

## Special Feature B

# Capital Flow Waves

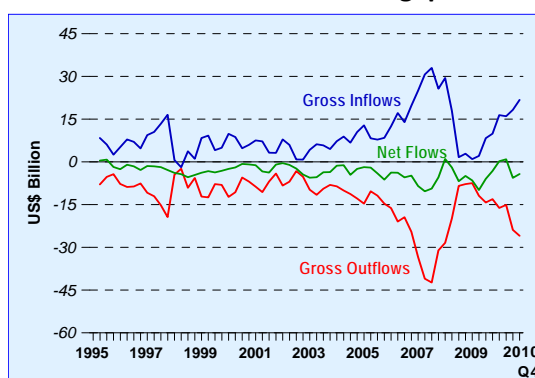
by Kristin J. Forbes and Francis E. Warnock<sup>1</sup>

## Introduction

Many countries experienced extreme movements or “waves” of international capital flows in the 1980s and 1990s, and capital flow volatility have increased even more in the past decade. Capital flows dried up in late 2001, surged throughout the mid-2000s, contracted sharply during the Global Financial Crisis, and then rebounded quickly in 2010. Waves in capital flows can have widespread economic consequences, such as amplifying economic cycles, increasing financial system vulnerabilities, and aggravating overall macroeconomic instability. In a new research project, summarised in this article, we attempt to better understand what causes the major ebbs and flows of international capital.<sup>2</sup> This project synthesises an existing academic literature on “sudden stops”, “surges” or “bonanzas”, and capital “flight”, and introduces additional dimensions to this literature that generate important new results and insights for

policy formulation. Almost all previous work on capital flow episodes relied on proxies for *net* capital flows, which cannot differentiate between changes in foreign and domestic behaviour. In contrast, we focus on *gross* capital inflows and outflows, distinguishing capital movements initiated by foreigners and domestic investors. The differentiation between gross inflows and gross outflows is important. Foreign and domestic investors can be motivated by different factors and respond differently to various policies and shocks. Policymakers might also react differently based on whether episodes of extreme capital flow movements are instigated by domestic or foreign sources. Analysis based solely on net flows, while appropriate a few decades ago, would miss the dramatic changes in gross flows that have occurred over the past decade and ignore important information contained in the flows. (Chart 1)

**Chart 1**  
**Net and Gross Flows for Singapore**



Note: Data are two-quarter moving averages in US\$ billion and in BOP terms (that is, inflows are positive and outflows are negative).

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<sup>2</sup> For more information on this project and details on the analysis and results, see Forbes and Warnock (2011).

## Measuring Extreme Capital Flow Episodes

Our methodology builds on the traditional measures of sudden stops and capital flow bonanzas, but with three fundamental changes. First, we use data on actual flows instead of current-account-based proxies for flows. Second, we use data on gross flows from the outset to identify episodes, rather than relying on proxies for net flows.<sup>3</sup> Finally, we analyse both large increases and large decreases of both inflows and outflows, instead of just focusing on increases or decreases, in order to improve our understanding of all types of capital flow episodes. More specifically, we use quarterly gross flows data to identify four types of episodes:

- “Surges”: a sharp increase in gross capital inflows;
- “Stops”: a sharp decrease in gross capital inflows;
- “Flight”: a sharp increase in gross capital outflows; and
- “Retrenchment”: a sharp decrease in gross capital outflows

The first two types of episodes—surges and stops—are driven by foreigners while the last two—flight and retrenchment—are driven by domestic investors.

We calculate y-o-y changes in four-quarter gross capital inflows and outflows and define episodes using three criteria: (1) current y-o-y change in four-quarter gross capital inflows or outflows is more than two standard deviations above or below the historic average during at least one quarter of the episode; (2) the episode lasts for all consecutive quarters for which the y-o-y change in annual gross capital flows is more than one standard deviation above or below the historical average; and (3) the length of the episode is greater than one quarter.<sup>4</sup>

To provide a more concrete example of our methodology, consider the calculation of surge and stop episodes. Let  $C_t$  be the four-quarter moving sum of gross capital inflows (GINFLOW) and compute annual y-o-y changes in  $C_t$ :

$$C_t = \sum_{i=0}^3 \text{GINFLOW}_{t-i}, \quad t = 1, 2, \dots, N \quad (1)$$

and

$$\Delta C_t = C_t - C_{t-4}, \quad t = 5, 6, \dots, N \quad (2)$$

Next, compute rolling means and standard deviations of  $\Delta C_t$  over the last five years. A “surge” episode is defined as starting in the first quarter  $t$  that  $\Delta C_t$  increases more than one standard deviation above its rolling mean. The episode ends once  $\Delta C_t$  falls below one standard deviation above its mean. In addition, in order for the entire period to qualify as a surge episode, there must be at least one quarter  $t$  when  $\Delta C_t$  increases at least two standard deviations above its mean. A “stop” episode, defined using a symmetric approach, is a period when  $\Delta C_t$  falls one standard deviation below its mean, provided they reach two standard deviations below at some point. The episode ends when  $\Delta C_t$  is no longer at least one standard deviation below its mean. Episodes of “flight” and “retrenchment” are defined similarly, but using gross outflows (excluding reserve accumulation) rather than gross inflows, and taking into account that in balance of payments (BOP) accounting terms, outflows by domestic residents are reported with a negative value. (In other words, when domestic investors acquire foreign securities, in BOP accounting terms, gross outflows are negative.)

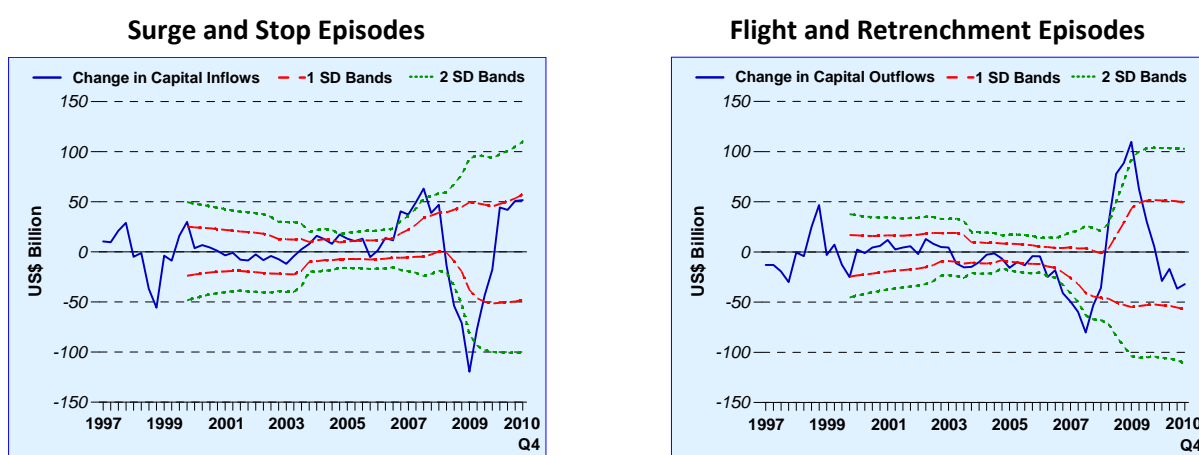
<sup>3</sup> Gross capital inflows are net purchases of domestic assets by foreign investors and gross outflows are net purchases of foreign assets by domestic investors.

<sup>4</sup> Summing capital flows over four quarters is analogous to the traditional literature’s focus on one year of flows and also eliminates the impact of seasonal fluctuations. The historical average and standard deviation are calculated over the last five years (20 quarters), which means that our episodes are always defined relative to the recent past.

Chart 2 shows our identification of episodes for Singapore; inflows (and, hence, surges and stops) are in the left panel, while outflows (flight and retrenchment) are in the right panel. Quarterly BOP data for Singapore are available from 1995. As our episode definitions require six years of data, we can only identify episodes beginning in 2001. In the left panel, the solid line is the change in annual gross capital inflows as defined in equation (2). The dashed lines are the bands for mean capital inflows plus or minus one standard deviation, and the dotted lines are the comparable two-standard-deviation bands. In the right panel, the solid line is the change in annual gross capital outflows, with the corresponding one- and two-standard-deviation lines.

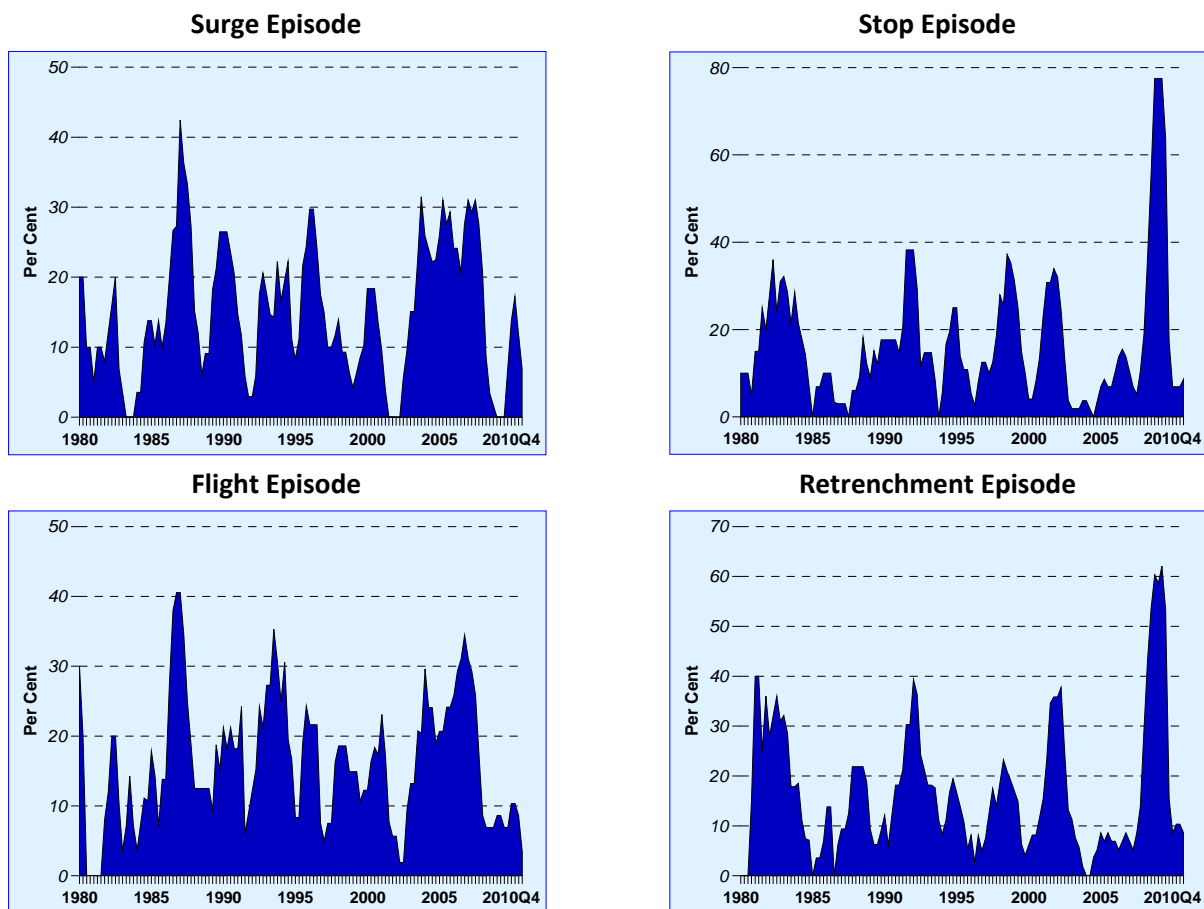
According to these criteria, Singapore had roughly simultaneous surge and flight episodes in late 2006 and 2007, and simultaneous stop and retrenchment episodes during the peak of the Global Financial Crisis (GFC).<sup>5</sup> Singapore was not alone in experiencing such episodes during these periods. Chart 3 shows the evolution of the incidence of each type of episode across 58 countries from 1980–2009 and shows that an elevated number of countries had surges and flight during the bubble years that preceded the GFC, and that an unprecedented number of countries experienced stops and retrenchment during the crisis. Indeed, in the fourth quarter of 2008, 78% of our sample of 58 countries experienced a sudden stop. However, over time Singapore has had relatively fewer episodes of extreme capital flow movements than other countries, although the shorter time series of quarterly data on Singapore's capital flows makes comparisons with other countries difficult.

**Chart 2**  
**Construction of Episodes for Singapore**



<sup>5</sup> More specifically, Singapore had a surge episode from Q4 2006 to Q1 2008 and a flight episode from Q2 2006 to Q4 2007. Singapore had stop and retrenchment episodes from Q2 2008 to Q2 2009.

**Chart 3**  
**Proportion of Countries with Each Type of Episode**



## What Drives Extreme Capital Flow Episodes?

Chart 3 suggests that global and possibly regional contagion factors are important in causing episodes of extreme capital flows. We confirm this with empirical tests. Theoretical and empirical research suggests that a parsimonious list of the possible determinants of capital flow waves would include global factors such as global risk, liquidity, interest rates, and growth; contagion through trade linkages, financial linkages, and geographic location; and domestic factors such as a country's financial market development, integration with global financial markets, fiscal position, and growth shocks. We estimate a probit-like model of the conditional probability of having a surge, stop, flight, or retrenchment episode in a given quarter (using the episodes as defined above).

Our results are substantially different than earlier work which focused only on extreme movements

in net capital flows instead of disaggregating these flows into those driven by foreign and domestic investors. We find an important role for global factors, especially risk, in explaining capital flow waves. Higher levels of global risk are negatively correlated with surges and flight and positively correlated with stops and retrenchment. This result holds for a range of episode definitions, estimation frameworks, and the inclusion of other explanatory variables and risk measures. Broad measures of risk that capture both changes in economic uncertainty as well as changes in risk aversion are positively correlated with stop and retrenchment episodes and negatively correlated with surges. Measures that isolate changes in risk aversion are positively and significantly related to stops, suggesting that risk aversion (and not just increased economic uncertainty) is an important factor determining stop episodes.

Other global factors help explain some types of episodes: global economic growth helps explain the two episodes driven by foreigners—higher global growth is positively correlated with surges and negatively correlated with stops—and global interest rates are positively correlated with retrenchment and stop episodes. Contagion also matters for certain episodes. In particular, contagion, especially through financial linkages, is an important factor causing investors to stop investing abroad and return money home (stop and retrenchment episodes), but less important in causing domestic or foreign investors to send money abroad. Contagion through trade flows is also important in explaining retrenchments.

In contrast to the significant results for the global and contagion factors, domestic factors are usually not significant in explaining extreme capital flow episodes. When the domestic economy is growing strongly, stops are less likely and surges are more likely. No other domestic variable, however, is robustly significant. Extreme capital flow episodes appear to be driven primarily by global factors (especially risk) and through contagion rather than by domestic factors.

## Sum-up

Our results on the importance of global, contagion, and domestic effects in causing extreme movements in capital flows have important implications for economic policy. Capital flow volatility can have substantial economic costs, especially in emerging economies. Past work finds that surges are correlated with real estate booms, banking crises, debt defaults, inflation, and currency crises, and that sudden stops are correlated with currency depreciations, slower growth, and higher interest rates. For policymakers hoping to reduce these vulnerabilities and mitigate negative outcomes, a clear identification of episodes and an understanding of their causes is vital.

## Reference

Forbes, K, and Warnock, F (2011), “Capital Flow Waves: Surges, Stops, Flight and Retrenchment”, *NBER Working Paper* No. 17351.

Just as noteworthy as the significant variables are those that are usually insignificant. In particular, there is no evidence that capital controls reduce a country’s likelihood of having a surge or stop episode, and therefore controls do not seem to reduce the extreme volatility of foreign capital flows. Given the recent interest in capital controls in many countries, we further examined this result by utilising several different measures: a broad *de facto* measure of financial integration (the sum of foreign assets and liabilities divided by GDP), a broad measure of capital account restrictions only available from 1995–2005, measures that focus specifically on controls on just inflows or outflows, and new indices that measure controls in the financial sector and regulations on foreign exchange. We find that no matter how we measure capital controls, they do not appear to reduce a country’s likelihood of having a surge or stop episode. Also noteworthy is that global liquidity does not affect the probability of extreme capital flow episodes.

Our results suggest that many domestic factors have only a limited effect on capital flow volatility. We find no evidence that capital controls can insulate an economy against capital flow waves. As a result, governments concerned about the effects of capital flow volatility should prioritise strengthening their country’s ability to withstand this volatility rather than trying to reduce it. Finally, the results indicate a significant role for global factors and contagion in driving episodes, suggesting an important role for global institutions and cross-country cooperation in reducing capital flow volatility.