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Capital Inflow Surges in Emerging Economies: How Worried Should Latin America and the Caribbean Be?

In the years leading up to the global economic crisis, Latin America and the Caribbean received large capital inflows. Nonetheless, the region survived the (albeit short-lived) dramatic events of 2007–09 reasonably well, with no financial crisis in any of the larger economies. After the crisis, capital inflows rose again: in 2010 gross inflows to seven Latin American countries (Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela) amounted to more than 6 percent of gross domestic product (GDP), and net inflows exceeded 3 percent of GDP. More recently following the May 2013 speech of then-Chairman of the U.S. Federal Reserve, Ben Bernanke, there has been concern regarding the potential effects of tapering asset purchases by the U.S. Federal Reserve System and rising interest rates, possibly spelling the end of large capital inflows to the Latin American and Caribbean region.

The literature on capital inflows suggests that while these flows represent an opportunity to spur investment and growth, they may also increase vulnerability to financial crises, macroeconomic instability, and ultimately recession. A relevant question, then, is whether the region can declare victory in being able to manage large capital inflows successfully or whether risks remain that justify strong measures.

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Our starting point is that the region has enjoyed strong surges in capital inflows. We therefore decided to condition the analysis on surges occurring. We do not seek to explain the reasons for such a surge. One justification for this decision is that capital flows appear to be driven as much, if not more, by push rather than pull factors. More specifically, we seek to understand what determines whether such surges end in either a banking crisis or a recession. While there is a substantial literature on the determinants of capital inflows, their potential impacts have received much less attention. The contribution of this paper is to analyze when inflow surges may end in severe economic problems, including financial or macroeconomic instability, rather than to identify the determinants of those surges.

We must first tackle the question of how to define a capital inflow surge. We are helped in this regard by a small but growing literature. However, the current definitions of inflow surges in the literature may be injudicious. We propose a new definition which considers the total size of the inflow episode across countries. We also employ a more traditional definition based on year-by-year inflows relative to a country-specific threshold. We contrast relevant statistics on the identified episodes using these two definitions and compare our episodes with others found in the literature.

We also consider whether the analysis should be conducted using gross or net inflows. We take the view that employing net flows may discard useful information and that gross flows are relevant where financial instability is a potential concern. Even if net flows are zero, a domestic financial system may intermediate large gross inflows when domestic residents purchase assets abroad. We choose to focus on gross inflows, but we include gross outflows as a potential explanatory variable, so as not to lose information.[1]

The empirical analysis in this paper develops a set of parsimonious models that discriminate reasonably well between the different economic outcomes. We then analyze the case of a typical country from the region with a recent capital inflow surge, providing a set of simulations. To illustrate the economic magnitude of our results, we simulate the changes in the estimated probabilities of negative outcomes given changes in certain critical variables. We suggest that, depending on the country/inflow characteristics, different policy measures may then be justified. However, a caveat is that emerging economies in general and Latin America and the Caribbean in

1. Gross inflows and outflows tend to be correlated, but the correlation is clearly not perfect. See Powell, Ratha, and Mohapatra (2002) for an early paper focusing on gross flows that makes this point.

particular have been experimenting with new policy measures, and we are not able to evaluate their potential effectiveness in this paper. This remains important future work when sufficient experience and data are available, but our results indicate that such policy experimentation does have a prima facie justification.

The contributions of this paper thus include a novel analysis of the potential impact of capital inflow surges, employing characteristics of the surge and of the country to discriminate between outcomes; the use of a new definition of what constitutes an inflow surge; a focus on gross inflows (but using outflows as a control); and an innovative simulation analysis focusing on countries that have experienced recent capital inflow surges in Latin America and the Caribbean. The paper is organized as follows. The next section presents a brief literature review. We then describe the data used in the empirical analysis, discuss a set of methodological issues, and outline the econometric results. The final section concludes.

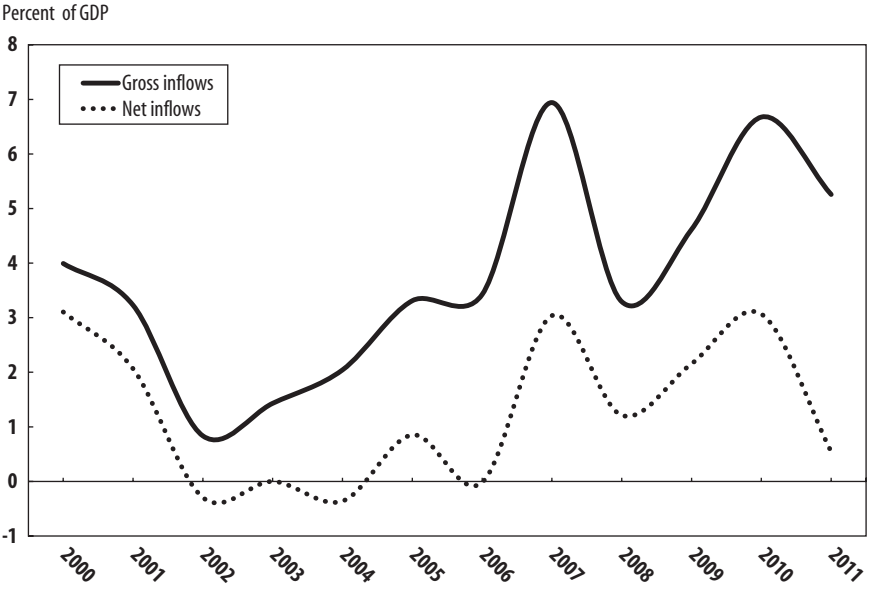
Capital Inflow Surges: A Brief Review

There is a substantial literature analyzing capital flows to emerging economies. This literature switches back and forth between considering net flows and considering gross inflows and gross outflows, arguably depending on the precise phenomenon under consideration. Figure 1 illustrates gross and net inflows to seven countries in the Latin American and Caribbean region.

One common theme is the identification of the determinants of inflows or, more specifically, the determinants of inflow surges or bonanzas. A general result from that strand of the literature is that global push factors tend to outweigh individual country pull considerations in the determination of either gross or net inflows.[2] Still, while strong capital inflows may fuel growth and development, their link to macroeconomic and financial stability is a second

2. See for example Calvo, Leiderman, and Reinhart (1992, 1993, 1996); Reinhart and Reinhart (2009). Fratzscher (2011) argues that while push factors (such as common global shocks to risk, liquidity, and asset prices) were most important before and during the global financial crisis, there is some evidence that pull factors (such as country-specific shocks, institutional quality, country risk rating, and macroeconomic fundamentals) have become more important in the postcrisis period. Ghosh and others (2012) find that push factors are important in determining whether a surge in net flows will occur, although they suggest that pull factors may determine the size of the surge. Our work is consistent with this approach, as we consider country-surge episodes and their particular characteristics.

FIGURE 1. Capital Inflows to Latin America[a]



a. Includes data for Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela.

key theme.[3] In the 1990s, for example, the literature focused on the required current account adjustments prompted by a sudden stop in net capital inflows.[4] More recently, the focus has shifted back to an analysis of gross capital flows, perhaps because gross flows have risen substantially and emerging economies have become substantial capital exporters as well as capital importers.[5] Some recent papers consider surges or bonanzas in net capital flows.[6] While inflows

3. See Diaz-Alejandro (1985) for an early reference. Some authors consider that capital inflows and large current account deficits contributed to the financial problems of the United States in 2008–09; see Portes (2009) and Reinhart and Rogoff (2009, chap. 13).

4. See Calvo, Izquierdo, and Mejía (2008); Calvo (2012).

5. See Cavallo and others (2015) for descriptive graphs and statistics on the growth of gross inflows and outflows for both advanced and emerging economies. For recent papers that focus on gross flows, see particularly Forbes and Warnock (2012) and Broner and others (2013), who consider different types of phenomena defined on gross flows, and Calderón and Kubota (2012), who find that gross inflows are a potential determinant of credit booms. Other papers that discuss the role of gross capital flows include Tille and van Wincoop (2010) and Hnatkovska (2010).

6. See, for example, Ghosh and others (2012); Caballero (2015).

and outflows tend to be correlated, such that net flows tend to be relatively more stable, a correlation of one is not guaranteed.[7] This suggests that while analyzing net flows may be of interest in some circumstances, it may come at the cost of losing valuable information. Moreover, where there are concerns regarding potential financial stability, we strongly suggest that an analysis of gross inflows will generally be relevant, to the extent that gross inflows may largely be intermediated by domestic entities. For these reasons, we choose to work with gross inflows, and our paper is then situated within the set of more recent papers that choose that route.

Regarding the link to economic instability, the literature may be divided into two (related) ideas: first, excessive capital inflows may provoke financial and particularly banking instability; second, they may provoke macroeconomic instability or, more specifically, a recession.

Capital Inflows, Lending Booms, and Banking Instability

Strong capital inflows are often thought to be closely associated with lending booms and banking instability. Indeed, one strand of the banking literature suggests that lending booms are associated with subsequent banking instability. For example, Gavin and Hausmann find that credit growth is a frequent precursor to banking crises.[8] Demirgüç-Kunt and Detragiache claim that credit growth is one of the most robust determinants of systemic banking crises.[9] At the same time, the International Monetary Fund (IMF) argues that although this is surely one determinant, high credit growth is still far from an accurate predictor of future problems.[10] Even the best-performing models have a relatively high rate of false alarms of crises (so-called type 1 errors) and missed crises (type 2 errors).

The results linking capital inflows and lending booms are somewhat mixed, however.[11] Sachs, Tornell, and Velasco find no association between lending booms and surges in capital inflows during crises in the 1990s.[12] Gourinchas,

7. See Powell, Ratha, and Mohapatra (2002) for an analysis of gross inflows and gross outflows and the relationship between them.

8. Gavin and Hausmann (1996). See also Schularick and Taylor (2012) and Gourinchas and Obstfeld (2012) for further support of this view

9. Demirgüç-Kunt and Detragiache (2005).

10. IMF (2011, chap. 3).

11. See Sachs, Tornell, and Velasco (1996), Eichengreen and Rose (1998), Radelet and Sachs (1998), Fernández-Arias and Hausmann (2001), Eichengreen and Arteta (2002), and Mendis (2002).

12. Sachs, Tornell, and Velasco (1996).

Valdes, and Landerretche report only a small increase in capital inflows during lending booms, based on data up to 1999.[13] Calderón and Servén, who use quarterly data spanning 1970–2010, find mixed evidence of an association between capital inflows, asset price booms, and lending booms.[14] Mendoza and Terrones find that half of the lending booms in their sample were accompanied by large gross capital inflows.[15]

In contrast, a set of recent papers does find links between rapid capital inflows (termed a surge, bonanza, or boom by different authors) and financial sector instability. For example, Reinhart and Reinhart examine how economies perform during and after capital flow bonanzas and find that they are associated with a higher probability of banking (and other) crises in developing countries, while Caballero finds that surges in net inflows are associated with an increased probability of systemic banking crises.[16] Furceri, Guichard, and Rusticelli find similar results for gross debt inflows.[17] Perhaps most relevant to this paper, Calderón and Kubota find, using a very different methodology, that "bad credit booms" (that is, those that end in a crisis) are related to gross capital inflows.[18] However, these authors do not find strong evidence of a link between credit booms and portfolio inflows.

Putting these results together suggests that while there may be a link from capital inflow booms to lending booms to banking instability, there may also be other channels at work. For example, capital inflow booms may foster a rapid growth in asset prices. Calvo offers an explanation of how capital inflow episodes enhance the liquidity of assets and hence facilitate asset price bubbles.[19] Asset price bubbles, in turn, alter the composition of bank lending, and banks may use assets (including land and housing) as collateral. Banks may then be more vulnerable to a fall in asset prices when the boom subsides, increasing the likelihood of a crisis.

Based on this review, we decided to consider the relation between capital inflow surges and banking instability, while remaining agnostic about the transmission channels.

13. Gourinchas, Valdés, and Landerretche (2001).
14. Calderón and Servén (2012).
15. Mendoza and Terrones (2008).
16. Reinhart and Reinhart (2009); Caballero (2015).
17. Furceri, Guichard, and Rusticelli (2011a). See also Aizenman and Jinjarak (2009) and Sá, Towbin, and Wieladek (2011).
18. Calderón and Kubota (2012).
19. Calvo (2012).

Macroeconomic Instability: Recessions

Another concern is that capital inflow surges could be associated with macroeconomic instability. Clearly, if the inflow surge creates the conditions for a banking crisis, this may well affect macroeconomic stability. Even if there is no banking crisis, however, a lending boom may be followed by a period of required deleveraging as the boom subsides. This deleveraging, if timely enough, reduces the probability of an actual crisis. On the other hand, as discussed above, a capital inflow surge may be associated with a strong rise in asset prices. Here again, even if this does not create the conditions for a banking crisis, it may require a sharp adjustment in the banking sector that provokes a credit crunch and a recession. Moreover, a capital inflow surge may cause the real exchange rate to appreciate.[20] Inflows tend to increase local absorption and increase expenditure on nontraded goods, pushing up their relative prices. Latin America and the Caribbean appear to be more vulnerable than other regions, perhaps in part because inflows have tended to fuel larger increases in consumption relative to investment in the region.[21] Moreover, Reinhart and Reinhart document that fiscal expansion is common during inflow surges across developing countries, exacerbating real appreciations, and Latin America's fiscal expenditures are more procyclical than those of other regions.[22]

The type of capital inflow also appears to matter: foreign direct investment (FDI) is generally targeted to investment projects, while debt and short-term inflows are more likely to finance consumption (both public and private). For example, Combes, Kinda, and Plane estimate that portfolio investment flows have the largest appreciation effect on the exchange rate, at about seven times greater than that of FDI or banking flows.[23]

A further concern is potential Dutch disease, with costs in terms of the loss of manufacturing competitiveness during the boom, especially for

20. Calvo, Leiderman, and Reinhart (1993) also document the sharp appreciation of currencies across the region in the capital inflow boom of the early 1990s. Cardarelli, Elekdag, and Kose (2009) use an index of exchange market pressure and show how Latin American countries faced appreciation pressures during the inflow period of 2004-2007.

21. See Athukorala and Rajapatirana (2003); Calvo, Leiderman, and Reinhart (1994).

22. Reinhart and Reinhart (2009). On Latin America, see Schadler and others (1993); Calvo, Leiderman, and Reinhart (1996); Cardarelli, Elekdag, and Kose (2009).

23. Combes, Kinda, and Plane (2011). Athukorala and Rajapatirana (2003) document that FDI flows to Latin American countries during the 1990s were concentrated in nontraded sectors (such as construction and commercial services), while in Asia they appeared to provide relatively more financing for exports.

high value added goods.[24] Such goods require specific skills, and successful production and exporting may entail significant learning. A real exchange rate appreciation can render manufacturing uncompetitive and thus result in a loss of essential skills. Consequently, the sector's adjustment will be slow and costly after the boom subsides. The effects are quite analogous to those associated with sudden stops. The resultant necessary adjustment is normally characterized by a sharp reduction in imports (with an increase in net exports) and a recession. We are therefore interested in whether capital inflow booms provoke not only banking instability, but also recessions, although again we remain agnostic regarding the potential transmission channels.

Data and Methodology

As discussed above, we consider that focusing only on net flows may limit the analysis, in particular given the importance of gross inflows intermediated through local financial systems as a potential source of financial fragility and a factor affecting economic stability. However, because an inflow surge may also provoke higher outflows, we decided to focus on gross inflows and include outflows as a further explanatory variable.[25]

Following the literature, we define gross inflows as the sum of (i) direct investment in the reporting economy; (ii) the net change in portfolio investment liabilities; (iii) the net change in financial derivatives liabilities; (iv) the net change in other investment liabilities; and (v) the credit items of the capital account.[26] We use a panel of forty-one emerging countries over the period 1980–2005 (see table A1 in the appendix for a list of the countries in the

24. Dutch disease refers to the effects of the economic boom in Holland that resulted from a large find of natural gas in the North Sea in the 1950s. This provoked strong export earnings, an appreciation of the real exchange rate, and a loss in the competitiveness of other exports. Once the boom was over, the country was left with reduced commodity exports, reduced manufacturing, and soaring unemployment. While Dutch disease was thus originally related to commodity windfalls, similar effects have been argued in relation to capital inflows. See Corden (1984) for a classic reference.

25. Following the usual convention, inflows are here understood as the flows of nonresidents, while outflows are understood as the flows of residents.

26. Outflows are defined using the same concepts, but instead of liabilities we use the country's assets plus the debit items in the capital account.

sample).[27] We also collected data for the period 2006–2010, with which we conduct various out-of-sample simulations.

Defining Inflow Surges

Any study of the effects of inflow surges must address the issue of defining what constitutes a surge, and a concern in this area is the extent to which the results depend on the definition adopted. We decided to use two quite different definitions. The first considers the time series of capital inflows, country by country, and employs the traditional threshold analysis to define an inflow surge. This type of measure is fairly common in the literature. It has the advantage of identifying inflow episodes that are large given an individual country's history, but it means that an inflow surge for one country may be quite different in size from an inflow surge in another country. Moreover, inflows that last several years but remain just below the threshold would not be considered a surge episode under this approach. We therefore decided to also employ a second definition that considers the size of inflow episodes across countries and then defines as surges those episodes with the greatest total capital inflows relative to trend. This definition has not been employed in the literature to date. Interestingly, there is considerable overlap in the surges identified under the two definitions.

One issue with defining a surge is the definition of the underlying trend and whether information across the entire sample (that is, after a particular surge episode) is employed to obtain the definition of that surge. We follow recent authors who avoid the use of entire sample means or other smoothing techniques that include future information. Instead, we employ a Hodrick-Prescott rolling trend using only past data.[28]

In considering the potential dangers of capital inflows, an aggregate measure across the years of a particular episode may be important. For example, receiving inflows just below a threshold for several years may be as dangerous as, or more dangerous than, receiving inflows just above a threshold for one year. Furthermore, countries tend to receive strong inflows in sequential years. Receiving, say, 6 percent of GDP in inflows for three consecutive

27. The sample was selected from the universe of forty-four countries in the J.P. Morgan Emerging Market Bond Index Plus (known as the EMBI+) and includes the forty-one countries that had at least one surge in the time period considered according to our definitions.

28. This follows Cardarelli, Elekdag, and Kose (2009). These authors also add surge episodes based on the 75th percentile of all (whole sample) regional surge episodes.

years may be quite different from receiving those same inflows in three non-consecutive years separated by five years of lower inflows.

To address these issues, we developed a definition of a surge that considers the total size of surge episodes, relative to trend, across countries. We estimated the country trend as described above and then consider all years in which actual inflows are above that trend. We group consecutive years where inflows are above the trend to form episodes and construct a database of all such episodes in our sample. We then define an inflow surge as an episode in which the total associated gross inflows minus the trend (that is, the area between the actual inflows and the trend while the actual inflows are above the trend) is greater than the median of all such episodes. Thus, while we use the country-specific trend to define each inflow episode, our definition of a surge episode is across countries. We refer to this as definition 1 in what follows.

Our second approach is the more traditional measure. We again consider the country-specific trend estimated on past data as described above and define a threshold as one standard deviation of the series above that trend. This is the general approach taken in several recent papers.[29] We then define an inflow surge episode as a group of consecutive years in which this threshold is breached, with inflows of more than 1 percent of GDP in each year. Here again, our unit of analysis is an inflow episode. We refer to this as definition 2 in what follows.

Figure 2 illustrates the two different definitions. To summarize, definition 1 encompasses the set of the largest inflow episodes (measured as the area between the actual inflows and the trend) across countries in the data set. Definition 2 episodes are produced by grouping consecutive years when actual inflows are greater than a threshold, defined as the country-specific trend plus one standard deviation of the historical series, and when inflows are at least one percent of GDP. It is a pure country-by-country measure.

29. For example, Gourinchas, Valdés, and Landerretche (2001) and Cardarelli, Elekdag, and Kose (2009) define a country-specific trend and then apply this type of methodology for the case of net capital flows. Caballero (2015) and Furceri, Guichard, and Rusticelli (2011a, 2011b) also follow this approach. This is also closely related to the methodology adopted in the sudden stop literature. For example, Calvo (1998) and Calvo, Izquierdo, and Mejía (2008) compare annual changes in capital flows to the sample mean. A sudden stop is defined as a fall of more than two standard deviations below the mean, although the episode is defined as starting when the fall in capital inflows is greater than one standard deviation of the series and ending symmetrically. Forbes and Warnock (2012) define a capital inflow bonanza as the opposite, applying a very similar methodology to gross inflows.

FIGURE 2. Definition of Inflow Surge Episodes

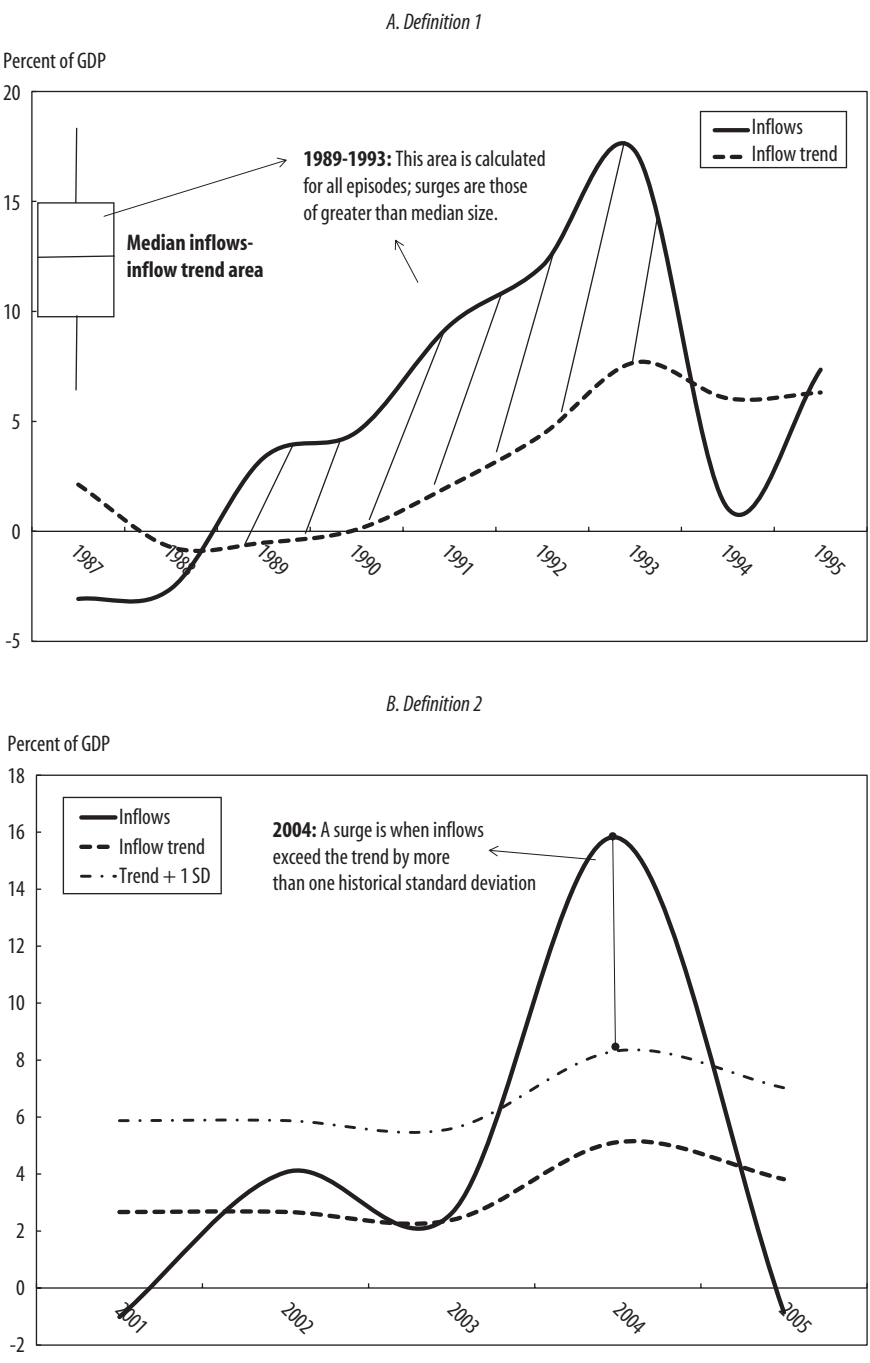
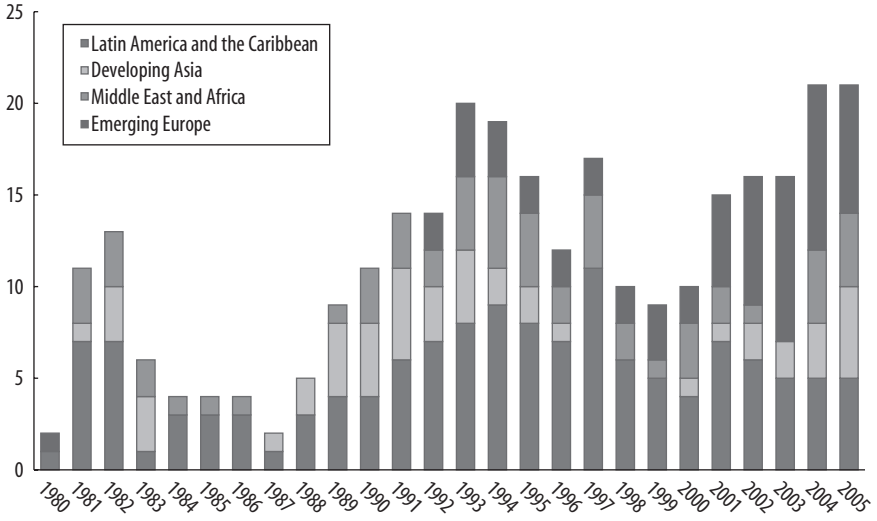


FIGURE 3. Number of Inflow Surge Episodes, by Region



a. The figure reports the number of episodes each year under definition 1. Emerging Europe includes the countries of central an d eastern Europe and the Commonwealth of Independent States.

Capital Inflow Surges in the Data

Applying these two definitions of capital inflow surges, we obtain a reasonable number of inflow episodes to work with. For example, under definition 1, we have 93 inflow surge episodes from 1980 to 2005.[30] Figure 3 plots the number of inflow episodes in each year for definition 1. We find that according to definition 1, surge episodes last 3.2 years, on average, versus 1.8 years under definition 2. However, about 15 percent of surges last five years or more under definition 1 and three years or more under definition 2. As in previous studies, we find some bunching of inflow episodes across time, suggesting that push factors are a large part of the explanation rather than individual country (pull) factors. We find inflow surge episodes in each world region, although Latin America and the Caribbean has the largest share of inflow episodes.

Table 1 gives the total number of inflow episodes by region and also by country within each region, as the number of countries within each region

30. There are sixty-eight capital inflow episodes under definition 2.

TABLE 1. Capital Inflow Episodes
Number of episodes

Definition	*Latin America and the Caribbean*	*Middle East and Africa*	*Emerging Europe*	*Developing Asia*
Definition 1	42	20	16	15
Definition 2	34	13	8	13
Number of countries in sample	15	10	11	8
Average number of episodes per country				
Definition 1	2.8	2.0	1.5	1.9
Definition 2	2.3	1.3	0.7	1.6

differs. Still, Latin America and the Caribbean has more episodes per country than any other region irrespective of the definition employed.

Despite the very different approaches behind these definitions, we find significant overlap between the two in terms of the identified surges. Tables A1 and A2 in the appendix give information on all the inflow surge episodes identified in our sample under each definition. The only inflow surge that we find according to one definition and not at all according to the other is in Chile, where we find a rather long inflow surge according to the first definition, but no inflow surge according to the second. This implies that while capital inflows were above the backward trend for many years (and count as one of the larger inflow episodes in the data), they did not breach the threshold of more than one standard deviation above the trend in any given year. In other cases, we find inflow episodes in overlapping years according to both definitions, although the start or end dates may differ.[31] As is to be expected, the episodes tend to last longer according to the first definition, as there is no requirement that capital inflows breach the threshold in any particular year, conditional on the episodes being large in terms of the total area between actual flows and the trend. Table 2 details how many surge years coincide between these two definitions, showing an overlap of about 80 percent in the whole sample.

We also compared the surges identified according to our definitions with those found in other recent papers. Forbes and Warnock define capital inflow surges in a somewhat analogous fashion to our second definition, although they employ quarterly data, consider four-quarter changes, and use a threshold

31. Moreover given the different methodologies, the measurement of some of the characteristics of the episodes may differ between the two definitions.

TABLE 2. Coincidence of Surge Episodes among Definitions
Percent

Definition	*Definition 2*	*Forbes and Warnock (2012)*	*Ghosh and others (2012), definition 1*	*Ghosh and others (2012), definition 2*	*Average across other papers*
Definition 1	80	73	75	76	75
Definition 2		85	82	83	83

of trend plus two standard deviations.[32] Ghosh and others employ annual data, but they define inflow surges on net flows rather than gross flows.[33] They provide two definitions: a more traditional measure using a threshold and a second using a clustering technique. We find considerable overlap between the surges identified according to our techniques and those identified by these authors. Table 2 gives statistics on the number of years that our definitions coincide with those of Forbes and Warnock and the two definitions employed in Ghosh and others. For our first definition, surge years coincide for about 73 percent of years and for our second, more traditional, definition, the coincidence is about 85 percent of years.[34]

We also considered defining surges based on the components of inflows rather than on total inflows. For example, instead of considering the total inflow series, we took the series of portfolio flows and used the same techniques to identify inflow surges. We also did the same with flows deriving from other investment liabilities, including banking flows. Again, we found considerable overlap between the inflow surges identified. Table 3 illustrates the overlaps. About 77 percent of surge years coincide between total capital inflow surges according to our first definition and inflow surges from other investment liabilities defined in similar fashion. For all of the other combinations between our two definitions and surges defined using portfolio and other investment liability flows, the coincidence of surge years exceeds 70 percent.

32. Forbes and Warnock (2012). They use analogous methods to consider surges, stops, flight, and retrenchment, based on an algorithm that is essentially the same as in Calvo, Izquierdo, and Mejía (2008).

33. Ghosh and others (2012).

34. Forbes and Warnock (2012) use quarterly data; for this table we compute surges according to their definition but using our annual data series. Ghosh and others (2012) employ net capital inflows. Although the data and definitions vary, there is then a high coincidence in surge years.

TABLE 3. Coincidence of Total Inflow Surges and Inflow Surges Defined Using Portfolio and Other Investment Liability Flows
Percent

Definition	*Portfolio flows*	*Other flows*
Definition 1	70.00	77.10
Definition 2	74.00	71.00

The literature also suggests a set of variables that may determine whether a capital inflow surge may result in financial or economic instability. These might be divided into variables that represent capital inflows, macroeconomic variables, and variables that characterize the nature of the financial system intermediating the flows. Regarding the inflows themselves, we focus on measures of the size of the episode and the composition of inflows. Regarding composition, the literature focuses on the magnitude of portfolio debt inflows, which are considered to be potentially volatile and to have poor risk-sharing properties; on the size of banking inflows, particularly given the banks' reliance on external (cross-border) funding in foreign currency; and on portfolio equity flows, given their potentially fickle nature. In terms of macroeconomic variables, we include international reserves, the real exchange rate, and gross outflows (the flows of nonresidents). For the financial system that intermediates the flows, we include credit growth and institutional variables, namely, whether there is an explicit deposit insurance scheme in place.[35] We also include the degree of financial reform and its various components, including the quality of banking supervision.[36] All explanatory variables are measured during the period of the capital inflow surge.[37]

35. The capital flows data are taken from the IMF *International Financial Statistics*; the macroeconomic data are from the World Bank's *World Development Indicators*; and the explicit deposit insurance variable is from Demirgüç-Kunt and Detragiache (2005).

36. These data are taken from Abiad, Detragiache, and Tressel (2008). It would be desirable to include data on the strength of financial systems, such as capital and liquidity. While the IMF Financial Soundness Indices are now one source (see Majnoni and Powell [2011] for the use of these data in another context), they do not cover the longer period necessary to obtain a large enough number of inflow surge episodes for the analysis in this paper.

37. Our aim is to consider the various characteristics of surges that may end in banking crises or recessions, rather than to find the determinants of a surge. We thus do not claim that the explanatory variables are exogenous to the surge, but view them as part of the surge characteristics. Therefore, we choose to work with contemporaneous variables rather than lagging those variables.

Our empirical methodology is to estimate a set of probit models to explain why some capital inflow episodes conclude with a banking crisis or a recession.[38] The dependent variable is a dummy indicating whether or not the capital inflow surge is associated with either of these events. Our unit of analysis for the regressions is a surge episode. While we pay a cost for this in terms of a reduced number of observations relative to a year-by-year type definition, our concern is whether a surge episode ends in a banking crisis or a recession, and we wish to link whether there is a banking crisis or a recession (or not) to each surge episode. An alternative would be a panel approach. However, as surges tend to take place across multiple years, there is a danger of double counting—linking the same banking crisis to multiple surge years that are actually part of the same episode. While such methodologies may appear to have more observations, we believe that our approach is cleaner. As we have fewer observations, we are also setting the bar higher in terms of obtaining significant coefficients and a model that discriminates well between the different outcomes.

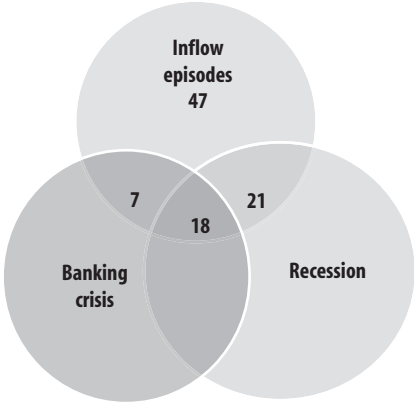
We use Laeven and Valencia's data set on systemic banking crises, and we draw on statistics on real growth from the IMF *International Financial Statistics* to create the recession dummy variable.[39] We follow the rule that if a banking crisis or recession occurs within a period of up to two years after the end of a capital inflow surge, then it is associated with that capital inflow surge. We do not include any banking crises or recessions that commence before the capital inflow surge commences. As an illustration, taking definition 1 of the capital inflow surges, we find that 47 of the 93 episodes do not end in either a recession or a banking crisis, 25 end in a banking crisis, 39 end in a recession, and 18 end in both a banking crisis and a recession. These statistics are illustrated in figure 4. We start from a common general specification for the probit estimations, although some variables are aggregates. We are also interested in identifying which specific variables are most significant within those aggregates. To do this, we eliminate variables following a standard reduction procedure that considers the statistical significance of the variable and the relevant statistics regarding how the model fits the data.[40] As

38. We do this separately for banking crises and for recessions. However, we experiment by testing a banking crisis as an explanatory variable in some of the specifications for recessions. It is always significant, but endogeneity is a concern in that the banking crisis may have been caused by the recession. We therefore prefer to employ specifications without the banking crisis in the model for recessions and without recessions in the model for banking crises.

39. Laeven and Valencia (2008).

40. For an explanation of probit regressions, see, for example, Maddala (1983).

FIGURE 4. The Number of Inflow Episodes and Economic Outcomes



is commonplace in such econometric exercises, there is no single accepted model-reduction strategy. We thus present several models, although there is considerable consistency across the models in terms of the statistically significant coefficients.[41]

Results

Tables 4 and 5 provide summaries of the econometric results. In each of the tables below, the first three columns pertain to the first definition of inflow surges and the second group of columns to the second definition. As discussed above, our decision to work with surge episodes and categorize whether each episode is associated with a banking crisis or recession implies fewer observations than in a more standard annual panel approach. This sets a higher bar in terms of finding significant results. On the other hand, this is a cleaner methodology, as surge episodes do indeed appear to be multi-year events.

We run the same specifications for the two definitions, and the results are broadly consistent. The first column of each group represents a general

41. The first columns of our tables are comparable general specifications. The reduction strategy adopted inevitably results in models that are somewhat different in terms of the remaining variables. Moreover, where the disaggregated variables are considered, the sample size may change since some variables are not available for some periods. We tried other experiments (not reported) to check that these changes in the sample do not affect the main results.

TABLE 4. Results of Probit Estimations for the Probability of a Banking Crisis

	Definition 1				*Definition 2*				
Explanatory variable	*I*	*II*	*III*	*IV*	*I*	*II*	*III*	*IV*	*V*
Inflow surge	0.053**	0.028	0.011		0.030	−0.155	−0.036		−0.010
	(0.025)	(0.028)	(0.024)		(0.051)	(0.133)	(0.038)		(0.082)
Banks/ Inflows		0.464**	0.367*	0.403***		0.787	0.142	0.231	
		(0.224)	(0.223)	(0.195)		(0.620)	(0.656)	(0.484)	
Portfolio/ Inflows		0.589**	0.518*			1.918**	1.344***		
		(0.262)	(0.302)			(0.901)	(0.399)		
Portfolio equity/ Inflows				0.280				0.095	−4.634
				(0.641)				(0.934)	(2.961)
Portfolio debt/ Inflows				0.526*				1.615***	1.548**
				(0.274)				(0.589)	(0.764)
Financial reform	−2.144**	−3.192***		−3.126***	−3.382***	−3.679**		−2.872***	
	(0.857)	(0.986)		(0.795)	(1.144)	(1.522)		(1.000)	
Banking supervision			−0.943***				−0.991**		−1.519***
			(0.348)				(0.429)		(0.567)
Entry barriers			0.097				0.322		
			(0.199)				(0.243)		
Security markets			0.148				−0.163		
			(0.239)				(0.290)		
Directed credit			−0.224				−0.241		
			(0.210)				(0.260)		
Restrictions on capital account			−0.431*				−0.049		
			(0.229)				(0.250)		

Deposit insurance	0.067	–0.090			0.367	0.265			
	(0.412)	(0.495)			(0.530)	(0.548)			
Outflows	–0.024	–0.042*			0.021	–0.013			
	(0.018)	(0.025)			(0.039)	(0.084)			
Credit growth	–0.439	–0.238			2.444***	3.146*			4.441*
	(0.350)	(0.372)			(0.886)	(1.679)			(2.303)
Reserves growth	–0.582	–0.475			–2.094***	–1.608*			–1.282
	(0.366)	(0.398)			(0.600)	(0.876)			(0.880)
Real exchange rate growth	–0.057	–0.320			1.196	0.837			
	(0.837)	(0.815)			(1.724)	(2.222)			
Summary statistic									
No. observations	70	70	79	77	54	54	59	55	52
Adjusted R^2	0.170	0.310	0.306	0.227	0.381	0.554	0.396	0.319	0.543

*Statistically significant at the 10 percent level.
**Statistically significant at the 5 percent level.
***Statistically significant at the 1 percent level.
Robust standard errors are reported in parentheses.

specification including the size of the episode, financial reform, and a set of macroeconomic controls. In the second column, we consider the composition of inflows, and in the third column we disaggregate financial reform into constituent elements. The specification in column four considers the composition of portfolio flows, dividing them into debt and equity flows. We add a fifth additional specification for the second definition, which considers the composition of portfolio flows with the banking supervision variable rather than the aggregate banking reform variable, which appears to work better in terms of fit.[42]

The main results are as follows. First, while the size of total inflows (the first variable, inflow surge) is not significant, the composition matters, with higher portfolio inflows leading to a higher probability of a banking crisis. Second, financial reform reduces the likelihood of a banking crisis. Third, there is mixed evidence for the importance of the macroeconomic variables. They are not significant at all for the first definition. However, depending on the specification, high credit growth appears to increase the likelihood of a banking crisis, while the increase in reserves appears to be a mitigating factor. There is also no evidence that an explicit deposit insurance scheme increases the probability of a banking crisis. In addition, higher banking inflows appear to increase the probability of a banking crisis across all specifications for the first definition of capital inflow surges.

With regard to which aspects of portfolio inflows and financial reform may be important, the evidence is fairly consistent across the different definitions. Within portfolio inflows, debt inflows appear to be particularly risky, as that variable is significant once portfolio inflows are disaggregated, whereas portfolio equity flows tend not to be significant. For financial reform, the quality of banking supervision is found to be statistically significant in specifications with both definitions. In addition, removing restrictions on the capital account also appears to lower the risk of banking crises in one specification for definition 1.

Our conclusion is that two variables matter the most in terms of lowering the likelihood of a banking crisis: (i) the composition of inflows, where lower portfolio inflows decrease the likelihood of crises, as do lower banking inflows under the first definition; and (ii) higher-quality supervision of the financial system intermediating those capital inflows.[43]

42. The sample size varies across some of these specifications, as we sometimes find that, given episode definitions, we cannot construct all of the relevant variables and hence lose observations. However, we also ran experiments with similar samples, and in general the coefficient values did not change significantly, although standard errors did rise in some cases.

43. We investigate the economic magnitude of these effects below when we consider an out-of-sample simulation.

We now consider the probability of recessions. Table 5 presents a similar set of regressions for the likelihood of a recession conditional on a capital inflow surge. The results of the probit regressions for the likelihood of a recession are quite different from those for a banking crisis. In general, we find fewer significant variables, and there is little evidence that either the size or the composition of the inflows matters for the probability of a recession emerging.[44] For definition 2, there is strong evidence that faster credit growth increases the likelihood of a recession. For the first definition, there is evidence that fast growth in international reserves is a mitigating factor. Again we do not find evidence that a real appreciation increases the likelihood of a recession. In contrast, financial reform appears to reduce the likelihood of a recession, although when we disaggregate this variable, we cannot distinguish clearly which elements of financial reforms are driving the result. All in all, the results are somewhat weaker than those for banking crises, with evidence that some of the macroeconomic variables matter more (reserves or credit growth, depending on the specification) and that financial reform reduces the likelihood of a recession.

Model Fit

To determine whether the models fit the data well and discriminate effectively between outcomes, we consider the receiver operating characteristic (ROC) curves for the probit estimations (see figure 5).[45] The ROC curves illustrate the sensitivity and the specificity of the respective model, where the sensitivity is one minus the fraction of type 1 errors and the specificity is one minus the fraction of type 2 errors. There is then a trade-off between the specificity and sensitivity. The ROC curve illustrates this trade-off and also gives an indication of how well the model discriminates across different economic outcomes. As an example, the ROC curve for one of the probit specifications (definition 2, specification 5) is plotted in figure 4.

In terms of discrimination, if the ROC curve lies on the 45-degree line, then the model does not improve on a pure random draw. On the other hand, if the area under the curve is 1.0, then the model discriminates perfectly between the different outcomes. The area under the ROC curve thus gives an indication of how well the model discriminates across economic outcomes.

44. We may find fewer significant variables due to the lower number of observations.
45. For an explanation of the ROC curve, see Greene and Hensher (2010).

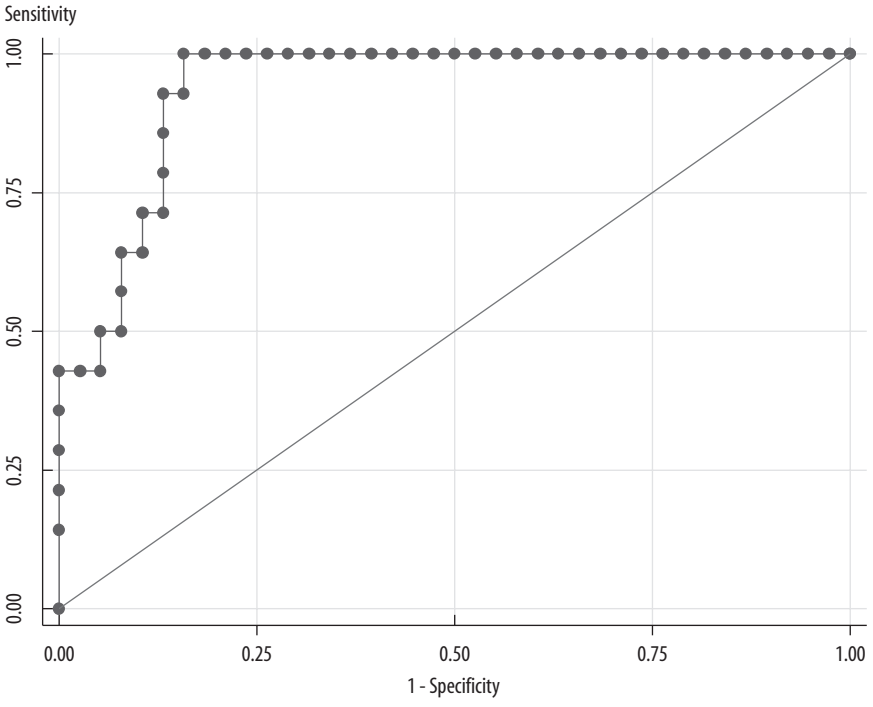
TABLE 5. Results of Probit Estimations for the Probability of a Recession

	Definition 1				*Definition 2*				
Explanatory variable	*I*	*II*	*III*	*IV*	*I*	*II*	*III*	*IV*	*V*
Inflow surge	0.014	0.011	0.002	0.011	−0.012	−0.034	−0.027	−0.037	
	(0.022)	(0.024)	(0.028)	(0.024)	(0.042)	(0.048)	(0.051)	(0.048)	
Banks/ Inflows		−0.103	−0.344	−0.145		0.682	0.178	0.201	
		(0.136)	(0.249)	(0.190)		(0.572)	(0.667)	(0.525)	
Portfolio/ Inflows		0.419	0.265			0.317	0.124		0.321
		(0.255)	(0.266)			(0.397)	(0.393)		(0.333)
Portfolio equity/ Inflows				0.122				−1.159	
				(0.691)				(1.379)	
Portfolio debt/ Inflows				0.464				0.548	
				(0.318)				(0.483)	
Financial reform	−1.883**	−1.780**		−1.591*	−2.948**	−3.341***		−2.456*	−2.802***
	(0.840)	(0.901)		(0.856)	(1.168)	(1.159)		(1.281)	(1.067)
Banking supervision			−1.078***				−0.527		
			(0.323)				(0.380)		
Entry barriers			0.255				−0.141		
			(0.199)				(0.252)		
Security markets			−0.106				−0.041		
			(0.263)				(0.299)		
Directed credit			−0.291				−0.424*		
			(0.203)				(0.241)		
Restrictions on capital account			0.333				−0.045		
			(0.236)				(0.274)		

Deposit insurance	0.229	0.106			0.616	0.741*			
	(0.394)	(0.414)			(0.430)	(0.448)			
Outflows	−0.010	−0.016	0.009	−0.017	0.056	0.048	0.061	0.040	0.049
	(0.016)	(0.017)	(0.022)	(0.018)	(0.044)	(0.043)	(0.048)	(0.045)	(0.039)
Credit growth	−0.203	−0.204	0.112	−0.210	3.069***	3.488***	3.978**	3.127***	3.182**
	(0.278)	(0.282)	(0.294)	(0.293)	(1.089)	(1.231)	(1.580)	(1.207)	(1.252)
Reserves growth	−0.669**	−0.650**	−0.670**	−0.702**	−0.538	−0.209	−0.175	−0.052	−0.321
	(0.299)	(0.295)	(0.281)	(0.301)	(0.686)	(0.652)	(0.673)	(0.662)	(0.518)
Real exchange rate growth	0.886	1.135	1.075	1.150	0.446	−0.088	−0.208	−0.458	
	(0.723)	(0.763)	(0.781)	(0.776)	(1.649)	(1.751)	(1.785)	(1.644)	
Summary statistic									
No. observations	70	70	70	68	52	52	51	48	55
Adjusted R^2	0.135	0.183	0.313	0.195	0.269	0.320	0.314	0.301	0.295

*Statistically significant at the 10 percent level.
**Statistically significant at the 5 percent level.
***Statistically significant at the 1 percent level.
Robust standard errors are reported in parentheses.

FIGURE 5. ROC Curve for a Probit Model of the Probability of a Banking Crisis



Area under the ROC curve = 0.9380.

As shown in the figure, the area under the ROC curve for the graphed specification is 0.94. Table 6 details the area under the ROC curves for the various specifications in tables 4 and 5. A value greater than 0.8 for this area is considered exceptionally good. As the table shows, all the values for banking crises are above this level and some are over 0.9. The models for recession are also near or above 0.8, although these models do not discriminate quite as well as those for banking crises.

A complementary exercise consists in using ROC curves to compare different specifications. We start with a simple model and successively add variables to visualize which variables allow for better discrimination across outcomes. Figure 6 illustrates this exercise for banking crises using the first definition of an inflow surge. Panel A shows the ROC curve for a probit regression of a banking crisis against no banking crisis with total inflows as the only independent variable. Panel B illustrates the ROC curve of a probit when

TABLE 6. Area under the ROC Curves for the Probit Models in Tables 4 and 5

Specification	*Definition 1*	*Definition 2*
Banking crisis (table 4)		
I	0.79	0.86
II	0.85	0.95
III	0.85	0.90
IV	0.81	0.84
V		0.94
Recession (table 5)		
I	0.73	0.82
II	0.76	0.86
III	0.77	0.83
IV	0.86	0.83
V		0.84

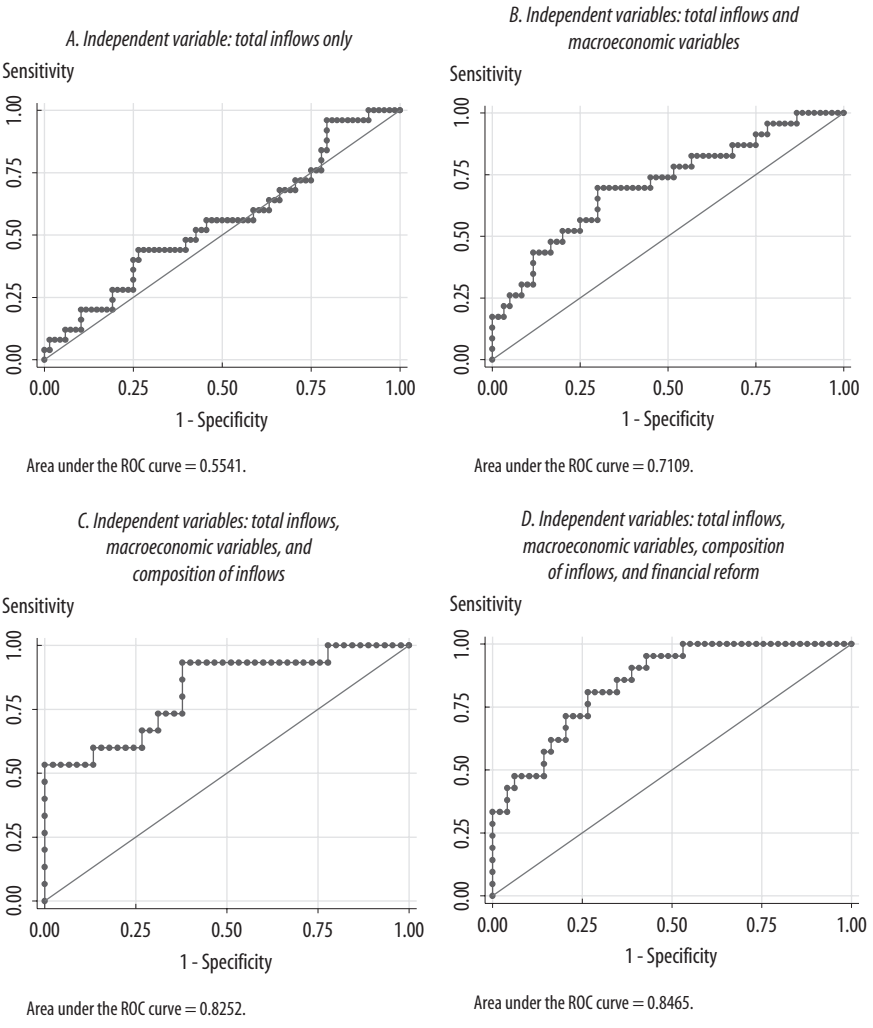
the macroeconomic variables are added—namely, the change in reserves, total outflows, the change in credit, and the change in the real exchange rate. Panel C then adds the composition of inflows (portfolio inflows and banking inflows) as a percentage of total inflows. Finally, panel D is the same specification given in table 4, column 2, which incorporates financial reform and the existence of deposit insurance. As shown in the graphs, total inflows alone add rather little in terms of discriminating power (the area under the ROC curve is 0.55, and 0.50 would be no discrimination). Adding the macroeconomic variables increases the area under the ROC curve by about 16 percent of the maximum possible area, and adding the composition of inflows raises it roughly 11 percent. Incorporating financial reforms adds a further 2 percent of the maximum area, which brings the curve to the 0.85 area found for that specification. Thus, while the macroeconomic variables are generally not individually significant in table 4, they do increase the discrimination power of the probit when added to a very simple model.[46]

Simulations

We now use the model to gauge risks in Latin America given the more recent capital inflow surges. We consider the period 2005–10 and then compare the resulting probability estimates with post-2010 outcomes, which we discuss

46. These results are subject to the usual caveat that model reduction strategies are path-dependent in econometrics. See, for example, Campos, Ericsson, and Hendry (2005) on general-to-specific model reduction strategies.

FIGURE 6. ROC Curves for a Banking Crisis Probit Model: A Simple to Final Specification



below. This simulation also serves to illustrate the economic magnitude of our results. Our procedure is the following. We first calculate how many capital inflow surges have taken place since 2005 given the two definitions we employ in this paper. The result is nine episodes in the region under definition 1 and seven episodes under definition 2. We then take the median values for all of the explanatory variables in the second specification of each definition in

TABLE 7. Simulated Probability of a Banking Crisis and Recession in a Typical Latin American Country and Variations

A. Banking Crisis	*Typical Latin American country*	*Maximum portfolio*	*Maximum banks*	*Minimum financial reform*	*Maximum financial reform*	
Definition 1	0.07	0.15	0.30	0.16	0.01	
Definition 2	0.08	0.69	0.12	0.11	0.01	
B. Recession	*Typical Latin American country*	*Maximum portfolio*	*Minimum financial reform*	*Minimum reserves growth*	*Maximum credit growth*	*Maximum financial reform*
Definition 1	0.38	0.49	0.48	0.47	0.35	0.23
Definition 2	0.24	0.35	0.28	0.25	0.47	0.07

tables 4 and 5.[47] Finally, employing the same second specification of tables 4 and 5, we compute the probability of a banking crisis and the probability of a recession obtained for the median values of the controls. We refer to this simulated case as a typical country in Latin America that had an inflow surge. The results are illustrated in the first column of table 7. We then replace the median value with the worst value in the data for those inflow surges (that is, the value that gives the highest probability of a banking crisis or a recession) for a set of the explanatory variables across the country-surge cases. This gives an idea of the sensitivity of the result to changes in the parameter values. The results are illustrated in the subsequent columns of table 7.

The results suggest a significant probability of a banking crisis (7 percent for a typical Latin American country) and an even higher probability of a recession (between 24 percent and 38 percent, depending on the definition used).[48] The two models for quite different surge definitions give very similar probabilities of banking crises. There is greater variation in the probability of a recession depending on the model.

There is also considerable variation in the probabilities when the median values are replaced with the worst values across the inflows being received by Latin American countries during this inflow episode. In part, this stems from the wide variation in the explanatory variables for the different inflow

47. The second specification includes the composition of inflows and yields the best model fit in most cases.

48. We consider 8 percent to be a relatively high probability of a systemic banking crisis. Basel II is calibrated to a 99.9 percent value at risk or, in other words, the probability of a bank failure in 1 of 1,000 years.

surges across Latin America since 2005. For example, the highest value of the bank flow variable is about two standard deviations (of the whole sample before 2005) above the median for that variable. More generally, as the table shows, replacing the median with these alternative worst values considerably increases the probability of a banking crisis and of a recession. The implication is that different countries experiencing an inflow surge may then be faced with very different probabilities of a banking crisis or a recession depending on the characteristics of the surge episode. In some cases an inflow surge may not constitute a serious cause for concern at all, while in other cases the risks may be relatively high.

At the time of writing, no country in our sample with the exception of Jamaica has suffered a banking crisis following the global crisis. However, the region did face a sharp slowdown in growth. Brazil, in particular, recorded a declining growth rate from 7.5 percent in 2010 with the recovery from the crisis to 2.7 percent in 2011 and 0.9 percent in 2012.[49] Formally, Brazil suffered a recession (defined as two sequential quarters of negative growth) in late 2011 and early 2012.[50] Brazil's post-2005 inflow surge was accompanied by strong credit growth and significant portfolio inflows, raising the probability of both a recession and a banking crisis, respectively. Indeed, one of the rationales of the rapid slowdown in growth in Brazil was the earlier strong expansion of consumer credit (during the inflow surge) and the subsequent implementation of more stringent lending criteria on the part of banks, in response to a rise in household indebtedness and nonperforming loans in that sector. This is consistent with our results: since initial solvency ratios were strong and banks reacted quickly, any serious threat to solvency was avoided (at least among the larger private banks), but this did have an impact on consumer demand and growth. We do not claim here to have predicted the recession in Brazil, and the results of the model are only probabilistic in nature, but they are certainly consistent with that outcome.

A further aspect of our findings is the role of portfolio flows in increasing the probability of a banking crisis according to our econometric results. As discussed in the literature review, the evidence on the link between capital

49. Real annual growth rates are as specified in the IMF World Economic Outlook database.

50. Quarterly growth figures are available from the Inter-American Development Bank's Latin Macro Watch database, available online at www.iadb.org/en/research-and-data/latin-american-and-caribbean-macro-watch,8633.html.

inflow surges, credit growth, and banking crises is quite mixed, and our results suggest that it is portfolio inflows to the economy as a whole that increase the likelihood of a banking crisis, and not inflows that specifically go through the banking system. An interesting question for further research, which goes beyond the scope of this paper, is to pin down the transmission mechanism at play here. One view is that portfolio inflows push up asset prices, perhaps beyond levels warranted by fundamentals, and the banking system may not internalize the risks of a subsequent crash in those prices in terms of either credit risk per se or the value of collateral that lies behind those credits. A second mechanism might be inflation, in that higher inflation (during the boom) tends to provoke greater uncertainty in relative prices, which might increase borrower defaults to the banking system when the boom subsides.

To shed light on these potential mechanisms, we ran statistical tests on the rises in nominal and real stock market prices and inflation during inflow surges that ended in banking crises verses rises in those variables during inflow surges that did not end in banking crises. Our hypothesis was that if the asset price story is valid, then we should find stronger asset price booms during inflow surges that ended in banking crises or, in the case of the inflation story, higher inflation during booms that ended in banking crises.

For definition 2 episodes, we found that stock markets boomed much more in nominal terms during inflow surges that ended in banking crises versus those that did not end in banking crises, with the difference being significant at the 5 percent level. We found no significant difference for real stock market prices or for inflation. For definition 1 episodes, we found inflation was significantly higher (also at the 5 percent level) during booms that ended in banking crises versus booms that did not end in such events and no significant differences in nominal or real stock market prices.

There is thus some evidence in favor of the asset price transmission mechanism and the inflation mechanism although it does not appear particularly strong. Of course, the two mechanisms are not mutually exclusive, so we suggest that there is prima facie evidence that both mechanisms may be at work. This only constitutes partial evidence, however, and further research is warranted.

Some important caveats are in order when interpreting our results more widely. First, our sample ends in 2005, and we have more surges in the 1990s than in the 2000s for Latin America and the Caribbean, although for emerging economies as a whole there were more surges in the early 2000s than in the 1990s. If the nature of surges has changed in some way that we are not

controlling for, either with the inflow composition variables or the macroeconomic controls, then the results may not continue to hold.

The data on financial reform, including banking supervision, end in 2005. Many Latin American countries continued to reform their financial sectors and improve regulation and supervision. Moreover, several countries have introduced new macro-prudential tools or are using those tools more actively. For example, Peru actively increased liquidity requirements on banks both before and after the Lehman Brothers crisis. Brazil introduced several types of macro-prudential measures. Indeed, the fact that there has been no serious threat to the Brazilian financial system, despite an inflow surge weighted heavily toward portfolio and banking flows and the subsequent sharp slowdown in growth, is surely in part due to continued improvements in financial regulation and supervision and other macro-prudential measures. Colombia and Uruguay both introduced dynamic provisioning systems to attempt to smooth credit cycles.[51]

It has not been possible to capture these types of policy changes in our work to date. However, as an indication of how improvements in the financial infrastructure might affect the above probabilities, in the final column of table 7 we replace the median value of the financial reform variable with the best value of financial reform among the nine countries that have been experiencing a capital inflow surge. This reduces the probability of a financial crisis (and that of a recession for definition 1) quite sharply.

Conclusions

In this paper, we defined capital inflow surges and investigated their effects, considering data for emerging economies over the period 1980 to 2005. We found that a considerable number of the surges were associated with a banking crisis, a recession, or both. We developed probit models to attempt to explain why some inflow surges appear to be associated with these negative outcomes, while others ended without problems. In general, we found that the composition of the inflows and the extent of financial reform, and in particular the quality of banking supervision, were significant explanatory factors for

51. See Fernández de Lis and García-Herrero (2013) on the experience of dynamic provisioning in Spain and other countries; see Galindo, Izquierdo, and Rojas-Suárez (2011) on provisioning rules in the Andean countries.

banking crises, while some macroeconomic variables (credit growth or the growth of reserves as a mitigating factor) played an important role in relation to the likelihood of a recession. For the most part, the models discriminated well, although the models for predicting banking crises appeared to be somewhat superior to those for predicting recessions.

Our finding that higher portfolio inflows increase the risk of banking crises suggests that there are other transmission mechanisms at play, rather than only inflows fueling a credit boom. One possible mechanism involves the effect of a boom in asset prices on banks' perceptions of creditworthiness or collateral values. We find complementary evidence that inflow surges that end in banking crises do appear to be associated with much stronger rises in asset prices.

We then applied the models to the post-global-crisis data for Latin America and the Caribbean. Depending on the definition of capital inflow surges, there were between seven and nine episodes. For the typical episode, we found that the model for banking crises estimated an 8 percent probability of a banking crisis, and the model for recessions estimated at least a 24 percent probability of a recession. These are fairly high figures, although there is considerable variation regarding the nature of the inflow surges and the extent of financial reform across these episodes. A caveat to the results is that they do not take into account recent macro-prudential measures by a number of countries to curtail the risks involved.

Our results indicate that there is considerable variation in capital inflow surges in emerging economies. The mere fact that a country today is experiencing a capital inflow surge does not mean that the risks of a banking crisis or a recession are high. Indeed, we find that the size of such a surge conveys little information regarding the risks. Rather, it is the particular nature of the inflow surge that must be analyzed to assess the risks. Our results further suggest that the risks may be mitigated if the financial system has undergone substantial reforms and, in particular, if the quality of banking supervision is high. However, when capital inflows are characterized by large portfolio inflows, particularly portfolio debt inflows and banking inflows, this is indeed a potential cause for concern. For countries in this situation, our results suggest a strong prima facie justification for interventions that may affect the composition of inflows and a clear justification for considering additional financial reforms, including further strengthening of banking sector oversight. These results may go some way toward explaining the quite different reactions to the current capital inflow surge across the region.

Appendix: Supplementary Tables

TABLE A1. Surges Identified in Emerging Economies: Definition 1, 1980–2005

Surge	*Country*	*Start*	*End*	*Surge*	*Country*	*Start*	*End*
1	Argentina	1991	1997	48	Lithuania	2003	2005
2	Belarus	2001	2004	49	Malaysia	1981	1983
3	Belize	1988	1989	50	Malaysia	1989	1993
4	Belize	1999	2003	51	Malaysia	2002	2004
5	Brazil	1981	1982	52	Mexico	1981	1981
6	Brazil	1992	1998	53	Mexico	1990	1993
7	Bulgaria	1992	1994	54	Morocco	1981	1982
8	Bulgaria	1999	2005	55	Morocco	1989	1994
9	Chile	1981	1982	56	Morocco	2004	2005
10	Chile	1984	1985	57	Nigeria	1981	1983
11	Chile	1996	1999	58	Nigeria	1993	1995
12	China	1993	1995	59	Nigeria	1997	1998
13	Colombia	1992	1997	60	Pakistan	2005	2005
14	Colombia	2004	2005	61	Panama	1981	1982
15	Dominican Republic	1984	1986	62	Panama	1985	1986
16	Dominican Republic	1994	1995	63	Panama	1989	1995
17	Dominican Republic	1997	2002	64	Panama	1997	1997
18	Ecuador	1981	1982	65	Panama	2004	2005
19	Ecuador	1990	1992	66	Peru	1982	1982
20	Ecuador	2001	2005	67	Peru	1991	1991
21	Egypt	1997	1998	68	Peru	1993	1997
22	Egypt	2000	2001	69	Philippines	1988	1996
23	Egypt	2004	2005	70	Philippines	2005	2005
24	El Salvador	1988	1989	71	Poland	1993	2000
25	El Salvador	1994	1999	72	Russia	1996	1997
26	El Salvador	2001	2003	73	Russia	2002	2005
27	Gabon	1984	1986	74	Sri Lanka	1982	1983
28	Gabon	2000	2000	75	Sri Lanka	1989	1991
29	Georgia	2001	2005	76	Trinidad and Tobago	1981	1983
30	Ghana	1993	1994	77	Trinidad and Tobago	1993	1994
31	Hungary	1993	1995	78	Trinidad and Tobago	1997	1998
32	Hungary	1998	1999	79	Trinidad and Tobago	2001	2002
33	Hungary	2003	2005	80	Thailand	1987	1991
34	Indonesia	1982	1983	81	Thailand	2004	2005
35	Indonesia	1991	1993	82	Tunisia	1990	1997
36	Indonesia	2005	2005	83	Turkey	1992	1993
37	Ivory Coast	1981	1983	84	Turkey	2002	2005
38	Ivory Coast	1995	1995	85	Ukraine	2001	2005
39	Ivory Coast	2004	2005	86	Uruguay	1981	1982
40	Jamaica	1980	1980	87	Uruguay	1986	1989
41	Jamaica	1984	1984	88	Uruguay	1994	1997
42	Jamaica	2000	2005	89	Uruguay	2000	2001
43	Jordan	1990	1991	90	Uruguay	2003	2005
44	Jordan	1994	1997	91	Venezuela	1990	1993
45	Jordan	1999	2002	92	Venezuela	1997	1999
46	Jordan	2004	2005	93	Vietnam	2000	2005
47	Kazakhstan	2001	2004				

TABLE A2. Surges Identified in Emerging Economies: Definition 2, 1980–2005

Surge	*Country*	*Start*	*End*	*Surge*	*Country*	*Start*	*End*
1	Argentina	1991	1993	35	Morocco	1990	1990
2	Belarus	2002	2002	36	Nigeria	1993	1995
3	Belize	1999	2000	37	Pakistan	2005	2005
4	Brazil	1992	1993	38	Panama	1981	1981
5	China	1994	1994	39	Panama	1985	1985
6	Colombia	1993	1997	40	Panama	1989	1989
7	Colombia	2005	2005	41	Panama	1990	1994
8	Dominican Republic	1995	1995	42	Peru	1982	1982
9	Dominican Republic	1999	1999	43	Peru	1991	1991
10	Ecuador	1990	1991	44	Peru	1994	1995
11	Ecuador	2001	2002	45	Philippines	1982	1982
12	Egypt	1997	1998	46	Philippines	1989	1996
13	Egypt	2005	2005	47	Philippines	2005	2005
14	El Salvador	1989	1989	48	Russia	1997	1997
15	El Salvador	1995	1998	49	Russia	2003	2003
16	Gabon	2000	2000	50	Sri Lanka	1982	1982
17	Ghana	1993	1993	51	Trinidad and Tobago	1993	1994
18	Hungary	1995	1995	52	Trinidad and Tobago	1997	1998
19	Indonesia	1993	1993	53	Thailand	1989	1989
20	Indonesia	2005	2005	54	Thailand	2004	2005
21	Ivory Coast	1995	1995	55	Tunisia	1980	1982
22	Jamaica	1984	1984	56	Tunisia	1990	1994
23	Jamaica	2001	2001	57	Turkey	1993	1993
24	Jamaica	2004	2005	58	Turkey	2004	2005
25	Jordan	1991	1991	59	Ukraine	2005	2005
26	Jordan	1995	1995	60	Uruguay	1982	1982
27	Jordan	1999	2000	61	Uruguay	1987	1989
28	Jordan	2005	2005	62	Uruguay	1995	1996
29	Lithuania	2005	2005	63	Uruguay	2000	2001
30	Malaysia	1983	1983	64	Uruguay	2003	2005
31	Malaysia	1989	1993	65	Venezuela	1982	1982
32	Malaysia	2004	2004	66	Venezuela	1987	1987
33	Mexico	1981	1981	67	Venezuela	1990	1992
34	Mexico	1990	1993	68	Venezuela	1997	1998

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