DOCUMENTOS DE TRABAJO

Capital Debt -and Equity- Led Capital Flow Episodes

Kristin J. Forbes
Francis E. Warnock

N.º 676 Agosto 2012

BANCO CENTRAL DE CHILE

DOCUMENTOS DE TRABAJO

Capital Debt -and Equity- Led Capital Flow Episodes

Kristin J. Forbes
Francis E. Warnock

N.º 676 Agosto 2012

BANCO CENTRAL DE CHILE

BANCO CENTRAL DE CHILE

CENTRAL BANK OF CHILE

La serie Documentos de Trabajo es una publicación del Banco Central de Chile que divulga los trabajos de investigación económica realizados por profesionales de esta institución o encargados por ella a terceros. El objetivo de la serie es aportar al debate temas relevantes y presentar nuevos enfoques en el análisis de los mismos. La difusión de los Documentos de Trabajo sólo intenta facilitar el intercambio de ideas y dar a conocer investigaciones, con carácter preliminar, para su discusión y comentarios.

La publicación de los Documentos de Trabajo no está sujeta a la aprobación previa de los miembros del Consejo del Banco Central de Chile. Tanto el contenido de los Documentos de Trabajo como también los análisis y conclusiones que de ellos se deriven, son de exclusiva responsabilidad de su o sus autores y no reflejan necesariamente la opinión del Banco Central de Chile o de sus Consejeros.

The Working Papers series of the Central Bank of Chile disseminates economic research conducted by Central Bank staff or third parties under the sponsorship of the Bank. The purpose of the series is to contribute to the discussion of relevant issues and develop new analytical or empirical approaches in their analyses. The only aim of the Working Papers is to disseminate preliminary research for its discussion and comments.

Publication of Working Papers is not subject to previous approval by the members of the Board of the Central Bank. The views and conclusions presented in the papers are exclusively those of the author(s) and do not necessarily reflect the position of the Central Bank of Chile or of the Board members.

Documentos de Trabajo del Banco Central de Chile
Working Papers of the Central Bank of Chile
Agustinas 1180, Santiago, Chile
Teléfono: (56-2) 3882475; Fax: (56-2) 3882231

Documento de Trabajo
N° 676

Working Paper
N° 676

CAPITAL DEBT- AND EQUITY-LED CAPITAL FLOW EPISODES*

Kristin J. Forbes
MIT-Sloan School of Management
and NBER

Francis E. Warnock
University of Virginia-Darden and
NBER

Abstract

Kristin Forbes and Francis Warnock's "Capital Flow Waves: Surges, Stops, Flight, and Retrenchment," in Journal of International Economics (forthcoming) identifies episodes of extreme capital flow movements—surges, stops, flight, and retrenchment—and finds that global factors, especially global risk, are significantly associated with extreme capital flow episodes whereas domestic macroeconomic characteristics and capital controls are less important. That analysis leads naturally to the question of which types of capital flows are driving the episodes, and if debt- and equity-led episodes differ materially. After identifying debt- and equity-led episodes, we find that most episodes of extreme capital flow movements around the world are debt-led and the factors associated with debt-led episodes are similar to the factors behind episodes identified with aggregate capital flow data. In contrast, equity-led episodes are less frequent, more idiosyncratic, and differ in nature from other episodes.

Resumen

En el trabajo de Kristin Forbes y Francis Warnock "Capital Flow Waves: Surges, Stops, Flight, and Retrenchment" Journal of International Economics (por aparecer) se identifican episodios extremos de cambios en los flujos de capital –aumentos, cortes, movimientos, y reducciones– y se encuentra que hay factores globales, en especial el riesgo global, que están significativamente asociados con episodios extremos de flujos de capital, mientras que las características macroeconómicas internas y los controles de capital son menos importantes. Este análisis lleva naturalmente a la pregunta de qué tipo de flujo de capital está impulsando los episodios, y si los episodios debidos a deuda y capital difieren en forma significativa. Después de identificar los episodios atribuibles a la deuda y el capital, en este trabajo encontramos que la mayoría de los episodios extremos de cambios en los flujos de capital de todo el mundo son impulsados por deuda, y los factores encontrados son similares a los de los episodios identificados con datos agregados de flujos de capital. Por el contrario, los episodios debidos al capital son menos frecuentes, más idiosincrásicos, y difieren en su naturaleza de otros episodios.

* Paper presented at the Central Bank of Chile 2011 Annual Conference, November 17-18, 2011. We thank for helpful comments and conversations José De Gregorio, Ramon Moreno, Carmen Reinhart, and participants at the Central Bank of Chile Annual Conference. Vahid Gholampour provided research assistance. The authors thank the Central Bank of Chile for generous support. Emails: kjforbes@mit.edu and warnockf@darden.virginia.edu.

1. Introduction

Forbes and Warnock (2012) helped to switch the focus of studies of extreme capital flow movements toward the use of data on gross inflows (mainly driven by foreigners) and outflows (mainly driven by domestics) rather than relying on net flows (the sum of the two). The old focus on net flows is understandable; in the early and mid-1990s net capital inflows roughly mirrored gross inflows, so the capital outflows of domestic investors could often (but not always) be ignored and changes in net inflows could be interpreted as being driven by changes in foreign flows. More recently, however, as the size and volatility of gross flows have increased while net capital flows have been more stable, the differentiation between gross inflows and gross outflows has become more 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 triggered 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 these flows. As domestic investors' flows have become increasingly important, changes in net flows can no longer be interpreted as being driven solely by foreigners. This point was made forcefully in Forbes and Warnock (2012).

One question immediately emerges from the Forbes and Warnock (2012) analysis: To what extent are the extreme episodes of surges, stops, retrenchment, and flight driven by different types of capital flows? This paper tackles this question by dividing up episodes into those that are "debt-led" and those that are "equity-led". For a given episode—for example, consider a surge of inflows—if the increase in flows was mainly through debt (specifically, bonds and banking flows) we identify that episode as a debt-led surge. If in contrast the surge resulted mainly from an increase in equity inflows

(specifically, portfolio equity and FDI), it is an equity-led surge. We use the same approach to define equity- and debt-led stops, retrenchment, and flight.

Our underlying quarterly data on gross inflows and gross outflows is identical to that in Forbes and Warnock (2012). It covers the period from 1980 (at the earliest) through 2009 and includes over 50 emerging and developed economies.[1] Using this database, we document the incidence of each type of episode of extreme capital flow movements over time, by income level and region. We show an unprecedented incidence of stops and retrenchment during the recent Global Financial Crisis (GFC), as investors around the world liquidated foreign investment positions and brought money home. Importantly, we show that the vast majority of extreme capital flow episodes across our sample—80% of inflow episodes (surges and stops) and 70% of outflow episodes (flight and retrenchments)—are fueled by debt, not equity, flows.

Next, the paper shifts to its second goal of understanding the factors that are associated with debt- and equity-led episodes of extreme capital flows. We follow the Forbes and Warnock (2012) analysis here by describing capital flow episodes as being driven by specific global factors, contagion, and/or domestic factors. To a first approximation equity-led episodes appear to be idiosyncratic, bearing little systematic relation to our explanatory variables. Notably, even the risk measures that were highlighted in Forbes and Warnock (2012) as being significantly related to extreme movements in aggregate capital flows have little or no significant relationship with equity-led episodes. In contrast, risk measures are important in explaining debt-led episodes; when risk aversion is high, debt-led surges are less likely and debt-led stops are more likely. Contagion, especially regional, is also important for debt-led episodes. Country-level variables are largely insignificant, except for domestic growth shocks; debt-led stops are more likely in countries experiencing a negative growth shock and debt-led surges are

[1] In some graphs we include 2010 data, but not in empirical analysis because recent years' balance of payments data are subject to substantial revisions.

more likely in countries with a positive growth shock. Capital controls have little or no significance in both equity-led and debt-led episodes, as also found in Forbes and Warnock (2012).

Our key results—that the majority of episodes are debt-led and that debt-led episodes are associated with factors that agree with theory and past work—suggest that understanding debt flows is critically important to understanding extreme capital flow movements. For example, the literature on credit booms (Gourinchas, Valdés, and Landerretche (2001), Mendoza and Terrones (2008)) is an important contribution to understanding sharp movements in capital flows.

The remainder of the paper is as follows. Section 2 focuses on measures of extreme capital flow episodes. It explains our methodology and presents some descriptive statistics. Section 3 discusses the global, contagion, and domestic factors we use to explain the incidence of surges, stops, flight, and retrenchment; explains the estimation strategy; and reports results on the factors associated with debt- and equity-led capital flow waves. Section 4 concludes.

2. Identifying Debt- and Equity-Led Extreme Capital Flow Episodes

This section discusses our measures of debt- and equity-led capital flow episodes and provides a descriptive analysis of the episodes.

2.1 Methodology

Several methodologies can be used to identify capital flow episodes; each has advantages and disadvantages. The traditional approach using proxies for net flows is exemplified in the "sudden stops" (e.g., Calvo et al. (2004)) and capital flow bonanzas (Reinhart and Reinhart, 2009) literature. A number of studies—Faucette, Rothenberg, and Warnock (2005), Cowan and De Gregorio (2007), Cowan, De

Gregorio, Micco, and Neilson (2008), and Rothenberg and Warnock (2011)—facilitated a switch from net flows to gross flows in the examination of extreme capital flow episodes.

In this paper, our methodology closely follows that in Forbes and Warnock (2012), which builds on the traditional measures of sudden stops and capital flow bonanzas but makes three fundamental changes relative to the traditional approach: using data on actual flows instead of current-account-based proxies for flows; using data on gross flows from the outset to identify episodes, rather than relying on proxies for net flows; and analyzing both large increases and large decreases of both inflows and outflows, instead of just focusing on increases or decreases. Forbes and Warnock (2012) is the first to analyze all types of capital flow episodes—driven by foreigners or domestics and when flows sharply increase or decrease.

Our main innovation relative to Forbes and Warnock (2012) is that we delve into the types of flows—debt (including banking) or equity (including FDI)—that are behind the extreme flow episodes. A cursory look at the underlying gross flows data for Chile (Figure 1) suggests that its aggregate gross capital flows are largely (but not entirely) driven by movements in debt flows.

More specifically, we use quarterly gross flows data in a sample of 58 countries over the period from 1980 through 2009 to identify four types of episodes:[2]

- "Surges": a sharp increase in gross capital inflows;
- "Stops": a sharp decrease in gross capital inflows;
- "Flight":[3] 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. For any type of episode, a debt-led episode is one

[2] We start with as broad a sample as possible and only exclude countries that do not have detailed quarterly gross flows data.
[3] "Flight" has also been referred to as "starts", as in Cowan et al. (2008), or "sudden diversification".

in which the debt flows were larger in magnitude than the equity flows. All other episodes are equity-led, in which portfolio equity and FDI flows were the majority of flows during the episode.

We calculate year-over-year changes in four-quarter gross capital inflows and outflows and define episodes using three criteria: (1) current year-over-year changes 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 year-over-year 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.[4]

To provide a more concrete example of our methodology, consider the calculation of surge and stop episodes. Let C_t be the 4-quarter moving sum of gross capital inflows (GINFLOW) and compute annual year-over-year changes in C_t:

$$C_t = \sum_{i=0}^{3} GINFLOW_{t-i} \ , \qquad \text{with} \quad t = 1, 2, \ldots, N \quad \text{and} \tag{3}$$

$$\Delta C_t = C_t - C_{t-4} \ , \qquad \text{with } t = 5, 6, \ldots, N \ . \tag{4}$$

Next, compute rolling means and standard deviations of ΔC_t over the last 5 years. A "surge" episode is defined as starting the first month t that ΔC_t increases more than one standard deviation above its rolling mean. The episode ends once ΔC_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 ΔC_t increases at least two standard deviations above its mean.

[4] Summing capital flows over four quarters is analogous to the literature's focus on one year of flows and eliminates seasonal fluctuations. The historical average and standard deviation are calculated over the last five years. We require that countries have at least 4 years worth of data to calculate a "historic" average.

A stop episode, defined using a symmetric approach, is a period when gross inflows fall one standard deviation below its mean, provided it reaches two standard deviations below at some point. The episode ends when gross inflows are no longer at least one standard deviation below its mean.

Episodes of flight and retrenchment are defined similarly, but using gross private outflows rather than gross inflows, and taking into account that in 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. A sudden flight episode therefore occurs when gross outflows (in BOP accounting terms) fall one standard deviation below its mean, provided it reaches two standard deviations at some point, and end when gross outflows come back above one standard deviation below its mean. A sudden retrenchment episode occurs when gross outflows increase one standard deviation above its mean, providing it reaches two standard deviations above at some point, and ends when gross outflows come back below one standard deviation above its mean.

For any type of episode, a debt-led episode is one in which the change in debt flows was larger in magnitude than the change in equity flows. That is, a debt-led episode is one in which the ΔC_t in equation (4) was driven primarily by a change in debt flows. All other episodes are equity-led, in which portfolio equity and FDI flows were the majority of flows behind the episode.

Our primary source of flow data is the International Monetary Fund's International Financial Statistics (IFS, accessed through Haver Analytics in January 2012) on quarterly gross capital inflows and outflows. There are a number of modifications necessary, however, to transform the IFS flow data into a usable dataset; some are straightforward, whereas others involve detailed inspection of country data and the filling in of gaps using source-country information. The creation of the underlying flows dataset is described in more detail in the Forbes and Warnock (2012) online Appendix A. This online appendix also lists the 58 countries in the resulting sample and the start date for which quarterly capital

flow data is available for each country. In our baseline measure, we define gross capital inflows as the sum of inflows of direct investment, portfolio, and other inflows; gross private capital outflows are defined analogously as the sum of direct investment, portfolio, and other outflows. We also conduct sensitivity tests using alternative measures. In 2007, our sample includes $10.8 trillion of gross capital inflows, capturing 97% of global capital inflows recorded by the IMF.

Figure 2 shows our identification of debt- and equity-led surges and stops for one country (Chile) from 1990 through 2009. The solid line is the change in annual gross capital inflows as defined in equation (4). 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. We classify an episode as a sudden stop if the change in annual capital inflows falls below the lowest line (the two-standard-deviation line) for at least one quarter, with the episode starting when it initially crosses the one-standard-deviation line and ending when it crosses back over the same line. Similarly, we classify an episode as a sudden surge if annual capital flows rise above the highest line (the two-standard-deviation line), with the episode starting when flows initially cross the one-standard-deviation line and ending when they cross back over the same line.

A given episode is debt-led if the change in debt (i.e., bond and banking) flows is larger in magnitude than the change in equity (i.e., portfolio equity and FDI) flows; otherwise the episode is equity-led. The debt-led surges and stops are identified in the figure; non-shaded episodes (i.e., times when the solid line crosses the outermost bands) are equity-led. For example, for Chilean inflows the most recent surge and stop were debt-led, whereas previous inflows episodes were equity-led.

2.2 The Episodes: Debt- and Equity-Led Surges, Stops, Flight, and Retrenchment

Using the quarterly gross flows data and the criteria discussed above, from 1980 through 2009 we identify 167 surge, 221 stop, 196 flight, and 214 retrenchment episodes. Table 1 lists episodes by country and suggests that the Chilean experience, with just as many equity-led as debt-led episodes, is not the norm. Table 2 aggregates the results from Table 1 and reports summary statistics on the incidence of episodes for the full sample and the average length of each episode by income group and region. Table 2 shows that most extreme capital flow episodes around the world are debt-led.[5] In other words, Tables 1 and 2 indicate that the vast majority of episodes of extreme capital flows—80% of inflow episodes and 70% of outflow episodes—are debt-led. Equity-led episodes are, by contrast, relatively infrequent.

3. Global, Contagion, and Domestic Factors

This section provides regression analysis of the relationship between our episodes of debt- and equity-led episodes of extreme capital flows and global, contagion, and domestic factors.

3.1 Estimation Strategy and Variables

Our estimation strategy follows Forbes and Warnock (2012). More specifically, to assess the role of these global, contagion, and domestic variables on the conditional probability of having a surge, stop, flight, or retrenchment episode each quarter, we estimate the model:

[5] We use income classifications in the year 2000 based on GNI per capita as reported by the World Bank, with "lower income" referring to countries classified as "Low income" and "Middle/lower income" by the World Bank, "Middle income" referring to countries classified as "Middle/higher income". "Higher income" refers to countries classified as "High income". We combine lower and middle/lower income into the group "lower income" because there are only four countries in our sample that qualify as lower income based on the World Bank classification. We focus on six regions: North America, Western Europe, Asia, Eastern Europe, Latin America, and Other. The "Other" region is South Africa and Israel.

$$Prob(e_{it} = 1) = F\left(\boldsymbol{\Phi}_{t-1}^{\text{Global}}\mathbf{B}_{\text{G}} + \boldsymbol{\Phi}_{i,t-1}^{\text{Contagion}}\mathbf{B}_{\text{C}} + \boldsymbol{\Phi}_{i,t-1}^{\text{Domestic}}\mathbf{B}_{\text{D}}\right) \quad , \tag{5}$$

where e_{it} is an episode dummy variable that takes the value of 1 if country *i* is experiencing an episode (surge, stop, flight, or retrenchment) in quarter *t*; $\boldsymbol{\Phi}_{t-1}^{\text{Global}}$ is a vector of global factors lagged by one quarter; $\boldsymbol{\Phi}_{i,t-1}^{\text{Contagion}}$ is a vector of contagion variables; and $\boldsymbol{\Phi}_{i,t-1}^{\text{Domestic}}$ is a vector of domestic variables. The appropriate methodology to estimate equation (5) is determined by the distribution of the cumulative distribution function, $F(\cdot)$. Because episodes occur irregularly (83 percent of the sample is zeros), $F(\cdot)$ is asymmetric. Therefore we estimate equation (5) using the complementary logarithmic (or cloglog) framework, which assumes that $F(\cdot)$ is the cumulative distribution function (cdf) of the extreme value distribution. In other words, this estimation strategy assumes that:

$$F(z) = 1 - exp[-exp(z)] \quad . \tag{6}$$

While we estimate each type of episode separately, we use a seemingly unrelated estimation technique that allows for cross-episode correlation in the error terms. This captures the fact that the covariance matrix across episodes is not zero, without assuming a structural model specifying a relationship between episodes. We also cluster the standard errors by country.

Forbes and Warnock (2012) provides a detailed review of the literature on capital flows that motivates the parsimonious set of variables we now use—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 focus on measures that are available over the full

sample period from 1985 to 2009 for most countries in the sample.[6] The variables are discussed in detail below.

3.1.1 Global Variables

For our initial analysis, we measure global risk as the Volatility Index (VXO) calculated by the Chicago Board Options Exchange.[7] This measures implied volatility using prices for a range of options on the S&P 100 index and captures overall "economic uncertainty" or "risk", including both the riskiness of financial assets as well as investor risk aversion. To measure global liquidity we use the year-over-year growth in the global money supply, with the global money supply calculated as the sum of M2 in the United States, Euro-zone, and Japan and M4 in the United Kingdom, all converted into US dollars. Global interest rates are measured using the average rate on long-term government bonds in the United States, core euro area, and Japan. Global growth is measured by quarterly global growth in real economic activity. The last three variables are based on data from the IMF's *International Financial Statistics* (IFS) database.

3.1.2 Contagion Variables

We use three measures to capture contagion effects. The first is a measure of geographic proximity, with a dummy variable equal to one if a country in the same region has an episode. The regions are described above. We also measure contagion through trade linkages (TL) as an export-weighted average of rest-of-the-world episodes:

[6] Most of the variables are available quarterly. For market statistics that are available at a higher frequency, we use quarterly averages. Economic statistics that are only available on an annual basis are calculated by approximating quarterly values based on the annual frequencies. Also, as specified in equation (5) each variable is lagged by one quarter unless noted.
[7] The VXO, as the old VIX is now known, is similar to the VIX. The VIX is calculated using a broader set of prices, but is only available starting in 1990. The correlation between the two measures is 99%, so we focus on the VXO for our baseline analysis to maximize sample size. Section 3.3 discusses alternative measures of risk.

$$TL_{xt} = \frac{\sum_{i=1}^{n} \left(Exports_{x,i,t} * Episode_{i,t} \right)}{\sum_{i=1}^{n} Exports_{x,i,t}} * \frac{Exports_{x,t}}{GDP_{x,t}} \qquad (7)$$

where $Exports_{x,i,t}$ is exports from country x to country i in quarter t from the IMF's Direction of Trade Statistics, $Exports_{x,t}/GDP_{x,t}$ is a measure of country x's trade openness, and $Episode_{i,t}$ =1 if country i had an episode in the quarter. TL_{xt} is calculated for each country x for each type of episode (surge, stop, flight, and retrenchment) in each quarter t.

We also include a measure of financial linkages that is as similar to the trade linkages measure as possible, given the more limited data available on bilateral financial linkages. The measure is based on banking data provided by the Bank of International Settlements and uses the algorithm underlying the analysis in McGuire and Tarashev (2006, 2007). While no measure of financial linkages is perfect, we focus on banking data because it is the only cross-country financial data that is of reasonable quality and widely available across countries and time periods. Let $BANK_{x,i}$ be total bank claims between country x and BIS reporting entity i, where some i are individual countries (the U.S., U.K., Netherlands, and Japan) but for confidentiality reasons other i are groups of countries.[8] Our measure of financial linkages (FL) first computes the GDP-weighted averages of episodes within each group; call this "group episodes", which will vary between zero and one.[9] Then for a country x, FL_x is a $BANK_{x,i}$-weighted average of the "group episodes" multiplied by a financial openness measure ($BANK_x/GDP_x$).

[8] The groupings are: AT CY GR IE PT; BE LU; FR DE IT ES; FI DK NO SE; HK MO SG BH, BS BM KY AN PA; GG IM JE; BR CL MX; TR ZA; TW IN MY KR; and CH AU CA.

[9] The GDP-weighted average of episodes within a group is computed because we do not have the full matrix of bilateral banking claims, just claims vis-à-vis groups (and a few individual countries).

3.1.3 Country Variables

To capture the domestic factors we use five variables. Depth of the financial system is the sum of each country's stock market capitalization divided by GDP from Beck and Demirgüç-Kunt (2009); in robustness tests we use other measures that are only available for smaller samples. Capital controls is a broad measure of the country's capital controls as calculated in Chinn and Ito (2008).[10] This statistic is one of the few measures of capital controls available back to 1985 for a broad sample of countries and we explore the impact of a range of other measures in Section 3.5. Real GDP growth is from the IFS, with the growth shock as the deviation between actual growth and the country's trend growth. Country indebtedness is public debt to GDP from the new database described in Abbas, Belhocine, ElGanainy, and Horton (2010). We also include a control for GDP per capita.[11]

3.2 Main Results

To assess whether global, contagion, and domestic factors are associated with debt- and equity-led surge, stop, flight, and retrenchment episodes, we estimate equation 5 using a complimentary logarithmic framework that includes adjustments for covariances across episodes and robust standard errors clustered by country. Results are in Table 3.

The immediate impression from the results in panel a for Equity-Led Episodes is that very few variables are significant. To a first approximation equity-led episodes appear to be idiosyncratic, bearing little systematic relation to the explanatory variables. Moreover, some of the estimates that are significant do not correspond to the underlying economic theory. For example, both equity-led surges and stops are more likely when global interest rates are low. The one noteworthy significant coefficient

[10] We focus on the KAOPEN measure of capital controls in Chinn and Ito (2008), updated in April 2011. In order to be consistent with other measures of capital controls in the additional tests in Section 3.3, we reverse the sign so that a positive value indicates greater controls.

[11] All country-level variables, except for the index of capital controls, GDP per capita, and the contagion variables, are winsorized at the 1% level to reduce the impact of extreme outliers.

estimate from panel a of Table 3 is that equity-led stops and surges are more likely when a country's trading partners are also experiencing them. It is also worth noting that the risk measures that were highlighted in Forbes and Warnock (2012) as explaining extreme episodes in aggregate capital flows have little or no significant relationship with equity-led episodes.

Risk measures, however, are significant in explaining debt-led episodes in extreme capital flows (panel b). When risk aversion is high, debt-led surges are less likely and debt-led stops are more likely. Contagion, especially regional, is also important for debt-led episodes. For the country-level variables, growth shocks are most important: Debt-led stops are more likely in countries experiencing a negative growth shock and debt-led surges are more likely in countries with a positive growth shock. Capital controls continue to have little or no significance in explaining debt-led episodes, as also documented for equity-led episodes and episodes of aggregate capital flows.

3.3 A Closer Look at Global Risk and Capital Controls

Two results from our baseline analysis of extreme capital flow episodes are the significance of global risk (at least for debt-led episodes) and insignificance of capital controls. This section looks more closely at these results.

The finding that global risk is the most consistently significant factor associated with capital inflow episodes (measured based on gross flows) has important implications for understanding capital flow movements. To better understand this role of risk, we use three different measures of risk (in addition to our baseline measure of the VXO): the VIX, the CSFB Risk Appetite Index (RAI), and the Variance Risk Premium (VRP).[12] The most common measures of risk—such as the VXO and the VIX—

[12] See section 3.1.1 for details on the VXO and VIX, which are nearly identical but cover different time periods. The RAI is the beta coefficient of a cross-sectional regression of a series of risk-adjusted asset price returns in several countries on the past variance of these assets. This calculation is based on 64 global assets, including equities and bonds for all developed countries and major emerging markets. If the beta is positive, the price of riskier assets is rising relative to the price of safer

capture both economic uncertainty as well as risk aversion. The RAI is constructed with the aim of capturing only risk aversion (or risk appetite) while controlling for overall risk and uncertainty. Misina (2003) shows, however, that it may not control for changes in overall risk unless a strict set of theoretical conditions are met. In contrast, the VRP index is based on a less rigid set of assumptions and therefore is a more accurate measure of risk aversion independent of expectations of future volatility (i.e., future risk). A minor disadvantage of the VRP (as well as the VIX) is that it is only available starting in 1990.

Tables 4a and 4b report the estimated coefficients on the risk variable if the base regression reported in Table 3 is repeated with these alternate measures of risk (with the top line replicating the baseline results from Table 3). Focusing first on debt-led episodes (panel a), for inflow episodes the coefficient on risk is highly significant in all but one case. Broad measures of risk (the VXO, VIX and possibly the RAI) 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. The measure that most accurately isolates changes in risk aversion (the VRP) is positively and significantly related to stops and negatively related to surges. This suggests that risk aversion (and not just increased economic uncertainty) is an important factor associated with debt-led stop and surge episodes. For equity-led episodes (panel b), risk matters only for flight, which is less likely when global risk aversion is high. Otherwise, no risk measure is associated with any type of equity-led episode. A key implication from Table 4 is that some of the main results of Forbes and Warnock (2012) for aggregate capital flow episodes are caused by debt-led episodes and not equity-led ones.

---

assets, so risk appetite among investors is higher. For more information, see "Global Risk Appetite Index" a Market Focus Report by Credit Suisse First Boston (February 20, 2004). To simplify comparisons with the other risk measures, we reverse the sign of the RAI. The VRP is the difference between the risk-neutral and objective expectation of realized variance, where the risk-neutral expectation of variance is measured as the end-of-month observation of VIX-squared and de-annualized and the realized variance is the sum of squared 5-minute log returns of the S&P 500 index over the month; see Zhou (2010).

A second key result from the baseline regressions in Table 3 is that a country's capital controls are not significantly related to any type of extreme capital flow episode (except that countries with greater controls are more likely to have flight episodes). This does not support the recent interest in capital controls as a means of reducing surges of capital inflows and overall capital flow volatility. To further explore this result, we use several different measures of capital controls. First, instead of a direct *de jure* measure of capital controls, we use a broad *de facto* measure of financial integration—the sum of foreign assets and liabilities divided by GDP.[13] Second, we consider a broad measure of capital account restrictions from Schindler (2009) that is only available from 1995 to 2005. Third, we use measures of capital account restrictions from the same source and time period, but that focus specifically on controls on just inflows or outflows.[14] Finally, we also use two new indices of capital controls from Ostry, et al. (2011) that measure capital controls in the financial sector and regulations on foreign exchange.

Tables 5a and 5b show the coefficient estimates on each of these capital control measures when we repeat the base regression from Table 3, but use the alternate measure of controls or financial integration (with the top line replicating the baseline results). Capital controls are almost never significant for either debt- or equity-led episodes, except occasionally for flight episodes. More capital account restrictions are associated with more debt-led flight episodes (for some measures of controls) and with fewer equity-led flight episodes (again, for some controls measures). Other than for flight episodes (for which 4 of the 10 coefficients are significant), only one coefficient out of thirty is (marginally) significant. Greater capital controls do seem be associated with a reduction in the probability of having surge or stop episode driven by foreigners–which is an argument made by policymakers to support the use of these controls.

---

[13] The financial integration data is from an updated and extended version of the dataset constructed by Lane and Milesi-Ferretti (2007), available at: http://www.philiplane.org/EWN.html.

[14] For regressions predicting surges and stops we use the index of controls on local purchases and sales, respectively, by nonresidents. For regressions predicting flight and retrenchments we use the index of controls on purchases or sales abroad, respectively, by residents.

4. Conclusions

We extend the analysis in Forbes and Warnock (2012) by separating episodes of extreme capital flows into those driven primarily by debt (i.e., bond and banking) flows and those driven by equity (portfolio equity and FDI) flows. Most episodes around the world—80% of episodes of sharp changes in capital inflows (driven by foreigners) and 70% of episodes of sharp movements in capital outflows (driven by domestics)—result primarily from changes in debt flows.

Risk measures are highly correlated with sudden changes in debt inflows (driven by foreigners), as found for aggregate capital flows in Forbes and Warnock (2012). When risk aversion is high, debt-led surges are less likely and debt-led stops are more likely. Contagion, especially within regions, is also important for debt-led episodes. Among the country-level variables, growth shocks are most important; debt-led stops are more likely in countries experiencing a negative growth shock and debt-led surges are more likely in countries with a positive growth shock. Capital controls are not significantly related to debt-led episodes, as also found in Forbes and Warnock (2012) for episodes based on overall capital flows. In contrast to debt-led episodes, equity-led episodes appear to be idiosyncratic, bearing little systematic relation to our explanatory variables. Notably, even the risk measures that were highlighted in Forbes and Warnock (2012) have little or no significant relationship with equity-led episodes.

Our results indicate that the majority of episodes are debt-led and that debt-led episodes are associated with factors that are in line with theory and past work. Much more work is needed, however, to understand the nature of extreme capital flow episodes, and especially episodes caused by sharp changes in capital outflows (flight and retrenchments).

References

Abbas, Ali, Nazim Belhocine, Asmaa ElGanainy, and Mark Horton. (2010). A Historical Public Debt Database." IMF Working Paper WP/10/245.

Beck, Thortsen and Asli Demirgüç-Kunt. (2009). "Financial Institutions and Markets Across Countries and over Time: Data and Analysis." World Bank Policy Research Working Paper No. 4943.

Calvo, Guillermo, Alejandro Izquierdo, and Luis-Fernando Mejía. (2004). "On the Empirics of Sudden Stops: The Relevance of Balance-Sheet Effects." NBER Working Paper 10520.

Chinn, Menzie and Hiro Ito. (2008). "A New Measure of Financial Openness." *Journal of Comparative Policy Analysis* 10(3): 309-22.

Cowan, Kevin, and Jose De Gregorio. (2007). "International Borrowing, Capital Controls and the Exchange Rate: Lessons from Chile." in *Capital Controls and Capital Flows in Emerging Economies: Policies, Practices and Consequences*, Boston: National Bureau of Economic Research.

Cowan, Kevin, José De Gregorio, Alejandro Micco, and Christopher Neilson. (2008). "Financial Diversification, Sudden Stops and Sudden Starts." in Kevin Cowan, Sebastian Edwards, and Rodrigo Valdés (eds.), *Current Account and External Finance*, Central Bank of Chile.

Faucette, Jillian E., Alexander D. Rothenberg, and Francis E. Warnock (2005). "Outflows-induced Sudden Stops." *Journal of Policy Reform* 8:119-130.

Forbes, Kristin, and Francis E. Warnock. (2012). Capital Flow Waves: Surges, Stops, Flight, and Retrenchment. *Journal of International Economics* (forthcoming).

Gourinchas, Pierre-Olivier, Rodrigo Valdés, and Oscar Landerretche. (2001). "Lending Booms: Latin America and the World." *Economia* 1(2), pgs. 47-99.

Lane, Philip and Gian Maria Milesi-Ferretti. (2007). "The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liabilities, 1970–2004." *Journal of International Economics* 73(November): 223-250.

McGuire Patrick and Nikola Tarashev. (2007). "International banking with the euro." *BIS Quarterly Review* (December).

McGuire Patrick and Nikola Tarashev. (2006). "Tracking international bank flows." *BIS Quarterly Review* (December).

Mendoza, Enrique and Marco Terrones. (2008). "An Anatomy of Credit Booms: Evidence from Macro Aggregates and Micro Data." NBER Working Paper #14049.

Misina, Miroslav. (2003). "What Does the Risk-Appetite Index Measure?," Working Papers 03-23, Bank of Canada.

Ostry, Jonathan, Atish Ghosh, Marcos Chamon, and Mahvash Qureshi. (2011). "Managing Capital Inflows: The Role of Controls and Prudential Policies." IMF mimeo.

Reinhart, Carmen and Vincent Reinhart. (2009). "Capital Flow Bonanzas: An Encompassing View of the Past and Present," in Jeffrey Frankel and Francesco Giavazzi, eds. *NBER International Seminar in Macroeconomics 2008.* Chicago: Chicago University Press.

Rothenberg, Alex and Francis E. Warnock. (2011). "Sudden Flight and True Sudden Stops." *Review of International Economics* 19(3): 509-524.

Schindler, Martin. (2009). "Measuring Financial Integration: A New Data Set." *IMF Staff Papers* 56(1): 222-238.

Zhou, Hao. (2010). "Variance Risk Premia, Asset Predictability Puzzles, and Macroeconomic Uncertainty." Federal Reserve Board, unpublished working paper.

Table 1: Surge, Stop, Flight, and Retrenchment Episodes by Country (1985 to 2009)

Equity-Led Episodes	Surge		Stop		Flight		Retrench	
Argentina							1992q4	1993q2
Australia	1993q4	1994q3	2005q1	2005q4	2006q2	2007q1	2005q1	2005q4
Australia	2006q2	2007q1						
Austria	2005q1	2005q4	2006q1	2006q4	2005q1	2005q4	2006q1	2006q4
Bangladesh	1998q1	1998q3			1995q3	1997q1		
BelLux	1999q3	2000q3	1994q1	1995q1	1999q3	2000q3	1994q1	1995q1
BelLux			2001q4	2002q3	2005q2	2006q1	2001q4	2002q3
Bolivia	1996q1	1996q3			2001q1	2001q2	2004q3	2005q1
Bolivia					2003q3	2004q1		
Brazil	1988q1	1988q4	1995q1	1995q2	1987q4	1988q3	1997q4	1998q2
Canada	2000q1	2001q1	1991q2	1991q3	2000q1	2001q1	2008q4	2009q3
Canada	2006q2	2007q1	2008q4	2009q2	2006q2	2007q1		
Chile	2005q4	2006q3	2000q2	2001q1	2007q2	2008q1	1997q2	1997q3
Chile			2007q1	2007q2			2000q2	2000q4
Colombia	2005q4	2006q3			2006q2	2006q3		
Croatia					2000q1	2000q4		
Croatia					2006q4	2007q3		
CzechRepublic	2002q3	2003q1	2003q2	2004q1			2002q1	2002q3
CzechRepublic			2006q2	2006q4				
Denmark	1993q3	1994q2	1998q3	1999q1	1993q3	1994q2	2001q2	2002q2
Denmark	1995q3	1996q2	2008q4	2009q4			2008q3	2009q4
Estonia							2000q1	2000q2
Finland	1998q4	1999q1	2009q2	2009q3	1998q4	1999q1	2009q1	2009q3
Germany							1990q4	1992q2
Guatemala			1994q4	1995q3	1998q2	1998q3	1988q3	1988q4
Guatemala					1999q1	1999q4	1989q2	1990q1
Guatemala					2001q1	2001q3	2002q2	2002q3
Hungary	2007q2	2008q1	2009q3	2009q4	2001q2	2002q1	2009q3	2009q4
Hungary					2006q1	2008q1		
Indonesia			1997q4	1998q3	2002q3	2003q2	1997q2	1998q3
Indonesia			2006q4	2007q1	2004q1	2005q1	2006q3	2007q1
Indonesia			2009q1	2009q3	2005q3	2006q2		
Ireland	2003q3	2004q2	2001q2	2001q3	1997q4	1998q4		
Ireland					2006q3	2007q2		
Israel	1999q2	2000q1	1998q3	1998q4	1998q1	1998q4	1995q2	1995q3
Israel	2006q1	2006q4	2001q2	2002q2	2006q1	2006q4	2001q2	2002q2
Israel			2007q3	2007q4			2007q3	2009q2
Japan			2006q3	2007q1			1987q4	1988q3
Korea							2005q1	2005q3
Malaysia					2006q2	2007q4		
Mexico					2001q3	2002q2	1991q3	1991q4
Netherlands			2001q2	2001q3	2005q2	2006q2	2001q2	2001q3
Netherlands			2002q1	2002q4			2002q1	2002q4

Equity-Led Episodes	Surge		Stop		Flight		Retrench	
NewZealand	2000q2	2001q1			2000q2	2001q1		
Nicaragua							2002q4	2003q2
Norway					1994q3	1995q3	1987q4	1988q4
Norway							1992q2	1994q1
Norway							1999q2	1999q3
Norway							2001q4	2002q3
Peru			1998q1	1998q2	2003q2	2004q1		
Philippines	1994q2	1994q3	1997q3	1998q4	1991q4	1994q2	1997q3	1998q2
Philippines	1996q1	1997q1			1999q1	1999q2		
Philippines	2005q2	2005q4			2007q1	2007q2		
Poland			2001q4	2002q3	2004q2	2005q1	2002q3	2003q2
Portugal	2003q4	2004q2	1999q3	1999q4	1990q2	1991q2	1989q4	1990q1
Portugal					2003q3	2004q1		
Romania			1999q4	2000q1	2003q4	2004q1		
Romania					2006q4	2007q2		
Russia			2006q2	2006q3				
Slovenia	2002q3	2003q3	2003q4	2004q2	1998q3	1999q2		
Slovenia			2008q3	2009q3				
SouthAfrica	1997q2	1998q1	2007q1	2007q2	1995q3	1996q2	1999q1	1999q2
SouthAfrica	2003q4	2004q4	2008q3	2009q3	1997q2	1998q2	2000q3	2001q1
SouthAfrica	2005q2	2006q2			2003q4	2004q3		
SouthAfrica					2006q1	2006q4		
Spain			1994q2	1995q1				
SriLanka	2000q1	2000q4	1994q2	1994q3	1995q1	1995q3	1993q2	1994q3
SriLanka			1995q4	1996q1			1998q4	1999q1
SriLanka			1998q3	1999q1			2001q4	2002q3
SriLanka			2001q2	2002q1				
Sweden							2001q1	2002q3
Taiwan	1999q2	2000q2			2000q1	2000q4	2008q2	2009q2
Taiwan	2003q3	2004q2			2003q3	2004q1		
Thailand			2008q3	2009q3			1986q4	1988q4
Thailand							2008q1	2009q3
Turkey					2006q4	2007q3		
US			1988q3	1988q4			2001q3	2002q2
US			2001q3	2002q2				
Venezuela	2003q4	2004q1						

Debt-Led Episodes	Surge		Stop		Flight		Retrench	
Argentina	1990q4	1992q3	1989q2	1990q3	1989q3	1990q1	1988q3	1989q1
Argentina	2003q1	2003q4	1994q4	1995q1	1991q2	1992q3	1998q3	1999q2
Argentina			1998q4	1999q3	2002q4	2003q1	2009q2	2009q4
Argentina			2000q4	2002q2	2006q3	2008q3		
Argentina			2008q2	2009q3				
Australia	1995q3	1996q3	1989q3	1991q3	1995q4	1996q3	1989q2	1991q1
Australia	2002q3	2002q4	1997q3	1998q1	2004q1	2004q3	1994q4	1995q2
Australia	2003q4	2004q3	1998q3	1998q4			2003q1	2003q3
Austria	1992q2	1993q1	1996q4	1997q1	1992q2	1993q1	1986q1	1986q2
Austria	1999q2	2000q1	1998q2	1998q3	1997q2	1998q1	1993q3	1993q4
Austria			2001q1	2002q1	1999q2	2000q1	1998q2	1998q3
Austria			2008q3	2009q3			2001q2	2002q1
Austria							2008q4	2009q4
Bangladesh	1989q1	1989q4	1991q3	1992q1	1987q1	1987q3	1992q2	1993q1
Bangladesh	2003q4	2004q1	2006q1	2006q2	1988q2	1989q3	2001q1	2001q4
Bangladesh	2005q1	2005q2			2005q4	2006q3	2009q3	2009q4
Bangladesh					2008q2	2008q4		
BelLux	1987q1	1987q4	1988q2	1989q1	1987q1	1987q4	1988q2	1989q1
BelLux			2008q2	2009q3			2008q2	2009q3
Bolivia	2007q3	2008q4	1995q1	1995q2	1994q1	1994q4	2006q2	2006q3
Bolivia			1999q2	2001q2	2008q4	2009q3		
Bolivia			2006q3	2007q2				
Brazil	1990q2	1991q1	1993q1	1993q3	1994q2	1994q4	1992q1	1992q4
Brazil	1994q1	1994q3	1999q1	1999q2	1998q3	1999q2	1995q2	1996q1
Brazil	1995q4	1996q2	2008q2	2009q3	2006q4	2007q3	2008q2	2008q3
Brazil	2006q3	2007q4						
Canada	1996q4	1997q3	1995q2	1996q1	1986q2	1986q4	1993q2	1993q3
Canada			1999q1	1999q4	1994q2	1994q4	1995q2	1996q1
Canada					1996q3	1997q2	1998q1	1998q3
Chile	2007q4	2008q3	2009q1	2009q3	1998q2	1999q4	2008q3	2009q3
Chile					2006q1	2006q4		
Colombia			2008q2	2009q1			2002q2	2003q1
Colombia							2007q2	2007q3
Croatia	2002q4	2003q4	2004q4	2005q3	2002q4	2003q1	2001q3	2002q1
Croatia							2004q4	2005q4
CzechRepublic			2008q4	2009q3	2003q3	2005q1	2000q1	2000q4
CzechRepublic							2008q4	2009q4
Denmark	2005q1	2005q4	1989q2	1989q4	2005q2	2005q4	1992q2	1993q2
Denmark			1991q4	1993q2			1994q3	1995q1
Denmark			1994q3	1995q1				
Estonia	2003q1	2005q1	1998q3	1999q3	2001q1	2001q2	1998q4	1999q1
Estonia			2008q2	2009q4	2004q2	2005q3	2008q2	2009q3

Debt-Led Episodes	Surge		Stop		Flight		Retrench	
Finland	1987q1	1987q4	1991q1	1992q2	1986q3	1987q1	1987q3	1987q4
Finland	1996q3	1997q3	2001q1	2001q4	1988q3	1989q1	1990q3	1990q4
Finland	2004q3	2004q4			1993q1	1993q3	1992q1	1992q3
Finland	2006q2	2007q1			2004q3	2005q1	2001q1	2001q4
Finland					2006q2	2006q4		
France	1986q3	1987q4	1991q1	1992q1	1986q4	1987q4	1991q2	1992q1
France	1997q4	1998q3	2001q4	2002q3	1992q3	1992q4	2001q4	2002q3
France	2001q1	2001q2	2008q1	2009q3	1997q4	1998q3	2008q1	2009q3
France					2001q1	2001q2		
Germany	1986q1	1986q4	1987q4	1988q3	1986q1	1986q4	1987q3	1988q2
Germany	1989q2	1990q1	1994q1	1994q4	1993q1	1993q4	1994q2	1994q4
Germany	1992q3	1993q2	2001q1	2002q2	2004q3	2005q4	2000q4	2002q2
Germany	2005q1	2005q4	2008q3	2009q3			2008q2	2009q3
Germany	2007q2	2008q1						
Greece	2005q1	2005q4	2006q1	2006q4	2005q1	2005q3	2006q1	2006q4
Greece			2009q2	2009q4				
Guatemala	1987q4	1988q1	2008q4	2009q3	1990q3	1991q2	1991q3	1992q1
Guatemala	2006q1	2006q4			2004q1	2004q4	2008q4	2009q3
HongKong			2008q3	2009q3			2008q3	2009q3
Hungary	2003q1	2003q4	1996q4	1997q1				
Hungary	2004q2	2005q3	2002q2	2002q3				
Iceland	1987q1	1987q4	1989q2	1990q1	1986q3	1987q2	1992q1	1992q3
Iceland	1995q4	1996q4	2001q2	2002q1	1993q2	1993q3	2001q3	2002q2
Iceland	2003q3	2006q1	2008q2	2009q3	1997q3	1998q2	2006q4	2007q1
Iceland					1999q1	1999q4	2008q1	2009q2
Iceland					2003q1	2006q1		
India	1993q4	1994q4	1989q4	1990q4	1990q3	1991q2	1992q1	1992q4
India	1996q2	1997q1	1991q3	1992q1	1995q4	1996q4	1999q2	2000q2
India	2003q3	2004q2	1998q2	1998q3	2000q4	2001q3	2002q1	2002q4
India	2004q4	2005q3	2008q3	2009q3	2004q1	2004q3	2007q4	2008q2
India	2006q4	2008q1			2008q4	2009q2		
Indonesia	1990q3	1991q2	1993q2	1993q3	1993q3	1994q3	2003q3	2003q4
Indonesia	1995q2	1996q3						
Indonesia	2005q4	2006q1						
Ireland	1989q3	1990q2	1991q3	1992q2	1987q2	1988q1	1991q4	1992q2
Ireland	1992q4	1993q4	2008q2	2009q3	1989q3	1990q1	2000q4	2001q3
Ireland	1995q3	1996q3			1992q3	1993q1	2008q2	2009q3
Ireland	1997q4	1999q1			1995q4	1996q3		
Ireland	2006q3	2007q3			2003q3	2004q2		
Israel	1986q3	1987q1	1988q3	1989q2	1986q2	1987q1	1991q1	1991q3
Israel	1989q4	1990q3	1996q3	1996q4	1992q1	1992q3	1993q3	1993q4
Israel			2008q4	2009q2				
Italy	1987q1	1987q3	1991q4	1992q2	1987q1	1987q3	1986q1	1986q2
Italy	1996q1	1997q1	1992q4	1993q3	2003q1	2003q4	1993q1	1993q3
Italy	2003q1	2003q4	1999q1	1999q2	2005q1	2005q4	2000q3	2002q3
Italy	2005q2	2006q1	2000q4	2002q3			2007q3	2008q4
Italy			2007q3	2008q4				

Debt-Led Episodes	Surge		Stop		Flight		Retrench	
Japan	1986q2	1987q3	1990q4	1991q4	1986q1	1987q2	1990q3	1991q3
Japan	1993q4	1995q1	1992q2	1993q1	1993q4	1994q4	1996q3	1996q4
Japan	2000q2	2001q1	1998q1	1999q1	2000q2	2001q1	1998q2	1999q4
Japan			2005q2	2005q3			2008q3	2009q3
Japan			2008q3	2009q3				
Korea	1994q3	1995q4	1997q2	1998q3	1994q2	1995q4	1997q3	1999q1
Korea			2008q1	2009q2	2002q4	2003q3	2008q3	2009q3
Korea					2006q1	2007q4		
Latvia	2003q3	2005q1	2005q3	2005q4	2006q3	2007q4	2005q3	2006q1
Latvia	2006q2	2007q4	2008q3	2009q3			2008q3	2009q2
Lithuania	2004q2	2004q3	2000q4	2001q2	2004q1	2004q4	2001q2	2001q3
Lithuania	2005q4	2006q2	2008q3	2009q4			2008q3	2009q3
Lithuania	2006q4	2008q1						
Malaysia			2005q4	2006q3			2008q3	2009q2
Malaysia			2008q3	2009q2				
Mexico	1989q2	1991q2	1994q4	1995q4	1987q3	1988q2	1992q2	1993q1
Mexico	2007q3	2008q2	2008q4	2009q3	1990q1	1990q4	1997q3	1997q4
Mexico					1993q2	1994q1	2008q4	2009q3
Netherlands	1995q3	1996q2	1990q4	1991q4	1986q2	1987q1	1990q4	1992q1
Netherlands	1997q4	1998q4	2008q1	2009q3	1997q4	1998q4	2008q1	2009q3
Netherlands	2005q2	2006q2						
NewZealand	1986q3	1987q2	1987q4	1988q3	1986q4	1987q2	1986q1	1986q2
NewZealand	2006q3	2007q3	2008q2	2009q3	1989q2	1990q2	1988q1	1989q1
NewZealand					2006q3	2007q3	2005q3	2006q1
Nicaragua			2000q3	2001q2	2001q1	2001q2	1998q1	1998q4
Nicaragua					2001q4	2002q1		
Norway	1992q4	1993q2	1988q3	1989q2	1986q3	1987q3	2007q4	2008q3
Norway	2000q3	2000q4	1991q3	1992q2	2000q2	2001q2	2009q2	2009q4
Norway	2002q4	2003q2	1997q4	1998q1	2005q4	2007q1		
Norway	2005q4	2007q1	2001q3	2002q1				
Norway			2007q4	2008q4				
Norway			2009q2	2009q4				
Panama			2008q4	2009q3			2008q4	2009q3
Peru	2006q4	2008q2	1998q4	1999q3	2001q1	2001q2	2007q1	2007q2
Peru			2005q4	2006q1	2005q4	2006q3	2007q4	2008q3
Peru			2008q4	2009q3	2009q2	2009q4		
Philippines	2007q1	2007q3	1992q1	1992q2			2008q1	2008q4
Philippines			2008q1	2009q1				
Poland	2003q4	2004q4	2008q4	2009q3			2008q3	2009q3
Poland	2007q1	2008q2						
Portugal	1987q3	1988q2	1992q3	1993q2	1993q1	1993q4	1987q4	1988q1
Portugal	1988q4	1990q2	1996q2	1996q3			1992q1	1992q2
Portugal	1994q3	1995q3	2002q4	2003q1			1996q1	1996q3
Portugal	2000q1	2000q4	2004q4	2005q2			2002q4	2003q1
Portugal	2006q1	2006q2	2008q3	2009q2			2004q3	2005q2

Debt-Led Episodes	Surge		Stop		Flight		Retrench	
Romania	2000q4	2001q2	2008q3	2009q4	2004q4	2005q3	2007q4	2008q2
Romania	2004q1	2005q3						
Romania	2006q4	2007q4						
Russia	2003q2	2004q1	2008q4	2009q3	2003q2	2004q2	2001q3	2002q2
Russia	2007q1	2008q1			2007q2	2009q1	2009q3	2009q4
SlovakRep	2004q3	2005q2	2006q1	2006q4	2008q2	2008q3	1999q1	1999q2
SlovakRep					2009q1	2009q4	2007q2	2007q3
Slovenia	2007q1	2007q4			2002q4	2003q3	2008q1	2009q3
Slovenia					2007q1	2007q4		
SouthAfrica	1987q1	1987q4	1990q2	1990q4	1991q2	1993q1	1987q4	1988q2
SouthAfrica			1998q3	1999q2				
SouthAfrica			2000q3	2001q1				
Spain	1987q1	1988q2	1992q1	1992q2	1988q2	1989q1	1987q1	1987q3
Spain	1990q4	1991q3	2001q3	2002q2	1990q1	1991q2	1991q4	1992q1
Spain			2008q1	2009q4	1992q3	1993q4	1994q2	1995q1
Spain							2001q3	2002q2
Spain							2007q3	2009q3
SriLanka	1989q4	1990q3	2008q1	2008q2	1990q3	1991q2	1990q1	1990q2
SriLanka					2007q3	2008q1		
SriLanka					2009q1	2009q3		
Sweden	1989q2	1990q4	1991q2	1992q2	1986q3	1988q1	1991q1	1992q1
Sweden	2004q4	2005q3	1997q1	1997q3	1988q4	1990q3	1997q1	1997q3
Sweden			2001q4	2002q3	1995q3	1996q3	2008q1	2009q3
Sweden			2008q4	2009q3				
Switzerland	2005q3	2006q2	2008q1	2009q1	2005q3	2006q1	2008q1	2009q1
Taiwan			1995q3	1995q4	1996q1	1996q3	1997q1	1997q4
Taiwan			1997q4	1998q3			2002q2	2002q3
Taiwan			2001q1	2001q2				
Taiwan			2005q1	2005q2				
Taiwan			2008q4	2009q2				
Thailand	1987q4	1990q3	1992q1	1992q4	1989q3	1990q2	1991q2	1991q4
Thailand	1995q2	1996q1	1996q3	1998q2	1993q2	1994q2	1994q4	1995q1
Thailand	2004q3	2006q1	2007q1	2007q4	2005q1	2006q1	1996q3	1997q2
Turkey	1990q1	1990q4	1991q3	1991q4	1991q1	1991q2	1994q3	1995q3
Turkey	1992q3	1993q4	1994q2	1995q1	1995q4	1996q3	2007q4	2008q2
Turkey	2000q1	2000q3	2001q1	2001q4			2009q2	2009q4
Turkey			2007q4	2008q2				
Turkey			2008q4	2009q4				
UK	1992q3	1993q4	1990q1	1990q3	1992q4	1993q2	1991q3	1992q2
UK			1991q3	1992q1	2000q3	2000q4	1998q1	1998q4
UK			1994q2	1994q4			2001q3	2002q2
UK			1998q1	1998q4			2008q2	2009q2
UK			2001q3	2002q2				
UK			2008q2	2009q2				
US	1992q3	1992q4	1989q4	1990q4	1986q2	1986q4	1990q3	1990q4
US	1993q3	1994q3	1998q1	1999q1	1993q3	1994q2	1998q1	1998q4
US	1999q4	2000q3	2007q4	2009q2	2004q1	2004q4	2008q1	2009q2
US	2006q4	2007q2			2006q4	2007q3		
Venezuela	2005q2	2005q4	2006q2	2006q4	2005q2	2006q2	2001q1	2001q4
Venezuela	2007q2	2008q1					2006q4	2007q1
Venezuela							2008q4	2009q3

Table 2
Summary Statistics for Episodes (1980-2009)

		Surge	Stop	Flight	Retrenchment
		% of episodes that are debt-led			
Full sample		82%	80%	71%	72%
By Income Group	High income	81	83	79	75
	Med income	81	83	63	76
	Lower income	84	68	64	56
By Region	North America	67	69	74	72
	Western Europe	89	87	81	77
	Asia	80	79	67	68
	Eastern Europe	88	71	64	82
	Latin America	81	85	74	67
	Other	33	54	42	29

Notes: Income groups are based on World Bank definitions, with "Lower income" including both low income and middle/low income countries according to World Bank classification; "Middle income" is middle/high income; "Higher income" is high income.

Table 3: Regression Results for Episodes of Extreme Capital Flows
(a) Equity-Led Episodes

	Surge	Stop	Flight	Retrenchment
Global Factors				
Risk	-0.023	-0.007	-0.063*	0.012
	(0.039)	(0.012)	(0.034)	(0.012)
Liquidity	-19.591	-6.498	4.088	-5.645
	(14.658)	(11.209)	(11.426)	(12.009)
Interest Rates	-0.355*	-0.285**	-0.216*	0.078
	(0.196)	(0.106)	(0.131)	(0.108)
Growth	38.518	-0.408	21.951*	-0.513
	(25.861)	(6.708)	(13.182)	(6.545)
Linkages				
Regional	-0.347	-0.287	-0.679**	-0.333
	(0.485)	(0.407)	(0.279)	(0.336)
Trade	2.838**	2.223**	-0.073	1.865*
	(0.910)	(0.944)	(0.863)	(1.090)
Financial	-3.188*	-0.301	-0.740	-0.222
	(1.770)	(0.919)	(1.358)	(1.048)
Domestic Factors				
Financial System	0.384	0.420	0.060	0.176
	(0.380)	(0.299)	(0.296)	(0.256)
Capital controls	0.021	0.013	-0.008	0.090
	(0.159)	(0.119)	(0.119)	(0.119)
Debt to GDP	-0.004	-0.003	-0.004	-0.009
	(0.007)	(0.008)	(0.006)	(0.008)
Growth Shock	-1.034	-0.745	-0.198	-0.283
	(0.673)	(0.773)	(0.595)	(0.828)
GDP per capita	-0.011	-0.010	-0.026*	0.012
	(0.016)	(0.017)	(0.015)	(0.016)
Observations	3,446	3,446	3,446	3,446

(b) Debt-Led Episodes

	Surge	Stop	Flight	Retrenchment
Global Factors				
Risk	-0.059**	0.013**	-0.016	0.007
	(0.021)	(0.005)	(0.023)	(0.006)
Liquidity	7.441	-0.714	-9.859	4.056
	(5.144)	(5.012)	(6.680)	(6.083)
Interest Rates	0.015	0.101**	-0.038	0.131**
	(0.058)	(0.049)	(0.084)	(0.042)
Growth	22.805**	-0.182	1.353	-1.836
	(9.448)	(3.230)	(7.349)	(3.398)
Linkages				
Regional	0.490	0.383**	0.849**	0.335**
	(0.306)	(0.128)	(0.315)	(0.159)
Trade	1.118**	0.298	0.539	0.566
	(0.434)	(0.679)	(0.514)	(0.454)
Financial	-1.821**	1.953**	-0.425	1.354**
	(0.903)	(0.679)	(1.903)	(0.503)
Domestic Factors				
Financial System	-0.403*	0.223*	-0.315	0.106
	(0.228)	(0.115)	(0.202)	(0.150)
Capital controls	0.011	-0.101	0.226**	-0.003
	(0.087)	(0.076)	(0.088)	(0.074)
Debt to GDP	-0.004	0.003	-0.007**	0.001
	(0.004)	(0.002)	(0.004)	(0.003)
Growth Shock	0.992**	-1.518**	-0.348	0.294
	(0.331)	(0.767)	(0.571)	(0.569)
GDP per capita	0.005	0.004	0.024**	0.016**
	(0.008)	(0.007)	(0.009)	(0.007)
Observations	3,446	3,446	3,446	3,446

Notes: The dependent variable is a 0-1 variable indicating if there is an episode (surge, stop, flight or retrenchment). Variables are defined in Section 3.1. Estimates are obtained using the complementary logarithmic (or cloglog) framework which assumes that $F(\cdot)$ is the cumulative distribution function (cdf) of the extreme value distribution. To capture the covariance across episodes, the set of four episodes is estimated using seemingly unrelated estimation with robust standard errors clustered by country. ** is significant at the 5% level and * at the 10% level.

Table 4: Coefficient on Global Risk Variable with Alternate Measures of Risk

(a) Debt-Led Episodes

Risk Measured by:	Surge	Stop	Flight	Retrenchment	# Obs
VXO	-0.059**	0.013**	-0.016	0.007	3,446
	(0.021)	(0.005)	(0.023)	(0.006)	
VIX	-0.073**	0.016**	-0.014	0.007	3,291
	(0.029)	(0.006)	(0.031)	(0.007)	
CSFB RAI	-0.036	0.101**	-0.027	0.112**	3,453
	(0.029)	(0.025)	(0.042)	(0.025)	
Volatility Risk Premium	-0.025*	0.005**	-0.004	0.001	3,291
	(0.013)	(0.002)	(0.009)	(0.003)	

(b) Equity-Led Episodes

Risk Measured by:	Surge	Stop	Flight	Retrenchment	# Obs
VXO	-0.023	-0.007	-0.063*	0.012	3,446
	(0.039)	(0.012)	(0.034)	(0.012)	
VIX	-0.041	-0.007	-0.078*	0.006	3,291
	(0.046)	(0.013)	(0.040)	(0.014)	
CSFB RAI	-0.124	0.010	-0.042	0.029	3,453
	(0.084)	(0.045)	(0.049)	(0.045)	
Volatility Risk Premium	-0.013	0.002	-0.019	-0.002	3,291
	(0.019)	(0.005)	(0.015)	(0.004)	

Notes: Table reports the coefficients on *Global Risk* when the base regressions reported in Table 3 are estimated except the corresponding variable is replaced with one of the alternative measures listed in the table. See Table 3 for additional information on estimation technique and additional variables included in the regressions. ** is significant at the 5% level and * at the 10% level.

Table 5: Coefficient on Capital Control Variable with Alternate Measures of Capital Controls

(a) Debt-Led Episodes

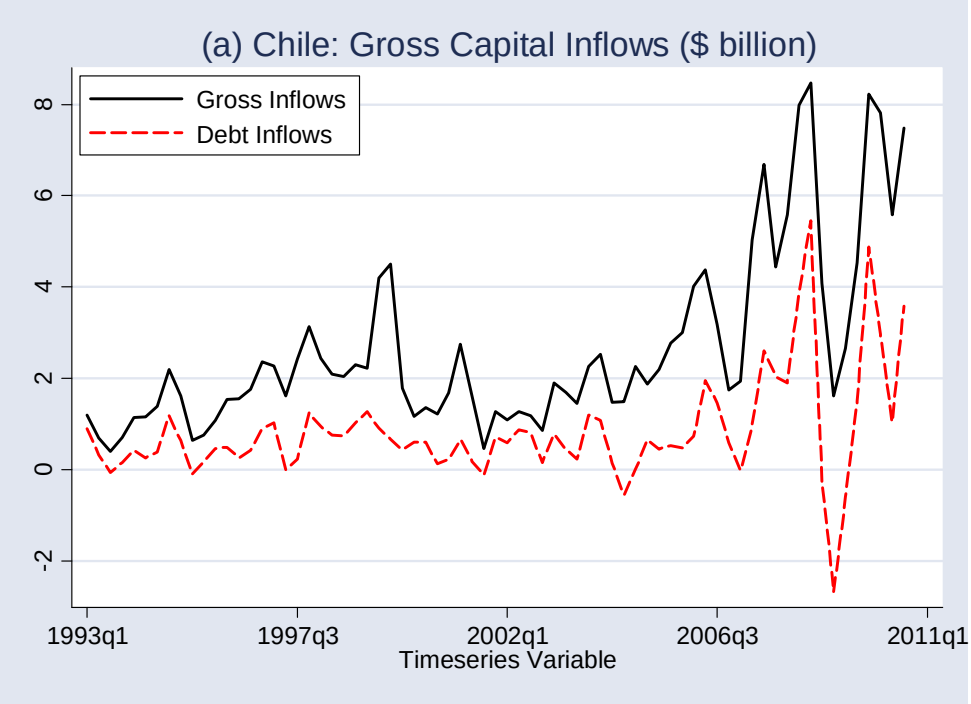
	Surge	Stop	Flight	Retrenchment	# Obs
Capital Controls Measured by:					
Capital controls	0.011	-0.101	0.226**	-0.003	3,446
Chinn Ito (2008)	(0.087)	(0.076)	(0.088)	(0.074)	
Financial Integration	-0.010	-0.000	-0.149	0.020	3,446
Lane Milesi-Ferretti (2007)	(0.034)	(0.016)	(0.095)	(0.015)	
Overall capital acct restrictions	0.427	-0.983*	1.390*	-0.210	1,783
Schindler (2009)	(0.731)	(0.591)	(0.749)	(0.595)	
Specific capital acct restrictions	0.222	-0.083	0.660	0.416	1,783
Schindler (2009)	(0.397)	(0.410)	(0.420)	(0.330)	
Financial controls	0.239	-0.401	0.553	0.417	1,210
Ostry et al. (2011)	(0.761)	(0.428)	(0.611)	(0.619)	
Forex regulations	-0.480	0.118	0.886	0.493	1,240
Ostry et al. (2011)	(0.499)	(0.571)	(0.614)	(0.632)	

(b) Equity-Led Episodes

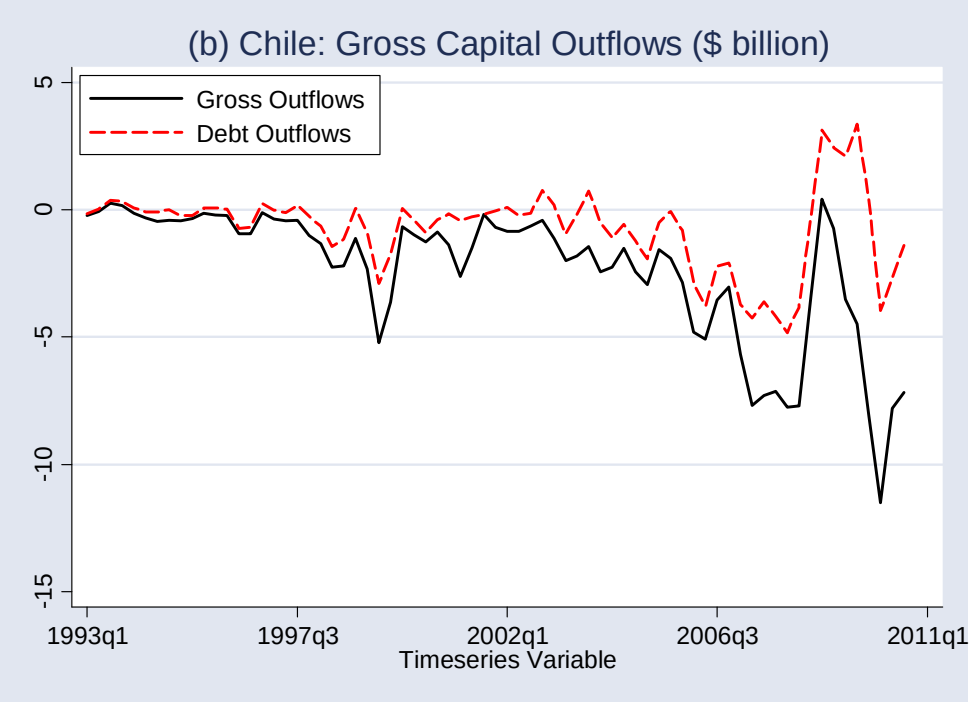
	Surge	Stop	Flight	Retrenchment	# Obs
Capital Controls Measured by:					
Capital controls	0.021	0.013	-0.008	0.090	3,446
Chinn Ito (2008)	(0.159)	(0.119)	(0.119)	(0.119)	
Financial Integration	0.001	-0.094	0.086**	-0.143	3,446
Lane Milesi-Ferretti (2007)	(0.098)	(0.064)	(0.043)	(0.074)	
Overall capital acct restrictions	0.060	1.201	-0.700	1.834	1,783
Schindler (2009)	(0.725)	(1.205)	(0.715)	(1.151)	
Specific capital acct restrictions	0.170	0.495	-1.076**	0.575	1,783
Schindler (2009)	(0.647)	(0.640)	(0.486)	(0.672)	
Financial controls	0.057	0.159	-0.680	0.884	1,210
Ostry et al. (2011)	(1.086)	(1.110)	(1.042)	(0.921)	
Forex regulations	-1.280	-0.518	-0.046	-0.363	1,240
Ostry et al. (2011)	(1.142)	(0.799)	(1.263)	(0.803)	

Notes: Table reports the coefficients on *Capital Controls* when the base regressions reported in Table 3 are estimated except the corresponding variable is replaced with one of the alternative measures listed in the table. All measures of capital controls have higher values if the country has greater capital controls, except the Lane-Milesi-Ferretti (2007) measure of financial integration which takes on a higher value if the country is more financially integrated. See Table 3 for additional information on estimation technique and additional variables included in the regressions. ** is significant at the 5% level and * at the 10% level.

Figure 1: Chile's Gross Flows
(a) Total and Debt Inflows

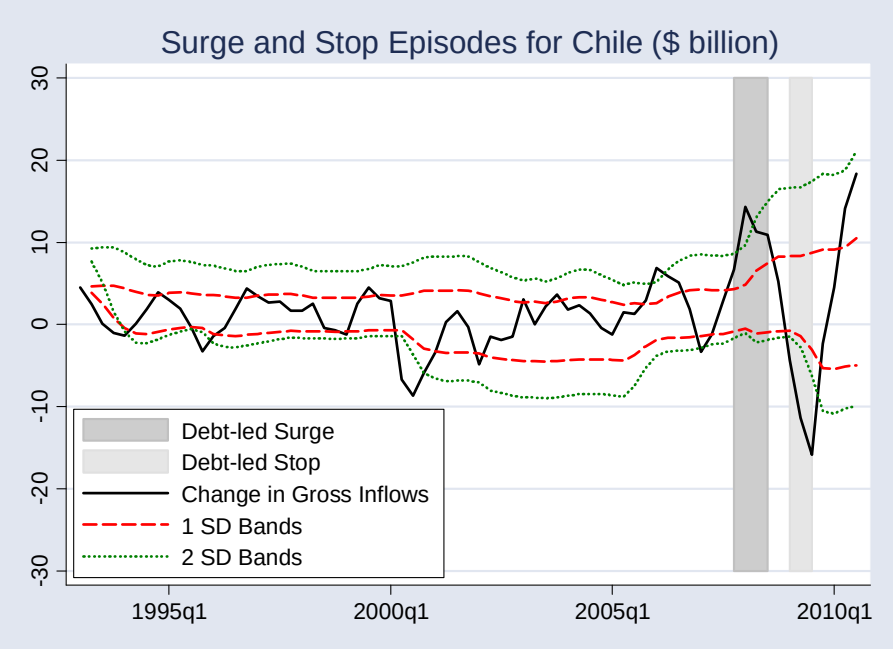


(b) Total and Debt Outflows

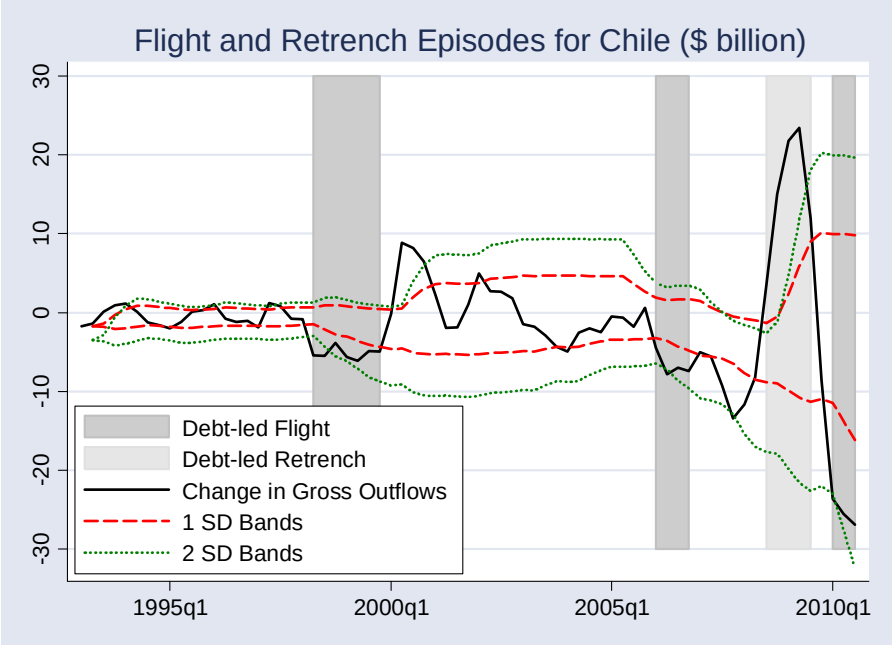


Notes: This graphs show debt and equity gross inflows and outflows for Chile. Each flow is calculated as the 2-quarter moving average. Gross outflows are reported using standard BOP definitions, so that a negative number indicates a gross outflow.

Figure 2
(a) Chile: Construction of the Surge and Stop Episodes

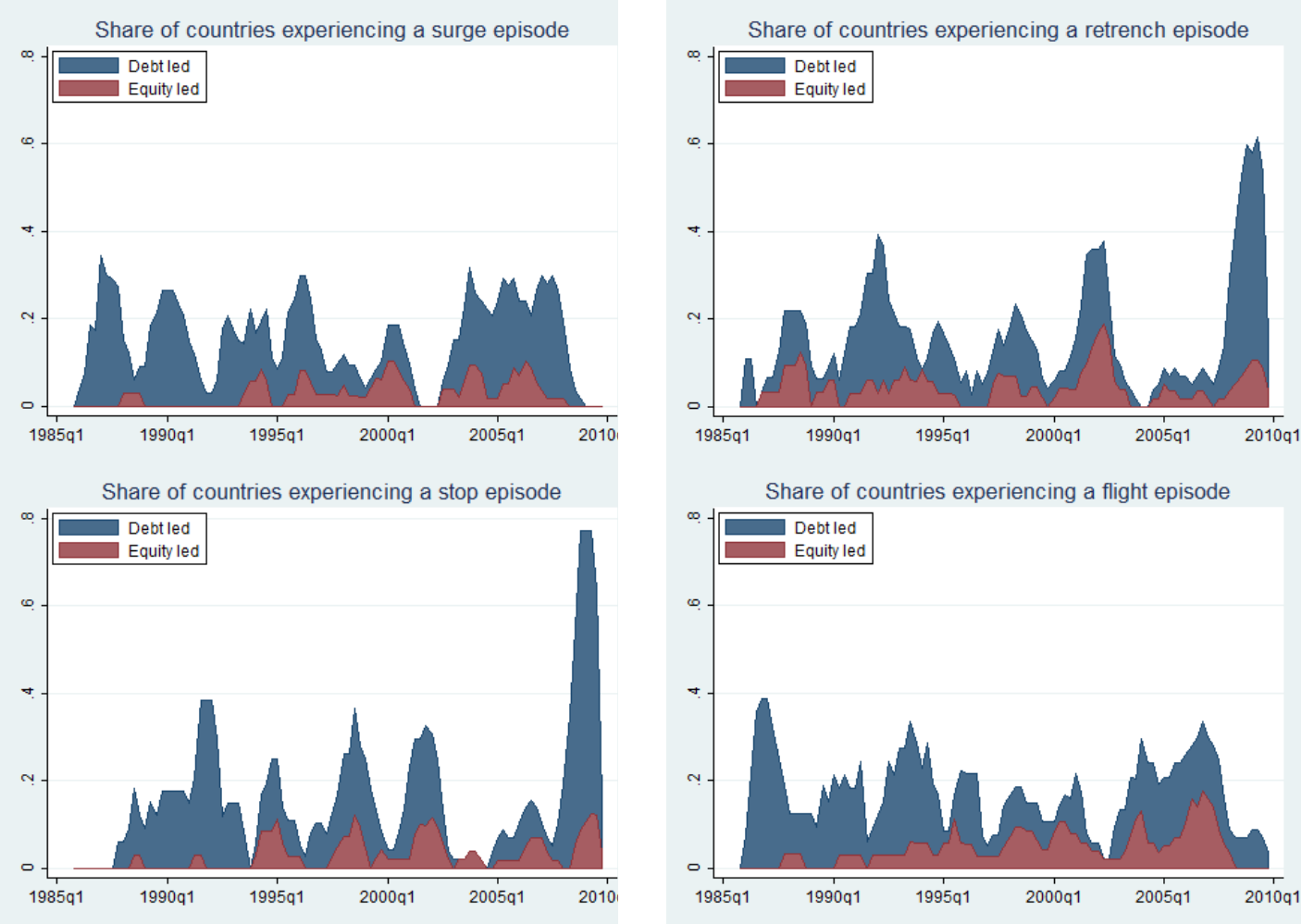


(b) Chile: Construction of the Retrenchment and Flight Episodes



Notes: The figures show the construction of our measures of debt- and equity-led surges and stops for Chile. A surge episode of any type begins when gross inflows (the solid line) exceed one standard deviation above the rolling mean, provided they eventually exceed two standard deviations above the mean. The surge episode ends when gross inflows again cross the one standard deviation line. A surge is identified as debt-led if debt inflows exceeded equity inflows during the episode. Stops are defined analogously; a stop episode begins when gross inflows fall one standard deviation below the rolling mean, provided they eventually fall two standard deviations below the mean, and ends when gross inflows again cross the one standard deviation line.

Figure 3
Percent of Countries with Each Type of Episode



Documentos de Trabajo
Banco Central de Chile

Working Papers
Central Bank of Chile

NÚMEROS ANTERIORES

PAST ISSUES

La serie de Documentos de Trabajo en versión PDF puede obtenerse gratis en la dirección electrónica: www.bcentral.cl/esp/estpub/estudios/dtbc. Existe la posibilidad de solicitar una copia impresa con un costo de $500 si es dentro de Chile y US$12 si es para fuera de Chile. Las solicitudes se pueden hacer por fax: (56-2) 6702231 o a través de correo electrónico: bcch@bcentral.cl.

Working Papers in PDF format can be downloaded free of charge from: www.bcentral.cl/eng/stdpub/studies/workingpaper. Printed versions can be ordered individually for US$12 per copy (for orders inside Chile the charge is Ch$500.) Orders can be placed by fax: (56-2) 6702231 or e-mail: bcch@bcentral.cl.

DTBC – 675 Agosto 2012
Capital Inflows and Booms in Assets Prices: Evidence from a Panel of Countries
Eduardo Olaberría

DTBC – 674 Agosto 2012
Evaluation of Short Run Inflation Forecasts in Chile
Pablo Pincheira y Roberto Álvarez

DTBC – 673 Julio 2012
Tasa Máxima Convencional y Oferta de Créditos
Rodrigo Alfaro, Andrés Sagner y Camilo Vio

DTBC – 672 Julio 2012
Peg, Downward Wage Rigidity, and Unemployment: The Role of Financial Structure
Stephanie Schmitt- Grohé y Martín Uribe

DTBC – 671 Julio 2012
Adapting Macroprudential Policies to Global Liquidity Conditions
Hyun Song Shin

DTBC – 670 Julio 2012
An Anatomy of Credit Booms and their Demise
Enrique Mendoza y Marco Terrones

DTBC – 669 Julio 2012
Forecasting Inflation with a Random Walk
Pablo Pincheira y Carlos Medel

DTBC – 668 Junio 2012
On the International Transmission of Shocks: Micro Evidence From Mutual Fund Portfolios
Claudio Raddatz y Sergio L. Schmukler

DTBC – 667 Mayo 2012
Heterogeneous Inflation Expectations, Learning and Market Outcomes
Carlos Madeira y Basit Zafar

DTBC – 666 Marzo 2012
Financial Development, Exporting and Firm Heterogeneity in Chile
Roberto Alvarez y Ricardo López

DTBC – 665 Marzo 2012
Determinantes e Impacto de Episodios de Reversión Abrupta de Flujos de Capitales: ¿Es Distinto un *Sudden Stop* de un *Sudden Flight*?
Gabriela Contreras, Alfredo Pistelli y Mariel Siravegna

DTBC – 664 Febrero 2012
Rational Inattention, Multi-Product Firms and the Neutrality of Money
Ernesto Pastén

DTBC – 663 Febrero 2012
Non – Ricardian Aspects of the Fiscal Policy in Chile
Luis Felipe Céspedes, Jorge Fornero y Jordi Galí

DTBC – 662 Febrero 2012
Cubrir o no Cubrir: ¿Ese es el Dilema?
Rodrigo Alfaro y Natán Goldberger

BANCO CENTRAL
DE CHILE

DOCUMENTOS DE TRABAJO • Agosto 2012