capital equals the world interest rate. Thus investment and output can be taken as *given* when making the consumption decision. The consumption-smoothing component of the current account (i.e., abstracting from consumption-tilting) is given by:

$$CA_t^* = Y_t - I_t - G_t - \theta C_t^* \quad \text{(A2)}$$

where Y is GNP. Substituting for consumption, yields (after some manipulation):

$$CA_t^* = -\sum_{j=1}^{\infty} \frac{E_t\left\{\Delta(Q_{t+j} - I_{t+j} - G_{t+j})\right\}}{(1+r)^j} \quad \text{(A3)}$$

The expression for the current account (10) is fundamental to the intertemporal optimizing approach. It states that the current account should equal the present discounted value of *expected changes* in national cash flow. As such, it embodies the familiar dictum that a country should adjust to permanent shocks but finance temporary shocks.[40]

To empirically implement (10), we estimate a vector autoregression (VAR) in the current account and national cash flow for each country individually:

$$\begin{bmatrix} \Delta(Q_t - I_t - G_t) \\ CA_t \end{bmatrix} = \begin{bmatrix} \phi_{11} & \phi_{12} \\ \phi_{21} & \phi_{22} \end{bmatrix} \begin{bmatrix} \Delta(Q_{t-1} - I_{t-1} - G_{t-1}) \\ CA_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_t^1 \\ \varepsilon_t^2 \end{bmatrix} \quad \text{(A4)}$$

or $x_t = \Phi x_{t-1} + \varepsilon_t$. Since $E_t x_{t+k} = \Phi^k x_t$, the expression for the optimal intertemporal consumption-smoothing current account—our proxy for the country's external financing need—becomes:

$$CA_t^* = -\sum_{j=1}^{\infty}(1+r)^{-j}[1 \quad 0]\Phi^k x_t = -[1 \quad 0](\Phi/(1+r))[I - \Phi/(1+r)]^{-1} x_t \quad \text{(A5)}$$

where for each country, the discount rate is set at $r = 0.02$, and a first-order VAR is estimated.

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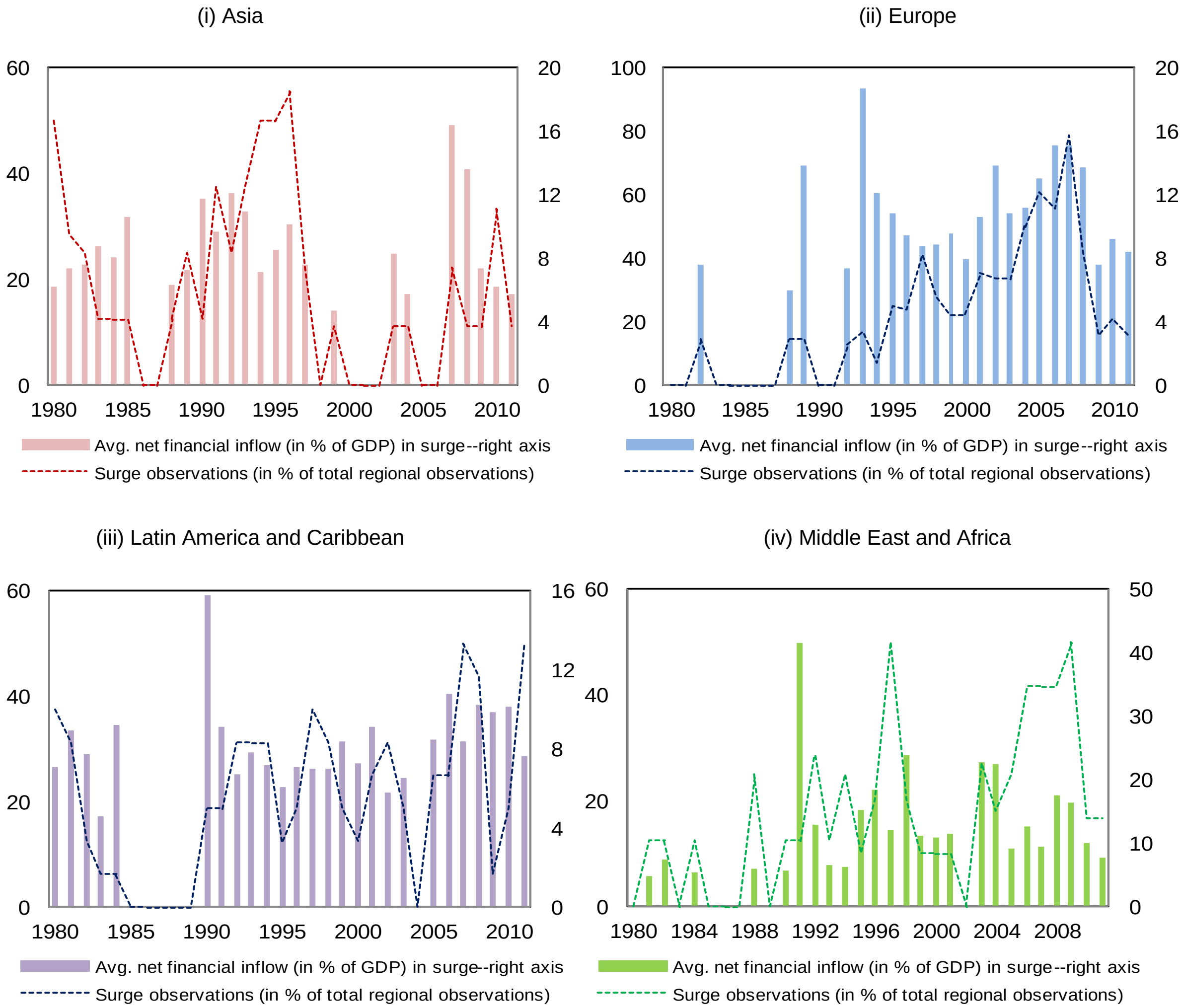
[40] For instance, if the shock is permanent, then by definition it is not expected to be reversed, so $\Delta(Q_{t+j} - I_{t+j} - G_{t+j}) = 0 \; \forall \; j$ and, according to (10), the country should not run a current account deficit. If however there is a purely temporary fall in output such that $\Delta(Q_{t+j} - I_{t+j} - G_{t+j}) > 0$, then the country should run a deficit.

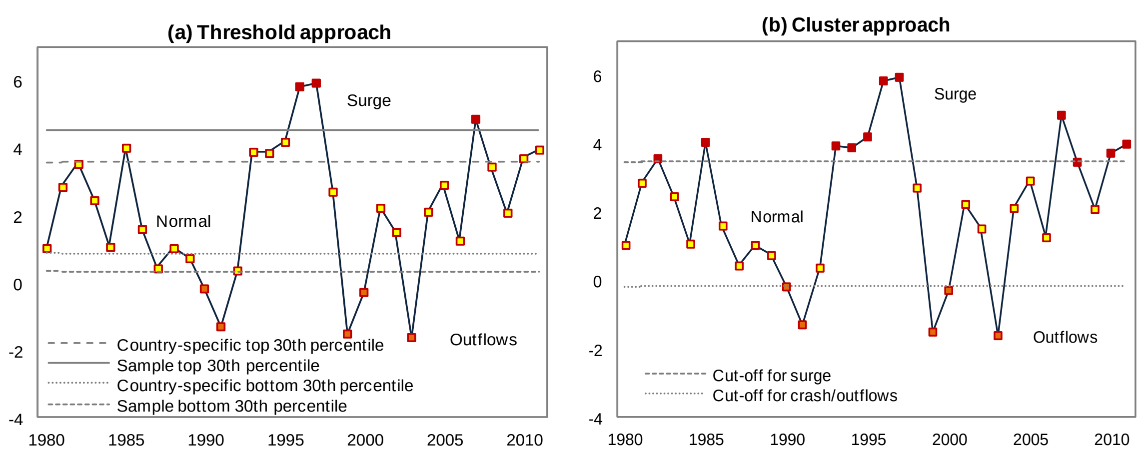
B. Data and Summary Statistics

Figure B1. Surges by Region, 1980-2011



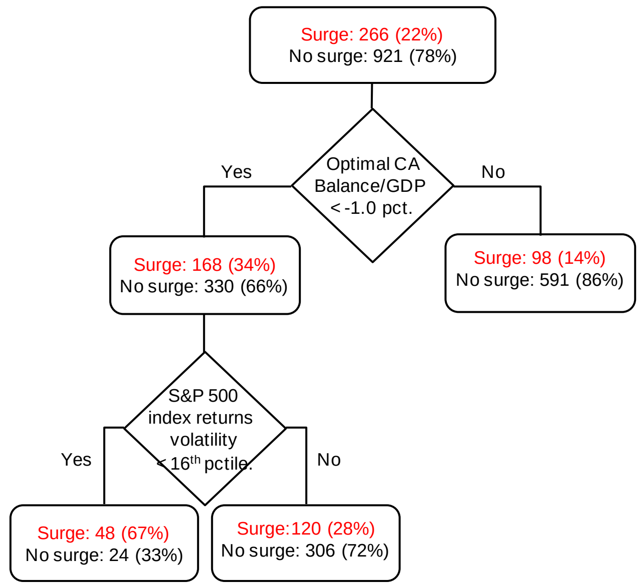
Source: Authors' calculations based on IFS database.

Figure B2. Colombia: Net Capital Flows to GDP (in percent), 1980-2011



Source: Authors' calculations based on IFS database.

Figure B3. Binary Recursive Trees for Surge Occurrence: Full Sample



Source: Authors' estimates.
Notes: Binary recursive trees have been constructed for all surge types using the Improved CHAID algorithm in SIPINA software (with the minimum size of nodes to split, and leaves specified as 20 and 10 observations, respectively; and the p-level for merging and splitting nodes specified as 0.05 and 0.001, respectively). Outlier observations for (lagged) optimal current account (i.e., in the bottom and top 0.005th percentile) have been excluded

Table B1. Variable Definitions and Data Sources

Variables	Description	Source
Capital account openness	Index (high=liberalized; low =closed)	Chinn-Ito (2008)[1]
Commodity price index	Log difference betw een actual and trend (obtained from HP filter) commodity price index	IMF's WEO database
Consumer price index, year average	Index	IMF's WEO database
Credit Suisse Risk Appetite Index	Measures excess return per unit of risk (low er values indicate periods of financial strain)	Bloomberg
Default onset	First year of sovereign debt crisis (inability to pay the principal or interest payments on the due date or w ithin the grace period)	Reinhart and Reinhart (2008)[3]
Exchange rate regime	De facto (3=Fixed; 2=Intermediate; 1=Flexible)	IMF's AREAER
Financial interconnectedness	Number of lenders of bank credit (0 to 15)	Minoiu and Reyes (2011)[4]
GDP, current/constant prices	In billions of USD (or LC)	IMF's WEO database
Institutional quality index	Average of ICRG's 12 political risk components	http://w w w .prsgroup.com/Default.aspx
Net capital flow s	Net financial flow s excluding financing items and other investment liabilities of general government (In billions of USD)	IMF's IFS database
Money market rate	In percent	IMF's IFS database
Optimal current account balance/GDP	Obtained from the intertemporal optimizing model of the current account follow ing Ghosh (1995)[2]	
Private sector credit	In billions of LC	IMF's IFS database
Real Effective Exchange Rate (REER)	Index	INS database
Real GDP per capita	In USD	IMF's WEO database
Real interest rate	[(1+nominal interest rate)/(1+expected inflation)]-1	Authors' calculations
Real interest rate differential	Difference betw een domestic real interest rate, real US interest rate, and REER deviation from trend	Authors' calculations
REER deviation from trend	Log difference betw een REER and REER trend (obtained from HP filter)	Authors' calculations
Regional contagion	Share of countries in the region w ith a surge	Authors' calculations
Regional contagion (magnitude)	Net capital flow to GDP in countries experiencing a surge in the same region	
S&P 500 index	Index	Bloomberg
S&P 500 index returns volatility	Annual average of tw elve-month rolling standard deviation of S&P 500 index annual returns	Authors' calculations
Stock of foreign exchange reserves	In billions of USD	IMF's WEO database
Stock market capitalization	Value of listed shares to GDP	Beck and Demirgüç-Kunt (2009)[5]
Trade links	Calculated as in Forbes and Warnock (2011); trade links= $\sum_{t=1}^{n} EX_{x,i,t-1} / GDP_{x,t-1}) * surge_{i,t}$ w here $EX_{i,t-1}$ is exports from country x to i in year t-1, $GDP_{x,t-1}$ is the GDP of country x in t-1, and $surge_{i,t}$ is a binary variable (=1) if country i had a surge in t	Authors' calculations using bilateral trade data from IMF's DOTS
U.S. 3-month Treasury Bill rate	In percent	IMF's WEO and Bloomberg
VIX	Chicago Board Options Exchange Market Volatility Index (high values indicate greater volatility of S&P 500 index options)	Bloomberg
VXO	Chicago Board Options Exchange Market Volatility Index (high values indicate greater volatility of S&P 500 index options)	Bloomberg

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Table B2. List of Surge Episodes with the Threshold Approach, 1980-2011

Country	Duration[a]	Avg. net capital flow (% of GDP)[b]	Country	Duration[a]	Avg. net capital flow (% of GDP)[b]	Country	Duration[a]
Albania	1988-89	9.9	El Salvador	2003	6.7	Panama	1981
Albania	1997	5.0	El Salvador	2006	6.0	Panama	1997-99
Albania	2006-11	8.5	El Salvador	2008	7.2	Panama	2001
Argentina	1993-94	8.6	Estonia	1997	15.9	Panama	2005
Argentina	1997-99	5.4	Estonia	2002-04	12.2	Panama	2007-08
Armenia	1996-2000	12.9	Estonia	2006-07	16.7	Panama	2010-11
Armenia	2009	9.4	Guatemala	1991-93	7.8	Paraguay	1980-82
Azerbaijan	1995-98	24.1	Guatemala	1998	5.1	Paraguay	2007
Azerbaijan	2003-04	32.3	Guatemala	2000-03	6.7	Peru	1994-97
Belarus	1997	4.8	Hungary	1993-95	15.0	Peru	2002
Belarus	2002	5.1	Hungary	1998-2000	11.3	Peru	2007-08
Belarus	2007	8.3	Hungary	2004-07	10.7	Peru	2010-11
Belarus	2009-11	9.7	Hungary	2008	8.8	Philippines	1980
Bosnia & Herzegovina	2001	16.1	India	2007	8.0	Philippines	1991
Bosnia & Herzegovina	2003-05	13.7	Indonesia	1995-96	5.1	Philippines	1994-97
Bosnia & Herzegovina	2007	13.6	Israel	1982	7.6	Philippines	1999
Brazil	1980-81	6.7	Israel	1997	6.8	Poland	1995-96
Brazil	1994	8.0	Israel	1999	4.9	Poland	1998-2000
Brazil	2007	6.5	Israel	2008	7.0	Poland	2005
Brazil	2011	4.6	Jamaica	1984	9.3	Poland	2007-10
Bulgaria	1992-1993	12.6	Jamaica	2001-03	8.9	Romania	1997-98
Bulgaria	2000	7.8	Jamaica	2005-09	12.2	Romania	2001-08
Bulgaria	2002-08	26.3	Jamaica	2011	10.9	Russia	2007
Chile	1980-81	12.6	Jordan	1988	5.7	Serbia	2007-08
Chile	1990	7.9	Jordan	1991-92	31.4	Slovak Rep.	1996
Chile	1992-97	7.2	Jordan	1994	6.8	Slovak Rep.	1998
Chile	2011	7.3	Jordan	2005-10	17.9	Slovak Rep.	2002
China	1994	4.9	Kazakhstan	1997	11.7	Slovak Rep.	2004-05
China	2004	5.7	Kazakhstan	2001	11.6	Slovak Rep.	2007
China	2010	4.8	Kazakhstan	2003-04	9.9	South Africa	1997
Colombia	1996-97	5.9	Kazakhstan	2006-07	14.0	South Africa	2005-07
Colombia	2007	4.8	Korea	1980-81	6.0	South Africa	2009
Costa Rica	1980	6.5	Latvia	1995	11.7	Sri Lanka	1980
Costa Rica	1999	4.8	Latvia	2001	10.9	Sri Lanka	1982
Costa Rica	2002	5.4	Latvia	2004-07	21.4	Sri Lanka	1989
Costa Rica	2006-08	8.8	Lebanon	2003	28.5	Sri Lanka	1993-94
Costa Rica	2011	6.1	Lebanon	2008-09	48.2	Sri Lanka	2009-11
Croatia	1996-97	12.8	Lithuania	1997-98	10.6	Thailand	1988-96
Croatia	1999	14.0	Lithuania	2003	8.8	Thailand	2010
Croatia	2001	11.8	Lithuania	2005-07	13.7	Tunisia	1981-82
Croatia	2003	11.6	Macedonia	2001	11.2	Tunisia	1984
Croatia	2006	12.5	Macedonia	2005	8.9	Tunisia	1992-93
Czech Rep.	1995-96	9.1	Macedonia	2006-08	10.8	Tunisia	2006
Czech Rep.	2000-02	9.2	Malaysia	1981-85	9.2	Tunisia	2008-09
Czech Rep.	2004	5.8	Malaysia	1991-93	14.5	Turkey	2004-07
Dominican Rep.	2000-01	6.3	Malaysia	1995-96	9.4	Turkey	2010-11
Dominican Rep.	2008	7.2	Mauritius	1988	6.1	Ukraine	2005
Dominican Rep.	2010-11	8.0	Mauritius	1990	5.6	Ukraine	2007-08
Ecuador	1990-91	10.7	Mauritius	2007-11	8.4	Uruguay	1980
Ecuador	1994	5.7	Mexico	1980-81	6.6	Uruguay	1982-83
Ecuador	1998	6.4	Mexico	1991-93	7.7	Uruguay	2005-08
Ecuador	2002	5.4	Mexico	1997	5.2	Uruguay	2011
Egypt	1997	4.6	Morocco	1994	5.5	Venezuela	1990
Egypt	2005	8.3	Morocco	2011	4.7	Venezuela	1992-93
El Salvador	1998	7.3	Pakistan	2006-08	5.5	Vietnam	1996-97
						Vietnam	2007-08

[a] Refers to the years of the surge episode.
[b] Mean of net capital flow to GDP (in percent) received over the surge episode.

Table B3. List of Surge Episodes with the Cluster Approach, 1980-2011

Country	Duration[a]	Average net capital flows (% of GDP)[b]	Country	Duration[a]	Average net capital flows (% of GDP)[b]	Country	Duration[a]	Average net capital flows (% of GDP)[b]
Albania	1988-89	9.9	Egypt	2007-08	4.1	Morocco	1992-94	4.2
Albania	2006-11	8.5	Egypt	2010	3.9	Morocco	1999	3.2
Algeria	1980	2.3	El Salvador	1995	4.1	Morocco	2008-11	4.2
Algeria	1989	1.5	El Salvador	1997-99	5.3	Pakistan	1993-94	3.1
Algeria	2008-10	3.5	El Salvador	2002-03	5.0	Pakistan	1996	3.6
Argentina	1992-94	6.9	El Salvador	2005-08	5.2	Pakistan	2005-09	4.5
Argentina	1996-99	5.2	Estonia	1997	15.9	Panama	1981	7.5
Armenia	1996-2000	12.9	Estonia	2003-04	12.9	Panama	1997-99	11.6
Azerbaijan	1996-98	27.0	Estonia	2006-07	16.7	Panama	2001	11.0
Azerbaijan	2003-04	32.3	Guatemala	1991-93	7.8	Panama	2005	13.5
Belarus	2007	8.3	Guatemala	1998	5.1	Panama	2007-08	11.4
Belarus	2009-11	9.7	Guatemala	2000-03	6.7	Panama	2010-11	11.5
Bosnia & Herzegovina	2001	16.1	Hungary	1993-95	15.0	Paraguay	1980-82	7.1
Bosnia & Herzegovina	2003-05	13.7	Hungary	1998-2000	11.3	Paraguay	2005	4.4
Bosnia & Herzegovina	2007	13.6	Hungary	2004-06	11.5	Paraguay	2007-08	4.6
Brazil	1980-82	5.8	Hungary	2008	8.7	Peru	1994-97	7.9
Brazil	1994-96	5.3	India	1994	3.3	Peru	2007-08	10.5
Brazil	2000	4.3	India	2003-04	3.4	Peru	2010	11.0
Brazil	2007	6.5	India	2006-07	6.0	Philippines	1980	6.1
Brazil	2009-2011	4.5	India	2009	3.2	Philippines	1991	5.1
Bulgaria	1993	18.0	Indonesia	1990-93	3.5	Philippines	1994-97	9.1
Bulgaria	2002	22.8	Indonesia	1995-96	5.1	Philippines	1999	4.7
Bulgaria	2005-08	33.4	Indonesia	2010	3.8	Poland	1995-96	7.4
Chile	1980-81	12.6	Israel	1981-82	6.0	Poland	1998-2000	6.8
Chile	1990	7.9	Israel	1987	4.3	Poland	2005	7.1
Chile	1992-94	7.3	Israel	1995-97	5.1	Poland	2007-10	8.2
Chile	1996-97	8.2	Israel	1999-2000	4.5	Romania	2002	7.9
Chile	2011	7.3	Israel	2008	7.0	Romania	2004-08	14.3
China	1993-96	4.3	Jamaica	1984	9.3	Russian	1997	3.4
China	2003-04	4.5	Jamaica	2001-02	9.8	Russian	2002	4.1
China	2009-10	4.3	Jamaica	2005-09	12.2	Russian	2005-07	4.4
Colombia	1982	3.6	Jamaica	2011	10.9	Serbia	2007	19.2
Colombia	1985	4.0	Jordan	1991-92	31.4	Slovak Rep.	1996	11.3
Colombia	1993-97	4.7	Jordan	2005-09	19.3	Slovak Rep.	2002	22.7
Colombia	2007-08	4.2	Kazakhstan	1997	11.7	Slovak Rep.	2004-05	13.2
Colombia	2010-11	3.8	Kazakhstan	2001	11.6	South Africa	1997-98	4.2
Costa Rica	1980	6.5	Kazakhstan	2004	11.0	South Africa	2004-09	5.2
Costa Rica	1995	4.3	Kazakhstan	2006	20.0	Sri Lanka	1980	5.0
Costa Rica	1999	4.8	Korea, Rep.	1980-82	5.1	Sri Lanka	1982	6.5
Costa Rica	2002	5.4	Korea, Rep.	1995-96	3.8	Sri Lanka	1989	5.0
Costa Rica	2005-08	7.7	Korea, Rep.	2003	3.2	Sri Lanka	1993-94	6.6
Costa Rica	2010-11	5.2	Korea, Rep.	2009	4.1	Sri Lanka	2009-11	6.4
Croatia	1996-97	12.8	Latvia	2004-07	21.4	Thailand	1989-96	10.5
Croatia	1999	14.0	Lebanon	2008-09	48.2	Thailand	2010	7.8
Croatia	2001	11.8	Lithuania	1998	11.7	Tunisia	1981-82	6.1
Croatia	2003	11.6	Lithuania	2006-07	15.9	Tunisia	1984	5.4
Croatia	2006	12.5	Macedonia	2001	11.2	Tunisia	1993	6.5
Croatia	2008	11.2	Macedonia	2005	8.9	Tunisia	2006	9.5
Czech Rep.	1995	11.4	Macedonia	2007-08	11.9	Tunisia	2008-09	6.5
Czech Rep.	2002	13.6	Malaysia	1981-85	9.2	Turkey	1993	4.5
Dominican Rep.	1980	4.4	Malaysia	1991-93	14.3	Turkey	2004-08	6.9
Dominican Rep.	1999-2001	5.7	Malaysia	1995-96	9.4	Turkey	2010-11	8.0
Dominican Rep.	2005	4.6	Mauritius	1980	3.7	Ukraine	2005	9.4
Dominican Rep.	2007-11	6.4	Mauritius	1988	6.1	Ukraine	2007-08	8.9
Ecuador	1990-92	9.8	Mauritius	1990	5.6	Uruguay	1982	10.4
Ecuador	1994	5.7	Mauritius	2007-11	8.4	Uruguay	2006-08	11.2
Ecuador	1998	6.4	Mexico	1980-81	6.6	Uruguay	2011	8.0
Ecuador	2002	5.4	Mexico	1991-93	7.7	Venezuela	1987	3.5
Egypt	1997-98	4.0	Mexico	1997	5.2	Venezuela	1990-93	10.4
Egypt	2005	8.3	Morocco	1990	3.4	Vietnam	1996	11.8
						Vietnam	2007-08	19.3

[a] Refers to the years of the surge episode.

[b] Mean of net capital flows to GDP (in percent) received over the surge episode.

Table B4. Estimation Results for Surge Magnitude: Constrained Model, 1980-2011

	(1)	(2)	(3)	(4)	(5)
Real interest rate differential	0.010	0.025	0.004	0.058	0.057
	(0.047)	(0.050)	(0.051)	(0.049)	(0.053)
S&P 500 index volatility	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Commodity price index	0.027	0.019	0.020	0.033	0.030
	(0.029)	(0.028)	(0.031)	(0.028)	(0.032)
Regional contagion	-0.002	0.003	0.010	0.010	0.012
	(0.062)	(0.064)	(0.064)	(0.066)	(0.064)
Optimal current account/GDP		-0.216	-0.169	-0.225*	-0.225*
		(0.134)	(0.122)	(0.123)	(0.125)
Real GDP growth			-0.035	-0.100	-0.111
			(0.228)	(0.216)	(0.222)
Capital account openness			0.010***	0.008**	0.007**
			(0.003)	(0.003)	(0.003)
Financial interconnectedness				-0.001	-0.001
				(0.002)	(0.002)
Exchange rate regime				0.033***	0.033***
				(0.011)	(0.011)
Institutional quality index					-0.003
					(0.092)
Default onset					-0.024
					(0.024)
Real GDP per capita (log)					0.009
					(0.020)
Observations	271	271	271	271	271
Regional dummies	Yes	Yes	Yes	Yes	Yes
R2	0.140	0.153	0.193	0.267	0.272

Notes: Dependent variable is net capital flow to GDP if a surge occurs. Constrained model refers to the specification where real interest rate differential between country i and the US (real domestic interest rate-real US interest rate-REER deviation from trend) is included. All regressions are estimated using pooled OLS. Constant, and regional specific effects are included in all specifications. All variables except for global factors (real US interest rate, S&P 500 index volatility, and commodity price index), regional contagion, and financial interconnectedness are lagged one period. Clustered standard errors (at the country level) reported in parentheses. ***,**,* indicate significance at 1, 5, and 10 percent levels, respectively.

Table B5. Likelihood of Surge by surge Type: Constrained Model, 1980-2011

	Asset-driven surge					Liability-driven surge				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Real interest rate differential	-0.548	0.391	0.205	0.208	0.022	0.935*	1.854***	1.972***	2.365***	2.350***
	(0.507)	(0.684)	(0.837)	(0.864)	(0.726)	(0.558)	(0.579)	(0.642)	(0.724)	(0.766)
S&P 500 index volatility	-0.018*	-0.031**	-0.024*	-0.023*	-0.012	-0.023*	-0.034**	-0.025*	-0.022	-0.015
	(0.010)	(0.013)	(0.013)	(0.013)	(0.012)	(0.012)	(0.014)	(0.015)	(0.014)	(0.013)
Commodity price index	1.267***	1.233***	1.180**	1.150**	1.451***	0.349	0.175	0.232	-0.130	0.174
	(0.411)	(0.474)	(0.462)	(0.476)	(0.513)	(0.428)	(0.412)	(0.418)	(0.423)	(0.405)
Regional contagion	0.729**	0.779***	0.263	0.241	0.093	1.025***	1.040***	0.737**	0.506*	0.343
	(0.285)	(0.302)	(0.326)	(0.317)	(0.328)	(0.311)	(0.309)	(0.305)	(0.288)	(0.280)
Optimal current account/GDP		-11.500***	-11.395***	-11.364***	-11.469***		-9.647***	-9.431***	-9.786***	-9.732***
		(2.445)	(2.443)	(2.434)	(2.374)		(1.620)	(1.629)	(1.836)	(1.791)
Real GDP growth			5.703***	5.591***	5.368***			5.548***	3.881***	3.940***
			(1.781)	(1.771)	(1.731)			(1.475)	(1.389)	(1.438)
Capital account openness			0.155***	0.155***	0.158***			0.070	0.072	0.080*
			(0.052)	(0.052)	(0.051)			(0.043)	(0.047)	(0.048)
Financial interconnectedness				0.011	0.008				0.103***	0.103***
				(0.022)	(0.023)				(0.019)	(0.019)
Exchange rate regime				0.013	-0.016				0.248***	0.229***
				(0.091)	(0.091)				(0.087)	(0.083)
Institutional quality index					2.827***					1.941***
					(0.864)					(0.642)
Default onset					-0.380					-0.637
					(0.437)					(0.479)
Real GDP per capita (log)					-0.227*					-0.289***
					(0.118)					(0.108)
Observations	1,017	1,017	1,017	1,017	1,017	1,111	1,111	1,111	1,111	1,111
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-R2	0.0470	0.119	0.160	0.160	0.184	0.0573	0.106	0.128	0.170	0.187

Notes: Dependent variable is a binary variable (=1if a surge occurs; 0 otherwise). Asset- (liability-) driven surge is defined as the surge when change in residents' assets (liabilities) is larger than the change in their liabilities (assets). Regressions are estimated using probit model, with clustered standard errors (at the country level) reported in parentheses. All variables except for real US interest rate, S&P 500 index volatility, commodity price index, regional contagion and financial interconnectedness are lagged one period. Constant and region-specific effects are included in all specifications. ***,**,* indicate significance at 1, 5, and 10 percent levels, respectively.

Table B6. Magnitude of Surge by surge Type: Constrained Model, 1980-2011

	Asset-driven surge					Liability-driven surge				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Real interest rate differential	0.117	0.119	0.097	0.132*	0.122	-0.038	-0.016	-0.038	0.043	0.036
	(0.016)	(0.079)	(0.071)	(0.075)	(0.098)	(0.060)	(0.065)	(0.067)	(0.065)	(0.073)
S&P500 index volatility	0.000	0.000	-0.001	-0.001	-0.000	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Commodity price index	0.100**	0.098**	0.087**	0.098**	0.099**	0.004	-0.010	0.005	0.014	0.012
	(0.043)	(0.042)	(0.042)	(0.043)	(0.045)	(0.041)	(0.044)	(0.044)	(0.040)	(0.046)
Regional contagion	-0.004	0.008	-0.011	-0.053	-0.056	-0.012	-0.019	0.007	0.028	0.042
	(0.072)	(0.082)	(0.096)	(0.096)	(0.121)	(0.090)	(0.090)	(0.089)	(0.095)	(0.092)
Optimal current account/GDP		-0.114	-0.056	-0.012	-0.014		-0.251	-0.191	-0.322**	-0.324**
		(0.175)	(0.164)	(0.165)	(0.171)		(0.151)	(0.139)	(0.156)	(0.161)
Real GDP growth			-0.133	-0.105	-0.143			0.005	-0.146	-0.152
			(0.157)	(0.156)	(0.192)			(0.344)	(0.317)	(0.311)
Capital account openness			0.012*	0.011*	0.011*			0.010***	0.007**	0.006
			(0.006)	(0.006)	(0.006)			(0.003)	(0.004)	(0.004)
Financial interconnectedness				-0.001	-0.001				-0.001	-0.001
				(0.002)	(0.002)				(0.002)	(0.002)
Exchange rate regime				0.026**	0.026*				0.039***	0.039***
				(0.012)	(0.015)				(0.014)	(0.014)
Institutional quality index					0.006					0.014
					(0.106)					(0.108)
Default onset					-0.024					0.006
					(0.044)					(0.028)
Real GDP per capita (log)					-0.001					0.010
					(0.026)					(0.020)
Observations	88	88	88	88	88	182	182	182	182	182
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R2	0.296	0.300	0.350	0.403	0.404	0.106	0.122	0.159	0.248	0.255

Notes: Dependent variable is net capital flow to GDP if a surge occurs. Asset- (liability-) driven surge is the surge when change in residents' assets- (liabilities-) is larger than the change in residents' liabilities (assets). All variables except for real US interest rate, S&P 500 index volatility, commodity price index, regional contagion and financial interconnectedness are lagged one period. Constant, and region specific effects are included. All regressions are estimated using OLS. Clustered standard errors (at the country level) reported in parentheses. ***,**,* indicate significance at 1, 5, and 10 percent levels, respectively.