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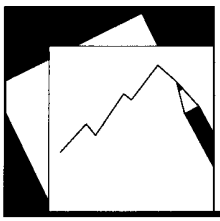

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Surges

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Surges[†]

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Abstract

This paper examines why surges in capital flows to emerging market economies (EMEs) occur, and what determines the allocation of capital across countries during such surge episodes. We use two different methodologies to identify surges in EMEs over 1980–2009, differentiating between those mainly caused by changes in the country's external liabilities (reflecting the investment decisions of foreigners), and those caused by changes in its assets (reflecting the decisions of residents). Global factors—including US interest rates and risk aversion—are key to determining whether a surge will occur, but domestic factors such as the country's external financing needs (as implied by an intertemporal optimizing model of the current account) and structural characteristics also matter, which explains why not all EMEs experience surges. Conditional on a surge occurring, moreover, the magnitude of the capital inflow depends largely on domestic factors including the country's external financing needs, and the exchange rate regime. Finally, while similar factors explain asset- and liability-driven surges, the latter are more sensitive to global factors and contagion.

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Contents

I. Introduction 3
II. Empirical Strategy 6
III. Identifying Surges 11
A. Methodology 11
B. Key Features 12
IV. Estimation Results 14
A. Occurrence of Surges 14
B. Magnitude of Flows in Surges 15
C. Asset- vs. Liability-Driven Surges 16
D. Sensitivity Analysis 18
V. What's Driving the Surges? Some Further Exploration 21
VI. Conclusion 23
References 25
Appendix A: The Intertemporal Optimizing Model of the Current Account 38
Appendix B: Data and Summary Statistics 39

Tables

1. Summary Statistics of Selected Variables 31
2. Likelihood of Surge, 1980–2009 32
3. Magnitude of Surge, 1980–2009 33
4. Likelihood of Surge: by Surge Type, 1980–2009 34
5. Magnitude of Surge: by Surge Type, 1980–2009 35
6. Likelihood of Surge: Sensitivity Analysis 36
7. Magnitude of Surge: Sensitivity Analysis 37
B1.Variable Definitions and Data Sources 40
B2. List of Surge Episodes with the Threshold Approach, 1980–2009 41
B3. List of Surge Episodes with the Cluster Approach, 1980–2009 42

Figures

1. Net Capital Flows to EMEs, 1980–2009 27
2. Surges of Net Capital Flows to EMEs, 1980–2009 27
3. Types of Surges, 1980–2009 27
4. Predicted Probabilities of Surge Occurrence 28
5. Predicted Probabilities of Asset- and Liability-Driven Surge Occurrence 29
6. Binary Recursive Trees for Surge Occurrence 30
B1.Colombia: Net Capital Flows to GDP, 1980–2009 39
B2. Surges by Region, 1980–2009 39

I. 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 reignited questions on 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 issues; a companion paper (Ghosh et al., 2012) looks at why, when, and how capital flow surge episodes end.

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.[2] 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). Moreover, from a policy perspective, large changes in capital flows—*surges*—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, we thus focus on surges, and examine what factors determine their occurrence as well as magnitude.[3]

While it is common to think of net inflows being the result of foreigners pouring money into the country (thereby increasing residents' foreign *liabilities*), 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, 2011) 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 capital flows still largely reflect changes in external liabilities), the distinction may

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[1] For example, in the two months following the U.S. sovereign debt rating downgrade in early 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 over end-2009 and mid-2011.

[2] See, for example, Chuhan et al. (1993), Taylor and Sarno (1997), Hernandez et al. (2001), and IMF (2011).

[3] Fernandez-Arias (1996) and Taylor and Sarno (1997) examine the main drivers of the early-1990 surge in capital flows to Asia and Latin America by analyzing the change in net capital flows. More recently, Reinhart and Reinhart (2008) and Cardarelli et al. (2009) catalog capital inflow "bonanzas" in advanced and emerging economies by focusing on large net flow observations, but mostly identify key stylized facts associated with these episodes. Forbes and Warnock (2011) focus on large gross capital flows to differentiate between episodes of surges, stops, flights, and retrenchment, and investigate more formally the causes of these episodes.

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 their determinants. We do so by first identifying surges in *net* capital flows, and then classifying the surge according to whether it corresponds mainly to changes in the country's foreign asset or liability position.[4] In addition, while earlier studies have often focused on a selected set of push and pull factors—typically ignoring the real domestic interest rate and/or the country's external financing needs—we systematically account for the plausible drivers of surges, including the return differential (adjusted for expected changes in the exchange rate), measures of risk in global markets, as well as the macroeconomic and structural characteristics, and the external financing needs of the recipient country. A key innovation of our study in this regard is to use an intertemporal optimizing model of the current account to proxy for the country's external financing needs.

We begin our empirical analysis by developing simple algorithms to identify surge episodes in 56 EMEs over 1980–2009. We employ two methods: a "threshold" approach—net flows (in percent of GDP) that fall in the top 30th percentile of the country's own, and the entire sample's, observations; and a "clustering" approach that avoids imposing ad hoc thresholds, and uses statistical clustering techniques on (standardized) net flows to distinguish between surges, normal flows, and outflows. With these two methods, we identify 290 and 338 surges (around one-fourth of the panel), respectively, 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.

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)—are key determinants of whether inflow surges to EMEs will occur. At the same time, whether a particular EME experiences a surge also depends on its own attractiveness as an investment destination. Fundamentals, including external financing needs implied by the consumption-

[4] Recent work by Forbes and Warnock (2011) comes closest to our study, but differs in several respects. Forbes and Warnock identify surges as large flows of assets or liabilities, rather than on the basis of net capital flows; as such, many of their identified surges do not correspond to periods of exceptionally large net inflows, and therefore do not carry the same policy implications (e.g., for currency appreciation pressures). They also only look at the determinants of surge occurrence, not of its magnitude. Finally, Forbes and Warnock comingle advanced and emerging market economies in their sample—not surprisingly, therefore, they tend to find that advanced economy interest rates are unimportant (as any effect of higher advanced economy interest rates in reducing flows to EMEs is likely offset by their positive impact on flows to advanced economies).

smoothing optimal current account deficit, financial openness and interconnectedness, real economic growth, and institutional quality also help determine the likelihood that the country experiences an inflow surge. Conditional on the surge occurring, moreover, domestic "pull" factors, including the country's growth rate, external financing needs, and exchange rate regime, are important in determining its magnitude. Broadly speaking, therefore, surges in capital flows to EMEs are driven by global push factors—but where they end up depends equally on domestic pull factors, which explains why not all countries experience a surge when aggregate flows toward EMEs rise sharply.

Our analysis also shows that inflow surges to EMEs are mainly liability-driven—only one-third of the net flow surges correspond to changes in residents' foreign asset transactions. The factors driving 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.

Our findings, which are robust to different estimation methodologies, surge identification algorithms, and model specifications, hold important policy implications. Inasmuch as surges reflect exogenous supply-side factors that could reverse abruptly, or are driven by contagion rather than fundamentals, the case for imposing capital controls (provided macro policy prerequisites have been met; Ostry et al., 2011) on inflow surges that may cause economic or financial disruption—and for greater policy coordination between source and recipient countries—is correspondingly stronger. 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 contribution to the existing literature is thus three-fold. First, we focus on *surges* of net capital flows, examining both why they occur, and the magnitude of the flows conditional on their occurrence. Second, we differentiate between asset- and liability-driven surges, 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 an important 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.

The rest of the paper is organized as follows. Section II outlines our empirical strategy for investigating the determinants of surge occurrence and magnitude. Section III describes how we identify inflow surges, and documents the key features associated with surge episodes. Section IV presents the main empirical results and sensitivity analysis. Section V further explores the drivers of inflow surges using binary recursive trees. Section VI concludes.

II. 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 (for example, Branson, 1968; and Kouri and Porter, 1974), later studies have characterized the determinants into "push" and "pull" factors, and focused more on evaluating the relative importance of each (for example, Chuhan et al., 1993; Fernandez-Arias, 1996; Fernandez-Arias and Montiel, 1996; Taylor and Sarno, 1997).[5] 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.[6]

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, for example, Chuhan et al., 1993; Taylor and Sarno, 1997; Griffin et al., 2004; IMF, 2011; Fratzscher, 2011).[7] 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.

And 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 is scant.[8] The few available studies (Reinhart and Reinhart, 2008; Cardarelli et al., 2009) simply

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[5] See Goldstein et al. (1991) for a review of early literature on the determinants of capital flows, and Forbes and Warnock (2011) for a more recent review.

[6] Fernandez-Arias and Montiel (1996) develop an analytical framework to incorporate the effect of domestic and global factors on capital flows by defining domestic factors as those that operate at the project/country level, and by imposing an arbitrage condition that equates the project's risk-adjusted expected rate of return to the opportunity cost of the funds (which depends on creditor country conditions). Their model thus links net capital flows with the domestic economic environment and credit worthiness, and creditor country's financial conditions.

[7] 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 a 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.

[8] 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).

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 current account deficit and real GDP growth. Looking at gross flows, Forbes and Warnock (2011) 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.[9] 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 model both the likelihood of inflow surges (as defined in Section III 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}:

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

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

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 where $F(.)$ is assumed to follow the standard normal cumulative distribution function so (1) can be estimated by probit, and (2) can be estimated by Ordinary Least Squares. 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.[10] Since many of the structural variables (for example, capital account openness) change only slowly, and because we are interested in the effect of global factors that will be common across recipient countries (for example, US interest rates), we do not include country for annual fixed effects, but control for region-specific effects and a range of country characteristics.[11]

Rate of return differential

The neoclassical theory predicts that capital should respond to interest rate differentials between countries—with capital flowing from countries with low return (capital-abundant advanced economies) to those with high return (capital-scarce emerging economies). The

[9] Forbes and Warnock's (2011) 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.

[10] If endogeneity exists, estimates from (1) and (2) will be inconsistent. We also estimate equations (1) and (2) using the instrumental variables (IV) probit and 2SLS estimation methods, respectively, where lagged values are used as instruments. These estimations yield very similar results, and are available upon request.

[11] Estimation results for (1) and (2) with country fixed effects are also reported in the sensitivity analysis.

nominal interest rate differential is given by the standard uncovered interest rate parity condition:

$$i_{jt}^{d} = i_{jt} - (i_{t}^{*} + (e_{jt+1} - e_{jt})) \tag{3}$$

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):

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

or

$$r_{jt}^{d} = r_{jt} - r_{t}^{*} - \Delta q_{jt+1}^{e} \tag{5}$$

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. We proxy for the expected real depreciation by the log difference between the current real effective exchange rate 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:

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

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, and world commodity prices as other global push factors.[12] Higher US interest rates (proxying the

[12] We use the volatility of S&P 500 index returns as an alternative to the more commonly used VIX index because the latter is only available from 1990 onwards. As a robustness check, however, we also use the: (i) 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)

(continued)

rate of return in advanced economies) are expected to reduce capital flows to EMEs. Likewise, greater volatility of the S&P 500 index—as a measure of global market uncertainty—is likely to reduce the 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 optimal 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 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

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VXO index—the precursor of the VIX—that is available from 1986 onwards. See Table B1 for a description of variables and data sources.

[13] See Appendix A for details.

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 (sovereign) 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 (for example, 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 estimated overvaluation of the currency (which should be negatively correlated) 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, particularly in the context of economic and financial crises/sudden stops (for example, Glick and Rose, 1999; Kaminsky et al., 2001; Forbes and Warnock, 2011), and identifies several channels (trade, financial, geographic location, or similar economic characteristics) through which contagion may occur.[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).[15]

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

[15] In addition, in the sensitivity analysis, we also include a measure of contagion through trade interconnectedness (defined as in Forbes and Warnock, 2011).

III. IDENTIFYING SURGES

A. Methodology

Our starting point for the empirical analysis is to identify inflow surges. A common approach in the literature is to use thresholds—for example, Reinhart and Reinhart (2008) select a cut-off of 20th percentile across countries of total net capital flows (in percent of GDP), and Cardarelli et al. (2009) define a surge when net private capital flows (again in proportion to 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 (2011) use quarterly data on gross capital flows, and define a surge as an annual increase in gross inflows that is more than one standard deviation above the (five-year rolling) average and where the increase is 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. Moreover, for EMEs, net capital flows mostly correspond to changes in liabilities, with relatively little action on the asset side.[17] 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 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.

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. We identify surges using two methods. The first approach, which follows the existing literature, is to define a surge as any year in which net capital flows exceed some threshold value. 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 observations of net flows that are large by (country-specific) historical as well as 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.

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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] This is in contrast to advanced economies, where net flows typically reflect largely offsetting gross flows of much greater magnitude. For only a few EMEs (e.g., Chile), and only in recent years, have gross flows become important.

Our second approach is more novel and avoids imposing ad hoc thresholds. We apply statistical clustering techniques (specifically, *k-means* clustering) to group each country's observations on (standardized) net flows 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. Using this technique, we group each country's data into three clusters that we identify with: (i) surges; (ii) normal flows; and (iii) outflows. In both approaches, we group consecutive surge observations to form a surge *episode* provided they are not interrupted by a year of normal flows or outflows.

While the particular choice of algorithm to identify surges inevitably involves trade-offs, our approaches have the advantage of ensuring uniform treatment across countries while still allowing significant cross-country variation in the absolute threshold of a surge.[18] The use of two, wholly independent approaches also gives confidence about the robustness of the obtained results. As with other empirical studies, however, dating the beginning and the end of surges is not always clear cut 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 that may otherwise be part of an episode. We therefore also construct a one-year window around the identified episodes, including the immediate pre- and post-surge years (provided the net capital flow is positive in these years), and check the robustness of our estimation results to these extended episodes.

B. Key Features

We apply the threshold and cluster approaches to a sample of 56 EMEs using annual data for the period 1980–2009.[19] There is considerable overlap in the resulting surge observations, with a correlation of about 0.8 between them, although the threshold approach yields somewhat fewer, but larger, surges.[20] For example, Figure B1 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

[18] In our approaches, 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.

[19] We use annual data because most of the explanatory variables are not available at quarterly frequency for EMEs, especially for the early years of our sample. The list of countries included in the sample is motivated by the EMEs covered in the IMF's Early Warning Exercise (IMF, 2010). Tables B2 and B3 list the countries included our sample, as well as the surge episodes obtained from the threshold and cluster approaches.

[20] 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).

distribution, as well as in the top 30th percentile of the overall distribution of net capital flows to GDP, and hence are coded as surges under the threshold approach. Through the cluster analysis, however, we obtain 9 surge observations, half of which are large from the country's historical (but not from a global) perspective. In what follows, we focus on the results when surges are defined using the threshold approach, which are more extreme as they reflect both country-specificity and international uniqueness, reserving the cluster-identified surges for our robustness checks.

Under the threshold approach, we obtain 290 surge observations (which yield 149 surge episodes), the majority of which are in Eastern Europe and Latin America. The average duration of each episode is around 2 years, while the average net capital flow during the episode is about 10 percent of GDP. As a proportion of GDP, the largest surges are actually in the Middle East and African countries (around 12 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). Similar patterns are obtained when cluster analysis is applied—338 surge observations (grouped into 168 surge episodes) are identified, most of which coincide with those from the threshold approach.

Classifying by the type of surge shows that the majority (more than two-thirds) are driven by an increase in residents' liabilities (liability-driven) rather than by a decline in the holdings of their assets abroad (asset-driven).[21] 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 (Figure 3, panel a).[22] Moreover, looking at surge episodes, nearly all begin with a liability-driven surge, suggesting that as foreign investment starts flowing into an EME, domestic investors follow suit, repatriating foreign assets in order to invest at home. 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 (Figure B2), 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

[21] 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) from the *Balance of Payments*. Thus, when a net capital flow surge corresponds to a larger increase in domestic residents' liabilities vis-à-vis a reduction in their assets, it is identified as liability-driven, while it is defined as asset-driven when the converse holds.

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

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 proportion of GDP) during the 1990s wave of capital flows, whereas emerging Europe experienced the largest surges in the mid-2000s wave. 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.

What are these factors? A simple tabulation of explanatory variables during surge, normal, and outflow periods suggests a number of global push and domestic pull factors may be relevant (Table 1). During surge periods, the US real interest rate and global market uncertainty (S&P 500 index 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, and faster output growth, as well as more open current and capital accounts (with greater financial interconnectedness), and stronger institutions.

IV. Estimation Results

The statistics reported in Table 1 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 determinants of 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.

A. 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 2, cols. [1]-[5]). According to the estimates, a higher real interest rate differential raises the likelihood of an inflow surge, though the coefficient only becomes statistically significant when domestic pull factors are taken into account. Greater global market uncertainty (volatility of the S&P 500 index) has a strong dampening effect on the probability of a surge of capital 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 domestic pull factors). 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 8 percent, and the probit sensitivity (proportion of surges correctly called) is about 14 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. 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. Countries with more flexible exchange rate regimes or that are in default are less likely to experience inflow surges, though neither variable is statistically significant. Adding these pull factors more than doubles the pseudo-R^2 to 20 percent and raises the sensitivity to 27 percent.

The right-hand panel of Table 2 (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 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 lower the likelihood of an inflow surge by 3 percentage points (where the unconditional probability of a surge in the estimated sample is 22 percent). Real exchange rate overvaluation lowers the estimated likelihood of a surge, though the coefficient is not statistically significant when the full set of domestic factors is added (Table 2, cols. [9]-[10]), while the domestic real interest rate, though positive, is not statistically significant in any of the specifications. Most of the other variables 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 21 percent.

To put the estimated effects in perspective, Figure 4 plots the implied probability of a surge evaluated around the means of the explanatory variables based on the estimates reported in column (10). Against an unconditional probability of 22 percent, a one standard deviation shock to the volatility of the S&P 500 index 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 some 4 to 5 percentage points, respectively.

B. 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 of GDP to about 54 percent of GDP as shown in Table 1). Is it possible to say anything about the size of the surge conditional on its occurrence? Table 3 reports the estimation results for the surge magnitude regression (2), where the dependent variable is net capital flow (expressed as a proportion of GDP), and the sample comprises only the surge observations.

Again, we present the constrained model in which the real interest rate differential enters the regression as a single term, and the unconstrained model where the US real interest rate, domestic real interest rate, and overvaluation are allowed their own coefficients. The real interest rate differential is statistically insignificant, while the global factors appear to play a more limited role. A 100 basis point decline in the real US interest rate is associated with

almost 1 percent of GDP larger capital flows (Table 3, cols. [7]-[12]), but commodity price booms and S&P 500 index volatility have mostly insignificant effects, suggesting that these factors 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. An interesting finding is that of a negative (and in the unconstrained model, statistically significant) effect of the regional contagion variable, which most likely indicates that an increase in the average flow to other countries in the region implies less capital left to be allocated to the country in question.

Since countries that experience a surge already share the macroeconomic and structural characteristics identified above, several of the domestic pull factors are statistically insignificant. 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 about 2 percent of GDP lower net capital flows. 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.

Overall, these findings are consistent with, but go beyond, the results of previous studies, and help to explain the stylized facts noted in Section III. Specifically, the finding that the likelihood of surge occurrence is influenced strongly by global factors—notably, the US interest rates, as argued by Calvo, Liederman and Reinhart (1993) and Reinhart and Reinhart (2008), 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. Certain macroeconomic (in particular, growth performance and the external financing need), and structural characteristics (notably, financial openness and institutional quality), are also important for a surge to occur, 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 driven not only by the real US interest rate and external financing need, but also by the exchange rate regime and financial openness, with countries that have less flexible exchange rate regimes or those that are more financially open experiencing larger surges.

C. 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 reflect changes in residents' assets (asset-driven surges) and those caused by 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.[23] The top panel in Tables 4 and 5 presents the results for the constrained model for the two types of surges, while the bottom panel presents estimates for the unrestricted model with the real US and domestic interest rates and real exchange rate overvaluation included as separate terms.[24]

The results for the probit model show that the real interest rate differential raises the likelihood of both asset and liability-driven surges, but the impact is statistically significant for the latter only (Table 4, columns [5]-[10]). Increased global market uncertainty however matters strongly for both types of surges, such that in times of increased global market uncertainty, foreign as well as domestic investors exit EMEs and prefer to invest in safe haven countries.[25] Nevertheless, foreign investors appear to be more sensitive to global market uncertainty: a one standard deviation shock to the S&P 500 index volatility reduces the likelihood of a liability-driven surge by 4 percentage points compared to 1 percentage point for asset-driven surges. Asset-driven surges are more likely when commodity prices are booming—whereas commodity prices have no discernible impact on liability-driven surges. By contrast, liability-driven surges are more subject to regional contagion.

Among the domestic pull factors, the external financing need, real economic growth, capital account openness, and institutional quality matter for both types of surges. Liability-driven surges, however, are more sensitive to the recipient country's external financing need and economic growth prospects—such that a one percentage point increase (at mean values), raises the likelihood of a liability-driven surge by about an additional 1 and 0.5 percentage point, respectively, as compared to an asset-driven surge (Figure 5). The impact of capital account openness is somewhat similar on both types of surges—moving from the 25th percentile of the capital account openness index to the 75th percentile raises asset- and liability-driven surge probabilities by about 3 percentage points. The strong impact of capital account openness on asset-driven surges is intuitive as only when capital flows are liberalized (and can leave the national jurisdiction) in the first place, could they be retrenched from abroad and invested in the domestic economy. Financial interconnectedness, however, has a more pronounced impact on liability-driven surges—indicating that EMEs with greater financial linkages are more likely to experience large foreign capital flows.

The results of the unconstrained 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

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[23] 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. As mentioned in Section III, asset-driven surges constitute only 7 percent of the full sample (about one-third of the surge observations); thus, results pertaining to these estimations may be interpreted with caution.

[24] The sample size for both asset and liability-driven surges is different as in each case we exclude the observations for the other type of surge from the estimation sample.

[25] Forbes and Warnock (2011) find that an increase in global risk raises the likelihood of retrenchment (that is, a decline in the residents' assets held abroad). Considering that their sample predominantly comprises advanced economies, their finding does not appear to be at odds with ours.

that of an asset-driven surge by 1 percentage point. Interestingly, asset-driven surges appear to react more strongly to changes in the real domestic interest rate, while liability-driven surges 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. For the other factors, the signs and magnitude of the estimated effects from the unconstrained model are very similar to those obtained above from the constrained model.

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 from the constrained model show that the real interest differential and other global factors are statistically insignificant for bother asset- and liability-driven surges. Domestic factors, however, do matter. The size of inflows received is larger if nominal exchange rate regimes are less flexible and capital accounts are more open (Table 5, panel a). Thus, a country with a pegged exchange rate experiences about 2 and 5 percent of GDP larger capital flows during asset- and liability driven surges, respectively, than if it had a more flexible exchange rate regime. Likewise, moving from the 25th percentile of the capital account openness index to the 75th percentile raises the size of the surge by about 1-2 percent of GDP for asset- and liability-driven surges. The external financing need and regional contagion, however, strongly impact the magnitude of liability-driven surges only such that larger external financing needs, and smaller inflows to other countries in the region imply larger surges. Moreover, the results from the unconstrained model (Table 5, panel b) show that real US interest rates, and real exchange rate overvaluation also strongly affect the magnitude of liability-driven surges—specifically, a 100 basis point increase in the real US interest rate, and a 10 percentage point real exchange rate overvaluation imply lower inflows by about 1 and 2 percent of GDP, respectively.

The results for both the occurrence and magnitude of surges suggest that while asset- and liability-driven surges have many common factors, there are also some important differences. In particular, liability-driven surges are 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, these findings make intuitive sense.

D. 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 (alternative proxies and additional regressors), and sample period.

Extended episodes

Pinning down the exact timing (beginning 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 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.[26] Tables 6 and 7 (col. [1]) present the estimation results for this exercise, which largely support the findings reported in Tables 2 and 3, respectively. Specifically, for surge likelihood, the US real interest rate, global market uncertainty, and commodity prices are all significant—while domestic factors such as the external financing need, real GDP growth rate, capital account openness, financial interconnectedness, and institutional quality are also strongly significantly. The main difference with the previous results is that the domestic real interest rate and the sovereign default dummy now become statistically significant. For surge magnitude, as before, the external financing need, a less flexible exchange rate regime, and expected real exchange rate change matter, as do the real US interest rate, and the amount of inflow received by other countries experiencing a surge in the region. There is also some evidence for extended episodes that commodity price booms lead to larger surges.

Cluster analysis

The estimation results for surges obtained through cluster analysis—which identifies about 4 percent more surge observations in the sample—also present a somewhat similar picture to those obtained from the threshold approach (Tables 6 and 7, 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 only notable exception being the capital account openness variable, which loses its statistical significance in Table 6. The weakening of the estimated impact of capital account openness however may reflect the fact that it matters more pronouncedly for extreme net flows as identified by the threshold approach. 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, along with the real US interest rate.

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 volatility index with the Credit Suisse risk appetite index (higher values

[26] The number of extended surge episodes is smaller than before (106) as several of the one or two-year apart surge episodes combine to form one long episode. The total number of surge observations is however larger (496).

indicating periods of financial ease, and greater investor risk appetite), and the VXO index (higher values indicating higher volatility in international markets, and lower risk appetite). The revised estimation results reported in Table 6 (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 Credit Suisse index) raise the likelihood of surge occurrence. The estimated coefficient of the VXO index is however negative but statistically insignificant, while the results of all other variables remain the same as before.

Columns [6]-[11] (in Tables 6 and 7) 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 significantly raises the 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 on surge likelihood/magnitude. The inclusion of these variables however does not affect much the estimated magnitude and significance of the other pull factors in the regressions.[27]

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 (Figure 4, panel b).[28] To examine if the role of global and local factors in later years has been somewhat different, we re-estimate our regressions for the 1990–2009 sample. The results summarized in column [13] (of Tables 6 and 7) 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.

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 equation (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.[29] Table 6 (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.

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[27] We also include proxies for fiscal balance to GDP, public debt to GDP, and the political regime in place, but find these variables to be statistically insignificant, while their inclusion does not alter the other results. All results are available upon request.

[28] 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.

[29] Specifically, the complementary log-log model specifies that $F(x_t'\beta + z_{it}'\gamma + \mu_i) = 1 - \exp\{-\exp(x_t'\beta + zit'\gamma + \mu i\}$.

V. 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 somewhat 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 strong 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 binary recursive tree—that readily allows for interactions between the various explanatory variables, fleshing out any context-dependence and threshold effects in the data. Formally, a binary recursive tree is a sequence of rules for predicting a binary variable on the basis of a vector of explanatory variables such that at each level, the sample is split into two sub-branches according to some threshold value of one of the explanatory variables. The explanatory variable (and the corresponding threshold value) used for splitting is the one that best discriminates between the groups that constitute the binary variable, as specified a priori by some criterion.[30] The splitting is repeated along the various sub-branches until the specific criterion is not met, and a terminal node is reached. The technique thus establishes orderings among explanatory variables such that a variable that appears toward the top of the tree could be considered as somewhat more important in distinguishing between the surge and no-surge cases.

Based on the results of the probit model, we include the global factors as well as the most statistically dominant domestic (macroeconomic and structural) factors to construct the binary tree (specifically, the optimal current account balance (to GDP), real GDP growth rate, capital account openness, and institutional quality). Figure 6 (panel a) presents the binary recursive tree obtained for the full sample, where the dependent variable is the occurrence of a surge. The tree 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 1.3 percent of GDP are more than twice as likely to experience a surge as countries with smaller deficits. However, global risk features notably, and countries with large external financing needs are 2½ times more likely to experience a surge when global market volatility (or risk aversion) is low. The tree correctly classifies about 81 percent of the sample; 16 percent of the surge observations and 98 percent

[30] While several algorithms are available to search for the best split, 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.

of the no-surge observations.[31] 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.

Next, we construct separate binary trees for asset- and liability-driven surges. The resulting trees, with the conditional probabilities of a surge at each node, are illustrated in Figure 6 (panel b). 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 1.3 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 17 percent, versus 5 percent for countries that have relatively smaller financing needs. Continuing along the left hand branch of the tree, the second node again depends on the optimal current account balance such that countries (in our sample) with external financing needs in excess of 9 percent of GDP are four times more likely to have an asset-driven surge than otherwise. The next important variable along the same branch is real GDP growth rate, with a threshold value of 6 percent, and a conditional probability of surge of about 86 percent for countries that exceed the threshold (versus 20 percent for countries below the threshold). Moving on to the right hand branch of the tree (that is, countries with optimal current account deficits smaller than 1.3 percent of GDP), we see that it is institutional quality that matters—countries with smaller financing needs, but in the top 30th percentile of the institutional quality index have a much higher likelihood of an asset-driven surge.

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 20th percentile of the S&P 500 index volatility), the conditional probability of a surge through an increase in residents' liabilities is 31 percent (versus 12 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 66 percent with optimal current account deficit larger than 1.4 percent of GDP, versus 22 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 0.2 percent of GDP are thrice as likely to experience a surge than those with smaller deficits. However, among the latter, countries with a stronger institutional quality 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

[31] Since the binary tree is generated here primarily for descriptive purposes, we use the full sample to determine the splitting criteria. An alternative way, preferable for predictive analytics, is to "cross-validate" by splitting the sample randomly into a core sample used for generating the tree, and a smaller test sample that is used for out-of-sample forecasts. To test the robustness of our results, we split the sample into 80 (core sample), and 20 percent (test sample); nevertheless, a similar tree is generated.

particular interactions between these factors, which could differ based on the surge type, such 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.

VI. Conclusion

This paper examines the drivers of large net capital flows—or surges—to EMEs by explicitly distinguishing between their occurrence and magnitude, and by differentiating between asset- and liability-driven surges, which likely correspond to the investment decisions of residents and foreigners, respectively. We use simple algorithms—based on thresholds and cluster analysis—to quantitatively identify such episodes, which while certainly not exhaustive, capture most 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 1980–2009 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 one point of time, and some countries experiencing them repeatedly. The amount of capital received in a surge varies considerably across countries, while most (over two-thirds) of the surges to EMEs are 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, particularly, economic performance, the external financing need, capital account openness, and institutional quality, do play some role in the occurrence of a 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 leads capital to flow out towards traditional safe-haven assets. Foreign investors, however, appear to be more sensitive to global conditions than domestic investors, 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 they reflect exogenous supply-side factors, that could

reverse abruptly, the case of EMEs for imposing capital controls in the face of inflow surges that may cause economic or financial disruption may be correspondingly stronger (provided macro policy prerequisites have been met; Ostry et al., 2011). Conversely, however, if the aggregate volume of capital to EMEs is driven by supply-side factors, but local factors (including capital account openness) also play a role in determining the allocation, then there may be a need for greater coordination between both source and recipient countries (to ensure that there are no unintended consequences of the policy actions of the former); and among EMEs to ensure that they do not pursue beggar-thy-neighbor policies against each other. 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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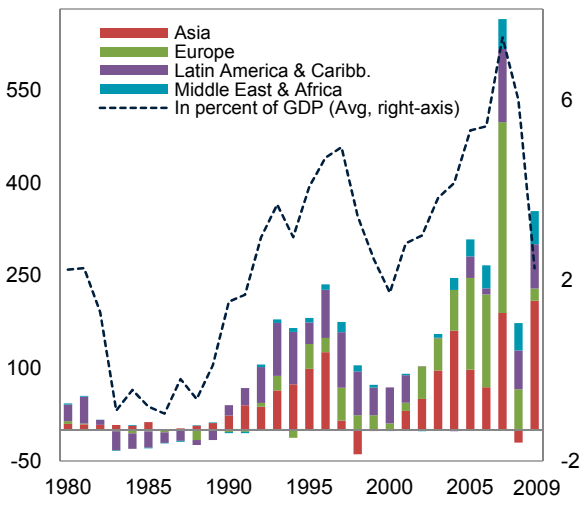
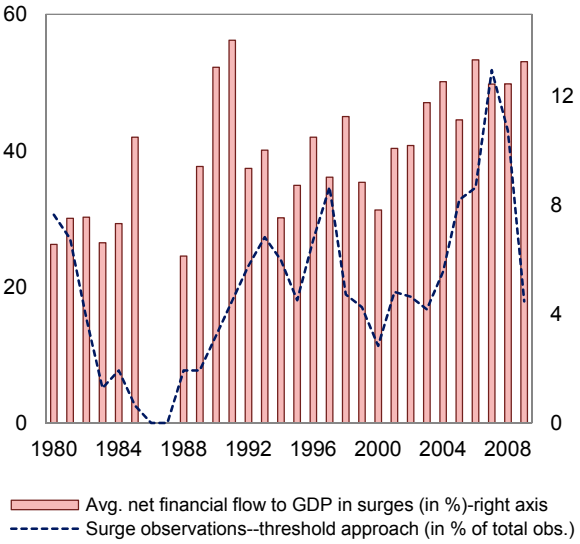
Figure 1. Net Capital Flows to EMEs, 1980-2009 (in USD billions)



Source: IMF's IFS database.

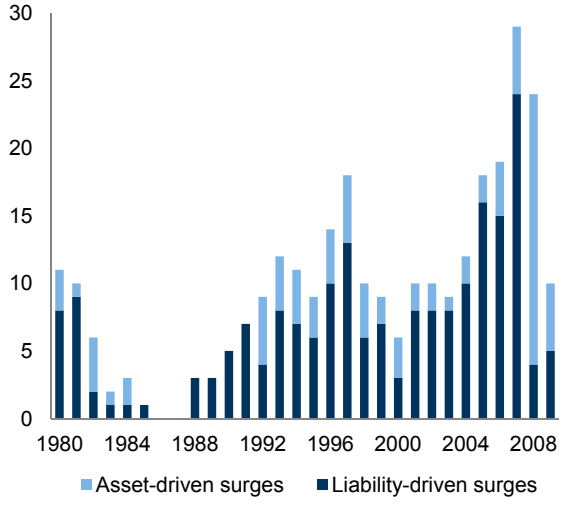
Figure 2. Surges of Net Capital Flows to EMEs, 1980-2009



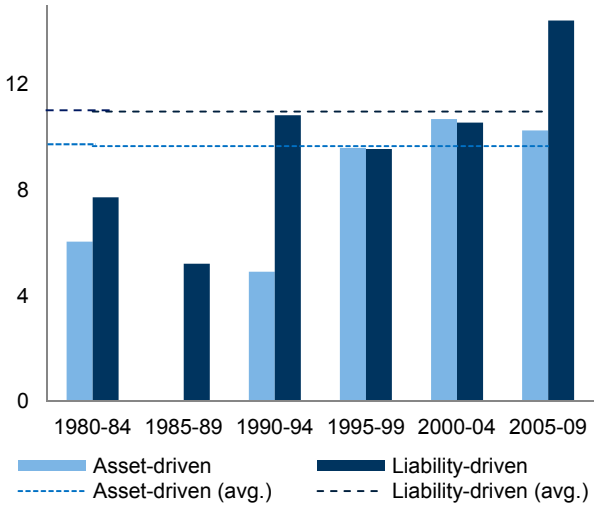
Source: Authors' estimates based on IFS.

Figure 3. Types of Surges, 1980–2009

(a) Number of surges based on type

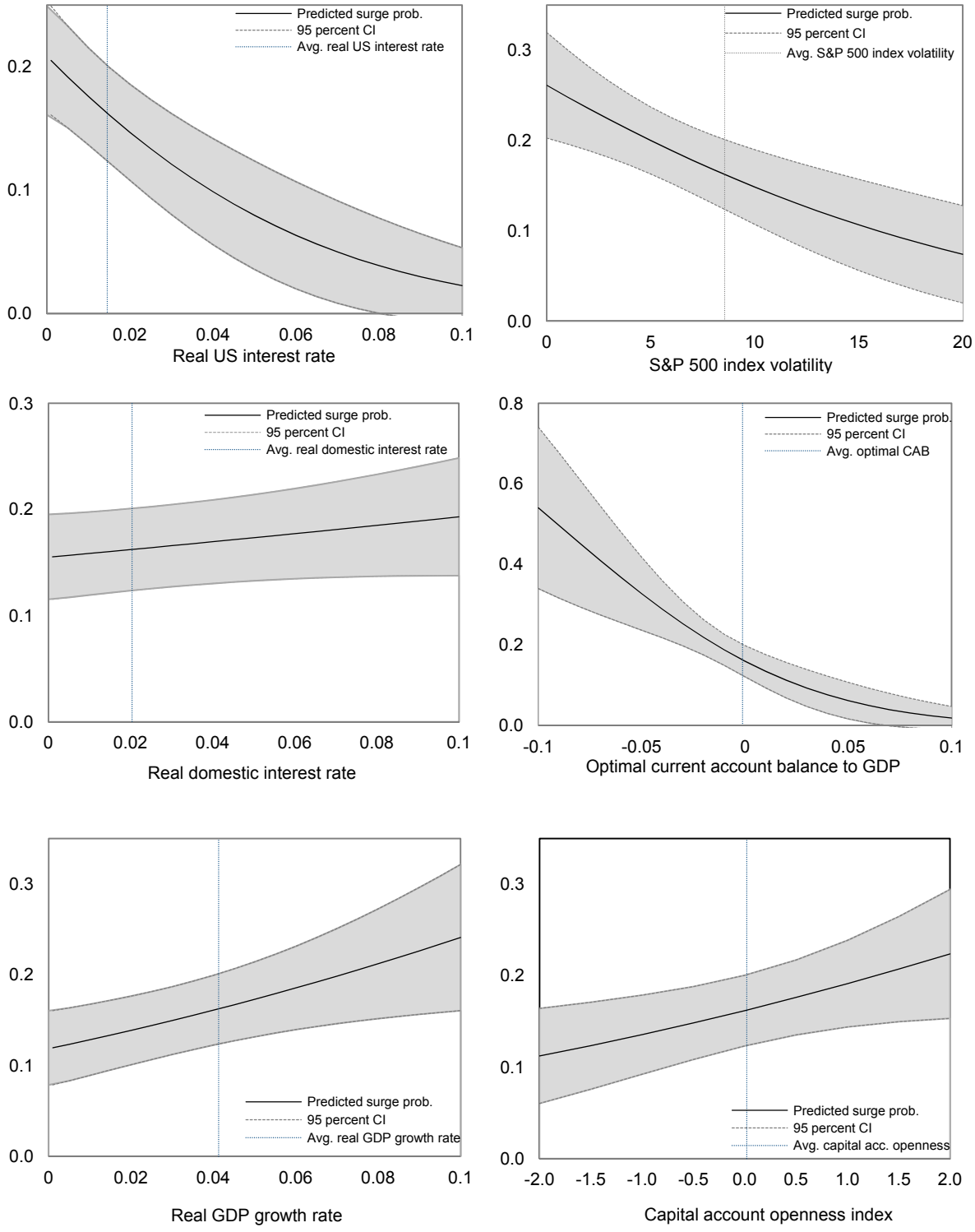


(b) Average net capital flow in different types of surges



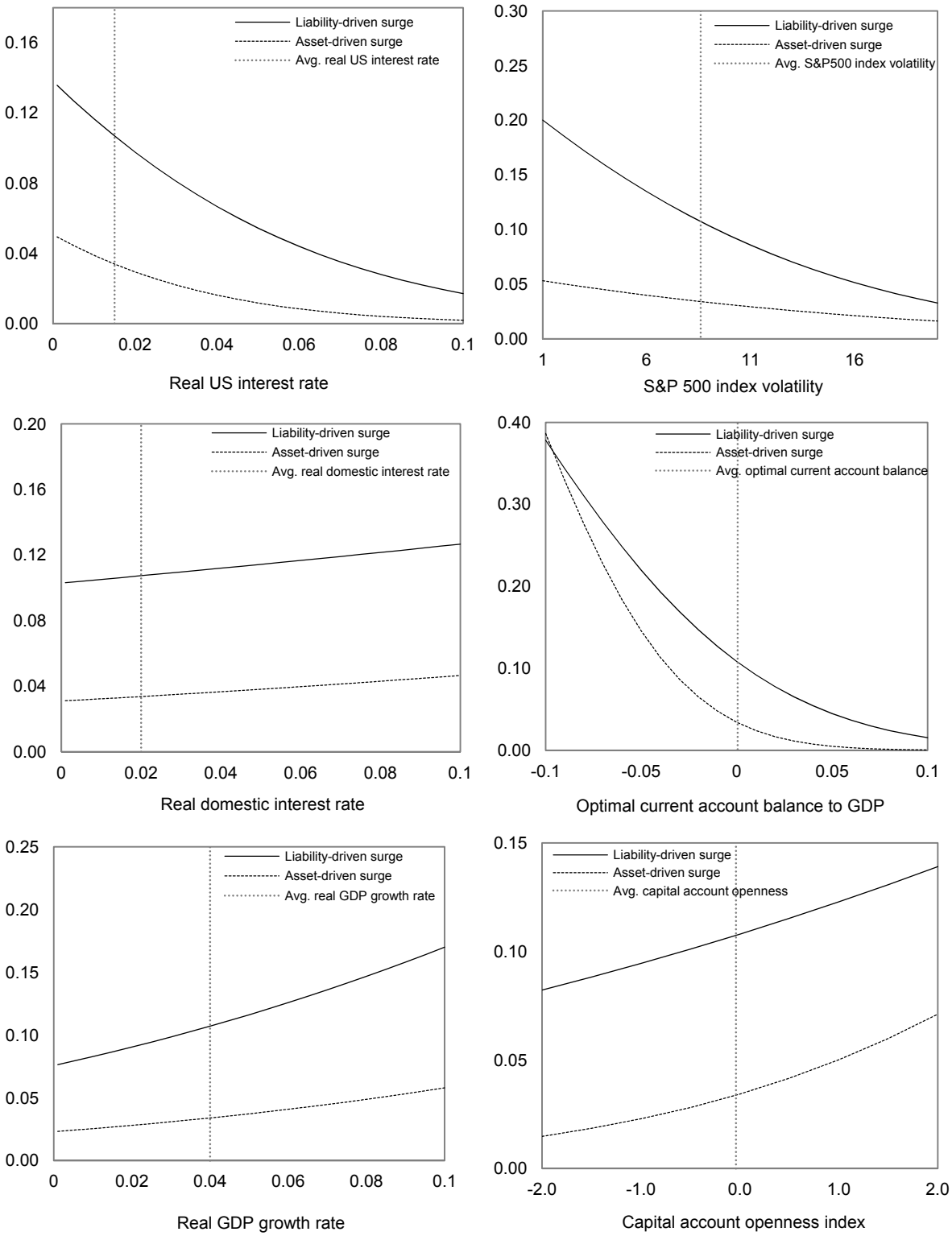
Source: Authors' estimates.

Figure 4. Predicted Probabilities of Surge Occurrence



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

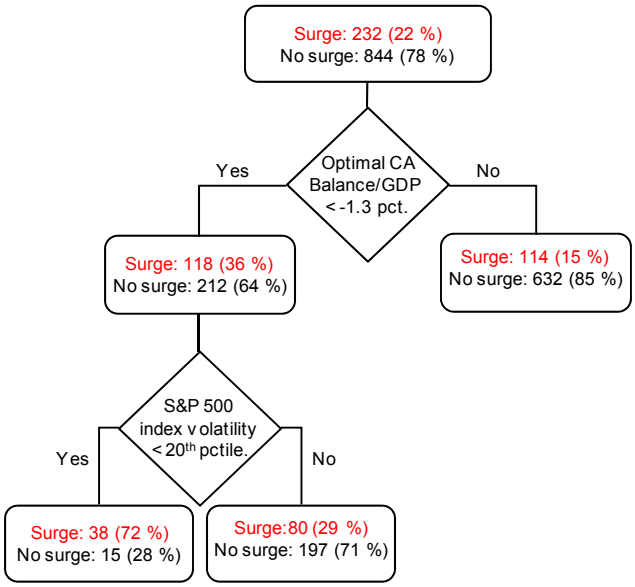
Figure 5. Predicted Probabilities of Asset- and Liability-Driven Surge Occurrence



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

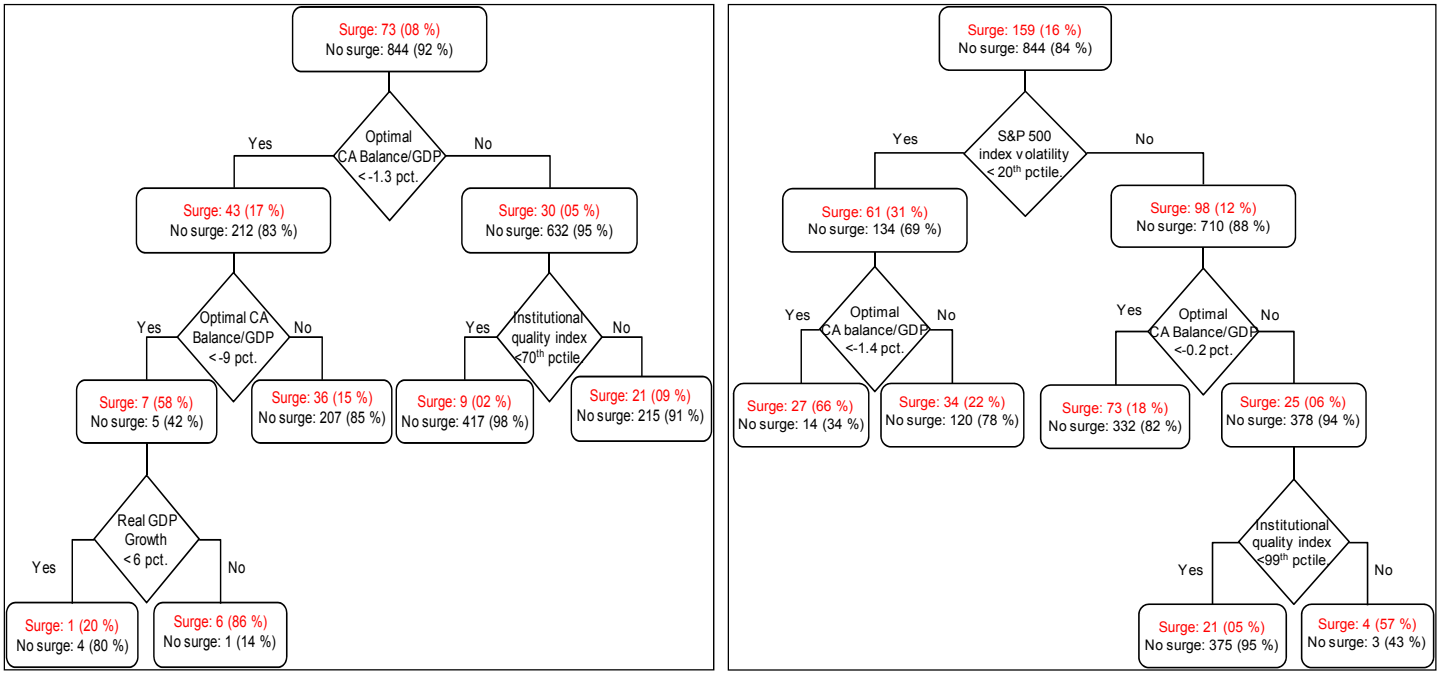
(a) All surges



(b) Types of surges

(i) Asset-driven surges

(ii) Liability-driven surges



Source: Authors' estimates.
Notes: Binary recursive trees have been constructed using the CHAID algorithm in SIPINA software (with the minimum size of nodes to split, and leaves specified as 10 and 5 observations, respectively; and the p-level for merging and splitting nodes specified as 0.05).

Table 1. Summary Statistics of Selected Variables

	Surge				
	Observations	Mean	Min	Max	Std dev.
Net capital flows to GDP (in %)	232	10.56 ***	4.49	54.06	7.38
Real US interest rate (in %)	232	1.13 ***	-1.70	5.20	1.79
S&P 500 returns index volatility	232	7.47 ***	2.35	16.88	3.59
Real domestic interest rate (in %)	228	2.40	-23.93	41.65	5.92
REER overvaluation (in %)	232	0.81 ***	-16.57	20.02	4.73
Optimal current account (in %)	232	-2.41 ***	-21.56	9.62	3.78
Real GDP growth rate	232	5.15 ***	-9.26	12.55	3.25
Trade openness (in %)	232	84.93 ***	14.64	188.98	38.27
Reserves to GDP (in %)	232	16.50 ***	1.58	87.78	10.72
Real GDP per capita (Log)	232	8.08 ***	5.80	10.25	0.83
De facto exchange rate regime	232	1.89	1.00	3.00	1.89
Capital account openness index	232	0.63	-1.81	2.54	1.48
Financial interconnectedness	232	8.34 ***	1.00	15.00	3.28
Institutional quality index	232	0.67 ***	0.34	0.89	0.09
	Non-surge				
Net capital flows to GDP (in %)	844	1.00	-39.83	28.55	4.69
Real US interest rate (in %)	844	1.54	-1.70	5.20	1.99
S&P 500 returns index volatility	844	8.85	2.35	16.88	3.59
Real domestic interest rate (in %)	839	1.92	-38.00	30.31	6.61
REER overvaluation	844	-1.00	-45.00	59.00	7.63
Optimal current account (in %)	844	1.00	-11.00	20.23	3.37
Real GDP growth (in %)	844	4.00	-15.00	25.65	4.23
Trade openness (in %)	844	67.33	12.10	220.41	37.43
Reserves to GDP (in %)	844	12.39	0.48	104.85	11.23
Real GDP per capita (Log)	844	7.73	5.59	10.20	0.94
De facto exchange rate regime	844	1.97	1.00	3.00	1.97
Capital account openness index	844	-0.08	-1.81	2.54	1.41
Financial interconnectedness	844	6.57	0.00	15.00	2.89
Institutional quality index	844	0.61	0.29	0.86	0.11

Source: Authors' calculations.

*Observations restricted to the estimated sample as in Table 2. 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. *** indicates significant difference between the surge and non-surge observations at the 1percent level.

Table 2. Likelihood of Surge, 1980-2009

	[A] Constrained Model					[B] Unconstrained Model				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Real interest rate differential	0.581	1.347**	1.330**	1.392*	1.271*					
	(0.536)	(0.570)	(0.662)	(0.721)	(0.682)					
Real US interest rate						-7.323**	-12.133***	-8.893***	-9.593***	-11.918***
						(3.499)	(2.930)	(2.941)	(3.015)	(3.033)
S&P500 index volatility	-0.038***	-0.057***	-0.052***	-0.046***	-0.034***	-0.040***	-0.064***	-0.058***	-0.052***	-0.040***
	(0.011)	(0.012)	(0.012)	(0.012)	(0.012)	(0.011)	(0.012)	(0.012)	(0.012)	(0.012)
Commodity price index	1.030***	0.912**	0.853**	0.655	1.124***	1.411***	1.452***	1.252***	1.094**	1.742***
	(0.391)	(0.404)	(0.397)	(0.403)	(0.399)	(0.422)	(0.424)	(0.433)	(0.443)	(0.432)
Regional contagion	0.970***	0.899***	0.461	0.301	0.297	0.763***	0.542**	0.260	0.082	0.029
	(0.271)	(0.267)	(0.287)	(0.319)	(0.294)	(0.277)	(0.261)	(0.284)	(0.311)	(0.282)
Real domestic interest rate						0.818	1.202	1.351	1.469	1.484
						(0.998)	(0.989)	(1.039)	(1.129)	(0.994)
REER overvaluation						-0.105	-1.157**	-1.134*	-1.114	-0.912
						(0.497)	(0.537)	(0.640)	(0.742)	(0.696)
Optimal current account/GDP		-10.112***	-9.931***	-9.887***	-9.880***		-11.106***	-10.683***	-10.688***	-10.984***
		(2.536)	(2.489)	(2.588)	(2.626)		(2.764)	(2.648)	(2.752)	(2.838)
Real GDP growth			6.601***	5.444***	5.551***			6.071***	4.804***	4.789***
			(1.669)	(1.610)	(1.634)			(1.736)	(1.690)	(1.735)
Capital account openness			0.098**	0.104**	0.130**			0.079*	0.083*	0.114**
			(0.047)	(0.048)	(0.052)			(0.047)	(0.048)	(0.051)
Financial interconnectedness				0.074***	0.076***				0.076***	0.081***
				(0.016)	(0.016)				(0.016)	(0.015)
Exchange rate regime				-0.118	-0.081				-0.134	-0.094
				(0.094)	(0.093)				(0.089)	(0.088)
Institutional quality index					2.562***					2.638***
					(0.749)					(0.739)
Default onset					-0.291					-0.199
					(0.367)					(0.344)
Real GDP per capita (log)					-0.329***					-0.399***
					(0.108)					(0.111)
Observations	1,076	1,076	1,076	1,076	1,076	1,076	1,076	1,076	1,076	1,076
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-R2	0.079	0.129	0.157	0.177	0.198	0.085	0.143	0.164	0.184	0.209
Percent correctly predicted	79.18	79.46	80.30	81.13	81.23	79.46	80.20	80.39	81.23	81.51
Sensitivity	13.79	16.38	21.12	26.29	27.16	14.22	20.26	22.84	25.86	28.88
Specificity	97.16	96.80	96.56	96.21	96.09	97.39	96.68	96.21	96.45	95.97

Source: Authors' estimates.

Notes: Dependent variable is a binary variable equal to 1if 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&P 500 index volatility, and commodity price index), regional contagion, and financial interconnectedness are lagged one period.

Table 3. Magnitude of Surge, 1980-2009

	[A] Constrained Model					[B] Unconstrained Model				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Real interest rate differential	0.024	0.040	0.006	0.077	0.080					
	(0.057)	(0.060)	(0.059)	(0.054)	(0.060)					
Real US interest rate						-0.979***	-1.036***	-0.944***	-0.885***	-0.899***
						(0.320)	(0.326)	(0.317)	(0.297)	(0.298)
S&P 500 index volatility	0.000	-0.000	-0.000	-0.001	-0.001	-0.001	-0.001	-0.001	-0.002	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Commodity price index	0.063**	0.055*	0.044	0.050	0.046	0.060*	0.050	0.046	0.054*	0.052
	(0.031)	(0.030)	(0.035)	(0.032)	(0.040)	(0.030)	(0.031)	(0.033)	(0.030)	(0.037)
Regional contagion	-0.149*	-0.129	-0.113	-0.146*	-0.152*	-0.248***	-0.229***	-0.207**	-0.225**	-0.232***
	(0.085)	(0.085)	(0.094)	(0.087)	(0.088)	(0.085)	(0.083)	(0.087)	(0.085)	(0.086)
Real domestic interest rate						-0.168*	-0.160*	-0.193**	-0.089	-0.100
						(0.096)	(0.094)	(0.091)	(0.062)	(0.068)
REER overvaluation						-0.198**	-0.226**	-0.214**	-0.238**	-0.253***
						(0.089)	(0.094)	(0.099)	(0.095)	(0.093)
Optimal current account/GDP		-0.295*	-0.203	-0.238	-0.225		-0.347**	-0.274*	-0.294**	-0.284*
		(0.158)	(0.152)	(0.154)	(0.168)		(0.145)	(0.141)	(0.143)	(0.158)
Real GDP growth			0.001	-0.151	-0.181			-0.178	-0.282	-0.286
			(0.260)	(0.251)	(0.260)			(0.247)	(0.245)	(0.253)
Capital account openness			0.010**	0.008*	0.006			0.008**	0.006	0.004
			(0.004)	(0.004)	(0.004)			(0.004)	(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				-0.042***	-0.042***				-0.037***	-0.037***
				(0.013)	(0.014)				(0.011)	(0.012)
Institutional quality index					0.003					0.045
					(0.097)					(0.087)
Default onset					-0.028					0.008
					(0.033)					(0.025)
Real GDP per capita (log)					0.007					0.006
					(0.022)					(0.021)
Observations	232	232	232	232	232	232	232	232	232	232
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R2	0.165	0.187	0.221	0.319	0.323	0.248	0.278	0.304	0.378	0.384

Source: Authors' estimates.

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 overvaluation) is included. All regressions 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 4. Likelihood of Surge: by Surge Type, 1980-2009

	Asset-driven surge					Liability-driven surge				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
[A] Constrained Model										
Real interest rate differential	-0.252	0.749	0.450	0.425	0.253	0.870	1.488**	1.664**	1.820**	1.691**
	(0.530)	(0.686)	(0.813)	(0.840)	(0.672)	(0.554)	(0.608)	(0.683)	(0.772)	(0.749)
S&P 500 index volatility	-0.016	-0.045***	-0.039**	-0.038**	-0.023	-0.050***	-0.066***	-0.063***	-0.054***	-0.046***
	(0.014)	(0.017)	(0.017)	(0.016)	(0.018)	(0.014)	(0.015)	(0.014)	(0.014)	(0.014)
Commodity price index	2.219***	2.366***	2.307***	2.261***	2.648***	0.245	0.113	0.021	-0.285	0.174
	(0.476)	(0.592)	(0.592)	(0.601)	(0.639)	(0.414)	(0.419)	(0.422)	(0.444)	(0.440)
Regional contagion	0.433	0.303	-0.282	-0.315	-0.303	1.142***	1.064***	0.728**	0.529*	0.484
	(0.344)	(0.359)	(0.441)	(0.443)	(0.417)	(0.278)	(0.269)	(0.289)	(0.308)	(0.302)
Optimal current account/GDP		-13.696***	-13.685***	-13.682***	-13.690***		-8.101***	-8.209***	-8.232***	-8.301***
		(2.621)	(2.642)	(2.643)	(2.553)		(2.731)	(2.667)	(2.904)	(2.950)
Real GDP grow th			5.348***	5.178***	4.892***			6.682***	5.168***	5.541***
			(1.906)	(1.919)	(1.848)			(1.820)	(1.746)	(1.809)
Capital account openness			0.179***	0.181***	0.198***			0.046	0.054	0.088*
			(0.060)	(0.059)	(0.063)			(0.043)	(0.046)	(0.049)
Financial interconnectedness				0.018	0.016				0.096***	0.100***
				(0.021)	(0.022)				(0.020)	(0.020)
Exchange rate regime				0.008	0.052				-0.160*	-0.121
				(0.115)	(0.116)				(0.091)	(0.089)
Institutional quality index					2.922***					2.207***
					(0.895)					(0.741)
Default onset					-0.326					-0.487
					(0.436)					(0.473)
Real GDP per capita (log)					-0.261**					-0.348***
					(0.112)					(0.116)
Observations	917	917	917	917	917	1,003	1,003	1,003	1,003	1,003
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-R2	0.083	0.174	0.215	0.216	0.239	0.0875	0.119	0.143	0.176	0.196
[B] Unconstrained Model										
Real US interest rate	-7.775*	-15.485***	-10.815***	-11.068***	-12.555***	-5.810*	-9.545***	-7.163**	-7.702**	-10.288***
	(4.547)	(4.009)	(4.093)	(4.123)	(4.692)	(3.278)	(2.936)	(2.967)	(3.090)	(3.074)
S&P 500 index volatility	-0.014	-0.051***	-0.045**	-0.043**	-0.028	-0.053***	-0.073***	-0.069***	-0.060***	-0.053***
	(0.015)	(0.018)	(0.019)	(0.018)	(0.020)	(0.014)	(0.015)	(0.015)	(0.015)	(0.015)
Commodity price index	2.680***	3.104***	2.876***	2.821***	3.367***	0.476	0.467	0.268	0.003	0.660
	(0.522)	(0.624)	(0.628)	(0.630)	(0.690)	(0.442)	(0.442)	(0.465)	(0.489)	(0.475)
Regional contagion	0.218	-0.206	-0.542	-0.582	-0.575	0.996***	0.817***	0.589**	0.379	0.272
	(0.358)	(0.352)	(0.418)	(0.421)	(0.392)	(0.287)	(0.269)	(0.291)	(0.306)	(0.293)
Real domestic interest rate	1.129	1.975**	1.822*	1.817*	1.879*	0.401	0.695	1.053	1.236	1.228
	(0.923)	(0.987)	(1.030)	(1.034)	(0.966)	(1.029)	(1.034)	(1.077)	(1.242)	(1.115)
REER overvaluation	1.673***	0.616	0.954	0.998	1.079	-1.125**	-2.035***	-2.224***	-2.326***	-2.016**
	(0.636)	(0.706)	(0.860)	(0.900)	(0.691)	(0.567)	(0.613)	(0.689)	(0.788)	(0.826)
Optimal current account/GDP		-15.517***	-14.955***	-14.933***	-15.323***		-8.975***	-8.882***	-8.944***	-9.248***
		(2.724)	(2.695)	(2.715)	(2.693)		(2.898)	(2.777)	(3.022)	(3.105)
Real GDP grow th			4.968**	4.708**	4.213**			6.172***	4.563**	4.797**
			(1.983)	(2.000)	(1.921)			(1.878)	(1.833)	(1.919)
Capital account openness			0.147**	0.146**	0.177***			0.036	0.043	0.076
			(0.062)	(0.060)	(0.065)			(0.043)	(0.047)	(0.049)
Financial interconnectedness				0.022	0.027				0.096***	0.102***
				(0.021)	(0.023)				(0.021)	(0.019)
Exchange rate regime				-0.026	0.026				-0.164*	-0.125
				(0.107)	(0.109)				(0.089)	(0.087)
Institutional quality index					2.940***					2.333***
					(0.890)					(0.740)
Default onset					-0.256					-0.401
					(0.364)					(0.467)
Real GDP per capita (log)					-0.360***					-0.397***
					(0.118)					(0.121)
Observations	917	917	917	917	917	1,003	1,003	1,003	1,003	1,003
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-R2	0.101	0.206	0.233	0.234	0.258	0.0914	0.129	0.148	0.181	0.205

Source: Authors' estimates.

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 is larger than the change in their liabilities (assets). Regressions 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 5. Magnitude of Surge: by Surge Type, 1980-2009

	Asset-driven surge					Liability-driven surge				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
[A] Constrained Model										
Real interest rate differential	0.046	0.047	0.005	0.050	-0.003	-0.002	0.024	-0.003	0.082	0.077
	(0.013)	(0.076)	(0.062)	(0.065)	(0.089)	(0.069)	(0.076)	(0.078)	(0.066)	(0.079)
S&P500 index volatility	-0.000	-0.000	-0.001	-0.002	-0.002	0.001	0.000	0.001	0.000	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
Commodity price index	0.089	0.089	0.069	0.085	0.053	0.087*	0.065	0.073	0.062	0.065
	(0.053)	(0.054)	(0.054)	(0.060)	(0.057)	(0.052)	(0.049)	(0.059)	(0.053)	(0.058)
Regional contagion	0.027	0.028	0.032	0.008	-0.035	-0.280**	-0.268**	-0.239*	-0.259**	-0.255*
	(0.045)	(0.043)	(0.056)	(0.055)	(0.066)	(0.137)	(0.123)	(0.126)	(0.125)	(0.129)
Optimal current account/GDP		-0.001	0.034	0.016	0.044		-0.501***	-0.391**	-0.443**	-0.428**
		(0.190)	(0.178)	(0.165)	(0.181)		(0.182)	(0.186)	(0.171)	(0.191)
Real GDP growth			-0.100	-0.105	-0.093			-0.054	-0.282	-0.293
			(0.156)	(0.149)	(0.242)			(0.377)	(0.350)	(0.345)
Capital account openness			0.012**	0.012**	0.010*			0.009*	0.005	0.004
			(0.005)	(0.005)	(0.006)			(0.004)	(0.004)	(0.005)
Financial interconnectedness				-0.002	-0.004				-0.000	-0.001
				(0.003)	(0.004)				(0.002)	(0.002)
Exchange rate regime				-0.023*	-0.024*				-0.050***	-0.051***
				(0.012)	(0.014)				(0.016)	(0.016)
Institutional quality index					-0.025					0.039
					(0.107)					(0.122)
Default onset					-0.033					0.016
					(0.039)					(0.037)
Real GDP per capita (log)					0.020					0.006
					(0.029)					(0.025)
Observations	73	73	73	73	73	159	159	159	159	159
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R2	0.263	0.263	0.330	0.382	0.405	0.178	0.231	0.253	0.364	0.368
[B] Unconstrained Model										
Real US interest rate	-0.506	-0.506	-0.479	-0.403	-0.373	-1.229***	-1.327***	-1.275***	-1.195***	-1.254***
	(0.371)	(0.373)	(0.347)	(0.296)	(0.368)	(0.380)	(0.391)	(0.397)	(0.383)	(0.380)
S&P500 index volatility	-0.001	-0.001	-0.001	-0.002*	-0.003*	0.000	-0.001	-0.000	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Commodity price index	0.066	0.066	0.049	0.066	0.031	0.102**	0.078	0.090	0.083	0.098*
	(0.052)	(0.053)	(0.050)	(0.055)	(0.058)	(0.050)	(0.049)	(0.057)	(0.052)	(0.057)
Regional contagion	-0.035	-0.034	-0.019	-0.029	-0.073	-0.381**	-0.375***	-0.356***	-0.358***	-0.359***
	(0.046)	(0.043)	(0.053)	(0.053)	(0.063)	(0.142)	(0.122)	(0.124)	(0.127)	(0.132)
Real domestic interest rate	-0.086	-0.086	-0.127	-0.071	-0.126	-0.203*	-0.186*	-0.210*	-0.079	-0.094
	(0.117)	(0.118)	(0.099)	(0.087)	(0.118)	(0.113)	(0.110)	(0.114)	(0.075)	(0.081)
REER overvaluation	-0.107	-0.107	-0.095	-0.122	-0.097	-0.196*	-0.240**	-0.225**	-0.240**	-0.251**
	(0.078)	(0.078)	(0.081)	(0.083)	(0.091)	(0.106)	(0.102)	(0.106)	(0.104)	(0.108)
Optimal current account/GDP		-0.009	0.019	0.006	0.031		-0.558***	-0.488**	-0.519***	-0.506***
		(0.174)	(0.152)	(0.152)	(0.171)		(0.171)	(0.185)	(0.158)	(0.184)
Real GDP growth			-0.218	-0.205	-0.139			-0.221	-0.384	-0.383
			(0.164)	(0.157)	(0.236)			(0.357)	(0.345)	(0.336)
Capital account openness			0.011**	0.011**	0.009			0.006	0.003	0.001
			(0.005)	(0.005)	(0.006)			(0.004)	(0.004)	(0.004)
Financial interconnectedness				-0.002	-0.004				-0.001	-0.001
				(0.003)	(0.004)				(0.002)	(0.002)
Exchange rate regime				-0.019	-0.021				-0.044***	-0.044***
				(0.011)	(0.014)				(0.014)	(0.014)
Institutional quality index					-0.013					0.100
					(0.117)					(0.108)
Default onset					0.005					0.019
					(0.036)					(0.032)
Real GDP per capita (log)					0.022					0.001
					(0.030)					(0.023)
Observations	73	73	73	73	73	159	159	159	159	159
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R2	0.304	0.304	0.376	0.411	0.437	0.269	0.334	0.347	0.431	0.440

Source: Authors' estimates.

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 estimated using OLS. Clustered standard errors (at the country level) reported in parentheses. ***,**,* indicate significance at 1, 5, and 10 percent levels, respectively.

Table 6. Likelihood of Surge: Sensitivity Analysis

	Surge definitions		Alternate regressors			Additional regressors							Sample	Estimation
	Extended	Cluster	Real US 10yr yield	RAI	VXO	Trade openness	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	**-14.295*** **	**-13.235*** **	**-6.150** **	**-8.398** **	**-11.299*** **	**-10.070*** **	**-10.600*** **	**-13.098*** **	**-10.649** **	**-11.910*** **	**-12.457*** **	**-15.919*** **	**-12.009*** **	**-17.543*** **
	(3.425)	(3.293)	(3.105)	(3.802)	(4.108)	(2.884)	(2.764)	(3.737)	(4.583)	(2.922)	(3.385)	(4.086)	(4.446)	(4.820)
S&P500 index/RAI/VXO	**-0.045*** **	**-0.036** **	**-0.028** **	**0.165***	-0.009	**-0.041*** **	**-0.039*** **	**-0.053*** **	**-0.033***	**-0.040*** **	**-0.041*** **	**-0.043*** **	**-0.043*** **	**-0.069*** **
	(0.013)	(0.016)	(0.012)	(0.095)	(0.008)	(0.013)	(0.012)	(0.016)	(0.018)	(0.012)	(0.012)	(0.014)	(0.017)	(0.017)
Commodity price index	**1.479*** **	**1.510*** **	**1.343*** **	**1.845*** **	**1.718*** **	**1.725*** **	**1.699*** **	**1.624*** **	**1.808*** **	**1.752*** **	**1.708*** **	**2.037*** **	**1.674*** **	**2.261*** **
	(0.493)	(0.450)	(0.409)	(0.463)	(0.478)	(0.444)	(0.432)	(0.573)	(0.540)	(0.428)	(0.454)	(0.525)	(0.484)	(0.640)
Regional contagion	0.321	0.516**	0.186	0.138	0.256	-0.017	0.035	-0.090	-0.291	0.019	0.012	0.232	-0.325	-0.297
	(0.330)	(0.252)	(0.279)	(0.305)	(0.307)	(0.279)	(0.278)	(0.325)	(0.387)	(0.286)	(0.280)	(0.317)	(0.345)	(0.409)
Real domestic interest rate	**2.279** **	**2.354** **	1.224	1.498	1.648	1.813*	1.597	1.241	1.517	1.507	1.609	1.617	1.021	2.335
	(1.030)	(0.993)	(0.964)	(1.156)	(1.227)	(0.980)	(1.008)	(1.314)	(1.313)	(1.017)	(1.015)	(1.058)	(1.280)	(1.500)
REER overvaluation	**-1.198** **	-1.141	-0.877	-0.865	-1.011	-0.401	-0.758	**-1.633** **	**-1.619***	-0.919	-0.944	-1.246	**-1.887** **	-0.798
	(0.510)	(0.712)	(0.708)	(0.711)	(0.664)	(0.692)	(0.706)	(0.792)	(0.853)	(0.683)	(0.708)	(0.801)	(0.786)	(0.989)
Optimal current account/GDP	**-12.441*** **	**-9.902*** **	**-10.603*** **	**-11.356*** **	**-10.511*** **	**-11.052*** **	**-11.017*** **	**-13.980*** **	**-11.039*** **	**-10.940*** **	**-10.963*** **	**-13.407*** **	**-12.211*** **	**-16.601*** **
	(3.049)	(2.758)	(2.754)	(3.047)	(2.987)	(2.571)	(2.881)	(2.792)	(3.186)	(2.830)	(2.947)	(2.659)	(3.401)	(3.640)
Real GDP growth	**4.037** **	**5.145*** **	**5.050*** **	**4.893*** **	**5.071*** **	**4.473** **	**4.853*** **	**4.849** **	**5.547** **	**4.862*** **	**4.787*** **	**5.401** **	**4.788** **	**6.949*** **
	(1.652)	(1.821)	(1.735)	(1.884)	(1.817)	(1.776)	(1.735)	(2.348)	(2.215)	(1.768)	(1.854)	(2.248)	(1.903)	(2.395)
Capital account openness	**0.134** **	0.028	**0.115** **	0.077	**0.094***	**0.093***	**0.104** **	0.082	0.051	**0.112** **	**0.121** **	**0.133***	0.056	**0.163** **
	(0.061)	(0.040)	(0.052)	(0.051)	(0.050)	(0.052)	(0.050)	(0.055)	(0.050)	(0.051)	(0.052)	(0.080)	(0.049)	(0.072)
Financial interconnectedness	**0.074*** **	**0.092*** **	**0.080*** **	**0.092*** **	**0.092*** **	**0.102*** **	**0.084*** **	**0.093*** **	**0.113*** **	**0.081*** **	**0.083*** **	**0.141*** **	**0.102*** **	**0.132*** **
	(0.017)	(0.014)	(0.016)	(0.016)	(0.016)	(0.014)	(0.016)	(0.016)	(0.016)	(0.015)	(0.017)	(0.022)	(0.016)	(0.022)
Exchange rate regime	-0.140	-0.088	-0.085	-0.129	-0.137	-0.036	-0.079	-0.160	**-0.200** **	-0.087	-0.084	-0.228	**-0.181** **	-0.071
	(0.102)	(0.089)	(0.090)	(0.087)	(0.087)	(0.096)	(0.089)	(0.102)	(0.091)	(0.091)	(0.094)	(0.149)	(0.089)	(0.128)
Institutional quality index	**2.395*** **	**1.603** **	**2.311*** **	**2.545*** **	**2.691*** **	**1.853** **	**2.397*** **	**3.334*** **	**2.369** **	**2.580*** **	**2.604*** **	**2.967*** **	**2.240** **	**4.280*** **
	(0.705)	(0.674)	(0.750)	(0.811)	(0.791)	(0.844)	(0.738)	(0.929)	(0.930)	(0.765)	(0.833)	(1.127)	(0.884)	(1.195)
Default onset	**-0.514***	-0.473	-0.222	-0.295	-0.324	-0.238	-0.176		-0.058	-0.213	-0.197	-0.145	-0.226	-0.674
	(0.290)	(0.381)	(0.361)	(0.503)	(0.509)	(0.344)	(0.345)		(0.567)	(0.342)	(0.341)	(0.355)	(0.540)	(0.655)
Real GDP per capita (log)	-0.369***	-0.229**	-0.365***	-0.466***	-0.448***	-0.429***	-0.427***	-0.462***	-0.432***	-0.411***	-0.415***	-0.708***	-0.438***	-0.645***
	(0.121)	(0.095)	(0.110)	(0.116)	(0.116)	(0.105)	(0.111)	(0.148)	(0.118)	(0.128)	(0.138)	(0.225)	(0.116)	(0.167)
Observations	1,076	1,076	1,076	998	944	1,076	1,076	825	766	1,066	1,036	1,036	832	1,076
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-R2	0.221	0.192	0.202	0.216	0.207	0.223	0.212	0.248	0.217	0.208	0.208	0.304	0.207	

Source: Authors' estimates.

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&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. 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&P 500 index volatility measure; VXO=Including the VXO index instead of the S&P 500 volatility 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

Table 7. Magnitude of Surge: Sensitivity Analysis

	Surge definitions		Alternate regressors			Additional regressors							Sample
	Extended	Cluster	Real US 10yr yield	RAI	VXO	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	**-0.735****	**-0.663****	-0.441	**-0.837*****	**-0.800****	**-0.537***	-0.415	**-0.820****	**-0.773***	**-0.875*****	**-0.863*****	-0.071	**-0.797*****
	(0.278)	(0.293)	(0.277)	(0.311)	(0.320)	(0.274)	(0.325)	(0.314)	(0.385)	(0.298)	(0.316)	(0.198)	(0.276)
S&P 500 index/RAI/VXO	-0.001	-0.001	-0.001	-0.005	**-0.001***	-0.002	-0.001	-0.002	-0.002	-0.002	-0.001	**-0.003*****	-0.001
	(0.001)	(0.001)	(0.001)	(0.008)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Commodity price index	**0.030****	0.034	0.023	0.057	0.055	0.053	0.030	0.045	0.043	0.051	0.048	**0.067***	**0.067****
	(0.015)	(0.030)	(0.036)	(0.041)	(0.041)	(0.035)	(0.034)	(0.044)	(0.041)	(0.037)	(0.043)	(0.036)	(0.026)
Regional contagion	**-0.296****	0.005	**-0.198****	**-0.253****	**-0.286*****	**-0.183****	**-0.202****	**-0.311*****	**-0.236****	**-0.225****	**-0.233*****	-0.032	**-0.252*****
	(0.117)	(0.024)	(0.088)	(0.097)	(0.098)	(0.082)	(0.093)	(0.092)	(0.108)	(0.088)	(0.085)	(0.062)	(0.083)
Real domestic interest rate	-0.044	-0.075	**-0.131***	**-0.143****	**-0.143****	-0.036	-0.040	-0.190**	-0.129	-0.083	-0.074	0.008	-0.056
	(0.044)	(0.055)	(0.074)	(0.068)	(0.070)	(0.068)	(0.067)	(0.088)	(0.089)	(0.068)	(0.064)	(0.063)	(0.049)
REER overvaluation	**-0.150*****	**-0.189****	**-0.247****	**-0.283*****	**-0.295*****	**-0.185****	**-0.187***	**-0.283****	**-0.252****	**-0.248*****	**-0.258*****	**-0.175****	**-0.162****
	(0.054)	(0.080)	(0.096)	(0.104)	(0.103)	(0.090)	(0.101)	(0.110)	(0.099)	(0.092)	(0.090)	(0.081)	(0.062)
Optimal current account/GDP	**-0.315****	**-0.358****	**-0.278***	-0.269	**-0.313***	**-0.299***	-0.192	-0.293	-0.264	**-0.275***	**-0.350****	-0.143	**-0.356****
	(0.127)	(0.135)	(0.157)	(0.162)	(0.162)	(0.163)	(0.153)	(0.195)	(0.160)	(0.157)	(0.164)	(0.153)	(0.145)
Real GDP growth	-0.116	-0.031	-0.267	-0.300	-0.361	-0.273	-0.247	-0.226	-0.213	-0.297	-0.265	-0.463	-0.138
	(0.168)	(0.193)	(0.256)	(0.251)	(0.256)	(0.259)	(0.260)	(0.270)	(0.292)	(0.256)	(0.256)	(0.326)	(0.195)
Capital account openness	0.000	0.006	-0.001	0.005	-0.001	0.000	-0.001	-0.002	-0.001	-0.001	-0.002	-0.001	0.001
	(0.002)	(0.004)	(0.002)	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
Financial interconnectedness	0.004	-0.002	0.005	-0.001	0.003	0.002	0.002	0.003	0.005	0.005	0.003	0.000	0.004
	(0.003)	(0.002)	(0.004)	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.008)	(0.003)
Exchange rate regime	**-0.026*****	**-0.030****	**-0.037*****	**-0.036*****	**-0.036*****	**-0.030*****	**-0.032*****	**-0.037*****	**-0.036*****	**-0.036*****	**-0.035*****	**-0.017***	**-0.026*****
	(0.008)	(0.011)	(0.012)	(0.011)	(0.011)	(0.010)	(0.008)	(0.013)	(0.012)	(0.012)	(0.012)	(0.009)	(0.008)
Institutional quality index	0.071	0.081	0.004	0.047	0.045	-0.008	-0.022	-0.003	0.056	0.039	0.031	-0.083	0.066
	(0.064)	(0.083)	(0.090)	(0.095)	(0.104)	(0.093)	(0.083)	(0.113)	(0.117)	(0.086)	(0.110)	(0.071)	(0.073)
Default onset	0.013	0.118	0.002	0.016	0.002	-0.011	0.008	0.000	0.018	0.001	0.002	-0.058*	0.024
	(0.014)	(0.071)	(0.026)	(0.024)	(0.027)	(0.027)	(0.028)	(0.000)	(0.026)	(0.027)	(0.025)	(0.031)	(0.015)
Real GDP per capita (log)	-0.003	0.001	0.009	0.006	0.009	0.001	-0.001	0.016	0.007	0.003	0.010	0.009	-0.003
	(0.015)	(0.015)	(0.021)	(0.022)	(0.022)	(0.020)	(0.014)	(0.025)	(0.025)	(0.023)	(0.026)	(0.013)	(0.016)
Observations	365	278	232	220	216	232	232	196	198	232	224	232	338
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.294	0.353	0.362	0.392	0.411	0.428	0.485	0.415	0.384	0.385	0.399	0.801	0.298

Source: Authors' estimates.

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 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; VXO=Including the VXO index instead of the S&P 500 index volatility measure; 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.

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:

$$c_t^* = \left(\frac{r}{\theta}\right)\left\{b_t + \frac{1}{(1+r)}\sum_{j=0}^{\infty} E_t \frac{(Q_{t+j} - I_{t+j} - G_{t+j})}{(1+r)^j}\right\} \tag{8}$$

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:

$$CA_t^* = Y_t - I_t - G_t - \theta C_t^* \tag{9}$$

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

$$CA_t^* = -\sum_{j=1}^{\infty} \frac{E_t\left\{\Delta(Q_{t+j} - I_{t+j} - G_{t+j})\right\}}{(1+r)^j} \tag{10}$$

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.[32]

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

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

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:

$$CA_t^* = -\sum_{j=1}^{\infty}(1+r)^{-j}[1 \quad 0]\Phi^k x_t = -[1 \quad 0](\Phi/(1+r))[I - \Phi/(1+r)]^{-1} x_t \tag{12}$$

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

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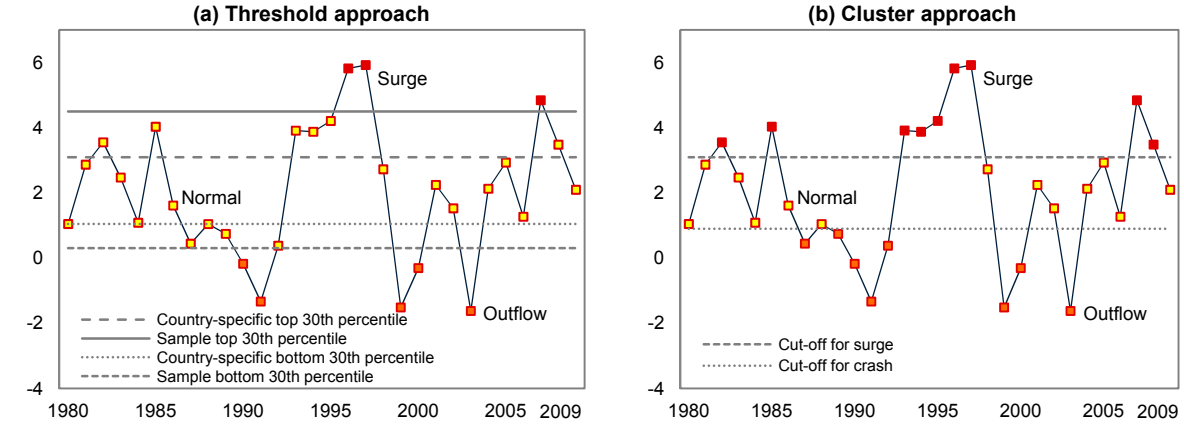
[32] For instance, if the shock is permanent, then by definition it is not expected to be reversed, so $\Delta(Q_{t+j} - I_{t+j} - G_{t+j}) = 0 \ \forall \ j$ and, according to (10), the country should not run a current account deficit. If however there is a purely temporary fall in output such that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

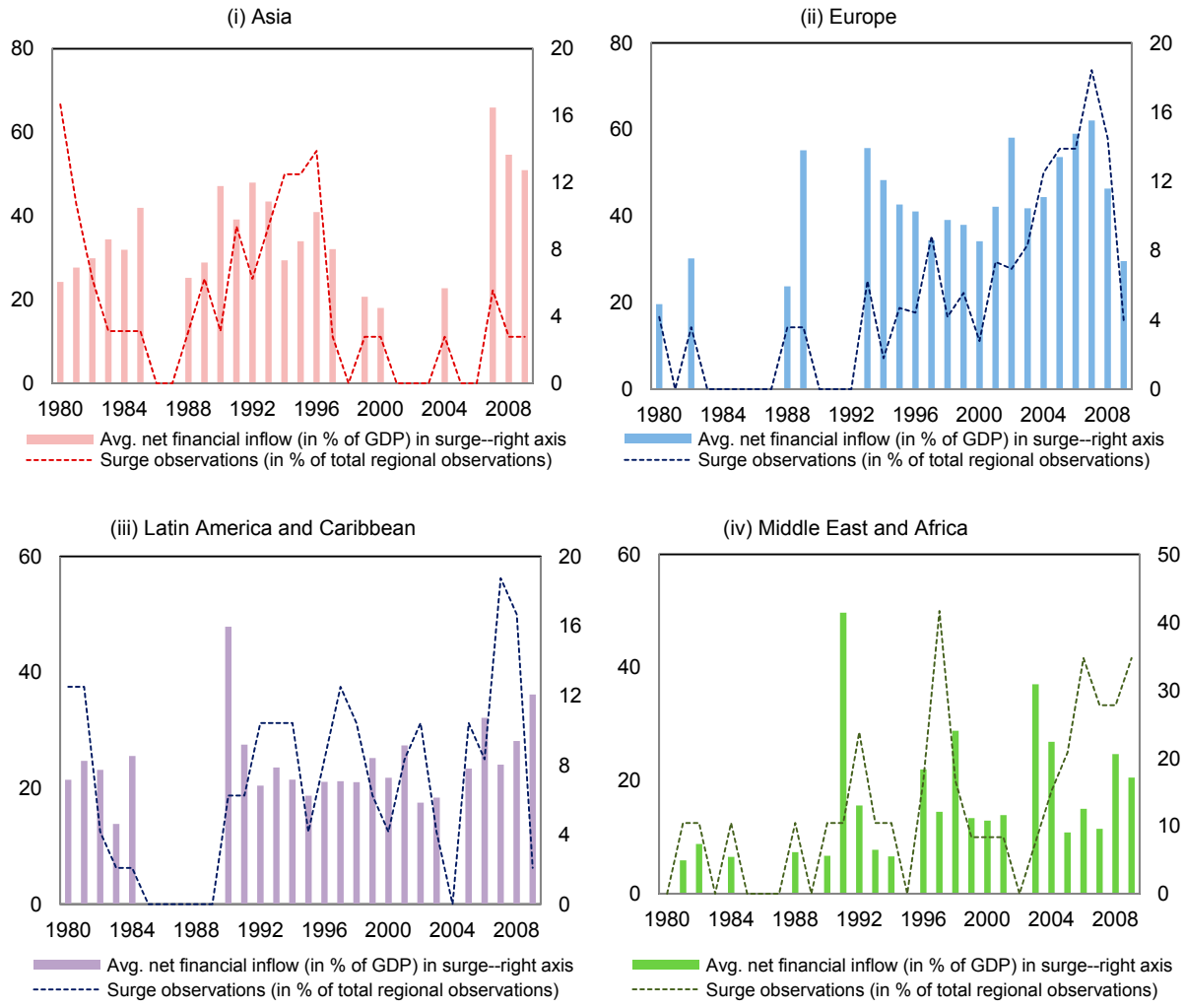
APPENDIX B: DATA AND SUMMARY STATISTICS

Figure B1. Colombia: Net Capital Flows to GDP (in percent), 1980-2009



Source: Authors' calculations based on IFS database.

Figure B2. Surges by Region, 1980-2009



Source: Authors' calculations based on IFS database.

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 commodity price index (trend obtained from HP filter)	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. The index is constructed by regressing excess returns of 64 emerging market assets on their standard deviation. The derived coefficient from the regression gives rise to the index w ith low er (higher) values indicating periods of financial strain (ease)	Bloomberg
Optimal current account balance/GDP	Obtained from the intertemporal optimizing model of the current account	Ghosh (1995)[2]
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 (1=Fixed; 2=Intermediate; 3=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
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
Nominal Effective Exchange Rate	Index	IMF's INS database
Institutional quality index	Average of 12 ICRG's political risk components	http://w w w .prsgroup.com/Default.aspx
Money market rate	In percent	IMF's IFS database
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+inflation)]-1	Authors' calculations
Real interest rate differential	Difference betw een domestic real interest rate, real US interest rate, and REER overvaluation	Authors' calculations
REER overvaluation	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 in the region experiencing a surge	
S&P 500 index	Index	Bloomberg
S&P 500 index 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= $\sum_{x=1}^{n} EX_{x,i,t-1} / GDP_{x,t-1}) * surge_{i,t}$ 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
VXO index	Chicago Board Options Exchange Market Volatility Index (high values indicate greater volatility of S&P 500 index options)	Bloomberg

1/ Chinn, M., and H. Ito, 2008, "A New Measure of Financial Openness," *Journal of Comparative Policy Analysis*, Vol. 10(3): 309-322.

2/ Ghosh, A., 1995, "International Capital Mobility Amongst the Major industrial Countries: Too Little or Too Much?" *Economic Journal*, Vol. 105(428): 107-128.

3/ Reinhart, C., and Reinhart, V., 2008, "Capital Flow Bonanzas: An Encompassing View of the Past and Present," NBER Working Paper 14321.

4/ Minoiu, C., and J. Reyes, 2011, " A Network Analysis of Global Banking: 1978-2009," IMF Working Paper WP/11/74 (Washington DC: IMF).

5/ Beck, T., and A. Demirgüç-Kunt, 2009, "Financial Institutions and Markets Across Countries and over Time: Data and Analysis," World Bank Policy Research Working Paper No. 4943 (Washington DC: World Bank).

Table B2. List of Surge Episodes with the Threshold Approach, 1980-2009

Country	Duration[a]	Avg. net capital flow (% of GDP)[b]	Country	Duration[a]	Avg. net capital flow (% of GDP)[b]	Country	Duration[a]	Avg. net capital flow (% of GDP)[b]
Albania	1988-89	9.9	El Salvador	1998	7.3	Panama	2001	11.0
Albania	1997	5.1	El Salvador	2003	6.7	Panama	2005	13.5
Albania	2006-09	7.9	El Salvador	2006	5.9	Panama	2007-08	11.4
Argentina	1993-94	8.6	El Salvador	2008	7.1	Paraguay	1980-82	7.1
Argentina	1997-99	5.4	Estonia	1997	16.0	Paraguay	2005	5.2
Armenia	1996-2000	12.9	Estonia	2003-04	12.9	Paraguay	2007	6.4
Azerbaijan	1996-98	27.0	Estonia	2006-07	16.8	Peru	1994-97	7.9
Azerbaijan	2003-04	32.3	Guatemala	1991-93	7.8	Peru	2002	4.9
Belarus	1997	4.8	Guatemala	1998	5.1	Peru	2007-08	10.5
Belarus	2002	5.1	Guatemala	2000-03	6.7	Philippines	1980	6.8
Belarus	2004	4.5	Hungary	1993-95	14.9	Philippines	1991	5.6
Belarus	2006-07	6.5	Hungary	1998-2000	11.1	Philippines	1994-97	9.9
Belarus	2009	8.0	Hungary	2003-06	10.6	Philippines	1999-2000	4.8
Bosnia & Herzegovina	2001	15.5	Hungary	2008	8.8	Poland	1980	4.9
Bosnia & Herzegovina	2003-05	13.8	India	2007	8.0	Poland	1995-2000	6.7
Bosnia & Herzegovina	2007-08	12.5	Indonesia	1995-96	4.6	Poland	2003	4.6
Brazil	1980-81	6.2	Israel	1982	7.6	Poland	2005	7.1
Brazil	1994	7.3	Israel	1997	6.8	Poland	2007-09	8.3
Brazil	2007	6.5	Israel	1999	4.9	Romania	2001-02	7.2
Bulgaria	1993	18.0	Israel	2008	7.5	Romania	2004-08	14.3
Bulgaria	2002-08	26.5	Jamaica	1984	8.5	Russia	2007	7.6
Chile	1980-81	13.3	Jamaica	2001-02	9.8	Serbia	2007	19.1
Chile	1990	8.4	Jamaica	2005-09	12.6	Slovak Rep.	1996	11.3
Chile	1992-97	7.5	Jordan	1991-92	31.4	Slovak Rep.	2002	22.7
Chile	2008	5.1	Jordan	2005-09	18.6	Slovak Rep.	2004-05	13.2
China	1994	4.9	Kazakhstan	1997	11.7	South Africa	1997	5.4
China	2004	5.7	Kazakhstan	2001	11.6	South Africa	2005-07	6.0
Colombia	1996-97	5.9	Kazakhstan	2004	11.0	South Africa	2009	5.8
Colombia	2007	4.8	Kazakhstan	2006	20.0	Sri Lanka	1980	5.0
Costa Rica	1980	6.5	Korea	1980-81	6.0	Sri Lanka	1982	6.5
Costa Rica	1999	4.8	Latvia	2004-07	21.3	Sri Lanka	1989	5.0
Costa Rica	2002	5.4	Lebanon	2008-09	47.8	Sri Lanka	1993-94	6.5
Costa Rica	2006-08	8.8	Lithuania	1998	11.7	Thailand	1981	6.2
Croatia	1996-97	12.8	Lithuania	2006-07	16.0	Thailand	1988-96	10.0
Croatia	1999	14.0	Macedonia	2001	11.2	Tunisia	1981-82	6.1
Croatia	2001	11.9	Macedonia	2005	9.3	Tunisia	1984	5.4
Croatia	2003	11.7	Macedonia	2007-08	11.9	Tunisia	1992-93	5.6
Croatia	2006	12.7	Malaysia	1980-85	8.4	Tunisia	2006	9.5
Croatia	2008	11.5	Malaysia	1991-93	14.3	Tunisia	2008-09	6.5
Czech Rep.	1995	11.9	Malaysia	1995-96	9.3	Turkey	1993	4.5
Czech Rep.	2001-02	10.9	Mauritius	1988	6.1	Turkey	2004-08	6.9
Dominican Rep.	2000-01	6.3	Mauritius	1990	5.6	Ukraine	2005	9.4
Dominican Rep.	2005	4.6	Mauritius	2007-09	7.1	Ukraine	2007-08	7.8
Dominican Rep.	2007-08	5.9	Mexico	1980-81	6.6	Uruguay	1980-83	6.2
Ecuador	1990-92	9.8	Mexico	1991-93	7.7	Uruguay	2005-08	9.3
Ecuador	1994	5.7	Mexico	1997	5.2	Venezuela	1990	29.2
Ecuador	1998	6.4	Morocco	1994	5.5	Venezuela	1992-93	4.7
Ecuador	2002	5.4	Pakistan	2006-07	5.7	Vietnam	1996	11.8
Egypt	1997	4.6	Panama	1981	7.6	Vietnam	2007-09	17.1
Egypt	2005	8.3	Panama	1996-99	10.3			

Source: Authors' calculations.

[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, 1980-2009

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	9.87	Egypt	2005	8.34	Mexico	1980-81	6.62
Albania	1997	5.14	Egypt	2007-08	4.08	Mexico	1991-93	7.68
Albania	2006-09	7.95	El Salvador	1995	4.13	Mexico	1997	5.18
Algeria	1980	2.28	El Salvador	1997-99	5.31	Morocco	1990-94	3.74
Algeria	1989	1.53	El Salvador	2002-03	5.02	Morocco	1999	3.22
Algeria	2008-09	3.79	El Salvador	2005-06	5.10	Morocco	2004	2.50
Argentina	1992-94	6.91	El Salvador	2008-08	7.14	Pakistan	1993-94	3.10
Argentina	1996-99	5.15	Estonia	1997	15.96	Pakistan	1996	3.62
Armenia	1996-2000	12.88	Estonia	2004	13.16	Pakistan	2005-08	4.45
Azerbaijan	1996-98	26.96	Estonia	2006-07	16.84	Panama	1981	7.55
Azerbaijan	2003-04	32.29	Guatemala	1991-93	7.84	Panama	1996-99	10.32
Belarus	2002	5.10	Guatemala	1998-98	5.11	Panama	2001	10.99
Belarus	2007	8.35	Guatemala	2000-03	6.70	Panama	2005	13.55
Belarus	2009	7.99	Hungary	1993-95	14.94	Panama	2007-08	11.37
Bosnia & Herzegovina	2001	15.53	Hungary	1998-2000	11.11	Paraguay	1980-82	7.14
Bosnia & Herzegovina	2004-05	14.55	Hungary	2004-06	11.51	Paraguay	2005	5.17
Bosnia & Herzegovina	2007	13.63	Hungary	2008-08	8.83	Paraguay	2007-09	4.88
Brazil	1980-82	5.29	India	1994	3.24	Peru	1994-97	7.94
Brazil	1994-96	5.03	India	2003-04	3.43	Peru	2007-08	10.51
Brazil	2000-01	4.01	India	2006-07	6.02	Philippines	1980	6.80
Brazil	2007	6.45	India	2009	3.30	Philippines	1991	5.63
Brazil	2009	4.43	Indonesia	1990-93	3.17	Philippines	1994-97	9.91
Bulgaria	1993	17.95	Indonesia	1995-96	4.59	Philippines	1999	5.17
Bulgaria	2002	22.80	Israel	1981-82	5.98	Poland	1995-96	7.39
Bulgaria	2005-08	33.74	Israel	1987	4.33	Poland	1998-2000	6.81
Chile	1980-81	13.34	Israel	1995-97	5.08	Poland	2005	7.13
Chile	1990	8.40	Israel	1999-2000	4.49	Poland	2007-09	8.34
Chile	1992-94	7.67	Israel	2008-08	7.51	Romania	2002	7.86
Chile	1996-97	8.40	Jamaica	1984	8.53	Romania	2004-08	14.26
China	1993-96	4.26	Jamaica	2001-02	9.82	Russian Fed	1997	3.43
China	2003-04	4.53	Jamaica	2005-09	12.58	Russian Fed	2002	4.13
China	2009	2.85	Jordan	1991-92	31.38	Russian Fed	2005-07	4.42
Colombia	1982	3.55	Jordan	2005-09	18.57	Serbia	2007	19.11
Colombia	1985	4.03	Kazakhstan	1997	11.68	Slovak Rep.	2002	22.67
Colombia	1993-97	4.75	Kazakhstan	2001	11.58	Slovak Rep.	2005	15.03
Colombia	2007-08	4.16	Kazakhstan	2004	11.05	South Africa	1997-98	4.23
Costa Rica	1980	6.49	Kazakhstan	2006	19.96	South Africa	2004-09	5.24
Costa Rica	1995	4.31	Korea, Rep.	1980-82	5.14	Sri Lanka	1980	5.03
Costa Rica	1999	4.82	Korea, Rep.	1995-96	3.82	Sri Lanka	1982	6.47
Costa Rica	2002-03	4.66	Korea, Rep.	2003-03	3.19	Sri Lanka	1989	5.02
Costa Rica	2005-08	7.73	Korea, Rep.	2009	4.15	Sri Lanka	1993-94	6.49
Croatia	1997	14.16	Latvia	2005-07	23.60	Thailand	1989-96	10.51
Croatia	1999	13.97	Lebanon	2008-09	47.85	Tunisia	1981-82	6.13
Croatia	2001	11.85	Lithuania	1998-98	11.68	Tunisia	1984	5.43
Croatia	2006	12.70	Lithuania	2006-07	15.97	Tunisia	1993	6.47
Czech Rep.	1995	11.89	Macedonia, I	2001	11.23	Tunisia	2006	9.50
Czech Rep.	2002	14.17	Macedonia, I	2005	9.34	Tunisia	2008-09	6.54
Dominican Rep.	1980	4.44	Macedonia, I	2007-08	11.94	Turkey	1993	4.51
Dominican Rep.	1998-01	5.16	Malaysia	1981-85	9.06	Turkey	2004-08	6.86
Dominican Rep.	2005	4.60	Malaysia	1991-93	14.32	Ukraine	2005	9.43
Dominican Rep.	2007-09	5.16	Malaysia	1995-96	9.28	Ukraine	2007-08	7.80
Ecuador	1990-92	9.80	Mauritius	1980	3.74	Uruguay	1982	10.37
Ecuador	1994	5.67	Mauritius	1988-88	6.12	Uruguay	2006-08	10.70
Ecuador	1998-98	6.37	Mauritius	1990	5.60	Venezuela	1987	3.45
Ecuador	2002	5.36	Mauritius	1999	4.26	Venezuela	1990-93	10.40
Egypt	1997-98	3.96	Mauritius	2007-09	7.15	Vietnam	2007-09	17.11

Source: Authors' calculations.

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

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