DNB Working Paper

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No. 441 / September 2014

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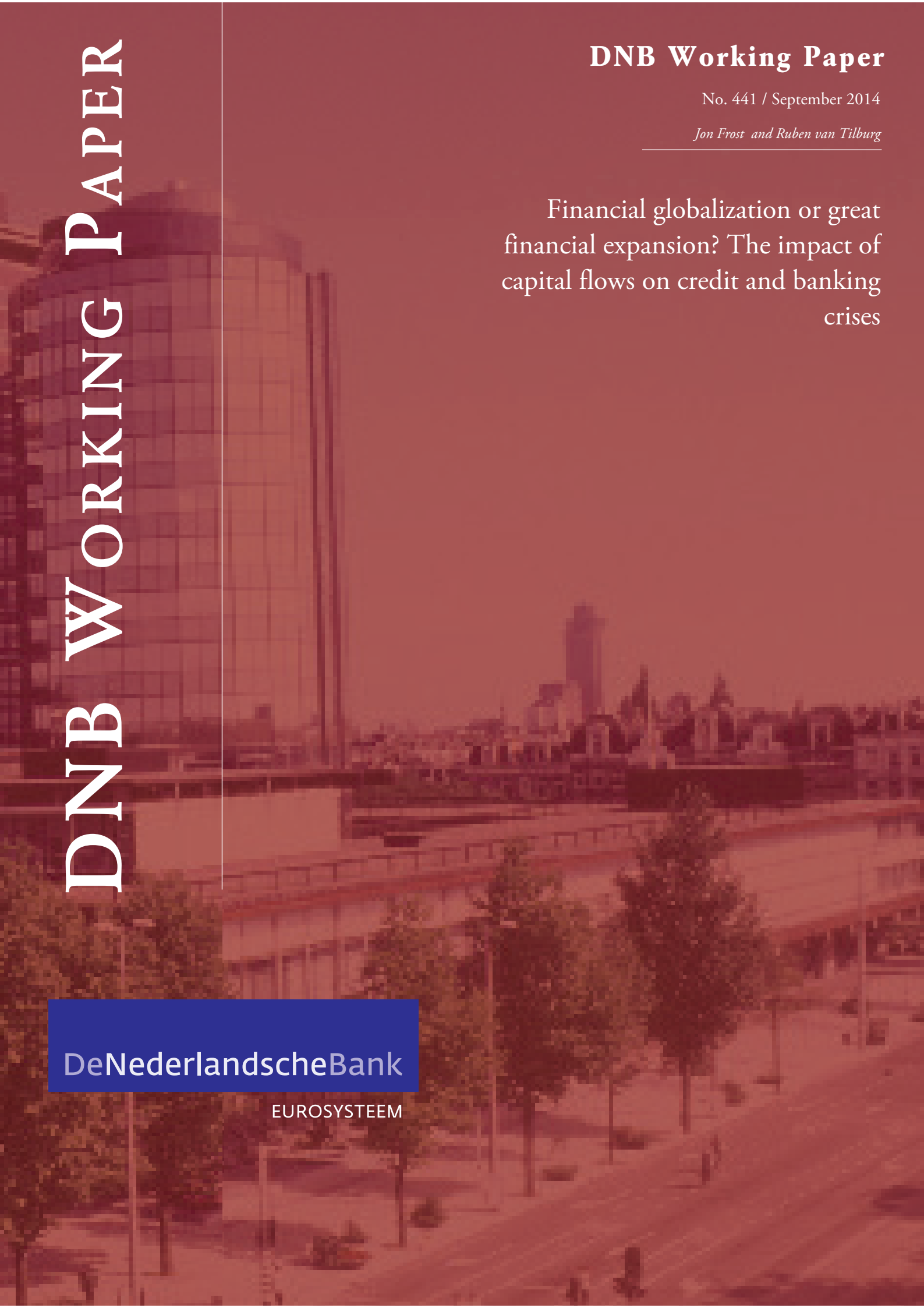

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* Views expressed are those of the authors and do not necessarily reflect official positions of De Nederlandsche Bank.

Working Paper No. 441

September 2014

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Financial globalization or great financial expansion? The impact of capital flows on credit and banking crises *

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24 September 2014

Abstract

This paper empirically examines the impact of capital flows on credit growth, credit excesses and banking crises using quarterly panel data from 43 advanced (AEs) and emerging market economies (EMEs). Regressions show that gross capital inflows precede credit growth and credit excesses. Both gross inflows and high private domestic credit precede banking crises. Formalized hypotheses allow us to study whether domestic or international drivers more frequently precede banking crises, and thus to evaluate "financial globalization" and the "great financial expansion" as explanations for country vulnerability to banking crises. Our evidence provides support for both narratives as drivers of country vulnerability; financial globalization seems to matter particularly for EMEs. We also provide some ground for caution on the effectiveness of capital controls and the desirability of very high levels of private credit to GDP.

Keywords : Gross capital flows, credit bubbles, financial globalization, banking crises.
JEL classification codes : E51, F32, G01, G15.

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The authors would like to thank Mostafa Tabbae and Simon Baltussen for extensive data support. Helpful comments were provided by Jakob de Haan, Ayako Saiki, Saskia van Ewijk, Jan Kakes, Iman van Lelyveld, Leo de Haan, Jeroen Hessel, Jolanda Peeters, Robert Vermeulen (all DNB), Steven Brakman (University of Groningen), Enrique Mendoza (University of Pennsylvania), Patrick McGuire (BIS), Aitor Erce (ESM), José Maria Serena (Banco de España) and participants at the IFABS conference, "Alternative Futures for Global Banking: Competition, Regulation and Reform" in Lisbon (June 2014) and a GEM seminar at University of Groningen (January 2014). The views expressed in this paper are those of the authors and do not necessarily reflect the position of De Nederlandsche Bank. All errors are our own.

I. Introduction

The three decades leading up to the global financial crisis were marked by two striking trends. On the one hand, the financial sectors of countries around the world grew at a rapid pace. Supported by a wave of financial liberalization in the 1970s and 1980s, by low inflation and output volatility in the ensuing years (the "Great Moderation") and perhaps also by accommodative monetary policy, many economies experienced a rapid expansion of credit to firms and households. This "Great Financial Expansion" (Hoogduin, 2014) was not confined to the major financial centers, but occurred in many countries at the same time; it was thus a global phenomenon. For both advanced economies (AEs) and emerging market economies (EMEs), private credit to GDP not only expanded but frequently even outstripped its long-term trend. In national and regional crises in the past several decades and in the global financial crisis of 2007-8, such credit excesses were followed by banking crises and sharp output contractions (Reinhart and Rogoff, 2009).

At the same time, the growth in the global financial system coincided with even more rapid financial integration between countries. As authorities removed restrictions on cross-border investment, financial institutions, firms and individuals increasingly invested abroad. The long periods of capital flows between economies contributed in many cases to greater trade flows and income convergence. Equity flows, such as foreign direct investment (FDI), were associated with greater risk sharing and technology transfers across borders and became an important source of stable financing for both advanced and emerging economies. Yet some types of capital flows, particularly debt financing by banks and capital market investors, proved very volatile, with "sudden stops" of foreign money and "capital flight" by residents a recurring theme of crises especially in EME crises. Since 2008, financial crises across AEs have also frequently had an important international component, with cross-border financial exposures playing a role both in the build-up of financial excesses and international propagation of financial stress.

The purpose of this study is to examine empirically how increasing integration between countries ("financial globalization") and the simultaneous growth of financial sectors within countries ("great financial expansion") interact with the vulnerability of a country to banking crises. Of course, both financial globalization and financial expansion can bring important economic benefits. There is a large literature on financial development and growth (e.g. Rajan and Zingales, 1998; Beck, Levine and Loayza, 2000; De Gregorio and Guidotti, 1995), and on the benefits and risks of financial openness (Rodrik, 1998; Rodrik and Subramanian, 2009; Henry, 2003; Quinn and Toyoda, 2010; Edwards, 2001; Kose, Prasad, Rogoff and Wei, 2006; Kose, Prasad and Taylor, 2006; Frost and Saiki, 2013). Yet here, we are interested primarily in the interaction of each trend with financial vulnerabilities, in determining whether these have been significant antecedents of banking crises. Exploring these two narratives is important not only

from a practical policy perspective, but also for deeper economic reasons. Fundamentally, are rapidly expanding financial sectors beneficial to global growth and stability? Are there important differences between investors based on their residency, or the type of investment (debt versus equity)? Where should policy focus its efforts in strengthening the resilience of the global financial system(s)?

In order to address these questions, we develop four testable hypotheses on the impact capital flows, domestic and other factors in contributing to credit excesses and crises. To test these hypotheses, we regress the change in private credit to GDP and the credit gap on a set of domestic factors and gross capital inflows, including their components. We use a similar methodology in probit regressions for banking crises, as defined by Laeven and Valencia (2013). With our quarterly panel of advanced economies (AEs) and emerging markets economies (EMEs) over the whole period of interest (1975-2011), we are able to compare variation both across and within countries and derive patterns at an aggregated level.

This study draws from four related strands of literature. The first strand relates to the impact of global capital flows on domestic financial vulnerabilities in the lead-up to the global financial crisis (Borio and Disyatat, 2011; Shin, 2012; Shin and Bruno, 2013; Calderón and Kubota, 2012) and its aftermath (Rey, 2013; Catão and Milesi-Ferretti). These studies focus especially on the role of global factors which can contribute to vulnerability, like global liquidity and the "leverage cycle" of internationally operating banks. A key conclusion of this literature is that financial imbalances, such as high leverage and currency and maturity mismatches on balance sheets, can arise across countries even in the absence of large current account imbalances. Thus, it is important to also monitor *gross* capital flows – i.e. to separate domestic investment by foreigners and foreign investment by residents. A number of studies show that foreigners and domestic residents have very different behavior during crises, which may be masked by netting them out; similarly, gross capital inflows can be more volatile and pro-cyclical than net inflows (Broner, Didier, Erce and Schmukler, 2011; Forbes and Warnock, 2012; Hessel and Peeters, 2012). Moreover, unlike narratives of the global financial crisis rooted in large savings and current account surpluses in EMEs, which are invested through reserve accumulation in the financial assets of AEs ("global savings glut"; Bernanke, 2005), this literature sketches a "global banking glut" in which banks' pro-cyclical growth of assets and liabilities across borders is a driver of financial imbalances.[1] Like these studies, we use data on gross

[1] The global savings glut and global banking glut narratives are not entirely exclusive. Bernanke, Bertaut, DeMarco and Kamin (2010) argue that both reserve accumulation of US Treasuries by China and oil exporters and investments by European banks in mortgage-backed securities (MBS) had an impact on long-term US interest rates and investment prior to the sub-prime crisis.

capital flows, but by including the current account balance in regressions, we seek to take into account *both* gross and net external imbalances.

A second and related strand of literature is on the desirability of financial openness. The removal of capital controls by both AEs and EMEs since the late 1980s was driven both by domestic policy choices and by multilateral initiatives, such as the OECD Codes of Liberalization or the requirements laid out in the Treaty on the Functioning of the European Union (Bakker and Chapple, 2001). Neoclassical theory predicts that financial openness should result in more efficient allocation of capital from countries which have a relatively high capital endowment (richer countries) to those (poorer countries) with less capital, with growth benefits both for sending and receiving countries. A divergence between savings and investment can be justified based on relative income levels and the life cycle hypothesis, by which countries with relatively younger populations should be more prone to save and invest than countries with older populations, which should dis-save (Modigliani and Brumberg, 1954). Yet in practice, capital frequently flows "uphill" from developing to developed countries (Lucas, 1990), and the empirical literature on openness and growth has been mixed (Rodrik, 1998; Henry, 2003; Quinn and Toyoda, 2010). This leads some (Rodrik and Subramanian, 2009) to argue that a re-imposition of capital controls could improve welfare outcomes. Yet others show that richer countries may benefit more from openness than EMEs, given "thresholds" of financial development above which benefits outweigh costs (Edwards, 2001; Kose, Prasad, Rogoff and Wei, 2006; Kose, Prasad and Taylor, 2006; Frost and Saiki, 2013). The IMF (2012) recently acknowledged that financial openness is more beneficial and less risky for countries that have a financial sector with the capacity to absorb inflows, the ability to deal with increased capital flow volatility and effective macroeconomic and financial supervision frameworks. Given the well-known "impossible trinity" or "trilemma", which holds that open capital accounts, a fixed exchange rate and independent monetary policy cannot be achieved at the same time, this trend toward opening has also meant changes in exchange rate and monetary policy regimes (Frankel, 1999). A number of countries have chosen policy divergence along a broad range of intermediate regimes (Aizenman and Ito, 2012). Our study takes account of both capital account openness and exchange rate regimes as important factors in country vulnerability.

A third strand is on the determinants of banking crises across countries. The seminal works of Kindleberger (1978) / Kindleberger and Aliber (2011) and Minsky (1986) emphasize the role of self-feeding booms and busts in domestic credit. More recently, several studies (Borio and Drehmann, 2009; Jorda, Schularick and Taylor, 2011; Gourinchas and Obstfeld, 2012) confirm that large increases in private domestic credit are among the most robust pre-cursors of banking crises both in AEs and EMEs over long periods of time, including the recent crisis. For both AEs and EMEs, such booms are often accompanied by real exchange rate appreciation, and banking

crises may lead to and be aggravated by currency crises (Kaminsky and Reinhart, 1999; Mishkin, 1999). Generally, there is less attention in the literature on isolating the domestic and foreign components of credit excesses in order to understand which has been the prime driver of the imbalances which lead to crises. An exception is Avdjiev, McCauley and McGuire (2012), who show that international credit, defined as cross-border lending, international borrowing by banks and FX lending, "enables domestic credit booms" and thus contributes to the incidence of crises.

Finally, a number of newer studies look at the costs of an excessively large financial sector (Cecchetti and Kharroubi, 2012; Arcand, Berkes and Panizza, 2012). These studies look empirically at the growth of private credit, and find a U-shaped relationship with output and productivity growth, whereby financial deepening is associated with lower growth above a threshold of roughly 100% of GDP ("too much finance")[2]. Relatedly, Haldane, Brennan and Madouros (2010) show that the rising share of the financial sector in value added in the past decades was not a "productivity miracle", but rather the result of growing leverage and risk-taking – a "productivity mirage". When the private gains of especially large financial institutions are set against as implicit government guarantees under tail risk scenarios and thus with profitable activities' full social costs, the overall contribution of the sector to value added is much smaller[3]. Kneer (2013a,b) shows another mechanism for a large financial sector to weigh on growth, namely the absorption of talent into the financial sector in the United States and Europe, which can have detrimental effects on productivity in the real sectors of the economy. These observations have led to calls by some for a shrinking of the financial sector (Bezemer, 2012; Epstein and Crotty, 2012). A contrary view is taken by Gennaioli, Shleifer and Vishny (2012), who posit that a larger financial sector may simply reflect a maturing economy and higher overall wealth levels. By considering the level of private domestic credit, our paper also examines these hypotheses and, in robustness checks, explores the existence of non-linear effects of credit on vulnerability.

The contribution of our paper is to bring together the work on capital flows, private credit excesses and banking crises across a broad ranging of countries using newly available (post-crisis) data. This has some parallels with Taylor (2013), who also attempts to empirically disentangle "external imbalances" and "credit booms" hypotheses for banking crises, and finds

2 This literature represents a break from the past literature on financial development, which often sees credit to GDP as a proxy for "financial depth" and thus for the ability of the financial sector to support growth. A representative study is De Gregorio and Guidotti (1995), who show that financial development, as proxied by bank credit to GDP, is associated with higher growth rates in most economies, but *lower* growth in Latin America. They attribute this result to a poor regulatory environment. Moreover, they interpret weak results in advanced economies as stemming from the important role of non-bank institutions.

3 Relatedly, Arnold and van Ewijk (2012) examine implications of the growth of transaction banking over this period, which has lower margins and is more tenable to aggressive asset expansion than traditional relationship banking.

more evidence in favor of the latter. Yet unlike Taylor's study, which emphasizes the lack of predictive power of current accounts – which mirror net capital flows – as compared to credit booms, we examine the link between gross capital flows and credit. To do this, we combine IMF data on gross capital flows with a new BIS database on private domestic credit, and run a series of panel regressions. This allows us to simultaneously consider the impact of credit booms, the level of credit and (gross) external imbalances, and thus to examine some of the avenues of future work which Taylor himself proposes. Moreover, in contrast to other studies on gross flows, we use a simpler classification of the *components* of gross international capital flows – namely "equity" (FDI and portfolio equity) and "debt" (portfolio debt and other flows). The latter groups together cross-border bank and investment flows, just as the new BIS data integrates bank and capital market borrowing. This further aids analysis of the link between international capital flows and domestic credit vulnerabilities.

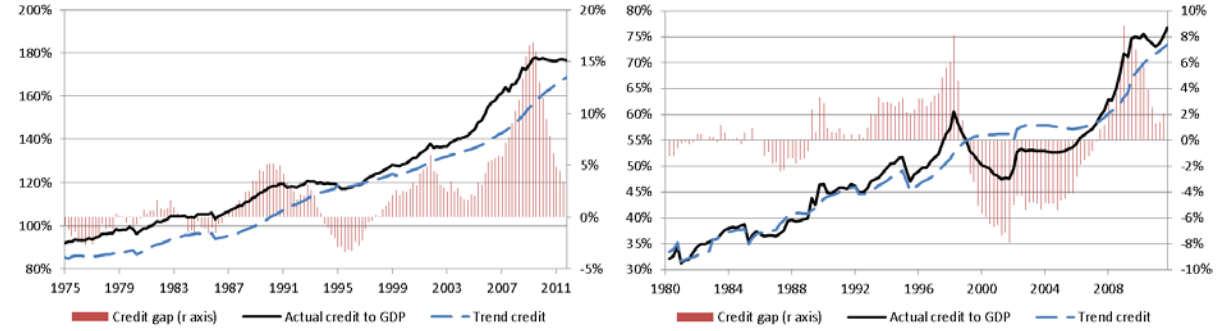
The paper is organized as follows. Section II describes the two global financial narratives in more detail. Section III lays out a schematic model of capital flows and credit excesses, formalizes our four hypotheses and describes our empirical framework. Section IV introduces the data and then correlations and graphical analysis for the relationship between gross capital flows, credit growth and banking crises. Section V contains our multivariate estimation results, while section VI offers robustness checks of the key results. Finally, section VII concludes with further interpretation and policy considerations.

II. Global financial narratives

The great financial expansion can be captured by a number of measures, including the size of financial sector assets, loan-to-deposit ratios and measures of market depth and liquidity. Yet perhaps the most widely used measure in the literature and in recent policy analysis is the ratio of private domestic credit to output, which is now available over a long panel for a number of countries from the new BIS database on total domestic credit (Dembiermont, Drehmann and Muksakunratana 2013). From an average of 93% of GDP in 1975, private credit in advanced economies (AEs) peaked at nearly 180% of GDP in 2008, while emerging market economies (EMEs) also saw dramatic deepening of domestic credit markets, albeit from lower base levels and with more volatility. Figure 1 shows the level of private credit to GDP for both groups of countries. Notably, credit to GDP significantly outstripped its long-term trend for AEs in the late 1980's, for EMEs in the mid-1990's and for both countries in the years leading up to the global crisis. This widening "credit gap", one sign of credit market excesses (Borio and Drehmann, 2009), grew for the global economy as a whole and for individual countries in particular. In many cases, this was followed by banking crises and a sharp contraction in credit, bringing the credit gap back into negative territory, even as the long-term trend has generally remained positive.

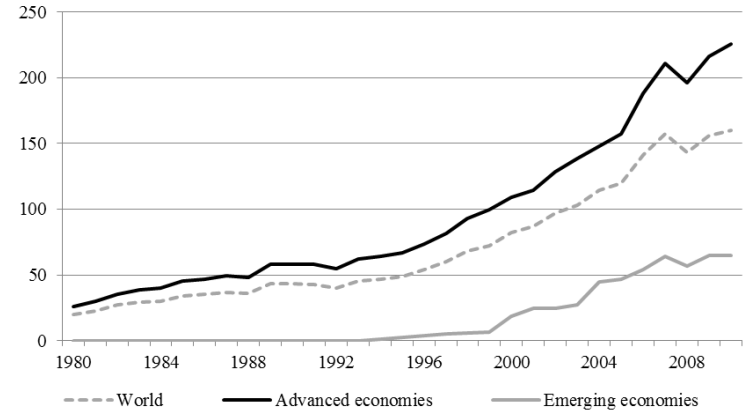
Figure 1: Total domestic credit and credit gap of advanced and emerging economies
In % of GDP

Advanced economies *Emerging economies*



Note: unweighted average of private domestic sector credit (both banking sector and capital markets) in % of GDP, trend credit to GDP based on one-sided Hodrick-Prescott (HP) filter with lambda of 400,000, and difference between actual and trend credit for the 43 countries in the paper's sample. The credit gap is defined using the standard methodology of the Basel Committee on Banking Supervision (BCBS), as used in the calibration of the counter-cyclical capital buffer (CCB). Definition of advanced and emerging based on the end-of-period IMF World Economic Outlook classification. The figure for EMEs begins in 1980, as the sample prior to 1980 is too small for representative averages.
Source: BIS and IMF IFS

Figure 2: International investment positions (IIP)
Average of foreign assets and liabilities in IIP as a % of countries' GDP



Note: unweighted average of foreign assets and liabilities in IIP, in % of GDP, for the 43 countries in the paper's sample. Definition of advanced and emerging based on the end-of-period IMF World Economic Outlook classification.
Source: IMF IFS

Financial globalization has booked an even more rapid increase in the past three decades. Between 1988 and 2006, the gross international investment positions (IIP) of AEs quadrupled from about 50% to over 200% of GDP (figure 2). These investment stocks, which correspond to the categories of capital flows in the IMF International Financial Statistics, show a large heterogeneity across countries, and are much larger for international financial centers like Luxembourg, Hong Kong or Singapore. A deeper look at the data reveals that the majority of global financial flows are between advanced economies. Figure 3 shows gross financial flows,

split into debt and equity, for the economies in our sample.[4] Equity, particularly FDI, tends to flow from advanced to emerging economies, and is relatively stable across the cycle, whereas debt flows are larger and more volatile, particularly since 2008.

Figure 3: Components of gross capital flows
in USD billions

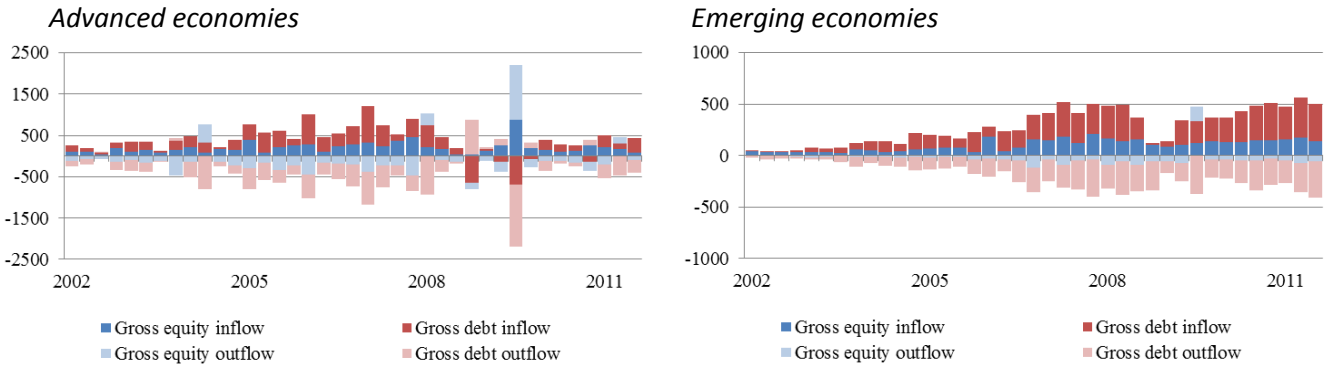
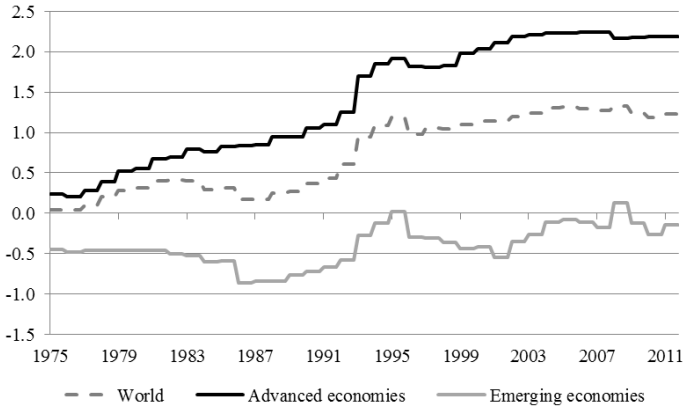


Figure 4: Capital account openness of economies
Average value of Chinn-Ito Index



Note: unweighted average of Chinn-Ito Index of *de jure* openness, which ranges from -1.5 (least open) to 2.446 (most open). Definition of advanced and emerging based on most recent IMF World Economic Outlook classification.
Source: Chinn and Ito, 2011

This de facto integration also reflects changes in the jure capital account frameworks. As shown by figure 4, AEs have liberalized more in the past 3 decades and remain more open than EMEs. There have been notable reversals in the long-term trend toward greater liberalization. For many EMEs (Malaysia in 1998, Argentina in 2002) and AEs (Iceland in 2008, Cyprus in 2013), banking and balance of payments crises have gone hand-in-hand, and authorities responded to these by reinstituting capital controls. Some countries, such as Brazil in 2010, have responded to strong inflows with the imposition of capital controls on foreign investment. Others, such as

[4] Gross inflows and outflows are defined by residency; hence, inflows reflect the build-up of claims by foreign residents, and outflows by domestic residents. Negative inflows and positive outflows, e.g. during the crisis, reflect repatriation of assets by both parties. As explained in more details section IV, "equity" is a sum of foreign direct investment (FDI) and portfolio equity flows, while "debt" is a sum of portfolio debt and other flows.

Korea in 2012, have used restrictions on foreign currency borrowing which, while targeted at specific activities of financial institutions, can have similar effects as capital controls.

III. Schematic model and testable hypotheses

As a point of departure for developing testable hypotheses, we consider a simple framework whereby both international capital flows and domestic factors can lead to credit growth and (relatedly) credit excesses, as measured by the credit gap. Persistently high credit growth and credit gaps, both of which are flow concepts, lead to higher overall levels of private domestic credit, a stock concept. Either of these can have an impact on the likelihood of a country experiencing a crisis. Finally, international capital flows could have their own ("autonomous") impact on crisis likelihood. Figure 5 shows these relationships schematically, whereby the channels of influence are numbered C1-C6.

The first two hypotheses we want to test can be roughly related to financial globalization, and specifically the impact of foreign capital on domestic credit conditions. Recent literature finds that the explanatory power of gross capital flows tends to be higher than that of net flows, particularly for AEs. There is research into the drivers of gross capital flows[5], and the impact of net capital flows on credit (Caballero, 2012) but relatively little attention to the impact of gross flows on domestic macro-economic and financial outcomes. A key aspect missing in the discussion is the channel by which gross international capital inflows impact credit booms and thus vulnerability to banking crises. While domestic variables can be expected to drive credit market developments, the financial globalization narrative would imply that international factors are as important. This would be consistent with gross international capital flows having a significant impact on credit growth and credit excesses (hypothesis H_1) on top of what can be explained by domestic variables. Among the components of gross capital flows, we would expect that especially debt flows would drive domestic credit (hypothesis H_2).

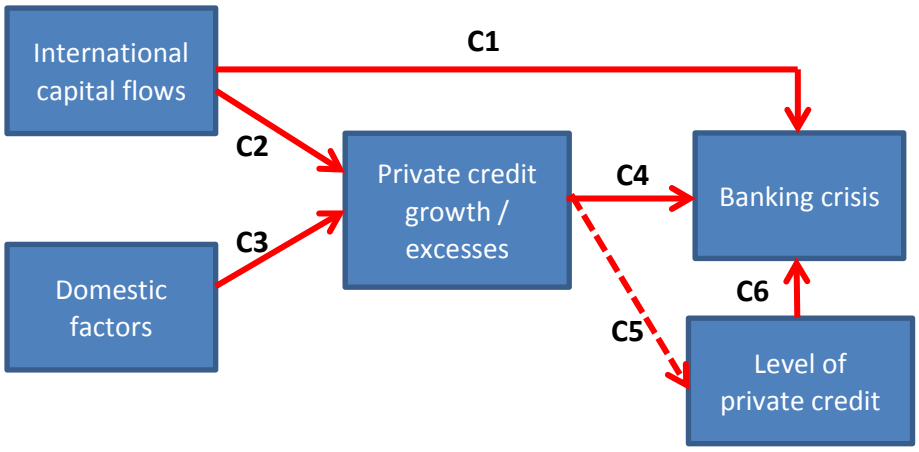
After considering the impact of capital flows on credit developments, a next step is to look at the actual vulnerability to banking crises. It has been thoroughly demonstrated in the literature that credit excesses tend to precede banking crises. If capital flows only had an impact on crisis probability through their impact on fuelling private domestic credit excesses, then a regression with both credit excesses and capital flows would not yield a significant coefficient for the latter. If, on the other hand, capital flows do have an impact on crisis probability even

5 For example, Broner et al. (2011) have looked at the behavior of gross flows across the cycle and during crises, finding that gross inflows and outflows are much more volatile and pro-cyclical than net flows. Herrmann and Mihaljek (2010) and Fratzscher (2012) have attempted to empirically distinguish between 'push' factors in global capital flows (global liquidity, risk aversion, etc.) and 'pull' factors (domestic fundamentals, quality of institutions, openness, etc.), with implications for whether policy responses to volatile flows should take place in source or receiving countries.

after controlling for credit excesses, then this would demonstrate that international flows have an autonomous impact on crisis vulnerability. A third hypothesis, H_3, thus tests the significance of international capital flows when controlling for other factors.

A final hypothesis – testable in the same regressions – relates more to the narrative of great financial expansion. Here, the focus is on the impact on crisis probability of larger national financial systems, as measured by *the absolute level* of private domestic credit. Hypothesis H_4 considers the autonomous impact on the probability of banking crises of the (trend) level of credit, on top of the impact of credit excesses and international capital flows. Statistical significance of the trend level of private domestic credit would be consistent with the great financial expansion as a driver of banking crisis vulnerability.

Figure 5: Overview of influence channels (C1-C6) and hypotheses



Note: arrows denote expected direction of influence for each channel (C1-C6). Solid lines are estimated with regressions in section V, while estimations of the dashed line are not reported.

Hypotheses on the relationships between capital flows, private credit and banking crises

*H_1 : **International capital flows** have a significant impact on **credit growth** and **credit excesses** on top of what can be explained by **domestic factors** (C2 is significant, controlling for C3)*

*H_2 : Among **international capital flows,** it is especially **debt flows** that have a significant impact on **credit growth** and **credit excesses** (debt component of C2 is significant, controlling for C3)*

*H_3: **International capital flows** have an autonomous impact on the probability of **banking crises** when controlling for **credit excesses** and **credit level** (C1 is significant, controlling for C4 and C6)*

*H_4: The trend **level of private credit** has an autonomous impact on the probability of **banking crises** when controlling for **credit excesses** and **International capital flows** (C6 is significant, controlling for C1 and C4)*

IV. Methodology and data

To test our hypotheses, we run a number of multivariate regressions for credit growth, the credit gap and banking crises against the relevant domestic and international macroeconomic

variables, including capital flows. In this section, we first describe our estimation method, and then our data sources and initial insights from the data from correlations and graphical analysis.

Estimation method

Based on theory, both private credit growth and credit excesses should be influenced by a number of domestic macroeconomic variables. For example, in a framework with a financial accelerator, it follows that credit market frictions, like asymmetric information and agency problems, lead to different behavior of financial intermediaries in different phases of the business cycle (Bernanke, Gertler and Gilchrist, 1994; 1999; see Gertler, Gilchrist and Natalucci, 2007 for an open economy extension of the model). Macroeconomic shocks are propagated and amplified through the banking sector (or, comparably, credit markets), which charges an "external finance premium" to borrowers that in turn depends on the state of the economy and borrowers´ net worth (equity value). Higher net worth gives borrowers both greater access to internal financing and a lower external finance premium. This allows for domestic credit to fluctuate endogenously and have a subsequent impact on the business cycle. This framework can be extended to disturbances in international credit, such as sudden stops (Mendoza, 2006), though our emphasis here is on the upturn rather than the downturn of the financial and business cycle.

In line with the expectations of this literature, we construct a set of variables which should influence credit to the private sector[6]. Among the domestic variables, a higher level of real long-term interest rates should be associated with lower credit growth. Higher real central bank policy rates could be more ambiguous, given that they will rise with economic activity and credit growth, the phenomena which they seek to slow, and will have some persistence. Inflation, which erodes the nominal value of existing and future debt contracts, will have a negative impact on credit growth. Real growth of the monetary base should be positively associated with credit. Higher net worth of firms, as expressed by the change in stock prices, should entail better access to external debt finance, as in the financial accelerator framework. A higher government budget deficit tends to reduce credit growth through crowding out of private credit.[7]

6 We are not aware of any fully comparable studies with multivariate analysis on drivers of credit growth in a cross-country panel. However, our choice of variables is similar to Mendoza and Terrones (2008), who use an event study methodology to relate credit booms to domestic variables such as output, consumption, investment and asset prices, and international variables such as real exchange rates, capital inflows, and currency account deficits.

7 GDP growth and the output gap are not included in the model, for two reasons. First, since our left-hand side variables are based on the credit to GDP ratio, output growth corresponds both to higher firm profits, net worth and thus a larger flow of new credit, and reduction in the ratio of the existing stock of credit to GDP through the denominator effect. Secondly, credit booms are associated with persistently higher growth prior to a banking crisis, meaning an endogeneity problem. As in Gu and Huang (2014), we find that the simplest means of correcting this effect is simply dropping GDP growth as a regressor.

Among the international variables, we include the 4-quarter average of gross capital inflows – or alternatively their components FDI, portfolio and other inflows – relative to GDP. Moreover, we include the current account balance; a current account surplus corresponds with a net outflow of savings, while a deficit entails a net inflow and thus quicker credit growth. Appreciation of the real effective exchange rate (REER) is associated both with strong capital inflows and with greater incentives for borrowing in foreign currencies.

Thus, our estimation for credit growth, or the change in private credit to GDP over the last 4 quarters in country i at time t is given as:

$$CGrowth_{i,t} = \alpha_i + \beta_1 IF_{i,t-L} + \beta_2 DF_{i,t-L} + \varepsilon_{i,t} \quad (1)$$

whereby $IF_{i,t-L}$ is a vector of international factors including gross capital flows in country i at time t minus a lag of L (in our case 4 quarters), $DF_{i,t-L}$ is a vector of domestic factors, α_i is a constant terms with country random effects, β_1 and β_2 are vectors of estimated coefficients and ε is a standard error term.

In a next step, we estimate credit gap in the same way and against the same variables:

$$CGap_{i,t} = \alpha_i + \beta_3 IF_{i,t-L} + \beta_4 DF_{i,t-L} + \varepsilon_{i,t} \quad (2)$$

The results of these estimations allow us to compare the relative statistical significance of the international and domestic factors and thus to provide answers for hypotheses H_1 and H_2. If the estimated coefficients of vectors β_1 and β_3 are statistically significant, this would be consistent with H_1 and thus a consistent role of international capital flows on credit growth and credit excesses. If the estimated coefficients for the *debt component* within vectors β_1 and β_3 are statistically significant, then we can confirm hypothesis H_2. Note that the statistical and economic significance of the coefficients for β_2 and β_4 is interesting in its own right, and helps us ensure that important domestic fundamentals are being controlled for; it is not, however, necessary for the confirmation of the hypotheses.

In order to estimate the probability of banking crisis, we use a simple probit model:

$$p(crisis_{i,t} = 1) = \Phi(\alpha + \beta_5 IF_{i,t-L} + \beta_6 TC_{i,t-L} + \beta_7 CGap_{i,t-L} + \beta_8 W_{i,t} + \varepsilon_{i,t}) \quad (3)$$

where $\Phi(.)$is a cumulative standard normal distribution function and $IF_{i,t-L}$ is again a vector of international factors. $TC_{i,t-L}$ is trend credit and $CGap_{i,t-L}$is again the credit gap. In line with our interest in capital account openness, and the banking crisis literature such as Kaminsky and Reinhart (1999) and Mishkin (1999), the vector $W_{i,t}$ contains the Chinn-Ito index of openness, a dummy for fixed exchange rate regimes and so-called "regional banking crisis dummies", which taken on a value of 1 when any other country in a region is in crisis[8]. Here, statistical significance of the coefficients in vector β_5 would be evidence to confirm H_3 on the role of capital flows on

[8] Such dummies are a rough proxy for intra-regional contagion, and fit closely with the work of Kaminsky and Reinhart (2000), who show that the conditional probability of a banking crisis rises dramatically given crises within the region. These are not lagged, as they should have an immediate effect on the likelihood of a crisis being triggered.

banking crises. Statistical significance of the coefficient β_6 would be evidence to confirm H_4 on the role of the level of private credit on banking crises. Statistical significance of the coefficient β_7 would be consistent with earlier studies on the role of credit excesses, while the coefficient β_8 allows us to assess the impact of capital account openness, exchange rate regimes and regional crises. Again, while these are important controls, significance of β_7 and β_8 is not necessary for the hypotheses.

Given strong evidence of serial (AR1) correlation in the dependent variables credit growth and credit gap, the estimations of equations (1) and (2) use feasible generalized least squares (FGLS). Equation (3) is estimated with a simple panel probit specification. Throughout our regressions, we exclude the two-year period following banking crises so as to mitigate the volatile effects following a crisis, or "post-crisis bias" (Bussière and Fratzscher, 2006).[9]

Data, correlations and graphical analysis

The data for our study combines the gross capital flows data from the IMF's Balance of Payments (BOP) and International Financial Statistics (IFS) with the BIS' new database on total domestic credit (Dembiermont, Drehmann and Muksakunratana, 2013). In an innovation relative to the existing literature, the IMF data on gross capital flows are grouped into two components: "equity", which comprises foreign direct investment (FDI) and portfolio equity flows, and "debt", which comprises portfolio debt and other flows. While not yet common in similar studies, we find that this decomposition is much more insightful than the three components (FDI, portfolio investment, other investment) which the IMF reports. Specifically, the distinction between FDI and portfolio equity is already tenuous; FDI is defined by the IMF as any equity investment greater than 10% in a target company, while a 9% stake would be a portfolio equity flow. Moreover, there is little inherent difference between the purchase by foreign investors of a bond in capital markets – a portfolio debt flow – and other flows, which generally take the form of bank lending, e.g. intragroup bank loans and cross-border syndicated loans. Finally, our analysis confirms that portfolio debt and equity inflows may behave very differently, often having opposite signs in the same quarter, which implies that decomposing portfolio flows may lead to important insights.

The BIS data on total private credit takes account of lending by domestic banks, all other sectors (particularly capital market borrowing) and non-residents.[10] The real policy rate of the

9 An alternative method to that chosen here would be a vector autoregression (VAR) model, as in Rey (2013). This method can also be used in a panel setting, as in Love and Zicchino (2006). The key advantage of a VAR approach is the ability to test relationships between time series data without any theoretical underpinning and allowing for the possibility that estimated variables are endogenous. The resulting impulse response functions can offer information on the scale and persistence of effects. We leave VAR methods as an avenue for future research.

10 An overview of the data is online at http://www.bis.org/statistics/credtopriv.htm. Intra-financial sector borrowing, which has been found in some studies (e.g. Shin, 2012) to be highly pro-cyclical, is not included in the dataset.

central bank is defined as the central bank's short-term benchmark rate corrected for inflation. To capture long-term interest rates, we use a 10-year government bond yield, which is also corrected for inflation. Other macroeconomic variables are generally taken from IFS, with gaps filled from the OECD, national sources and Oxford Economics. In total, our sample includes 43 countries, of which 27 AEs and 16 EMEs[11]. Data is on a quarterly basis in the period Q1 1975 to Q4 2011. As with any long cross-country sample, the dataset remains an unbalanced panel, with data for emerging markets and transition countries before 1990 particularly thin. Our definition of banking crisis comes from the popular database of Laeven and Valencia (2013), and draws on 6 criteria for crises.[12] Over our sample period, there are 51 banking crises, or an unconditional probability of 0.82% of a crisis in any given quarter. Table 1 shows descriptive statistics, while Annex I gives further information on data sources and data preparation.

Table 1: Descriptive statistics of main variables

	Observations	Mean	St. deviation	Minimum	Maximum
GDP growth (1-year, %)	5176	3.35%	3.98%	-24.12%	16.70%
Inflation (1-year, %)	5738	33.8%	318.9%	-11.0%	14029.5%
Real policy rate (%)	4390	1.7%	13.2%	-98.7%	324.8%
Real monetary base growth rate (%)	4137	11.7%	16.1%	-47.6%	300.1%
Real long-term interest rate (%)	4567	2.0%	10.5%	-98.3%	56.4%
Real change in stock prices (2-year, %)	4238	32.0%	69.0%	-84.5%	1116.7%
Budget balance (% of GDP)	3956	-2.1%	5.1%	-33.7%	26.1%
Current account balance (% of GDP)	4460	0.1%	5.5%	-27.6%	27.7%
REER appreciation (2-year, %)	5166	0.6%	12.4%	-66.5%	101.9%
Gross total inflows (1-year, % of GDP)	4444	17.1%	89.8%	-60.7%	1659.9%
Gross equity inflows (1-year, % of GDP)	4299	9.4%	65.0%	-53.3%	1111.5%
Gross debt inflows (1-year, % of GDP)	4291	8.3%	30.5%	-119.9%	557.4%
Credit growth (1-year, % of GDP)	4761	2.8%	10.0%	-73.7%	146.9%
Credit gap (% of GDP)	4913	1.4%	13.2%	-165.1%	64.7%
EME dummy	6364	0.372	0.483	0	1
Banking crisis dummy (Laeven & Valencia)	6364	0.008	0.090	0	1

Table 2 shows the correlation between the debt and equity components of the financial account, on both the inflows and outflows side. Overall, correlations between inflows and outflows are rather high, thus confirming the results of Broner, Didier, Erce and Schmukler (2011). Notably, debt inflows are less correlated with equity outflows, and equity inflows less correlated with debt outflows, than with outflows of the same type.

11 Sample countries are Argentina, Australia, Austria, Belgium, Brazil, Canada, China, Colombia, Czech Republic, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Malaysia, Mexico, Netherlands, Norway, Philippines, Poland, Portugal, Russia, Singapore, South Africa, Spain, Sweden, Switzerland, Taiwan, Thailand, Turkey, Ukraine, United Kingdom and United States.

12 The criteria include extensive liquidity support, significant bank restructuring costs, nationalizations, guarantees, asset purchases and deposit freezes. We do not use the distinction between systemic and non-systemic bank crises.

Table 2: Correlations between components of gross inflows and outflows (in %)

	Gross total inflow	Gross equity inflow	Gross debt inflow
Gross total outflow	99.7%	98.0%	89.6%
Gross equity outflow	95.1%	97.6%	76.5%
Gross debt outflow	95.7%	90.2%	93.9%

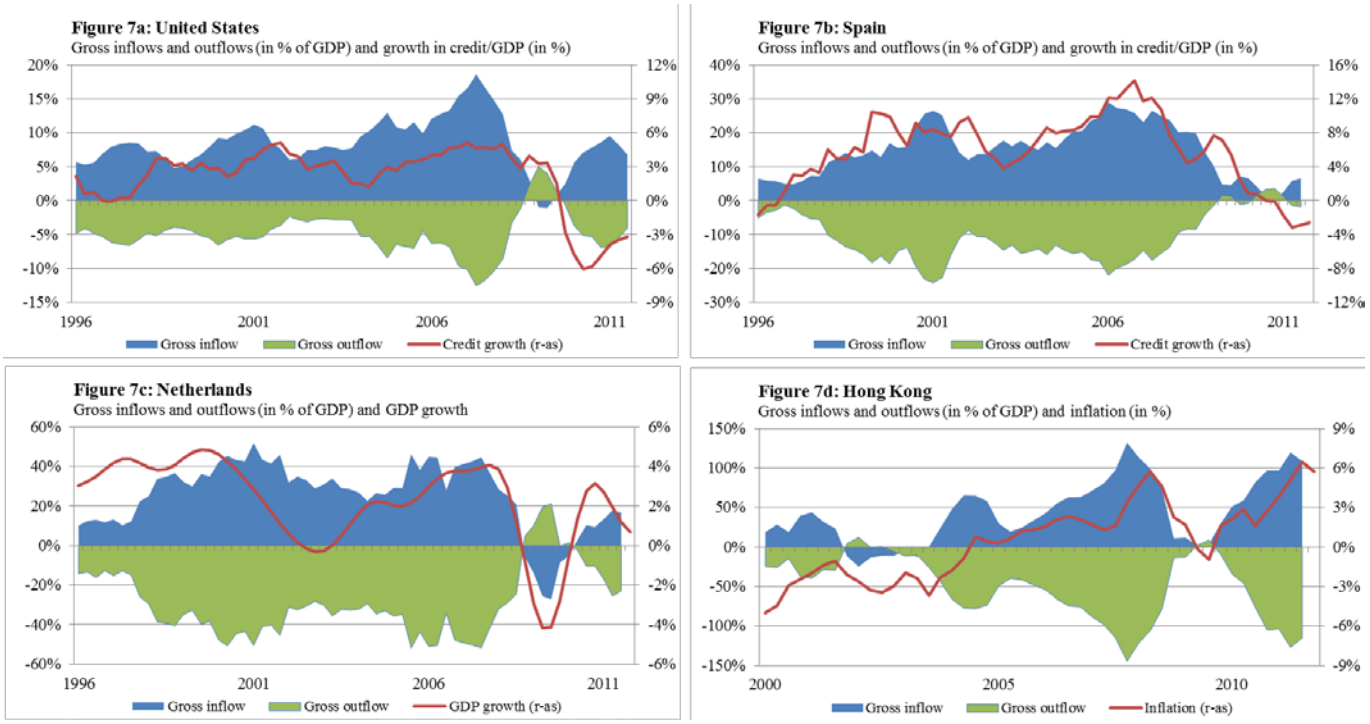
Looking at correlations with the other variables in our sample, Table 3 shows the positive relationship of gross capital inflows – especially debt inflows – with credit growth and the credit gap. Similarly, gross debt inflows are positively correlated with GDP growth; while the causality can run either way, this shows bank loans and capital market debt investment to be among the most pro-cyclical flows. Gross equity inflows have a lower correlation coefficient with GDP growth, implying more stability across the cycle than gross debt inflows. Notable is also the very low positive correlation between gross equity inflows and real changes in stock prices. A stronger budget balance, which is more likely when the economy is growing, and itself can improve a country's fiscal risk profile and create space for private investment (the opposite of "crowding out" of private credit), is associated with greater overall and debt inflows. A stronger current account balance is associated with stronger equity inflows, while REER appreciation shows a mild positive correlation with debt inflows.

Table 3: Correlations between components of gross inflows and other variables (in %)

	Gross total inflow	Gross equity inflow	Gross debt inflow
Credit growth	9.1%	6.1%	14.1%
Credit gap	9.0%	6.1%	13.6%
GDP growth	5.2%	3.3%	8.8%
Inflation	-2.0%	-1.2%	-3.1%
Real policy rate	-1.6%	-1.9%	-1.9%
Real monetary base growth	-1.0%	-0.8%	-1.1%
Real long-term interest rate	-1.0%	-1.2%	-2.1%
Real change in stock prices	0.6%	0.9%	1.1%
Budget balance	11.6%	7.6%	17.7%
Current account balance	13.5%	15.7%	7.0%
REER appreciation	1.3%	0.5%	3.2%

While the correlations shed some light on the relationship between our variables, it is notable that the scale of inflows to GDP varies considerably across countries, and there are strong idiosyncratic country differences in the correlations between macroeconomic variables and inflows. For example, in the US and Spain, two countries with substantial pre-crisis credit booms, total gross inflows fit relatively closely with changes in credit to GDP (Figures 7a and 7b, correlations of 30% and 78%, respectively). Both countries also have a particularly strong negative correlation between gross flows and long-term interest rates (-53% for the US, -69% for

Spain), providing some signs for the effect of foreign investment on financial market conditions. Meanwhile, gross inflows are more associated with GDP growth in the Netherlands than in other countries (figure 7c, correlation of 43%). Finally, gross portfolio inflows are more heavily associated with inflation in some Asian countries, including Hong Kong (Figure 7d, correlation of 78%). In each of these cases, the 2008-9 crisis represents a trend break, with gross inflows and outflows reversing, meaning a simultaneous repatriation of foreign assets and liabilities. Annex II sheds more light on the behavior of key variables including capital flows around national banking crisis episodes.



V. Multivariate estimation results

Having described our hypotheses, estimation method and data, we now move on to the results of the multivariate regressions.

Credit growth and credit excesses

We begin with the results of FGLS regressions for credit growth (Table 4). The impact of capital flows on credit growth is apparent both for advanced and emerging economies. Gross inflows have a strong association with credit growth, at the 95% significance level. This result holds in a pooled sample, and in separate estimations for AEs and EMEs. Moreover, when interacting the gross and net flows with a dummy variable for EMEs, we find that the impact of total flows on credit growth in EMEs is even stronger, both in terms of statistical and economic significance. When looking at the components of gross and net flows, we find that especially debt inflows lead to credit growth throughout the sample. Gross equity inflows have no

statistically significant impact on credit growth. The current account balance, which we also use as an external (net) variable, has the expected negative sign – i.e. greater credit growth when a country has a current account deficit – though this does not hold in the sub-sample of only AEs (specifications 3 and 4). REER appreciation has the expected positive sign throughout.

Table 4. Dependent variable: Credit growth (change in credit to GDP)

	(1)	(2)	(3)	(4)	(5)	(6)
	Total flows	Flow components	Only AEs	Only AEs	Only EMEs	Only EMEs
Inflation, 1-year	-0.138**	-0.204***	0.0249	0.0495	-0.105	-0.131
	[-2.388]	[-3.461]	[.1728]	[.3409]	[-1.356]	[-1.642]
Real policy rate, 1-year	0.114	0.0909	0.172*	0.164	0.0327	-0.0376
	[1.602]	[1.209]	[1.701]	[1.447]	[.296]	[-.3354]
Real monetary base growth, 1-year	0.00488	0.00552	-0.0000783	-0.000899	0.0312	0.0209
	[.5521]	[.6167]	[-.0087]	[-.1002]	[1.384]	[.9062]
Real long-term interest rate	-0.137**	-0.184***	-0.0971	-0.0700	-0.101	-0.0574
	[-2.437]	[-3.297]	[-.6545]	[-.4605]	[-1.404]	[-.7829]
Real stock price increase, 2-year	0.00241	0.00395	0.00472	0.00448	-0.000152	-0.00111
	[.9884]	[1.588]	[1.643]	[1.557]	[-.034]	[-.2386]
GG Budget balance, 1-year	0.534***	0.530***	0.428***	0.380***	0.831***	0.761***
	[8.321]	[8.106]	[6.418]	[5.56]	[4.779]	[4.273]
Current account balance, 1-year	-0.145**	-0.196***	0.0141	0.0391	-0.502***	-0.465***
	[-2.297]	[-3.164]	[.2049]	[.567]	[-3.644]	[-3.313]
REER appreciation, 2-year	0.0860***	0.0900***	0.0450**	0.0465**	0.121***	0.114***
	[6.134]	[6.363]	[2.428]	[2.507]	[5.348]	[4.995]
Gross capital inflows, 1-year	0.00766***		0.00797***		0.198***	
	[2.579]		[2.952]		[3.249]	
Gross equity inflows, 1-year		0.000815		-0.000448		0.00639
		[.1821]		[-.1102]		[.0656]
Gross debt inflows, 1-year		0.0217***		0.0224***		0.402***
		[3.291]		[3.799]		[4.157]
Gross inflows*EME dummy	0.267***					
	[5.449]					
EME dummy	0.0150	0.0304***				
	[1.442]	[3.119]				
Constant	0.0357***	0.0388***	0.0257***	0.0231**	0.0593***	0.0588***
	[5.535]	[6.102]	[2.778]	[2.495]	[4.524]	[4.413]
Chi-squared	270.1	242.3	98.01	105.0	157.5	165.0
# of observations	2132	2102	1450	1446	682	656

Significance at 90%, 95% and 99% level denoted with *, ** and ***. All independent variables have 4q lags.

Meanwhile, several of the domestic control variables – including inflation (-),real long-term interest rates (-),and government budget balance (+) – have the expected sign and are significant in the pooled sample, though not always for AEs and EMEs separately. Real stock price increases, which are associated with higher collateral values (net worth) and easier lending conditions for corporates, have only a weak positive effect. The positive coefficient of real monetary base growth is as expected – while the positive coefficient for the real policy rate is the opposite of expectations. Notably, neither is significant. The somewhat significant positive coefficient of higher real policy rates for the AE sample may imply that the *reaction* of AE central banks to frothy financial and economic conditions seems to dominate over the *transmission* of real policy rates to credit growth over a one-year horizon.

An important question is whether the same variables that explain credit growth are also of use in estimating credit excesses, as measured by the credit gap. Table 5 shows the same regressions for the credit gap; all specifications are fully analogous. Here, total gross inflows are again associated with a larger credit gap, at a yet higher significance level (99%), and the effect is again even stronger for EMEs than for AEs. Among the components, the results are again driven by debt inflows, while equity inflows have no statistically significant effect. Among the domestic variables, it is notable that inflation, real monetary base growth and real long-term interest rates do not have a similarly consistent, statistically significant effect on credit excesses as in the previous estimations of credit growth. Real stock price increases now take on a negative sign, suggesting that for credit excesses, the substitution between equity and debt financing may be more important – though it is not consistently significant. The general government budget balance retains a positive and significant effect (crowding out effect).

Table 5. Dependent variable: Credit Gap (deviation of credit to GDP from trend)

	(1)	(2)	(3)	(4)	(5)	(6)
	Total flows	Flow components	Only AEs	Only AEs	Only EMEs	Only EMEs
Inflation, 1-year	-0.0107	-0.0383	0.0980	0.166	0.0103	0.0294
	[-.1614]	[-.5615]	[.4166]	[.6937]	[.1956]	[.5567]
Real policy rate, 1-year	0.148*	0.153*	0.109	0.0992	0.106	0.00612
	[1.868]	[1.809]	[.8072]	[.639]	[1.457]	[.0829]
Real monetary base growth, 1-year	0.00890	0.00936	0.00713	0.00577	0.0229*	
	[.9822]	[1.028]	[.6205]	[.5015]	[1.68]	
Real long-term interest rate	0.0165	-0.0122	0.529**	0.589***	-0.0579	0.0151
	[.2687]	[-.1985]	[2.394]	[2.625]	[-1.233]	[.3214]
Real stock price increase, 2-year	-0.00189	-0.00141	-0.000711	-0.000586	-0.00331	-0.00465
	[-.732]	[-.5348]	[-.1865]	[-.1526]	[-1.196]	[-1.643]
GG Budget balance, 1-year	0.694***	0.662***	0.811***	0.727***	0.360***	0.496***
	[8.804]	[8.171]	[7.833]	[6.894]	[2.961]	[3.99]
Current account balance, 1-year	-0.243***	-0.273***	-0.103	-0.0988	-0.596***	-0.822***
	[-2.687]	[-2.999]	[-.8495]	[-.8257]	[-5.352]	[-8.629]
REER appreciation, 2-year	0.00649	0.0101	-0.0115	-0.0105	0.0165	
	[.4378]	[.6756]	[-.4675]	[-.4284]	[1.175]	
Gross capital inflows, 1-year	0.0214***		0.0210***		0.179***	
	[5.149]		[4.477]		[4.546]	
Gross equity inflows, 1-year		0.00470		0.00298		0.0275
		[.7275]		[.4228]		[.4603]
Gross debt inflows, 1-year		0.0423***		0.0415***		0.352***
		[6.111]		[5.327]		[5.606]
Gross inflows*EME dummy	0.168***					
	[3.166]					
EME dummy	-0.0254	-0.0182				
	[-1.092]	[-.726]				
Constant	0.0335**	0.0356**	0.0169	0.0137	-0.000838	0.00512
	[2.379]	[2.341]	[.8299]	[.6959]	[-.0741]	[.4537]
Chi-squared	195.9	197.4	124.8	134.3	137.8	314.1
# of observations	2140	2108	1454	1450	686	693

Significance at 90%, 95% and 99% level denoted with *, ** and ***. All independent variables have 4q lags.

Overall, we find the international factors to be strongly significant and in line with theoretical expectations for both credit growth and credit excesses. The strong significance of

international capital flows in both sets of regressions thus allows us to confirm hypothesis H_1. The significance of coefficients for the debt component of capital flows confirms hypothesis H_2. While domestic factors such as inflation, interest rates and the fiscal stance matter for credit growth, the credit gap is driven to a greater extent by both a net inflow of foreign savings (current account) and gross inflows. The separate regressions for advanced and emerging economies already give evidence that credit excesses in EMEs seem to be more consistently determined by international factors than those in AEs, and that the magnitude of the impact may be larger in EMEs.

Probability of banking crises

To test hypothesis H_3, we now turn to the probability of countries experiencing banking crises. Table 6 shows the results of panel probit regressions with international factors, the credit gap and the trend level of private credit. Specification 1 confirms that gross inflows and the current account balance each have the expected sign and are statistically significant both in the pooled sample and for advanced economies. Thus, higher inflows and a higher current account deficit are associated with a higher probability of a crisis 4 quarters later. As in the regressions for credit growth and credit gap, the interaction term between EMEs and gross capital flows is significant, suggesting an even higher impact of gross capital inflows on the propensity of crises in EMEs. Among components (specification 2), it is debt inflows which are most clearly linked to the chance of crisis, while equity inflows actually have an (insignificant) negative sign.

In line with the literature on financial openness, we also include the Chinn-Ito Index of capital account openness in the regressions; the coefficient is small and insignificant throughout, showing that – when controlling for macroeconomic factors and capital flows – the degree of openness has no significant impact on crisis probability. A dummy for countries with fixed exchange rate regimes has a consistently positive but insignificant coefficient, in line with previous findings on the vulnerability of fixed regimes (Mishkin, 1999). Regional crisis dummies are shown to have a positive and significant sign (specifications 3 and 4). When included, they weaken the statistical significance and size (but not sign) of the coefficients for gross inflows. The results are robust to splitting the sample by AEs and EMEs (specifications 5 and 6).

Again, the regressions show strong significance for international factors, meaning we can confirm hypothesis H_2 across the whole sample. The significant coefficient of the interaction term for EMEs and gross capital flows, and the results of specification 6, in which both credit gap and capital flows are highly significant, together show that for EMEs, banking crises, too, are more likely to be explained by international than by domestic factors.

The same regression results also allow us to test hypothesis H_3. The first two rows of table 6 show that in both the pooled sample (specifications 1 to 4) and for only AEs (specification 5), the

trend credit to GDP has a highly significant and positive effect on the probability of a banking crisis. This is true even in the presence of the credit gap, which has the expected positive sign, but is not significant. It is only in the regression with only EMEs (specification 6) that the coefficient for the level of private credit turns negative and insignificant. Given the much lower level of private credit to GDP in the EMEs in our sample, this may be evidence of non-linear effects, which we will test formally in section VI.

Table 6. Dependent variable: Banking crisis (Laeven and Valencia, 2010)

	(1) Total flows	(2) Flow components	(3) Regional crisis dummies	(4) Regional crisis dummies	(5) Only AEs	(6) Only EMEs
Trend credit (in % of GDP)	0.420***	0.338**	0.769***	0.765***	0.636***	-0.784*
	[2.987]	[2.156]	[2.954]	[2.817]	[3.085]	[-1.731]
Credit gap (in % of GDP)	0.583	0.583	1.202	1.259	0.143	1.136
	[1.189]	[1.133]	[1.56]	[1.563]	[.2485]	[.6819]
Current account balance, 1-year	-2.928**	-1.987	-1.660	-1.175	-2.572	-3.459
	[-2.379]	[-1.532]	[-.8731]	[-.59]	[-1.551]	[-1.024]
Gross capital inflows, 1-year	0.0927**		0.223		0.295	5.237***
	[2.37]		[.6056]		[1.2]	[2.688]
Gross equity inflows, 1-year		-0.246		-1.805		
		[-1.397]		[-1.028]		
Gross debt inflows, 1-year		0.796**		0.936		
		[2.36]		[1.3]		
Gross inflows*EME dummy	2.927**		1.199			
	[2.253]		[.6317]			
EME dummy	0.237	0.468***	1.119***	1.329***		
	[1.081]	[2.601]	[2.676]	[3.689]		
Capital account openness^			0.0121	0.0223	0.0450	-0.0765
			[.1334]	[.2405]	[.4685]	[-.6745]
Fixed exchange rate dummy^			0.139	0.179	0.280	0.356
			[.5953]	[.7647]	[1.387]	[1.371]
Banking crisis dummy, Asia^			2.191***	2.174***		
			[6.643]	[6.567]		
Banking crisis dummy, Americas^			2.523***	2.528***		
			[6.939]	[6.883]		
Banking crisis dummy, Europe^			2.489***	2.557***		
			[8.324]	[8.221]		
Constant	-2.967***	-2.934***	-4.756***	-4.845***	-3.528***	-2.562***
	[-14.04]	[-13.37]	[-8.808]	[-8.964]	[-9.061]	[-8.396]
Random component variance	-14.87	-14.97	-15.80	-14.84	-15.94	-5.265
	[-.5113]	[-.5156]	[-.5445]	[-.5126]	[-.4255]	[-.3172]
Pseudo R-squared	0.366	0.367	0.671	0.676	0.255	0.544
Chi-squared	34.26	35.62	95.48	94.45	26.24	12.69
# of observations	3550	3468	3525	3443	2366	1159

Significance at 90%, 95% and 99% level denoted with *, ** and ***. All independent variables have 4q lags, except capital account openness, the fixed exchange rate dummy and banking crisis dummies (denoted with "^"), which are contemporaneous.

Summary of regression results

Overall, it appears that gross capital flows do have an important impact on credit growth and credit excesses, alongside the current account balance and real appreciation. Especially for EMEs, gross capital flows also seem to significantly precede banking crisis at a lag of 4 quarters, with stronger impact on EMEs. We find reasonable evidence that international factors – especially gross debt inflows – have a significant impact on credit growth and credit excesses on

top of what is explained by domestic fundamentals, and can thus confirm hypotheses H_1 and H_2. The impact on banking crises is also apparent (H_3). Taken together, this supports the narrative of financial globalization as a driver of country vulnerability, particularly in EMEs. At the same time, the level of private credit has explanatory power on the vulnerability to banking crisis beyond the impact of capital flows and the credit gap. This allows confirmation of hypothesis H_4 on the great financial expansion as a driver of crises, particularly in AEs.

VI. Robustness checks

Given that our empirical framework is subject to a number of methodological choices, this section tests whether our results are sensitive to alternative definitions of independent variables, differences in capital account openness between countries and non-linear relationships between our variables of interest. Overall, we can confirm that the key results of section VI continue to hold under each exercise.

Are results robust to alternative definitions of independent variables?

The clearest methodological choice required in the model of credit growth and the credit gap is the decision to correct variables for inflation and use real interest rates, monetary base growth, stock price changes and exchange rate appreciation. The first column of Tables 7 and 8 (in annex III) shows that this correction does not change the sign of coefficients compared with the baseline models in tables 4 and 5, though coefficients become smaller and less significant, as part of the effect of each is now being conflated with the inflation rate. Using 1-year REER appreciation continues to lead to a highly significant coefficient for credit growth, but not for the credit gap; 1-year changes in the stock price now have a negative and significant impact on credit growth and the credit gap, perhaps because of short-term noise in the movement of stock prices. Taken together, we confirm the methodological choice for real rates and for 2-year stock price and REER rises, and show that the impact of capital flows remains unchanged.

The use of a country fixed effects estimation with ordinary least squares (OLS), rather than the FGLS framework, is illustrated in specification (3) in table 7. This leads to a loss of significance for the coefficient of the gross inflows variable for credit growth, while the coefficient on the interaction term for EMEs remains strong and significant. When using fixed effects for estimations of the credit gap, in specification (3) of table 8, the coefficients of gross inflows and the cross-term actually become more significant[13]. This exercise suggests that the idiosyncratic characteristics of countries (cross-section dimension) and shared global conditions (time dimension) can influence the strength and significance of the relationship between gross flows and credit growth, but the positive relationship is only moderately sensitive to the choice

13 While not shown, results become even stronger in OLS estimations when neither fixed effects nor FGLS are used.

of methods to account for variability in each dimension. Again, given the characteristics of our sample data, we continue to stand by the FGLS approach.

The choice of a lag of 4 quarters for all independent variables can also be adjusted, e.g. to 2 and 8 quarters as in specifications (4) and (5) of both tables. While the behavior of most control variables does not change considerably, there is one interesting effect for gross inflows: the coefficient of the cross-term with EMEs actually becomes negative for both credit growth and the credit gap at 8 quarters, even as the total effect of gross inflows for EMEs (the sum of the coefficients of the inflow and cross-term variable) remains positive. The fact that the impact of inflows on credit growth and excesses is less persistent in EMEs may be a reflection of more volatile changes in gross flows to EMEs, particularly around instances of sudden stop. On a related note, net inflows, which are considered in specification (5), have a positive and significant impact on credit excesses of similar magnitude for both AEs and EMEs, but only significantly affect credit growth in EMEs. This seems to imply that the relationship with net inflows is less reliable than that with gross inflows.

Are there structural differences based on capital account openness and exchange rate regime?

A key question in light of the policy debate on financial openness is whether there are structural differences in the relationships described depending on a country's capital account regime. Table 9 (in annex III) shows regressions for credit growth and the credit gap with the sample broken down into a more open group, with a Chinn-Ito Index greater than or equal to the sample median (specifications 1 and 4), and a group of more closed countries with a value below the median (specification 2 and 5). On the domestic variables, there is relatively little difference in the behavior of control variables among both groups; the coefficient for inflation turns positive for open economies, but it is not significant. Yet the impact of gross inflows is notable: for relatively closed economies, stronger inflows are not associated with higher credit growth, but do remain positively and significantly linked to credit excesses, with a much higher coefficient for gross inflows. A higher current account balance (surplus) is associated with lower credit growth and excesses for open but not closed economies, while REER appreciation is only associated with credit growth (not excesses), with stronger impact on closed economies. When the Chinn-Ito index is itself included as an explanatory variable, greater openness is associated with lower credit growth, but higher credit excesses – perhaps given the correlation with AEs. Overall, there is not a clear message on the impact of an open capital account. While there are differences between the two groups in the channel regarding which external factors affect domestic credit, closed economies do not appear insulated from international factors.

Regressions on the probability of banking crisis can also be broken down by capital account openness. Specifications 1 and 2 in table 10 show probit regressions of banking crisis split by

relatively open and closed economies. Notably, the coefficient of gross capital flows remains significant for both groups, but the size of the coefficient is higher for closed economies, likely given the smaller scale of inflows. Trend credit and the current account balance are only significant for open economies (which tend to have deeper credit markets and thus be closer to the level of "too much finance"). Specification 3 shows that liberalization of the capital account is not associated with a higher probability of crisis one year later; the negative coefficient (significant at the 90% level) implies that if anything, countries that liberalize are *less* likely to undergo a banking crisis in the immediately following quarters.[14]

Table 10 also contains regressions on banking crisis with countries split by exchange rate regime. As seen in specification 4, countries with floating exchange rates display similar patterns to the whole sample – but none of the results are significant. Meanwhile, countries with fixed exchange rates (specification 5), are more vulnerable both to gross capital inflows and current account deficits, as seen from the higher coefficients on the probability of crisis. Looking at *changes* in exchange rate regime – a variable which is +1 when a country has moved to a fixed regime in the past 4 quarters, and -1 when it has moved to a floating regime – no statistically significant link can be established.[15]

Overall, these results seem to indicate that relatively closed economies are not necessarily more sheltered from the effects of foreign capital flows on credit growth, excesses and crises than relatively open economies. Countries with fixed exchange rate regimes seem especially vulnerability to capital flows, but the (non-) effect of openness is similar regardless of exchange rate regime. Thus, while financial globalization may be associated with greater vulnerability, this confirms the largely disappointing results on the effectiveness of capital controls as a strategy to defend against external imbalances (Kose et al., 2006; Frost and Saiki, 2013).

Are there non-linear relationships between credit, capital flows and crises?

A final question is the extent to which the relationships between capital flows, private credit and crises are non-linear. To test for such relationships in a simple manner, we estimate the probability of banking crisis with quadratic terms for both the level of credit to GDP and capital flows to GDP. Table 11 in annex III shows the results.

We have shown that both a larger size of private borrowing to GDP and a deviation of credit to GDP from its long-term trend are associated with a greater chance of crisis; specification 1

14 There could be important issues of endogeneity driving this result; for example, countries are less likely to liberalize and more likely to close the capital account in periods of instability. Nonetheless, dividing the variable into positive values (liberalization) and negative values (closing of the capital account) yields similar results. Lagging the variable by 4 to 20 quarters yields the same results, though it becomes insignificant for lags of 8 or more quarters.

15 Asymmetric alternatives, e.g. dummies for a move to a fixed regime, move to a floating regime, or any change in regime, yield similarly insignificant results – even when all other variables are omitted. This also holds at various lags of the variables (4 to 20 quarters).

reiterates the baseline regression of table 6 for purposes of comparison with the specifications to follow. Yet when included together, the coefficients for the level of credit to GDP (-) and its quadratic term (+) have opposite signs (specification 2). This means that both low levels and high levels of credit to GDP imply susceptibility to a banking crisis, while values near the middle of the distribution are associated with a lower propensity. Based on the coefficients, the level of credit to GDP which minimizes crisis risk is near 92% - similar to the findings of Arcand, Berkes and Panizza (2012), Cecchetti and Kharroubi (2012) and Law and Singh (2014) for the level of private credit and growth. Meanwhile, as shown in specification (4) the coefficients for capital flows (+) and their quadratic term (-) are the opposite, implying that intermediate levels of flows are associated with a higher propensity for crisis. Yet like regressions for the impact of private credit on growth, the results are not robust to splitting the sample into AEs and EMEs (specifications 5 and 6). While the non-linear relationships of these and other variables are not fully elucidated here, this may be an avenue for future research.

VII. Conclusion: potential applications and extensions

Our results underline that foreign capital flows can be a contributing factor to domestic credit excesses and banking crises. It is perhaps intuitive that changes in domestic credit are associated with changes in foreign liabilities. Credit to GDP is a stock measure of domestic debt liabilities of borrowers through bank and capital market lending, while the financial account is a flow measure for one part of the financing of domestic banks and markets. Nonetheless, the empirical results show that external financing can drive credit booms, particularly if they come in the form of gross debt inflows. By combining gross inflow data with information on the current account, a measure of *net* imbalances, we can gain a richer understanding of foreign-funded credit dynamics than analysis with only net flows. The relationship between gross foreign funding and domestic credit conditions could be investigated with other indicators, as well – such as loan-to-deposit ratios of banks, lending rates or the supply of international credit.

There are a number of reasons why foreign fund flows may have different effects than domestically sourced savings. First, foreign financing is not limited by the size of an economy, and hence can exceed domestic credit levels possible with only domestic financing. This can disturb the savings and investment equation. Moreover, it is possible that foreign creditors tend to lend to “marginal borrowers” with inferior credit quality, and that they have less access to information on creditworthiness than domestic agents. Finally, foreign-financed credit may be more tenable to shocks given that such activities may not be core activities of the providing institutions and that foreign banks and institutional investors may be less physically and strategically committed to the host markets. Our results do not imply that substantial inflows of foreign capital are universally followed by vulnerabilities; indeed, the literature is rich with

examples of direct and indirect benefits to foreign investment (Kose et al., 2006; Brunnermeier et al., 2011; Obstfeld, 2014). Moreover, it is likely that the vulnerability to credit excesses would decrease with measures of financial market development such as the efficiency of domestic capital markets which can channel flows into productive investment. The weak impact of capital market openness on the probability of crisis, and the fact that domestic credit in relatively closed economies is also influenced by foreign factors, underlines that capital controls are unlikely to provide systematic respite. On the other hand, the crisis underlined the vulnerability of advanced economies, as well, to certain forms of capital flows (such as foreign wholesale funding) and foreign-funded credit excesses.

By zooming in on domestic credit levels and banking crises, we also have the opportunity to examine the impact of rapidly rising credit levels in countries across our sample (great financial expansion) and to compare its relative importance in preceding banking crises. Our results offer further confirmation that the credit gap and level of trend credit are associated with greater vulnerability to crisis. Rapid credit growth can come both from domestic factors and foreign financing. While teasing these two out is necessarily difficult, our analysis shows that foreign inflows also have an autonomous impact on the probability of banking crises on top of the effect through credit excesses. Moreover, our regression results show that especially in AEs the *level* of private credit appears to be positively associated with banking crises over and above what is explained by international factors and the credit gap. This underlines that the credit to GDP level – so often used as a proxy for financial development – is also associated with debt overhangs. Excessively deep credit markets can be linked to banking instability.

Our results have a bearing on discussions on global capital flows, macroeconomic management and the future of financial regulation. If gross capital flows contribute to the build-up of domestic vulnerabilities, then there may be arguments for policy measures to manage them, e.g. through various macroeconomic and macroprudential measures. While our results do not give grounds for optimism on the effectiveness of capital controls, there may be a broad range of currency-based and activity-based macroprudential measures which allow authorities to build up buffers in the financial system and economy when capital is flowing in, both to stem the likelihood of crisis and allow for better crisis responses. If the great financial expansion is a key driver of cross-country vulnerability, then policy should focus on domestic vulnerabilities through financial regulation and structural financial reform. If national financial sectors – as proxied by credit to GDP – are simply too large, then measures to encourage deleveraging and encourage more sustainable credit dynamics in the future are in order.

While our empirical exercise cannot offer bold answers to the big questions about financial globalization and the great financial expansion, it gives some further evidence that each are important, and that policy makers will have to grapple with solutions to both foreign and

domestically funded credit excesses well beyond the current post-crisis period. For policy makers in emerging market economies, managing the effects of financial globalization will remain particularly challenging.

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Annex I: data sources and preparation

As with any large cross-country panel of macroeconomic data, we have had to use a variety of data sources and their different definitions. Moreover, adjustments have been made to correct for incomplete series and data breaks in order to ensure that data is useable for regressions[16]. The most notable alterations of the data are as follow:

- **Gross capital flows:** IMF BOP data on gross capital flows consist of foreign investment in the reporting economy ("gross inflows") and resident investment abroad ("gross outflows"). Net inflows are defined as the difference between the two. Both inflows and outflows can be grouped into the components "equity", which comprises foreign direct investment (FDI) and portfolio equity flows, and "debt", which comprises portfolio debt and other flows.[17] Overall gross capital inflows, the debt and equity components and net inflows (used in the robustness checks) are defined as the average over the past four quarters of capital flows (in USD) to domestic GDP (in USD).
- **Credit trend, gap and growth:** Private domestic credit in local currency (LC) – from the BIS database on credit to the private non-financial sector – is divided by current GDP in LC[18]. In line with the guidance of the BCBS for calibration of the countercyclical capital buffer (CCB), the credit trend is calculated with a one-sided HP filter and lambda of 400,000. Credit gap is the difference between the actual credit-to-GDP level from the trend level. Credit growth is defined as the 4-quarter percentage increase in the level of credit-to-GDP relative to the initial level.
- **Interest rates:** The policy rate is compiled from Datastream and national sources, based on the short-term rate targeted by each country's national central bank. Long-term interest rates are defined as the yield on 10-year LC government bonds, and are compiled from the OECD, national sources and Oxford Economics.[19] The nominal rates are corrected with the inflation rate over the past four quarters to yield the real interest rates.[20]

[16] Intra-series gaps are interpolated as 0 (flow data), or as a simple average of the previous and following quarter (stock data).

[17] Data for China, Taiwan and Iceland come from national sources. Because India (full sample), Korea (prior to 1988), the Philippines (before 1996) and Malaysia (before 2002) do not report the breakdown of portfolio inflows into debt and equity, we have assumed that all portfolio inflows are in the form of debt. A test of the opposite assumption – that all portfolio flows are equity when the breakdown is unreported – does not materially alter the results of any of the correlation exercises or regressions.

[18] Due to data availability, credit data for three countries – Philippines, Colombia and Taiwan – is taken from IFS line 32, and thus represents only bank lending.

[19] All interest rates are quarterly averages. For Ukraine, due to the lack of a 10-year benchmark bond, we have used the average coupon rate for issues in each quarter with a minimum maturity of 4 years, weighted by volume. Missing quarters have been interpolated using a cubic spline.

[20] Ideally, the real 10-year bond yield should correct for future inflation expectations over the coming 10 years, which are more likely to drive investor decisions. Various specifications have been tried and do not significantly alter the empirical results. Hence, for simplicity, we have stuck to a method consistent with that of the policy rate.

- **Monetary base:** data comes from the IMF's International Financial Statistics. For most countries, M0 is used.[21] The increase relative to 4 quarters previously is corrected with the inflation rate over the same four quarters.
- **REER and stock price growth:** data comes from the IMF's International Financial Statistics. Changes are expressed as a percentage increase in the index over the past two years (baseline) or one year (robustness check). The real effective exchange rate (REER) index already takes account of inflation in the domestic country and trading partners. The increase in stock prices is corrected using the inflation rate over the same period.
- **Openness and exchange rate regime:** The Chinn-Ito Index of capital account openness (Chinn and Ito, 2008), has been imported without alteration[22]. The exchange rate classification of Reinhart and Rogoff (2009) has been converted to a dummy variable, with currency unions, pegs and crawling bands narrower than or equal to +/-2% are considered fixed, and all other regimes floating. Because both series are available at annual frequency, annual values are repeated in each quarter of the respective year.

The paper's dataset is available in STATA-compatible (.dta) format upon request.

21 Definitions of the monetary base differ starkly across countries. For France, Austria and Luxembourg, M1 has been used, while for other EU countries, we have used currency in circulation. For India, M2 is used as a proxy.
22 The index, which is based on reporting in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER), is not available for Luxembourg or Taiwan.

Annex II: relationship of key variables around crisis episodes

In order to have a better understanding of the movement of our variables of interest around the time of a banking crisis, this annex shows mean values of the variables in the 8 quarters leading up to and following a banking crisis.

Figure 9 shows the behavior of capital flows around crisis periods, divided by AEs and EMEs. It is clear that gross inflows tend to surge around a year before a banking crisis, albeit at a much higher level relative to GDP in AEs. Levels of inflows often plummet during and immediately after a banking crisis, and for EMEs at least, tend to stay well below their average levels in the ensuing quarters. Net inflows show a similar pattern for EMEs, which generally do not have large external assets, yet not for AEs, where sales of external assets may help soften the blow of drying up foreign investment in the immediate post-crisis quarters. Among the components of gross inflows (figure 10), it is again debt inflows which exhibit the typical boom-bust behavior, while equity inflows remain positive for both AEs and EMEs throughout the crisis period, even if there is a drop below the whole-period average after a banking crisis.

When looking at credit growth and the credit gap (figure 11), a similar picture of high growth followed by collapse emerges, though especially EMEs exhibit a temporary higher credit growth rate in the two quarters immediately following a crisis – potentially due to denominator effects of GDP. These effects are short-lived, and by 8 quarters after a crisis, both credit growth and the credit gap are well below their long-run averages. Nonetheless, the volatility of the relationship in this period justifies the decision to exclude the post-crisis period from regressions on the relationship between capital flows, credit growth and crises.

Taking a five-year window around crises, figure 12 confirms that especially for advanced economies, below-average policy rates and long-term interest rates often precede crises. This relationship seems much less robust for emerging economies which – in addition to lower (real) policy rates and higher (nominal) interest rates overall – may have had banking crises in periods of high inflation and balance of payments stress, when policy rates were being used as a tool to guard against depreciation and market interest rates rose suddenly in the crisis quarters.

While graphical analysis cannot yet confirm or deny our empirical hypotheses, it strengthens the evidence that both capital flows (portfolio and other inflows) and credit excesses tend to precede banking crises across both advanced and emerging economies.

Figure 9: Gross and net capital flows around a banking crisis

In % of GDP

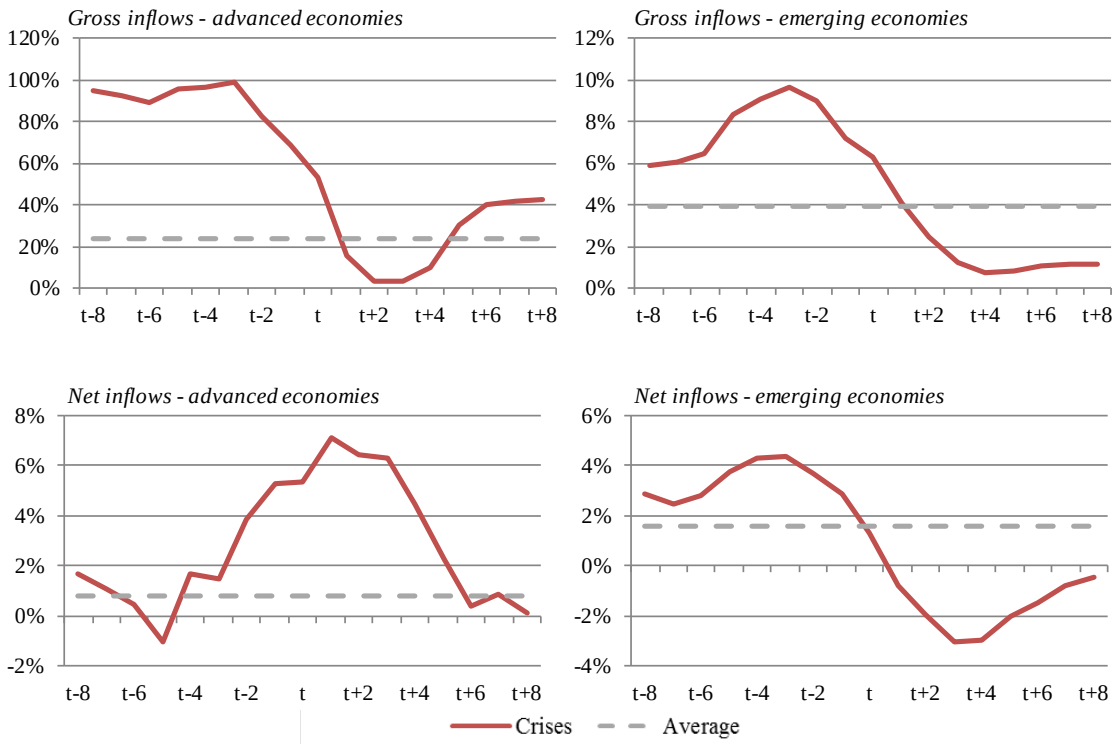


Figure 10: Components of gross capital flows around a banking crisis

In % of GDP

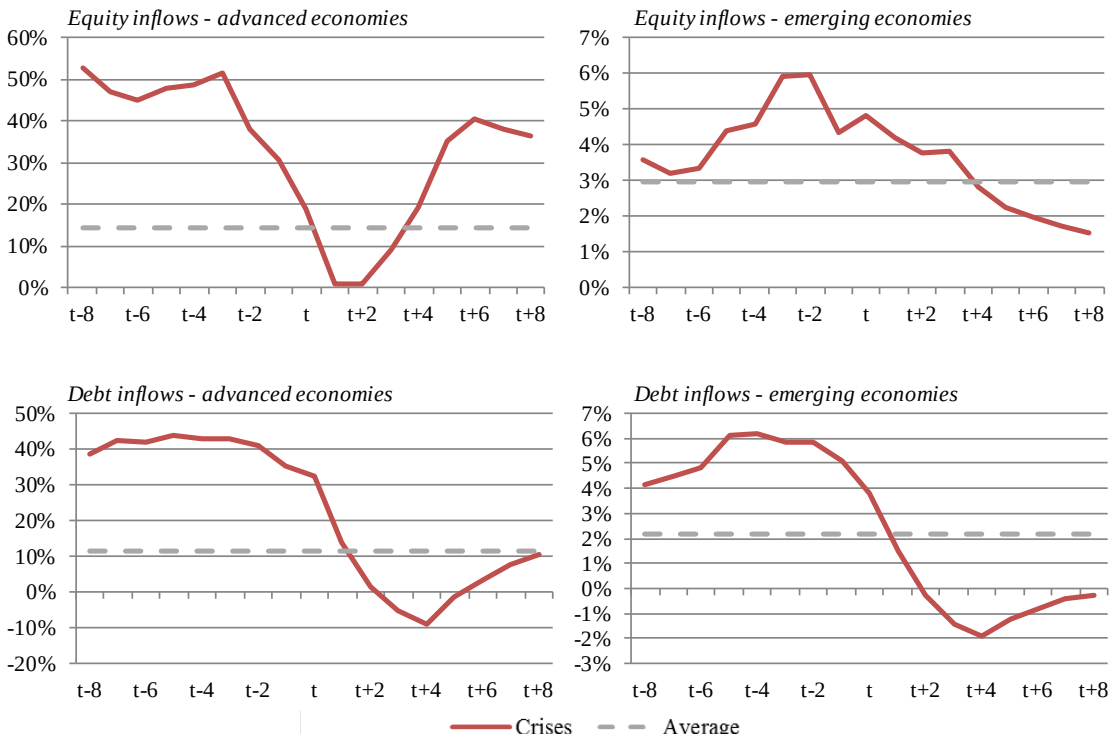


Figure 11: Credit growth and credit gap around a banking crisis

In % of GDP

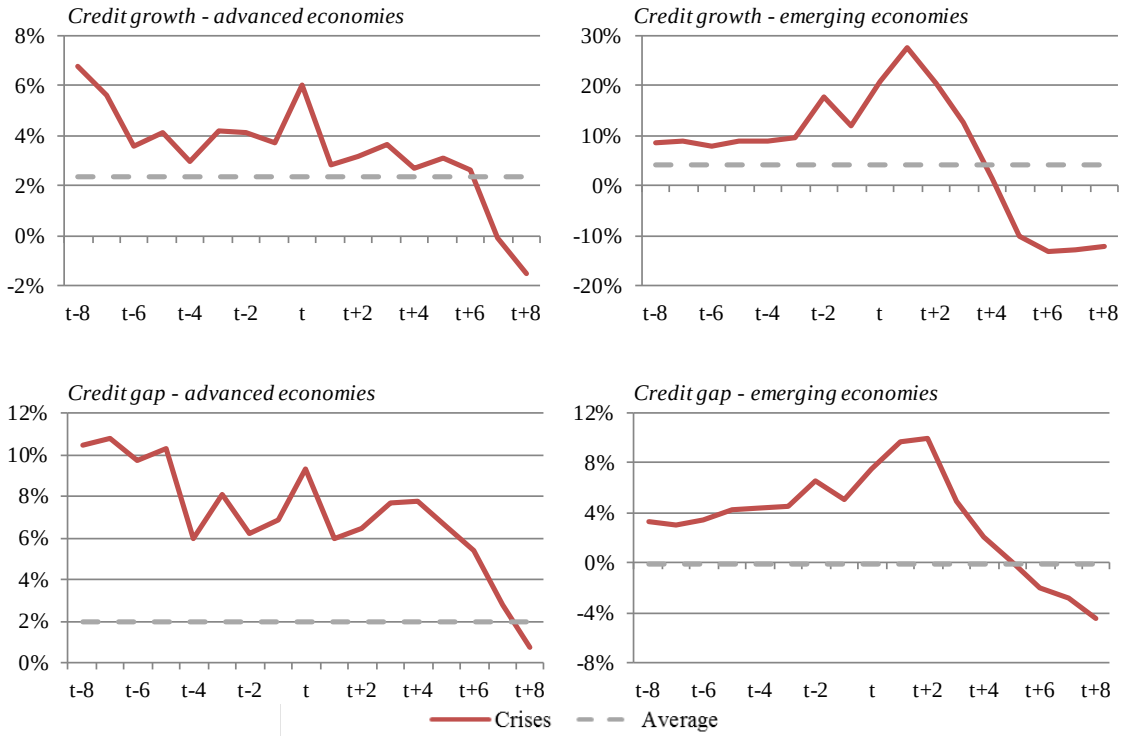
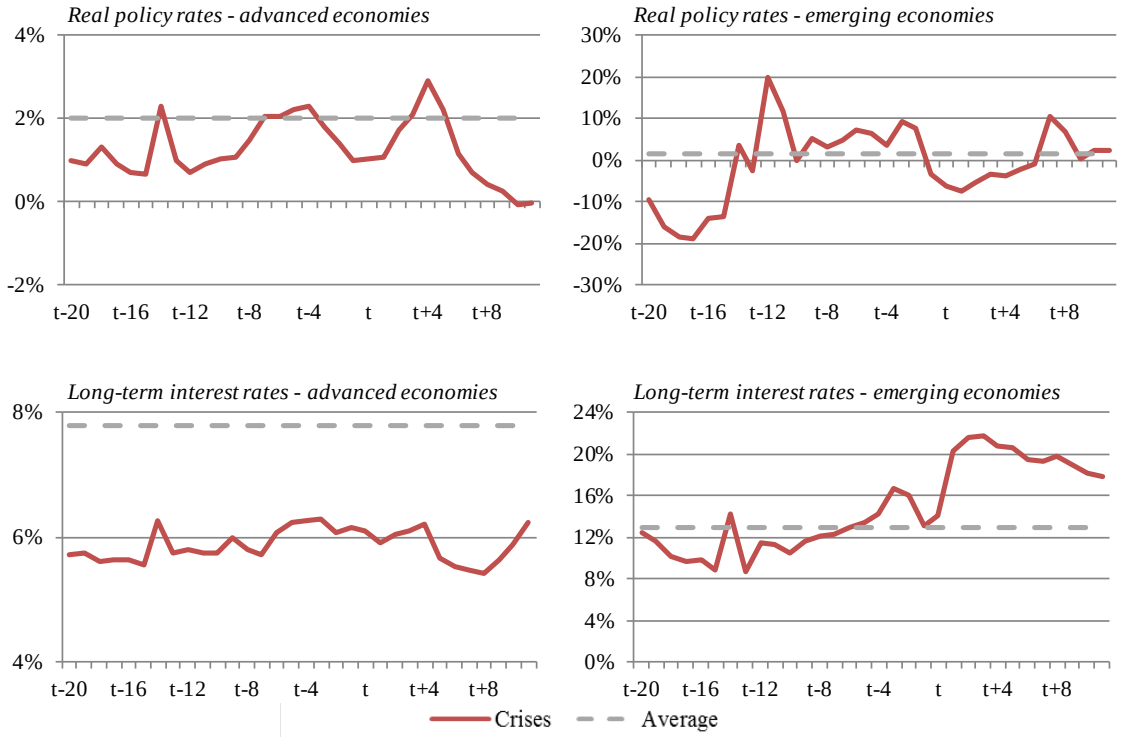


Figure 12: Interest rates around a banking crisis

In % of GDP



Annex III: regression results from robustness checks

Table 7. Dependent variable: Credit growth (change in credit to GDP), alternative specifications

	(1) Nominal rates	(2) 1-year rates	(3) Fixed effects	(4) 2q lag	(5) 8q lag	(6) Net inflows
Inflation, 1-year	-0.0483	-0.222***	-0.189***	-0.220***	-0.155**	-0.0803
	[-.7709]	[-3.85]	[-3.924]	[-2.939]	[-2.549]	[-1.361]
Nominal policy rate, 1-year	0.120*					
	[1.787]					
Real policy rate, 1-year		0.122*	0.0975	0.209***	0.0521	0.0807
		[1.724]	[1.421]	[2.957]	[.9912]	[1.128]
Nominal monetary base growth, 1-year	0.00435					
	[.5032]					
Real monetary base growth, 1-year		0.00833	0.0228*	-0.00265	0.000464	0.00624
		[.9433]	[1.817]	[-.3002]	[.0519]	[.7053]
Nominal long-term interest rate	-0.104**					
	[-2.002]					
Real long-term interest rate		-0.142**	-0.234***	-0.247***	-0.257***	-0.103*
		[-2.524]	[-4.658]	[-4.619]	[-4.926]	[-1.809]
Nominal stock price increase, 2-year	0.00144					
	[.6498]					
Real stock price increase, 1-year		-0.00514*				
		[-1.662]				
Real stock price increase, 2-year			0.0255***	0.00116	0.0282***	0.00270
			[8.651]	[.5017]	[8.362]	[1.108]
GG Budget balance, 1-year	0.523***	0.595***	0.501***	0.456***	0.0829	0.542***
	[8.007]	[9.463]	[10.29]	[6.957]	[1.106]	[8.575]
Current account balance, 1-year	-0.137**	-0.198***	0.0323	-0.303***	-0.0438	-0.0919
	[-2.148]	[-3.105]	[.5953]	[-4.688]	[-.6715]	[-1.374]
NEER appreciation, 2-year	0.103***					
	[6.682]					
REER appreciation, 1-year		0.0868***				
		[5.615]				
REER appreciation, 2-year			0.163***	0.0592***	0.0555***	0.0862***
			[11.76]	[4.349]	[3.843]	[6.144]
Gross capital inflows, 1-year	0.00781***	0.00801***	0.00247	0.0144***	0.0217***	
	[2.622]	[2.658]	[.6079]	[4.684]	[9.579]	
Gross inflows*EME dummy	0.273***	0.263***	0.167***	0.292***	-0.182***	
	[5.528]	[5.353]	[3.269]	[6.912]	[-3.202]	
Net capital inflows, 1-year						0.0155
						[.5498]
Net inflows*EME dummy						-0.477***
						[-6.039]
EME Dummy	0.0169	0.0195*		0.0156	0.0351***	0.0153
	[1.616]	[1.842]		[1.496]	[3.461]	[1.523]
Constant	0.0318***	0.0414***	0.0389***	0.0373***	0.0266***	0.0359***
	[4.883]	[6.357]	[9.85]	[5.569]	[4.34]	[5.699]
Chi-squared	272.3	263.6		274.3	256.0	270.8
# of observations	2075	2152	2132	2191	1988	2132

Significance at 90%, 95% and 99% level denoted with *, ** and ***. All independent variables have 4q lags, except for specifications (4) and (5). Specification (3) uses fixed effects instead of feasible generalized least squares (FGLS).

Table 8. Dependent variable: Credit gap, alternative specifications

	(1) Nominal rates	(2) 1-year rates	(3) Fixed effects	(4) 2q lag	(5) 8q lag	(6) Net inflows
Inflation, 1-year	-0.144**	-0.0129	0.0360	0.0155	-0.141*	0.0114
	[-2.144]	[-.197]	[.4772]	[.173]	[-1.911]	[.1649]
Nominal policy rate, 1-year	0.114					
	[1.505]					
Real policy rate, 1-year		0.140*	0.0690	0.117	-0.0631	0.165**
		[1.794]	[.6424]	[1.489]	[-1.133]	[2.06]
Nominal monetary base growth, 1-year	0.00842					
	[.948]					
Real monetary base growth, 1-year		0.00809	-0.00363	-0.00791	-0.00833	0.0106
		[.8961]	[-.1847]	[-.8812]	[-.9133]	[1.163]
Nominal long-term interest rate	0.0500					
	[.8769]					
Real long-term interest rate		0.0108	-0.0924	-0.0495	-0.0746	0.00342
		[.1771]	[-1.175]	[-.8554]	[-1.266]	[.0539]
Nominal stock price increase, 2-year	-0.00205					
	[-.8721]					
Real stock price increase, 1-year		-0.00613*				
		[-1.915]				
Real stock price increase, 2-year			-0.00694	-0.00268	0.0172***	-0.00133
			[-1.503]	[-1.106]	[4.798]	[-.511]
GG Budget balance, 1-year	0.687***	0.676***	1.071***	0.410***	0.436***	0.788***
	[8.552]	[8.854]	[14.05]	[5.118]	[4.375]	[10.2]
Current account balance, 1-year	-0.241***	-0.244***	-0.203**	-0.460***	0.0544	-0.230**
	[-2.628]	[-2.734]	[-2.393]	[-4.908]	[.5487]	[-2.472]
NEER appreciation, 2-year	0.0309*					
	[1.883]					
REER appreciation, 1-year		-0.0154				
		[-.966]				
REER appreciation, 2-year			0.0880***	0.0268*	0.0487***	0.00889
			[4.067]	[1.89]	[3.165]	[.5936]
Gross capital inflows, 1-year	0.0210***	0.0216***	0.0191***	0.0248***	0.0293***	
	[5.027]	[5.245]	[3.014]	[5.213]	[11.33]	
Gross inflows*EME dummy	0.168***	0.176***	0.242***	0.221***	-0.215***	
	[3.13]	[3.318]	[3.039]	[4.905]	[-3.349]	
Net capital inflows, 1-year						-0.0523*
						[-1.744]
Net inflows*EME dummy						-0.0768
						[-.8922]
EME Dummy	-0.0265	-0.0259		-0.0330	0.00219	-0.0272
	[-1.163]	[-1.137]		[-1.329]	[.0909]	[-1.215]
Constant	0.0329**	0.0341**	0.0398***	0.0300**	0.0332**	0.0430***
	[2.372]	[2.481]	[6.441]	[1.976]	[2.303]	[3.183]
Chi-squared	193.6	202.6		175.6	244.9	159.7
# of observations	2083	2160	2140	2200	1996	2140

Significance at 90%, 95% and 99% level denoted with *, ** and ***. All independent variables have 4q lags, except for specifications (4) and (5). Specification (3) uses fixed effects instead of feasible generalized least squares (FGLS).

Table 9. Dependent variables: Credit growth and **Credit gap**, split by capital account openness

	(1) Credit growth Open economies	(2) Credit growth Closed economies	(3) Credit growth with openness	(4) Credit gap Open economies	(5) Credit gap Closed economies	(6) Credit gap with openness
Inflation, 1-year	0.153	-0.181**	-0.176***	0.356*	-0.119	-0.0408
	[.9846]	[-2.372]	[-3.335]	[1.713]	[-1.365]	[-.6609]
Real policy rate, 1-year	0.277**	0.109	0.1000	0.388***	0.0682	0.100
	[2.276]	[1.072]	[1.528]	[2.918]	[.6126]	[1.364]
Real long-term interest rate	-0.333**	-0.155**	-0.189***	0.170	-0.0424	-0.00891
	[-2.092]	[-2.213]	[-3.691]	[.9231]	[-.5534]	[-.1575]
Real stock price increase, 2-year	0.00397	0.00214	0.00347	-0.00314	-0.00149	-0.00116
	[1.372]	[.4935]	[1.539]	[-1.03]	[-.3284]	[-.4844]
Real monetary base growth, 1-year	0.00645	0.0176	0.00546	0.00915	0.0197	0.00907
	[.7056]	[.8702]	[.6691]	[.995]	[.9605]	[1.078]
GG Budget balance, 1-year	0.485***	0.687***	0.532***	0.675***	0.425**	0.667***
	[6.924]	[4.045]	[8.198]	[7.534]	[2.07]	[8.166]
Current account balance, 1-year	-0.240***	-0.107	-0.249***	-0.491***	0.00796	-0.339***
	[-3.311]	[-.8854]	[-4.18]	[-4.391]	[.0525]	[-3.935]
REER appreciation, 2-year	0.0656***	0.110***	0.0947***	0.0219	0.00414	0.0110
	[3.125]	[5.298]	[7.36]	[.9842]	[.1899]	[.8029]
Gross capital inflows, 1-year	0.00845***	-0.0108	0.00343	0.0187***	0.124***	0.0102
	[3.388]	[-.4494]	[.3483]	[5.143]	[4.718]	[.9097]
Chinn-Ito Index of openness			-0.00607**			0.0100**
			[-2.171]			[2.181]
Constant	0.0344***	0.0633***	0.0585***	0.0302*	0.00334	0.0236*
	[3.793]	[5.375]	[7.898]	[1.879]	[.1633]	[1.755]
Chi-squared	128.9	107.2	248.6	153.9	69.74	156.2
# of observations	1316	816	2107	1316	824	2115

Significance at 90%, 95% and 99% level denoted with *, ** and ***. All independent variables have 4q lags.

Table 10. Dependent variable: Banking crisis, split by capital account openness and exchange rate regime

	(1) Open economies	(2) Closed economies	(3) Change in openness	(4) Floating XR	(5) Fixed XR	(6) Change in XR regime
Trend credit (in % of GDP)	0.650***	-0.108	0.158	0.325	0.251	0.169
	[2.969]	[-.4609]	[1.173]	[1.344]	[1.206]	[1.23]
Credit gap (in % of GDP)	-0.0237	0.402	0.449	0.00985	0.590	0.435
	[-.0317]	[.5243]	[.8303]	[.0141]	[.7159]	[.8317]
Current account balance, 1-year	-6.127**	-0.871	-1.977	0.604	-5.021**	-2.206*
	[-2.522]	[-.3551]	[-1.525]	[.3356]	[-2.303]	[-1.713]
Gross capital inflows, 1-year	0.101**	0.996*	0.401*	0.646	0.479*	0.527**
	[2.238]	[1.881]	[1.731]	[1.476]	[1.767]	[2.368]
Fixed exchange rate dummy^	0.292	0.270	0.213			
	[1.377]	[1.259]	[1.437]			
Chinn-Ito Index^				-0.110	-0.0583	-0.0410
				[-1.098]	[-.8838]	[-.7795]
Change in Chinn-Ito Index^			-0.458**			
			[-2.572]			
Change in exchange rate dummy^						-0.0881
						[-.1735]
Constant	-3.319***	-2.583***	-2.717***	-2.821***	-2.594***	-2.563***
	[-9.033]	[-11.36]	[-14.41]	[-11.04]	[-13.21]	[-18.87]
Random component variance	-16.02	-15.20	-14.42	-14.61	-15.43	-14.03
	[-.4473]	[-.4473]	[-.495]	[-.4052]	[-.03]	[-.4778]
Pseudo R-squared	0.106	0.211	0.179	0.139	0.188	0.162
Chi-squared	16.52	10.76	30.70	10.79	17.31	25.02
# of observations	1803	1747	3522	1575	1950	3525

Significance at 90%, 95% and 99% level denoted with *, ** and ***. All independent variables have 4q lags, except capital account openness, the fixed exchange rate dummy and changes in these (denoted with "^"), which are contemporaneous.

Table 11. Dependent variable: Banking crisis, test for non-linear effects

	(1) Baseline	(2) Credit to GDP quadr. term	(3) Capital flows quadr. term	(4) Baseline with quadr. term	(5) Only AEs	(6) Only EMEs
Trend credit (in % of GDP)	0.378***	-0.115		-0.0122	0.263	-1.878
	[2.623]	[-.7722]		[-.0579]	[.8522]	[-1.429]
(Trend credit)^2		0.151***		0.162**	0.118	0.743
		[2.631]		[2.158]	[1.221]	[.957]
Credit gap (in % of GDP)	0.936*			0.377	0.322	0.775
	[1.943]			[.7138]	[.5084]	[.427]
Gross capital inflows, 1-year	0.0726**		0.336**	0.0750**	0.0739*	5.627***
	[1.98]		[2.427]	[2.012]	[1.959]	[3.318]
(Gross capital inflows)^2			-0.0221*			
			[-1.746]			
Gross inflows*EME dummy	3.096**			3.494***		
	[2.445]			[2.752]		
EME dummy	0.244			0.197		
	[1.109]			[.9283]		
Constant	-2.932***	-2.488***	-2.360***	-2.761***	-3.031***	-2.036***
	[-13.43]	[-20.43]	[-37.45]	[-13.53]	[-10.63]	[-5.878]
Random component variance	-14.95	-14.74	-15.09	-14.80	-15.78	-12.75
	[-.5211]	[-.5225]	[-.53]	[-.5209]	[-.44]	[-.2562]
Pseudo R-squared	0.366	0.266	0.232	0.373	0.233	0.537
Chi-squared	27.93	10.37	10.10	33.44	22.95	14.91
# of observations	3618	4422	3960	3618	2459	1159

Significance at 90%, 95% and 99% level denoted with *, ** and ***. All independent variables have 4q lags.

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