

# Linking Bank Crises and Sovereign Defaults: Evidence from Emerging Markets

---

This paper studies the mechanisms through which bank and sovereign distress feed into each other, using a large sample of emerging market economies over three decades.



**Irina Balteanu**

Bank of Spain

**Aitor Erce**

European Stability Mechanism

---

European Stability Mechanism

## Disclaimer

This Working Paper should not be reported as representing the views of the ESM. The views expressed in this Working Paper are those of the author(s) and do not necessarily represent those of the ESM or ESM policy.



# Linking Bank Crises and Sovereign Defaults: Evidence from Emerging Markets

---

Irina Balteanu<sup>1</sup> Bank of Spain

Aitor Erce<sup>2</sup> European Stability Mechanism

## Abstract

We analyze the mechanisms through which bank and sovereign distress feed into each other, using a large sample of emerging market economies over three decades. After defining “twin crises” as events where bank crises and sovereign defaults combine, and further distinguishing between those bank crises that end up in sovereign defaults and vice-versa, we study what differentiates “single” and “twin” events. Using an event analysis methodology, we document systematic differences between “single” and “twin” crises across various dimensions. We show that many of the regularities often associated with either “bank” or “debt” crises are present in twin events only. We further show that “twin” crises themselves are heterogeneous events: the proper time sequence of crises that compose “twin” episodes is important for understanding these events. Guided by these facts, we use discrete-variable econometric techniques to assess the main channels of distress transmission between crises. We find that balance sheet interconnections, credit dynamics, financial openness and economic growth are important drivers of twin crises. Our results inform the flourishing theoretical literature on the mechanisms surrounding feedback loops of sovereign and bank stress.

**Keywords:** Banking Crises, Sovereign Defaults, Feedback Loops, Balance Sheets

**JEL codes:** E44, F34, G01, H63

---

1 Email: [irina.balteanu@bde.es](mailto:irina.balteanu@bde.es)

2 Email: [a.erce@esm.europa.eu](mailto:a.erce@esm.europa.eu)

## Disclaimer

This Working Paper should not be reported as representing the views of the ESM. The views expressed in this Working Paper are those of the author(s) and do not necessarily represent those of the ESM or ESM policy.

No responsibility or liability is accepted by the ESM in relation to the accuracy or completeness of the information, including any data sets, presented in this Working Paper.

© **European Stability Mechanism, 2017** All rights reserved. Any reproduction, publication and reprint in the form of a different publication, whether printed or produced electronically, in whole or in part, is permitted only with the explicit written authorisation of the European Stability Mechanism.

# Linking Bank Crises and Sovereign Defaults: Evidence from Emerging Markets<sup>1</sup>

Irina Balteanu

Aitor Erce

We analyze the mechanisms through which bank and sovereign distress feed into each other, using a large sample of emerging market economies over three decades. After defining “twin crises” as events where bank crises and sovereign defaults combine, and further distinguishing between those bank crises that end up in sovereign defaults and vice-versa, we study what differentiates “single” and “twin” events. Using an event analysis methodology, we document systematic differences between “single” and “twin” crises across various dimensions. We show that many of the regularities often associated with either “bank” or “debt” crises are present in twin events only. We further show that “twin” crises themselves are heterogeneous events: the proper time sequence of crises that compose “twin” episodes is important for understanding these events. Guided by these facts, we use discrete-variable econometric techniques to assess the main channels of distress transmission between crises. We find that balance sheet interconnections, credit dynamics, financial openness and economic growth are important drivers of twin crises. Our results inform the flourishing theoretical literature on the mechanisms surrounding feedback loops of sovereign and bank stress.

*KEYWORDS: Banking crises, Sovereign Defaults, Feedback Loops, Balance Sheets.*

JEL CODES: E44, F34, G01, H63

---

<sup>1</sup> This is a significantly revised version of our previous paper *Banking Crises and Sovereign Defaults in Emerging Countries: Exploring the Links*. We thank M. Bussière, G. Cheng, J. Frost, J. Jimeno, E. Kharroubi, G. Perez-Quirós, R. Portes, P. Rabanal, two anonymous referees, and seminar participants at European Stability Mechanism, 2014 Emerging Market Finance Workshop, Bank of Spain, Bank for International Settlements, 2012 European Summer Symposium in International Macroeconomics, 2012 Workshop for the Sixth High-Level Seminar of the Eurosystem and Latin American Central Banks, Tenth Emerging Markets Workshop and CEMLA Meetings for their comments, and K. Siskind for excellent editorial assistance. L. Fernandez, M. Gomez, B. Urquizu and I. Gramatki provided excellent research assistance. The views herein are the authors’ and should not be reported as those of the Bank of Spain, the European Stability Mechanism or the Eurosystem.

## 1. Introduction

Fast-growing balance sheets and falling capital ratios in recent decades have increased banking system risks, leading to larger and more frequent public interventions after financial crises (Alessandri and Haldane, 2009). In turn, these interventions have strained sovereigns and, at times, threatened their debt sustainability (Reinhart and Rogoff, 2011). Still, distress has often transmitted in the opposite direction with acute fiscal problems triggering financial crises (Caprio and Honohan, 2008). This perverse feedback loop of fiscal and financial distress has been at the core of the recent crises in advanced economies.<sup>2</sup> On the one hand, the materialization of contingent claims in the form of deposit guarantees brought havoc to the Icelandic government's balance sheet.<sup>3</sup> On the other hand, pro-cyclical fiscal policy and a lack of competitiveness led to a sovereign debt crisis in Greece which, in turn, severely weakened local banks.<sup>4</sup>

While intertwined sovereign and bank crises are nothing new, the literature looking at how crises combine ("twin crises" literature) has only recently begun to examine their links.<sup>5</sup> Concerning emerging markets, only a few papers address the two-way nature of this relationship. Panizza and Borenzstein (2008) find that the probability of a bank crisis conditional on a default is higher than the unconditional one, while the probability of a default conditional on a bank crisis is just slightly higher than the unconditional one. Reinhart and Rogoff (2011) obtain the opposite result: bank crises are significant predictors of sovereign crises, but not the other way around.<sup>6</sup> Unfortunately, these papers do not formally study the channels through which these diverging results materialize. Similarly, while there is an increasing amount of work using advanced economies, the focus is on the recent crisis.<sup>7</sup> Relatedly, the theoretical literature is moving beyond modelling the macroeconomic effects of sovereign defaults (Mendoza and Yue, 2011 or Arellano, 2009) into explaining the role of financial dynamics (Malucci, 2013) and banks' balance sheets (Sosa-Padilla (2012) or Engler & Gobbe-Sttefen (2014)).

Our paper contributes to this growing literature by using event analyses and discrete-variable econometric models to study the channels through which sovereign and bank crises intertwine. Using a large sample of emerging markets over three decades, we study the dynamics of a set of variables describing the balance sheet linkages between banks and sovereigns, banking sector characteristics, the state of public finances, and the overall economy. New to the literature, we differentiate between four types of events: "single" bank crises i.e. bank crises that are not followed by sovereign defaults; "single" sovereign debt crises i.e. sovereign defaults not followed by a bank crisis; "twin bank-debt" crises, which start with a bank crisis, followed by a sovereign one; and "twin debt-bank" crises, where a sovereign crisis is followed by a bank crisis.

We find that there are systematic differences between "twin" and "single" crisis events across most of the variables we study, and, in particular, across variables describing the interplay between the balance sheets of domestic banks and of the relevant central bank and government, the level and dynamics of financial intermediation, public finances, financial openness, and real growth. Moreover, by separating "single" and "twin" events, we show that a number of empirical facts usually associated with either "bank" or "debt" crises are to be found in "twin" events only. This is

---

<sup>2</sup> See Mody and Sandri (2011), Acharya et al. (2014), Alter and Beyer (2013).

<sup>3</sup> Bank failures increased net public debt by 13% of GDP (Carey, 2009).

<sup>4</sup> As foreign investors withdrew, banks became major public debt holders. Successive rating downgrades, ending in a debt restructuring, contributed to the collapse of the Greek banks.

<sup>5</sup> The "twin crises" literature has mainly focused on the link between bank and balance-of-payments crises (Kaminsky and Reinhart, 1999).

<sup>6</sup> Reinhart and Rogoff (2011) present four stylized facts. First, bank crises often lead sovereign crises. Second, external debt surges ahead of bank crises. Third, public debt increases ahead of sovereign crises (sovereign had "hidden debts"). Fourth, short-term debt increases before debt and bank crises.

<sup>7</sup> Moody's (2014) and Alter and Beyer (2013), using a VAR, find a strong interdependence between fiscal and banks risks in the euro area.

the case for deposit runs and credit crunches, which we show are not a necessary consequence of sovereign defaults.

Another interesting finding is that, in contrast to what a significant part of the “twin crises” literature seems to implicitly assume, “twin crises” are far from being homogenous events, and considering the sequence of crises within “twin” episodes is important for understanding their transmission channels and economic consequences. We uncover contrasting dynamics of budget deficits and expenses, inflation, short-term foreign debt and capital inflows, which would have otherwise gone unnoticed. In addition to those differences, we also find remarkable similarities across “twin” types. Both types of “twin” events are accompanied by deeper recessions, boom-bust credit dynamics, and feature stronger balance sheet connections between the banks and the sovereigns.

Event studies are similar to univariate regressions in that they “only” examine the dynamics around the times of the crises indicator by indicator. But crises are about multiple vulnerabilities. For that reason, we also assess the importance of the above mentioned factors on the transmission of stress using multinomial and bivariate models. Our results show that the balance sheet interconnections between banks and their sovereigns and central banks, economic growth, credit creation and financial openness all help explain the onset of twin crises events.

The next section discusses the main feedback channels between bank and sovereign risk, as identified in the literature. Section 3 introduces the definitions of crises and describes the data. Section 4 presents the econometric analysis and discusses the main results. Section 5 derives implications of our findings for the literature. Finally, section 6 concludes.

## **2. How does distress transmit? An overview of the literature**

Banking crises may put strains on governments through both direct and indirect channels. The former refers to the fiscal costs that the sovereign incurs to bail out the banking sector. The latter goes through the impact of crises on the broader economy and market sentiment. Similarly, when considering the transmission channels of a fiscal crisis on the financial sector, the effect of the default on the broader economy can be traced through the domestic financial system, in addition to the direct balance-sheet linkages. Below, we briefly discuss the main channels through which sovereign and bank crises intertwine as identified in the literature.<sup>8</sup>

### **Balance sheet channels**

According to Candelon and Palm (2010), bank rescue operations may impair the sustainability of public finances.<sup>9</sup> These operations can include central bank liquidity provisioning, public recapitalization or the execution or materialization of public guarantees and contingent liabilities. According to Gray and Jobst (2013) and Gray et al. (2013), contingent liabilities can have a strong impact on fiscal risk. Acharya et al. (2014) show that if the sovereign becomes overburdened, the value of public guarantees falls, aggravating the feedback loop from the financial sector into the sovereign. In turn, when considering the transmission of a fiscal crisis to the banking system, Noyer (2010) argues that if assets need to be written off or rescheduled, banks are the first in line to take a hit. This way, banks’ sovereign exposures might lead to large capital losses, threatening banks’ solvency. Brutti (2009) shows that the sovereign’s incentive to repay is driven by the risk of

---

<sup>8</sup> The fiscal costs of bank crises are well documented (see Feenstra and Taylor (2012), Reinhart and Rogoff (2011) or Arellano and Kocherlakota (2012)).

<sup>9</sup> Rosas (2006) find public bank bailouts more likely in open, rich economies or if turmoil was due to regulatory issues. Instead, electoral limits and central bank independence favor bank closure.

triggering a bank crisis. In fact, according to Livshits and Schoors (2009), the government has incentives to not adjust prudential regulation when public debt becomes risky. While this keeps borrowing costs low, a sovereign default may trigger a bank crisis. IMF (2002) shows that banks do not hold capital against sovereign risk, as prudential regulation considers government bonds risk-free.<sup>10</sup> Drechsler et al. (2013) present a similar argument regarding the euro area. According to them, capital regulation and the ECB's collateral policy give preferential treatment to euro area government bonds, providing incentives for banks to load up on such bonds, setting the stage for the appearance of perverse feedback loops. According to Darraq-Pires et al. (2013), the positive connection between fiscal and bank risk is due to the banks' reliance on sovereign securities for hedging liquidity shocks.

### **Macroeconomic channels**

Regarding the transmission of bank crises into the sovereign realm, Reinhart and Rogoff (2008c) note that, after a bank crisis, the deterioration of the fiscal position is likely to occur due to a combination of lower revenues and higher expenditures (assistance to troubled banks and outlays associated with the economic downturn). In the same vein, Candelon and Palm (2010) argue the economic downturn accompanying bank crises increases the deficit and drives up public debt. Honohan (2008) argues that a critical factor explaining the subsequent fiscal distress, beyond the direct cost of bank rescues, is the collapse in tax revenues due to the deep contraction created by the bank crisis.<sup>11</sup> Reinhart and Rogoff (2009) provide evidence of a strong negative impact of financial turmoil on asset prices, employment and output.<sup>12</sup> Also Baldacci and Gupta (2009) show that using fiscal policy to solve a bank crisis leads, even in a favorable external environment, to sharp rises in debt and deficit.<sup>13</sup> Goldstein (2003) argues that distress can transmit to the sovereign even if debt levels are low. In fact, over half of the default episodes surveyed by Reinhart and Reinhart (2009) took place against debt levels below 60% of GDP.<sup>14</sup>

Laeven and Valencia (2011) focus on the ability of bank rescues to minimize the credit crunch created by the bank crisis. They show that firms dependent on external financing benefit significantly from bank rescues. Similarly, Kollmann et al. (2012) find that recent bank rescues helped improve macroeconomic performance. Still, while they show that bank rescue operations lead to increased investment, they find that sovereign debt purchases by domestic banks crowd out private investment, in line with the evidence in Gennaioli et al (20014b) and Popov and Van Horen (2013).

As regards "twin debt-bank crises", Reinhart and Rogoff (2008b) show that defaults go hand in hand with inflation, currency devaluations and bank crises.<sup>15</sup> According to these authors, the ensuing fiscal contraction may lead to reduced economic activity, further damaging the financial system.<sup>16</sup> Moreover, the economic downturn may be reinforced by a credit crunch, as banks reduce lending due to capital losses and the increase in uncertainty that comes with the default. Popov and Van Horen (2013), Broner et al. (2014) and Gennaioli et al. (2014b) support the view that large sovereign

---

<sup>10</sup> The authorities often react to debt problems by coercing local banks to hold sovereign debt (in non-market terms), aggravating the situation in an event of default (Díaz- Cassou et al., 2008).

<sup>11</sup> The effects are specific to each episode, but estimated fiscal costs of the median systemic banking crisis stand at 15.5% of GDP, with public debt increasing by around 30% of GDP.

<sup>12</sup> Erce (2012) suggests that the degree of bank intermediation strongly affects a debt restructuring's ripple effect through the economy.

<sup>13</sup> They further argue that the composition of fiscal stimulus affects the length of crises. There is a trade-off between boosting aggregate demand (short-run) and productivity growth (long-run).

<sup>14</sup> As noted by Goldstein (2003), debt-to-GDP fails to take into account contingent liabilities.

<sup>15</sup> De Paoli et al. (2009) find that two thirds of sovereign defaults overlap with banking crises, and almost half with both banking and currency crises.

<sup>16</sup> Relatedly, Angeloni and Wolff (2012), using individual bank data, assess the impact of sovereign exposures on banks' performance during the euro-area crisis.

exposures can limit banks' ability to extend loans to the private sector, triggering a credit crunch. These papers document a stronger reallocation away from domestic lending in the euro area periphery during the recent crisis.<sup>17</sup>

### **External sector channels**

Bank crises may ignite a currency crash, making the sovereign unable to repay foreign currency debt (Reinhart and Rogoff, 2011, De Paoli et al., 2009). This is more likely to happen if the central bank uses reserves to finance bailouts, or the government uses monetization to overcome the crisis (Jacome, 2015).

In addition, bank crises could lead to a drop in external financing, via their impact on market sentiment. Cavallo and Izquierdo (2009) show that, in emerging markets, capital flows may collapse for months or years after bank crises, potentially triggering a solvency crisis.<sup>18</sup> Conversely, Reinhart and Rogoff (2008a) find that bank crises are often preceded by strong capital inflows. Focusing on advanced economies, Van Rixtel and Gasperini (2013) argue that banks' borrowing constraints in foreign currency affect the creditworthiness of sovereigns. All these can be worsened by too much foreign debt and too much short-term debt (Obstfeld, 2011).<sup>19</sup>

Turning to the transmission of sovereign stress, Gennaioli et al. (2014b) show that sovereign defaults tend to trigger capital outflows and foreign credit crunches. In their view, strong financial institutions amplify the costs of default, disciplining the government. Also Broner et al. (2013), Gennaioli et al. (2014a) and Das et al. (2011) show that corporate borrowers and banks may face a sudden stop in financing after a sovereign default. Sovereign defaults can curtail access to foreign capital also to private agents. A similar effect is described in Reinhart and Rogoff (2011). Sovereign rating downgrades can lead to sudden stops and higher borrowing costs.

### **Risk channels**

According to Candelon and Palm (2010), following a public intervention to resolve a bank crisis, the risk premium increases.<sup>20</sup> This, through the "sovereign ceiling", raises borrowing costs also for the private sector, reinforcing the economic contraction.

As regards the transmission of sovereign stress, IMF (2002) provides a comprehensive overview of the effects of sovereign defaults on local banks. The paper documents an increase in the interest rates on liabilities (due to the higher risk not being matched by increased returns on assets - on the contrary, in this context government securities usually offer non-market rates), as well as an increase in the rate of non-performing loans (as higher financing costs lead to corporate bankruptcies). Additional pressure on banks to reduce lending might come from the fact that the uncertainty following the default may lead to a deposit run or a collapse of interbank markets (Panizza and Borenzstein, 2008).

---

<sup>17</sup> These papers present a nuanced view of the effects of bond purchases by locals. Others (Andritzky (2012), Asonuma et al. (2014)), show these purchases can stabilize sovereign bond markets.

<sup>18</sup> They find that the probability of a banking crisis conditional on a capital flow bonanza is higher than the unconditional probability in 61% of the countries they cover (for the period 1960-2007).

<sup>19</sup> In discussing the role of gross flows in crises, Obstfeld (2011) argues that "gross liabilities, especially those short-term, are what matter".

<sup>20</sup> Laeven and Valencia (2012) show that blanket guarantees increase the fiscal costs of bank crises.

### 3. Data

Our sample contains 104 emerging and developing countries and covers three decades, from 1975 to 2007<sup>21</sup>. We exclude from our analysis all banking and sovereign episodes linked to the recent global crisis. We concentrate on the pre-2008 events as we aim at providing a historical perspective into a flourishing literature that focuses on the post-2008 situation.

#### 3.1. Definition and incidence of events

To identify and date sovereign debt crises, we rely on two sources of information: Standard & Poor's (2007) and Reinhart and Trebesch (2016). S&P defines sovereign defaults as situations where: (i) the government does not meet scheduled debt service on the due date or (ii) creditors are offered either a rescheduling (bank debt) or a debt exchange (bond debt) on less favorable terms than the original issue.<sup>22</sup> However, the S&P dataset contains only defaults on private external debt and in countries that are rated by the agency.

To obtain information on defaults for the rest of the countries in our sample, we resort to Reinhart and Trebesch's (2016) comprehensive dataset on sovereign defaults on external private and public debt. This dataset helps us identify defaults in developing and "low-income countries", which not only are not rated by S&P, but also had very little private external debt to default on before 2007. Reinhart and Trebesch classify defaults on official creditors as episodes of "significant and persistent arrears to official creditors", which occur when arrears to official creditors (including to the IMF and World Bank) exceed 1% of GDP for three consecutive years or more.<sup>23</sup>

With regard to banking crises, we use the "systemic" events identified by Laeven and Valencia (2013a) as situations in which a country's financial sector experiences a large number of defaults, and firms and financial institutions face great difficulties repaying contracts on time. Thus, this definition excludes minor banking events, involving only isolated banks. Given that ending dates of both sovereign and bank crises are hard to establish, we mark the first year of each crisis only.

Crisis of the same type that occur at less than three years apart are considered single events. Finally, we define "twin crises" as pairs of sovereign debt and bank crises that take place at intervals of less than three years from each other.

Accordingly, we isolate the following types of events: "single" bank crises i.e. bank crises that are not followed by sovereign distress; "single" sovereign debt crises i.e. sovereign defaults that are not followed by a bank crises; "twin bank-debt" crises, that start with a bank crisis, followed by a sovereign one within three years; and "twin debt-bank" crises, where a sovereign crisis is followed by a banking one within three years<sup>24</sup>.

Using these definitions we obtain 100 sovereign debt crises and 81 bank crises. Of these, 34 are twin events – that is, more than one third of either banking or debt crises compound into twin ones. Further distinguishing between twin crises according to the sequence of events delivers 18 "twin bank-debt" crises and 16 "twin debt-bank". Tables 1 and 2 list our twin episodes.

---

<sup>21</sup> As our focus is on sovereign default, we do not include advanced economies, given that they feature no defaults in our sample period.

<sup>22</sup> While there are situations in which defaults may either take the form of high inflation episodes or be averted through an IMF intervention, we take a stricter view and focus on explicit defaults only.

<sup>23</sup> We do not consider Paris club restructurings as default events, given that they often come much later than the actual default and, moreover, some of them are part of the HICP program.

<sup>24</sup> To adequately assign a sequence to those twin events occurring within a year, we resorted to IMF Article IV consultations and program reviews (where available), articles from the financial press, and country monographs.



### 3.2. Variables: definitions and sources

In light of the previous discussion regarding the channels of transmission between banking and sovereign distress, we focus our analysis on the behavior around crises of four categories of variables measuring: balance sheet interconnections, banking sector characteristics, the state of public finances, and macroeconomic and external factors. Table 3 in Appendix 1 lists all variables used in the analysis, along with their definitions and sources.

We study the balance sheet interrelations between the public and banking sectors, using the aggregate balance sheet of domestic depository institutions, as reported in the IMF's *International Financial Statistics* (Table 4). Regarding the balance sheet relation between banks and the central bank, this is given by reserves (including domestic currency holdings and deposits with the central bank) and claims on monetary authorities (comprising securities and claims other than reserves) on the asset side; and by credit provided by monetary authorities to the banking system, on the liability side.<sup>25</sup> This last entry collects most of the financial aid provided by the central bank during crises times.

In turn, banks and the government are linked by banks' claims on central, state and local governments, and non-financial public enterprises, on the assets side; and by central government deposits on the liabilities side.<sup>26</sup> For our purposes, the banking system's exposure to the government is computed as banks' claims on central government<sup>27</sup>. Two important indicators reflecting bank-government interconnectedness cannot be recovered from our dataset: recapitalization expenditures and the provision of guarantees. As there is no comprehensive cross-country time-series dataset on the costs of bank recapitalization, we use Laeven and Valencia's (2013a) sample, where bank recapitalization accounts for around half of the fiscal costs, while the other half is made up of asset purchases and debt relief programs.<sup>28</sup>

Data are of annual frequency. Monetary and financial variables come from the IMF's *International Financial Statistics database (IFS)*. Fiscal variables come mainly from the Economist Intelligence Unit (EIU), which is the most complete cross-country database on government revenues and expenses. However, given that this dataset starts in 1980 only and has several gaps, we collect data from alternative sources: IFS, Mitchell's (2007) series on "International Historical Statistics", the World Economic Outlook database, and Article IV reports. Data on debt and debt composition come from the World Bank's *World Development Indicators (WDI)*. Finally, as detailed in Table 4, other macroeconomic and banking sector variables come from *WDI*, *IFS*, or the *Global Financial Development* dataset.

---

<sup>25</sup> This can be seen from the perspective of the central bank's balance sheet as well (claims on deposit money banks, IFS line 12e). Instead, we measure banks' liabilities to the central bank using their own balance sheet data, but both measures should be similar.

<sup>26</sup> This comprises working balances and similar funds placed by units of the central government with deposit money banks. Capital owned by the government is not included.

<sup>27</sup> We choose to use "claims on central government" mainly because of data availability. The series on "claims on local/regional government" and "claims on public companies", while important indicators of contingent liabilities, are very noisy and do not have good coverage for emerging market countries. Using a measure of "total claims on government" instead (central + local + public companies) produces very similar results to the ones reported in the paper.

<sup>28</sup> Public recapitalization of troubled banks can come from the central bank or the government, and consist of loans or buying of new shares. Following a recapitalization, the balance sheet of the banking system will record an increase in assets, in the form of higher: (i) deposits at the central bank, (ii) holdings of central bank securities, (iii) cash or (iv) holdings of government securities. On the liability side, "loans from the central bank/government" or "shares and other equities" will increase. While part of this funding is included in the balance sheet items we use in the analysis, unfortunately we have no way to discern whether the increase in equity comes from public or private sources.

#### 4. Bank Crises and Sovereign Defaults: An Event Analysis

Following Gourinchas and Obstfeld (2012) and Broner et al (2013), we first implement an event analysis methodology, which allows us to estimate how the conditional expectation of each variable depends on the temporal distance to each type of event, given the proximity of other crises, and relative to a “tranquil times” baseline. Consider a variable of interest  $Z_{it}$ , where subscripts  $i$  and  $t$  refer to the country and the period respectively. Our panel specification looks as follows:

$$Z_{it} = \alpha_i + \sum_{e=\{B,D,BD,DB\}} \sum_{p=-3}^{p=3} \beta_{ep} \cdot D_{ei(t+p)} + \varepsilon_{it}$$

In the equation above,  $D_{ei(t+p)}$  denotes a dummy variable equal to 1 when country  $i$  is  $p$  periods away from a type  $e$  crisis in period  $t$ . The index  $e$  denotes, respectively, debt crises ( $D$ ), systemic bank crises ( $B$ ), twin debt-bank crises ( $DB$ ) and twin bank-debt crises ( $BD$ ). The event window around crisis episodes is set to seven years – three years around the crisis. The regression includes country fixed effects,  $\alpha_i$  and, in some specifications, country-specific trends. The error term  $\varepsilon_{it}$  captures all the remaining variation.<sup>29</sup>

The coefficients  $\beta_{ep}$  measure the conditional effect of a type  $e$  crisis on variable  $Z$  over the event window, relative to “tranquil times”. Having a common “tranquil times” baseline makes the comparison among coefficients straightforward and allows us to plot the estimated coefficients and compare the dynamics around different types of crises. As we work with normalized data, similar to Broner et al. (2013), we gauge the economic significance of our coefficients as the product of the coefficient and the median standard deviation of the (non-standardized) dependent variable across countries with the same type of crisis.

##### 4. 1. What are the facts?

Below, we present the main stylized facts obtained from our event analyses, with the help of charts 1-28 in Appendix 2, which plot the economic significance of the  $\beta_{ep}$  coefficients and contrast the behavior of variables around the different types of crisis events.<sup>30</sup>

##### *Balance sheet relations*

Figures 1 to 4 in Appendix 2 show the dynamics of central bank liquidity provisioning and banks’ sovereign holdings (scaled either by GDP or domestic assets) around single banking ( $B$ ) and twin bank-debt episodes ( $BD$ ).

Liquidity support provided by the central bank is already significantly larger than “tranquil” levels ahead of  $B$  events, peaks at the time of the crisis, and falls back to non-crisis levels by  $T+2$ . In contrast, ahead of  $BD$  crises, central bank liquidity support is significantly lower; it then starts to increase just ahead of the crisis, and remains elevated for the subsequent two years. While liquidity

<sup>29</sup> As our sample is highly heterogeneous, we minimize the effect of the most extreme observations by normalizing our series using country-specific standard deviations.

<sup>30</sup> Appendix 3 contains the regression results. In addition, the discussion presented in this section is based on a set of tests that determine the significance of the differences in levels and dynamics of each variable around the different types of crises.

support is significantly higher ahead of  $B$  than ahead of  $BD$ <sup>31</sup>, the opposite is true in the aftermath of the bank crises.<sup>32</sup>

Banks' sovereign exposures increase significantly during both  $B$  and  $BD$  events, starting from similarly low pre-crisis levels. The main difference lies in the pattern of the increase. In  $BD$ , sovereign exposures increase both before and after the bank crisis, such that, at  $T+3$  banks' holdings of sovereign debt are significantly higher than "tranquil" levels<sup>33</sup>. In  $B$  the increase occurs in the aftermath only.

To sum up, the interplay between banks' and both central bank and government balance sheets reveals systematic differences around the two episodes, which could reflect different pre- and post-crisis strategies to deal with banking sector problems, different banking sector characteristics and different initial shocks. Figures 1 to 4 clearly show the shift in the balance sheet interconnections between the banking and public sectors during the two events. Ahead of  $B$ , low pre-crisis amounts of claims on government combine with high liquidity support, while in the aftermath, liquidity support drops quickly and claims on government start rising. In  $BD$ , the fast and substantial accumulation of government paper ahead of the banking crisis combines with no liquidity support from the central bank, while in the aftermath of the banking crisis, the accumulation of claims on government moderates and central bank support shoots up.

Figures 20 to 23 turn to the differences between  $D$  and  $DB$  in terms of central bank liquidity support and banks' sovereign exposure. Liquidity support is flat in  $D$  events, whereas it increases dramatically in  $DB$  events. In the aftermath of  $DB$  defaults, liquidity support remains persistently above pre-crisis levels. Indeed, banks in  $DB$  episodes are the ones who receive the largest liquidity support, both relative to the GDP and assets. This suggests that these defaults are more damaging to banks' balance sheets, and, on the other hand, they leave the sovereign with little margin to support the banking sector.

The dynamics of banks' holdings of sovereign debt provide more insights into the stronger damage to banks' balance sheets associated with  $DB$  defaults. The most striking difference is that banks' holdings of sovereign debt are significantly larger and accumulate at a faster pace in  $DB$  than in  $D$  events. Post-default, there is a significant decline in sovereign exposures in both events (partly due to the restructuring). In line with Gennaioli et al. (2014b),  $DB$  crises take place against banks that are significantly more exposed to the government. Large bank holdings of sovereign debt in  $DB$  could also be due to financial repression (as in Reinhart (2012) and Reinhart and Sbrancia (2015)).

### ***The banking sector***

Banking sectors around  $BD$  crises are, on average, significantly larger than in "tranquil" times; in fact, they are the largest among our four types of crises. There is substantial build-up in assets ahead of all episodes but the single debt crises, where the ratio stays mostly flat (figures 5 and 24). Remarkably, while asset downsizing in  $B$  and  $DB$  events starts early on and is as large as the preceding build-up, asset downsizing in  $BD$  events starts later and is more gradual.<sup>34</sup>

---

<sup>31</sup> It is hard to say whether larger central bank support ahead of  $B$  is due to differences in shocks hitting the banks (i.e. persistent tensions and a gradual deterioration of the banking sector in  $B$  versus an unexpected shock to an otherwise healthy system in  $BD$ ), the size of the banks, or strategies chosen to deal with the crisis (support through other channels or mismanagement of the banking problems).

<sup>32</sup> This could be due to differences in the severity of the bank crisis (bank tensions recede after  $B$ , but remain high after the banking crisis in  $BD$ ); resolution strategies focused on bank restructuring (versus provision of liquidity to keep the system afloat), or the availability of fiscal space (the "late" response from the central bank in  $BD$  crises could be due to the government initially using out its resources to try to fix the bank crisis and the central bank stepping in as the sovereign goes in default).

<sup>33</sup> This could be due to either attempts by the government to strengthen the banks or to banks buying government bonds (incentivized or forced to) sustain the government or to banks' choice to retrench from the private sector into safer assets (Broner et al. 2014).

<sup>34</sup> In fact, even as the sovereign defaults, the banking sector is still larger than pre-crisis levels.

The larger size of the banking sector around *BD* suggests that during these events banks need larger public support, while their potential collapse could have a more damaging effect on the economy, giving the government more incentives to intervene (Gennaioli et al, 2014a). Relatedly, the diverging dynamics of bank assets in the aftermath of *B* and *BD* could indicate that the policy response in *BD* is to keep the banking sector afloat, postponing deleveraging until the crisis engulfs the sovereign (Acharya et al., 2014). As regards *DB* events, the sovereign default has a significantly larger impact on the banking sector than in *D*.

Figure 6 shows the evolution of credit to the private sector (as a share of GDP) around *B* and *BD*, both of which feature a boom-bust pattern. Indeed, credit to the economy is significantly above “tranquil” times and expands significantly ahead of both events, and especially in *BD* (indeed, in the year of the crisis the credit/GDP ratio in *BD* is more than double than in *B* and more than triple than in *DB*). Credit crunches of similar magnitudes follow in the wake of both *B* and *BD* events. Figure 25 shows the large difference in credit dynamics between *D* and *DB*. Credit in *DB* exhibits dynamics similar to *B* and *BD*, although the pre-crisis increase is smaller than in other two episodes. In turn, credit to the private sector stays flat ahead of *D*, and it even starts to recover slightly in the wake of single defaults events.

The evolution of bank deposits to domestic assets is depicted in Figures 7 and 26. We find that both twin crisis episodes are accompanied by large falls in deposits relative to domestic assets. In *BD* there is a gradual, but continuous drain on deposits, which is under way already at (t-3) and continues throughout the event window, which contrasts with the flat dynamics around *B* episodes (if anything, deposits increase slightly relative to domestic assets in the wake of *B* crises). In *DB*, a sharper and more sudden deposit run accompanies the sovereign default. This points to the loss of confidence that cripples banks after sovereign defaults in *DB*. In turn, single sovereign defaults do not have such negative impact on the banking sector.

Figures 8 and 27 look at the share of the banking system that is foreign-owned. We find that banking crises tend to not combine with sovereign defaults when banking sectors are predominately domestic-owned (foreign ownership in *B* crises is well below levels in *BD* and also significantly below “tranquil” levels). In turn, defaults are more likely to be followed by banking crises in countries whose banking sectors have larger shares of domestically-owned banks. This once again points to financial repression, as domestic-owned banks are more likely to be captive to the government and be most affected by a default.

### ***Public finances***

Figures 9 and 10 compare the behavior of public expenses and budget balance during bank and twin bank-debt crises. Pre-crisis budget balances are similar, and worsen throughout both event windows. In *B*, the gradual worsening occurs mostly pre-crisis, driven by decreasing budget revenues and increasing public spending. In contrast, in *BD* similar pre-crisis dynamics are followed by a sharp deterioration in the aftermath of the bank crisis, which is due to a large increase in public spending. The dynamics of public debt, in Figure 11, diverge even more. The large increase in *BD* events contrasts with flat levels during *B* crises. Indeed, in *BD*, public debt accumulates as the bank crisis is underway and continues unabated so that, going into the sovereign default, public debt is much larger than in “tranquil” times. This reflects the high cost incurred by the sovereign in the process of bank rescues. Indeed, we map our definition of crises into Laeven and Valencia’s (2013a) dataset on the fiscal costs of bank crises and obtain several static indicators describing the severity of the various types of bank crises. As shown in Table 5 of Appendix 1, the difference between *B* and *BD* episodes is not in the intensity of the bank crisis (non-performing loans and bank closures are similar

in both types of events), but in the fiscal costs of solving these crises. Fiscal costs during *BD* crises are almost double those of *B* crises, including much larger recapitalization costs.

Overall, despite both events occurring against similar levels of budget balance and governments in *BD* being less indebted ahead of the crisis, debt stocks and fiscal positions become significantly weaker during *the latter* events. In fact, during *BD* episodes, public debt increases by almost 30%, which is the most among the four types of crises. We trace this difference back to a larger provision of fiscal support during twin events. This difference in fiscal and recapitalization costs could be due either to differences in the available fiscal space or different crisis resolution strategies.

Figures 28 and 29 depict the behavior of budget balances and expense for single debt and twin bank-debt crises. Budget deficits and public spending are similar and significantly larger than “tranquil times” ahead of both defaults, and a fiscal adjustment starts the year of the default in both events. There is however, a markedly different behavior of public spending following the default in the two crises. Public spending decreases gradually in *D*, but drops sharply in *DB* and, moreover, remains well below “tranquil” levels after the *DB* default. Closely related, the indicators in Table 5 show that fiscal and recapitalization costs of bank crises occurring after sovereign defaults are strikingly small. Finally, Figure 30 shows public debt increasing in the run-up to defaults and remaining above pre-crisis levels in both events. Debt grows faster ahead of *DB* and falls more rapidly in its aftermath. These differences in public spending dynamics, and the small recapitalization costs in *DB*, signal to either a lack of fiscal space in the aftermath of *DB* defaults or to the adoption of a more austere stabilization package, both of which negatively affect the banking sector in the short run.

### ***Domestic economy***

Figure 12 shows that banking crises that are part of *BD* events are more disruptive than single banking crises. Real growth is significantly below “tranquil” levels ahead of *B* and gradually worsening until  $T+1$ , but the recovery is swift, with growth above pre-crisis rates by the end of the event window. In contrast, in *BD* crises growth collapses at  $T$  and remains significantly below average in the aftermath of the banking crisis. This pattern is accompanied by a large jump in inflation in the aftermath of *BD* bank crises (Figure 13). In contrast, inflation is higher than in “tranquil” times ahead of *B*, but moderates to “tranquil” levels immediately after the crisis.

Figures 30 and 31 trace the dynamics of real growth and inflation in *D* and *DB*, respectively. Growth stays significantly below average, and inflation significantly above average, in *D* episodes. In contrast, *DB* defaults have a larger immediate negative impact on growth and are accompanied by very high inflation rates (and even outright hyperinflation)<sup>35</sup>. Inflation falls drastically in the aftermath of both defaults, most likely as a result of stabilization efforts by authorities.

Finally, figures 18 and 37 show that twin crises are accompanied by strong exchange rate pressures/currency crises. This is especially true for *BD*, as banking crises in these events are those which trigger the largest currency depreciation (a result consistent with Kaminsky and Reinhart, 1999). This, in turn, puts pressure on the sovereign, given that in emerging markets debt is in a large part denominated in foreign currency. The dynamics around twin crises stand in sharp contrast to those around single crises, where the real exchange rate stays mostly flat and similar to “tranquil” levels.

---

<sup>35</sup> The very high numbers obtained in the case of *DB* are due to the presence of very high inflation, and also hyperinflation episodes, among the *DB* cases.

### ***Capital flows and financial openness***

We find that financial openness has a key role to play in shaping the transmission between banking and sovereign stress. We look at three measures of access to international capital markets: capital inflows (% GDP), net capital flows (% GDP) and the Chinn-Ito index of capital account openness (standardized value between 0 and 1).

The differences between the four types of crises are striking (Figures 15, 16 and 19 for *B* vs *BD*; and figures 34, 35 and 37 for *D* vs *DB*). All three variables stand at levels significantly below average ahead of defaults that are part of *DB* crises. Combined with the large negative real interest rates (an indicator of financial repression – Reinhart (2012) and Reinhart and Sbrancia (2015)), this suggests that sovereign stress is more likely to transmit to the banking sector in times of financial repression and limited access to capital markets. It is during these times that governments can only borrow from captive domestic banks. In these circumstances, a sovereign default has a devastating effect on domestic banks.

In contrast to *DB*, *BD* crises occur during periods of capital account liberalization and larger than average capital inflows. In the wake of the banking crises that are part of *BD*, there is a collapse in capital inflows (which fall more than 6% of GDP in 4 years) and a reversal in capital account openness. In contrast, capital inflows around *B* crises (as those around *D* ones) are flat and similar to "tranquil" levels. These findings complement the literature on capital account liberalization and financial crises (Diaz-Alejandro, 1985), as we show that only those banking crises that are part of twin events fit the description in the literature.

Figures 17 and 36 look at the share of short-term debt in total foreign debt. Complementing the findings in Reinhart and Rogoff (2011), who show that short-term debt increases dramatically ahead of crises, we find this is the case during twin crises only (both *BD* and *DB*), pointing to larger losses in investor confidence in these cases.

#### **4.2. Timing matters**

In contrast to our approach, the empirical literature so far has not accounted for the differences in the time sequence of crises composing twin events. While for some variables such an approach might not yield new insights, the analysis presented above reveals that, when contrasting the behavior of variables around *DB* and *BD* events, there are dynamics that are not shared by both types of twin crises.

We find that, when taking into account the different sequence of crises during twin episodes, there are remarkable differences in behavior of the budget deficit, budget expenses, recapitalization costs, inflation rate, short-term external debt, financial openness and capital flows. Indeed, the results on the latter two variables point forcefully to the importance of distinguishing between *DB* and *BD* events; *DB* happen in times of low access to international capital markets and low degree of financial openness, while *BD* take place in times of bonanzas and capital account liberalization. In contrast, results like the existence of boom-bust dynamics within the banking system or the collapse in GDP in the aftermath of crises are common to both types of twin events and would have been found even if the timing of shocks would have been disregarded.

### **5. Understanding the drivers of twin events**

So far, our analysis has been directed to understanding the dynamics around each of the four types of crises. In this section, we go a step further and build a series of econometric models with the aim of

understanding what determines that a country has a single or a twin crisis, and what country characteristics increase the probability that a banking crisis turns into a twin bank-debt crisis or that a debt crisis turns into a twin debt-bank crisis.

To answer these questions, we present below two alternative multivariate approaches: multinomial logits and bivariate ordered probits.<sup>36</sup> The models are designed to help us understand what factors seem to be significant determinants of single crises remaining single, or evolving into twin crises. Guided by our previous findings, the models include both levels and first differences of the following variables: real growth, debt and deficit (as % of GDP), financial intermediation (bank assets to GDP), balance sheet connections (banks' exposure to the sovereign and central bank liquidity provisioning), capital flows, and financial openness.

### Multinomial Logit

The multinomial logit model (Greene, 2012) allows to study situations where there is a number of categorical outcomes which can be observed. This makes the method a useful approach for the modelling of our question of interest. The model is derived and estimated using Newton–Raphson maximum likelihood, as follows. Suppose that there are  $k$  categorical outcomes and—without loss of generality—let the base outcome be 1. The probability that the response for the  $j$ -th observation is equal to the  $i$ -th outcome is

$$p_{ij} = \Pr(y_j = i) = \begin{cases} \frac{1}{1 + \sum_{m=2}^k \exp(\mathbf{x}_j \beta_m)}, & \text{if } i = 1 \\ \frac{\exp(\mathbf{x}_j \beta_i)}{1 + \sum_{m=2}^k \exp(\mathbf{x}_j \beta_m)}, & \text{if } i > 1 \end{cases}$$

Where  $j$  is the row vector of observed values of the independent variables for the  $j$ -th observation and  $\beta_m$  is the coefficient vector for outcome  $m$ . In our specification  $x_j$  includes lagged levels and changes of real growth, debt and deficit (as percentage of GDP), bank assets (as percentage of GDP), banks' exposure to the sovereign and central bank liquidity (both as percentage of banks' assets), capital inflows and financial openness. Using the above, the log pseudo-likelihood is:

$$\ln L = \sum_j w_j \sum_{i=1}^k I_i(y_j) \ln p_{ik}$$

where  $I_i(y_j) = \begin{cases} 1, & \text{if } y_j = i \\ 0, & \text{otherwise} \end{cases}$ , and  $w_j$  is an optional weight.

Table 26 presents the results. We observe that better and improving growth dynamics are the best recipe against a twin crisis. There is a relatively striking absence of an effect of growth dynamics on the occurrence of single banking crises. Regarding balance sheet interconnections, while we do not observe a significant effect of the banks' exposure to the sovereign on the occurring of twin crises, we find a very significant effect coming from the provision of central bank (CB) liquidity. We observe that the larger the provision of CB funding, the more likely that a country will face a twin bank-debt crisis. Similar to what we observe in the event analyses, we find a significant role for financial intermediation dynamics in stress transmission. According to our findings, large and growing banking systems play a dichotomous role. Countries with such banking sectors are more likely to suffer twin bank-debt crises, but also less likely to experience the transmission of sovereign

---

<sup>36</sup> We also performed an experiment using panel logit models (available under request). As the results were similar to the ones presented here, for the sake of brevity we have not included them.

distress. Finally, the results from the multinomial logit give remarkable importance to the role played by financial openness. According to our coefficients, countries that are financially more open prior to a crisis are less likely to suffer single crises and debt-bank twin events. We find, however, that for the full sample, financial liberalization increases the likelihood of suffering bank-debt crises. As shown by the coefficient associated with the change in financial openness, the effects of liberalization appear to be remarkably strong when countries are opening up. In periods of increasing liberalization, countries are more likely to suffer both simple bank crises and twin bank-debt crises.

### Bivariate Probit

One way in which estimation of the joint probability distribution of two categorical variables can be achieved is by modelling a bivariate (ordered) probit.<sup>37</sup> Similar to univariate models, bivariate models can be derived from a latent variable model. Assume that the likelihood of bank crises and sovereign defaults are respectively denoted by two latent variables  $y_{1i}^*$  and  $y_{2i}^*$ , which are determined by:

$$y_{1i}^* = x'_{1i}\beta_1 + \varepsilon_{1i}$$

$$y_{2i}^* = x'_{2i}\beta_2 + \gamma y_{1i}^* + \varepsilon_{2i}$$

where  $\beta_1$  and  $\beta_2$  are vectors of unknown parameters,  $\gamma$  is an unknown scalar,  $\varepsilon_1$  and  $\varepsilon_2$  are error terms, and subscript  $i$  denotes an individual observation.<sup>38</sup> We include in  $x'_{2i}$  and  $x'_{1i}$  the same set of control variables in lagged levels that we included in the multinomial logit. In addition, we include the product of the first differences of these controls with the crisis dummies. This interaction is designed to tell us whether the underlying factors are more or less relevant following a crisis. Notice that, to obtain consistent estimates of  $\beta_2$ , at least one element of  $x_1$  should not be present in  $x_2$ .<sup>39</sup> In our case this variable is the banking sector exposure to the sovereign.<sup>40</sup>

Table 27 contains the results, which show, once more, the importance of economic growth for the emergence of twin crises. Growth appears to significantly affect the spillover of bank stress to sovereign default. We also find a significant role of public debt dynamics in the transmission of sovereign stress. During sovereign defaults, debt increases are associated with bank crises. Complementing the evidence obtained before regarding balance sheet interconnectedness, we also document an important role for the banks' exposure to the sovereign. We find that the larger the exposure, the more likely is that a country faces a bank crisis following a sovereign default. Lastly, we again find a significant role for financial openness: more financially open countries are more likely to suffer bank crises, especially after sovereign defaults.

## 6. Implications for the literature

The stylized facts in this paper have important implications for the flourishing theoretical literature modeling the joint dynamics of sovereign and bank risk. Our multi-faceted evidence allows us to evaluate the capacity of various modeling environments to combine underlying conditions and shocks generating the emergence of feedback loops between banking and sovereign crises.

Our findings have implications for the Dynamic Stochastic General Equilibrium literature interested in designing models capable of replicating the implications of debt defaults. Our results show that,

---

<sup>37</sup> Using this methodology Adams (2006) studies whether R&D spillovers affect the allocation of resources to learning & internal research.

<sup>38</sup> The explanatory variables in the model satisfy:  $E(x_{1i}\varepsilon_{1i}) = 0$  and  $E(x_{2i}\varepsilon_{2i}) = 0$ .

<sup>39</sup> <http://www.adeptanalytics.org/download/ado/bioprobit/bioprobit.pdf>

<sup>40</sup> We cannot use nonlinearity as a source of identification as it is done, for instance, in the Heckman model, because if the exclusion restriction fails, the linear system is unidentified.



although growth collapses and capital flight are integral part of twin crises, theories relying exclusively on productivity and/or external shocks (like Arellano, 2009 or Mendoza and Yue, 2011) are less suited to fit the effect of a default. According to our findings, it is only when defaults combine with banking crises that GDP collapses in the way this literature is trying to replicate. Importantly, these growth slumps come hand in hand with credit crunches, increases in the size of central banks' balance sheets and tightening of balance sheet relations between banks and sovereigns. To the extent that these features are not an integral part of the modelling strategy, models will have a very hard time replicating the dynamics of economic activity. On that account, theories acknowledging the role of balance sheet inter-connectedness and the role of the central bank in accommodating stress (Engler & Gobbe-Sttefen, 2014; Malucci, 2013) can provide more accurate analyses of twin crisis events.

Our evidence also provides support to several recent theories according to which, in the presence of large banking systems, governments have more incentives to avoid defaults, as their effects on the economy would be amplified through the impact on banks' balance sheets (see Gennaioli et al., 2014a; or Farhi and Tirole (2016)). The results also provide support to theories arguing that monetary and fiscal coordination, and the ensuing central bank balance sheet expansion, are an integral part of crisis resolution strategies (Corsetti and Dedola, 2013). According to our findings, during the spread of sovereign crises to the banking sector, the shift from providing credit to the private sector to providing financing to the public sector is an empirical regularity. This result provides support for modeling strategies along the lines of Broner et al. (2014). Similarly, the results regarding the boom-bust pattern and funding strike within the banking system, provides support for theories such as Fahri's and Tirole's (2016) model of the *doom loop*.

## 7. Conclusions

In light of the virulence and long-lasting effects of the various banking and sovereign debt crises hitting the world economy since 2007, understanding the channels through which sovereign and bank risks feed into each other is of utmost importance. In this paper, we contribute to these ongoing efforts by studying past episodes of bank and sovereign distress in emerging markets, making the distinction between "single" episodes and those in which bank and sovereign debt crises combine ("twin" crises).

By providing a detailed account of the economic dynamics around different crisis episodes, our results can help in building better early warning indicators and inform the development of theoretical models where these issues can be formally studied. Our contribution is three-fold. Firstly, we find that there are systematic differences between "single" crises and "twin" ones, across several dimensions, including the balance sheet interconnection between the banking and public sectors, the characteristics of the banking sector, the state of public finances, the macroeconomic environment and financial openness. Secondly, contrary to what is customary in most of the literature, we show that considering the sequence of crises within "twin" events is important for understanding their transmission channels and economic consequences. Finally, by using different econometric techniques, we show that the balance sheet interconnection between banks and their sovereign, economic growth, credit dynamics and the extent of financial openness all help explain the onset of twin crises events.

By providing a detailed understanding of the economic dynamics and stylized facts around different crisis episodes, our results can help in building better early warning indicators and inform the development of theoretical models where these issues can be formally studied.

## REFERENCES

- Acharya, V., Drechsler, I. and Schnabl, P. (2014), “A Pyrrhic Victory: Bank Bailouts and Sovereign Credit Risk”, *Journal of Finance*, forthcoming.
- Alessandri, P. and Haldane, A. (2009), “Banking on the State”, *Bank of England*.
- Alter, A. and Beyer, A. (2013), “The Dynamics of Spillover Effects during the European Sovereign Debt Turmoil”, *mimeo*.
- Andritzky, J.R. (2012), “Government Bonds and Their Investors: What Are the Facts and Do They Matter?”, *IMF Working Paper no. 12/158*.
- Angeloni, C. and Wolff, W. (2012), “Are banks affected by their holdings of government debt?”, *Bruegel Working Paper no. 2012/07*.
- Arellano, C. and Kocherlakota, N.R. (2012), “Internal Debt Crises and Sovereign Defaults”, *Federal Reserve Bank of Minneapolis, mimeo*.
- Baldacci, E. and Gupta, S. (2009), “Fiscal Expansions: What Works”, *Finance & Development*, Vol. 46 (4), pp. 35-37.
- Broner, F., Didier, T., Erce A. and Schmukler, S. (2013), “Gross Capital Flows: Dynamics and Crises”, *Journal of Monetary Economics*, Vol. 60(1), pp. 113–133.
- Broner, F., Erce, A., Martin, A., and Ventura, J. (2014), “Sovereign Debt Markets in Turbulent Times: Creditor Discrimination and Crowding Out”, *Journal of Monetary Economics*, Vol. 61 (C), pp. 114-142.
- Broto, C. and Perez Quiros, G. (2013), “Disentangling contagion among Sovereign CDS spreads during the European debt crisis”, *Bank of Spain Working Paper no. 1314*.
- Brutti, F. (2010), “Legal enforcement, public supply of liquidity and sovereign risk”, *Institute for Empirical Research in Economics, University of Zurich Working Paper no. 464*.
- Candelon, B. and Palm, F.C. (2010), “Banking and Debt Crises in Europe. The Dangerous Liaisons?”, *CESifo Working Paper no. 3001*.
- Caprio, G. Jr. and Honohan, P. (2008), “Banking Crises”, *Institute for International Integration Studies Discussion Paper no. 242*.
- Cavallo, E. and Izquierdo, A. (2009), “Dealing with an International Credit Crunch: Policy Responses to Sudden Stops in Latin America”, *Inter-American Development Bank, mimeo*.
- Carey, D. (2009), “Iceland: The Financial and Economic Crisis”, *OECD Working Paper no. 725*.
- Cecchetti, S.G, Kohler, M. and Upper, C. (2009), “Financial crises and economic activity”, *NBER Working Paper no. 15379*.
- Chinn, M. D. and H. Ito (2006), "What Matters for Financial Development? Capital Controls, Institutions, and Interactions," *Journal of Development Economics*, Vol. 81(1), pp. 163-192 (October).
- Corsetti, G., and Dedola, L. (2013), “The Mystery of the Printing Press: Self-fulfilling Debt Crises and Monetary Sovereignty”, *CEPR Discussion Paper no. 9358*.
- Darracq-Pariès, M., Maurin, L and Moccero, D. (2013), “Financial Conditions Index and Credit Supply Shocks for the Euro Area”, *ECB Working Paper no. 1644*.

- Das, U., Papaioannou, M., and Trebesch, C. (2009), “Sovereign Default Risk and Private Sector Access to Capital in Emerging Markets”, in: Primo Braga, C. A. and Dömeland, D. (Eds): “*Debt Relief and Beyond: Lessons Learned and Challenges Ahead*”. World Bank.
- De Paoli, B., Hoggarth, G. and Saporta, V. (2009), “Output costs of sovereign crises: some empirical estimates”, *Bank of England Working Paper no. 362*.
- Diaz-Alejandro, C. (1985), “Good-bye financial repression, hello financial crash”, *Journal of Development Economics, Vol. 19(1-2), pp. 1-24*.
- Diaz-Cassou, J., Erce, A. and Vazquez, J. (2008), “Recent episodes of sovereign debt restructuring: A case-study approach”, *Bank of Spain Occasional Document no. 0804*.
- Diebold, F., and Yilmaz, K. (2009), “Measuring financial asset return and volatility spill overs, with an application to global equity markets”, *Economic Journal, Issue 119, pp. 158–171*.
- Drechsler, I., Drechsler, T., Marques-Ibanez, D., and Schnabl, P. (2013), “Who Borrows from the Lender of Last Resort?”, *mimeo*.
- Erce A. (2012), “Selective Sovereign Defaults”, *Globalization and Monetary Policy Institute, Working Paper no. 127*.
- Engler, P., and C. Grobke-Steffen (2014), “Sovereign Risk, interbank freezes and aggregate fluctuations”, *Cesifo Working Paper*.
- Farhi, E., and J. Tirole (2016), “Deadly Embrace: Sovereign and Financial Balance Sheets Doom Loops”, *NBER Working Paper 21843*.
- Feenstra, R.C and Taylor, A.M. (2012), “International Economics”, Second edition, *Worth Publishers*.
- Gennaioli, N., Martin, A. and Rossi, S. (2014a), “Sovereign Default, Domestic Banks and Financial Institutions”, *Journal of Finance, Vol. 69(2), pp.819-866*.
- Gennaioli, N., Martin, A. and Rossi, S. (2014b), “Banks, Government Bonds and Default: What do the Data Say? *mimeo, CREI*
- Goldstein, M. (2003), “Debt Sustainability, Brazil and the IMF”, *Peterson Institute Working Paper no. WP03-1*.
- Gray, D. and Jobst, A. (2013), “Systemic Contingent Claims Analysis – Estimating Market-Implied Systemic Risk”, *IMF Working Paper no.13/54*.
- Gray, D., Gross, M., Paredes, J., and Sydow, M. (2013), “Modelling Banking, Sovereign and Macro Risk in a CCA Global VAR”, *IMF Working Paper no. 13/218*.
- Heinz, F. and Sun, Y. (2014), “Sovereign CDS Spreads in Europe: The Role of Global Risk Aversion, Economic Fundamentals, Liquidity, and Spillovers”, *IMF Working Paper 14/17*.
- Honohan, P. (2008), “Risk Management and the Costs of the Banking Crisis”, *The Institute for International Integration Studies Discussion Paper no. 262*.
- IMF (2002), “Sovereign Debt Restructurings and the Domestic Economy Experience in Four Recent Cases”, *Policy Development and Review Department*.
- Kaminsky, G., and C. Reinhart (1999), "The Twin Crises: The Causes of Banking and Balance-of-Payments Problems", *American Economic Review, vol. 89(3), pp. 473-500*.
- Kollmann, R., Roeger, W., and in't Veld, J. (2012), “Fiscal Policy in a Financial Crisis: Standard Policy vs. Bank Rescue Measures”, *American Economic Review, Vol. 102(3), pp. 77-81*.
- Laeven, L. and Valencia, F. (2012), “The Use of Blanket Guarantees in Banking Crises”, *Journal of International Money and Finance, Vol. 31(5), pp. 1220–1248*.

- Laeven, L., and Valencia, F. (2013a), “Systemic Banking Crises Database”, *IMF Economic Review*, Vol. 61(2), pp. 225-270.
- Laeven, L. and Valencia, F. (2013b), “The Real Effects of Financial Sector Interventions During Crises”, *Journal of Money, Credit and Banking*, Vol. 45(1), pp. 147-177.
- Livshits, I. and Schoors, K. (2009), “Sovereign Default and Banking”, *mimeo*.
- Malucci, E. (2013), “Sovereign Defaults, Off-shore Borrowing and Banking Crises”, *mimeo*.
- Mendoza, E., and V. Yue (2011), “A General Equilibrium Model of Sovereign Default and Business Cycles”, IMF Working Paper 11/166.
- Meissner, C.M. and Bordo, M.D. (2006), “Financial Crises, 1880-1913: The Role of Foreign Currency Debt”, *WEF Working Paper no. 0002*.
- Mitchell and Brian R., (2007), “*International Historical Statistics: 1750 – 2005*”, (London: Palgrave MacMillan).
- Mody, A., and Sandri, D. (2011), “The Eurozone Crisis: How Banks Came to be Joined at the Hip”, *IMF Working Paper no. 11/269*.
- Moody’s (2014), “European Sovereign Debt and Banking Crises: Contagion, Spillovers and Causality”, *Moody’s Investors Service, Credit policy*.
- Noyer, C. (2010), “Sovereign crisis, risk contagion and the response of the central bank”, *mimeo*.
- Obstfeld, M. and Gourinchas, P.O. (2012), “Stories of the Twentieth Century for the Twenty-First”, *American Economic Journal: Macroeconomics*, American Economic Association, Vol. 4(1), pp. 226-65.
- Panizza, U. and Borensztein, E. (2008), “The Costs of Sovereign Default”, *IMF Working Paper no. 08/238*.
- Popov, A., and Van Horen, N. (2013), “The impact of sovereign debt exposure on bank lending: Evidence from the European debt crisis”, *DNB Working Paper no. 382*.
- Reinhart, C.M. and C.Trebesch (2016), “The International Monetary Fund: 70 Years of Reinvention”, *Journal of Economic Perspectives*, Vol. 30 (1), pp. 3–28.
- Reinhart, C.M. and M.B. Sbrancia (2015), “The Liquidation of Government Debt”, *Economic Policy*, Vol. 30(82), pp.291-333, March.
- Reinhart, C.M. (2012), “The Return of Financial Repression”, *Banque de France Financial Stability Review*, No. 16, April.
- Reinhart, C.M. (2009), “The economic and fiscal consequences of financial crises”, *MPRA Paper no. 13025*.
- Reinhart, C.M. and Reinhart, V. (2009), “Fiscal stimulus for debt intolerant countries?”, *MPRA Paper no.16937*.
- Reinhart, C.M. and Rogoff, K.S. (2008a), “Banking Crises: An Equal Opportunity Menace”, *NBER Working Paper no.14587*.
- Reinhart, C.M and Rogoff, K.S. (2008c), “This Time is Different: A Panoramic View of Eight Centuries of Financial Crises”, *NBER Working Paper no.13882*.
- Reinhart, C.M. and Rogoff, K. S. (2009), “The Aftermath of Financial Crises”, *American Economic Review*, Vol. 99(2), pp. 466-72.
- Reinhart, C.M. and Rogoff, K.S. (2011), “From Financial Crash to Debt Crisis”, *American Economic Review*, Vol. 101(5), pp. 1676-1706.

Rosas, G. (2006), “Bagehot or Bailout? An Analysis of Government Responses to Banking Crises”, *American Journal of Political Science* Vol. 50(1), pp. 175-191.

Van Rixtel, A., and Gasperini, G. (2013), “Financial Crises and bank funding: recent experience in the euro area”, *BIS Working Paper no. 40*

## APPENDIX 1: TABLES AND FIGURES

Table 1. Twin crises: Bank-to-Debt

Country	Bank crisis	Debt crisis
Algeria	1990	1991
Argentina	1980	1982
Chile	1981	1983
Djibouti	1991	1992
Dominican Republic	2003	2005
Ecuador	1982	1982
Ecuador	1998	1999
Egypt	1980	1986
Georgia	1991	1994
Indonesia	1997	1998
Mexico	1981	1982
Morocco	1980	1983
Nicaragua	2000	2003
Philippines	1983	1983
Senegal	1988	1990
Uruguay	1981	1983
Uruguay	2002	2003
Venezuela	1994	1995

Source: Laeven and Valencia (2013a), S&P (2009), Reinhart and Trebesch (2016)

---

**Table 2. Twin crises: Debt-to-Bank**

---

<b>Country</b>	<b>Debt crisis</b>	<b>Bank crisis</b>
Albania	1991	1994
Argentina	1989	1989
Argentina	2001	2001
Armenia	1994	1995
Azerbaijan	1994	1995
Bolivia	1986	1986
Brazil	1990	1990
Cameroon	1985	1987
Costa Rica	1986	1987
Jordan	1989	1989
Macedonia	1992	1993
Panama	1987	1988
Peru	1976	1983
Turkey	1982	1982
Russian Federation	1998	1998
Ukraine	1998	1998

---

Source: Laeven and Valencia (2013a), S&P (2009), Reinhart and Trebesch (2016)

**Table 3. Variables: definitions and sources**

<b>Variable</b>	<b>Definition</b>	<b>Source</b>
<b>“Exposure” variables</b>		
Banking sector’s claims on government/GDP or domestic assets	Claims on central government (line 22a)/GDP level Claims on central government (line 22a)/domestic assets	International Financial Statistics
Liquidity support/GDP or domestic assets	Credit from Monetary Authorities (line 26g)/GDP level Credit from Monetary Authorities (line 26g)/domestic assets	International Financial Statistics
<b>Banking sector variables</b>		
Credit to the private sector /GDP	Claims to the private sector (line 22d)/GDP level	International Financial Statistics
Domestic assets/GDP	Sum of all items on the asset side, foreign assets excluded (line 20+line 20c +line 20+line 22)/GDP	International Financial Statistics
Deposits/domestic assets	(Demand Deposits (line 24) + Time, Savings and Forex Deposits (line 25) + Restricted Deposits (line 26b))/domestic assets	International Financial Statistics
Chinn-Ito index	Measure a country's degree of capital account openness, standardized between zero and one	Chinn and Ito (2006)
Foreign banks among total banks (%)	Share of foreign-owned banks in total number of banks. A foreign bank is a bank where 50% or more of its shares are owned by foreigners.	Global Financial Development database (GFD)
<b>Fiscal variables</b>		
Budget balance (% GDP)	(Government revenues – government expense)/GDP level	EIU; IFS; WEO; Mitchell (2007); Art.IV reports.
Budget expense (%GDP)	General government total expense/GDP level	EIU; IFS; WEO; Mitchell (2007); Art.IV reports.
Government debt (%GDP)	General government debt/GDP level	World Development Indicators
<b>Macroeconomic variables</b>		
Real GDP growth (%)	Annual change of real GDP	World Development Indicators
Inflation (%)	Annual change of the Consumer Price Index	World Development Indicators
Capital inflows (%GDP)	(“Foreign direct investment liabilities“, “Portfolio investment liabilities” and “Other investment liabilities”)/GDP	International Financial Statistics
Net capital flows (%GDP)	(Total capital inflows-total capital outflows)/GDP	
ST debt/Total external debt	Ratio of short-term external debt over total external debt	World Development Indicators
Real effective exchange rate	Nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs.	World Development Indicators
Real interest rate	Lending interest rate adjusted for inflation as measured by the GDP deflator.	World Development Indicators



**Table 4. The aggregate balance sheet of the banking sector**

ASSETS	LIABILITIES
Reserves (line 20)	Demand Deposits (line 24)
Claims on Monetary Authorities	Time, Saving and Forex Deposits (line 25)
Securities (line 20c)	Money Market Instruments (line 26aa)
Other claims (line 20n)	Bonds (line 26ab)
Foreign assets (line 21)	Restricted Deposits (line 26b)
Claims on other resident sectors (line 22)	Foreign Liabilities (line 26c)
Central Government (line 22a)	Central Government Deposits (line 26d)
Deposit Money Banks (line 22e)	Credit from Monetary Authorities (line 26g)
State and Local Government (line 22b)	Liabilities to Other Banking Institutions (line 26i)
Nonfinancial Public Enterprises (line 22c)	Liabilities to Financial Institutions (line 26j)
Private Sector (line 22d)	Capital Accounts (line 27a)
Other Banking Institutions (line 22f)	
Nonbank Financial Institutions (line 22g)	

Source: International Financial Statistics (IMF)

**Table 5. Intensity of banking crises: static indicators (as in Laeven and Valencia, 2013a)**

Crises types	NPL at peak	Change in number of banks	Fiscal costs	Recapitalization costs (gross)	Recapitalization costs (net)
“Single” banking crises	27.59	-18.90	12.99	6.06	4.87
Bank to Debt crises	35.34	-22.00	25.51	14.22	9.33
Debt to Bank crises	35.90	-43.40	4.87	1.92	1.92
Total average	30.02	-23.31	14.21	6.94	5.24

Sources: Laeven and Valencia (2013a), S&P and authors' calculations. “NPL” refers to non-performing loans. Change in number of banks refers to the change between  $T$  and  $T+3$ . Fiscal and recapitalization costs are measured as % of GDP.

## APPENDIX 2: “BANK” vs. “BANK-TO-DEBT” CRISES

Figure 1. Credit from the Central Bank (% GDP)

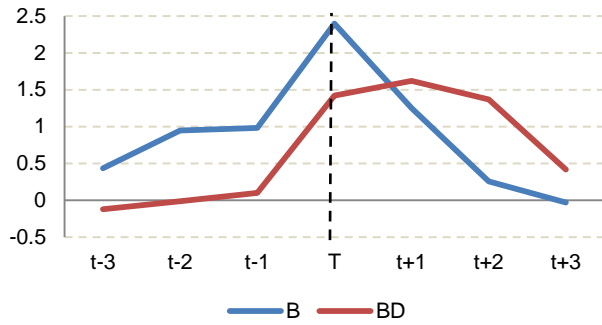


Figure 2. Credit from the Central Bank (% dom. assets)

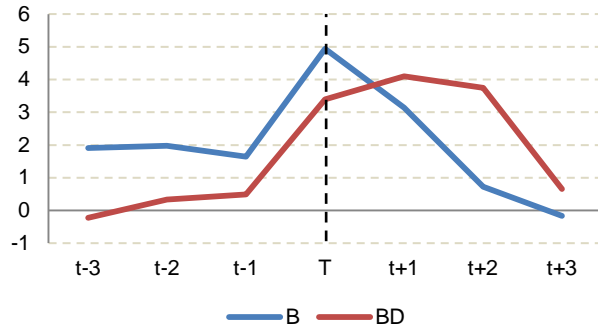


Figure 3. Claims on government (% GDP)

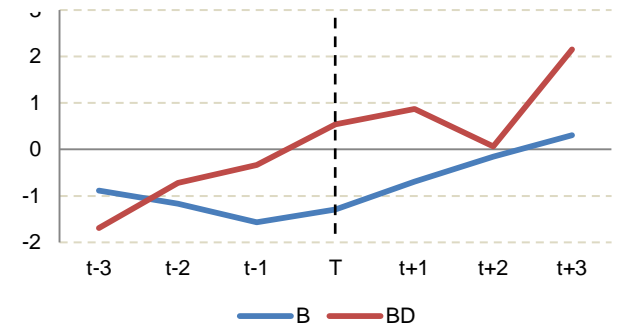


Figure 4. Claims on government (dom. assets)

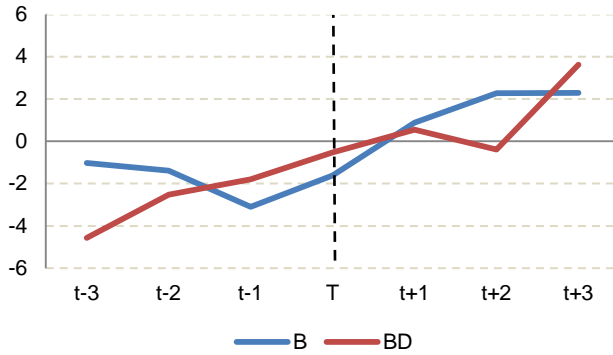


Figure 5. Domestic assets (%GDP)

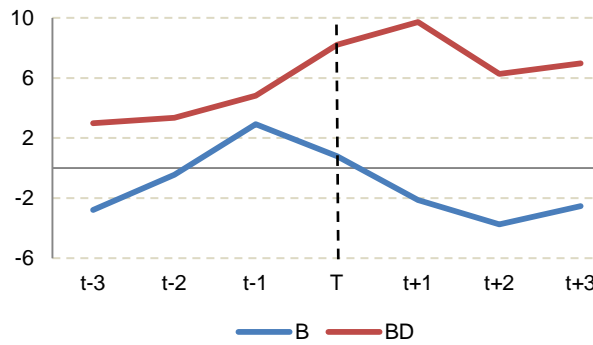


Figure 6. Credit to private sector (% GDP)

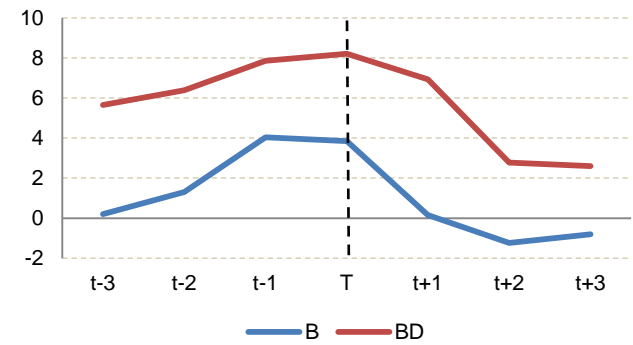


Figure 7. Deposits/assets (% GDP)

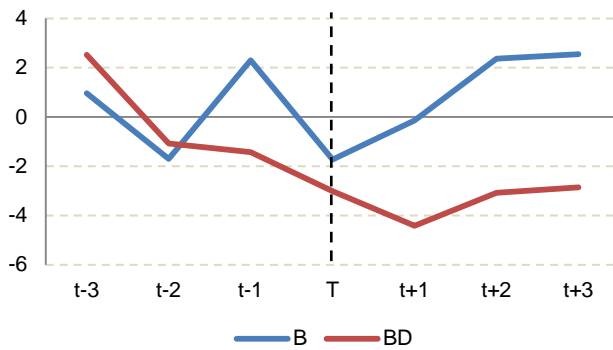


Figure 8. Foreign banks among total banks (%)

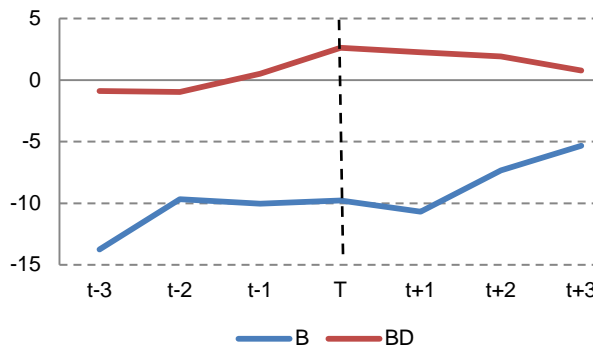


Figure 9. Budget expenditures (%GDP)

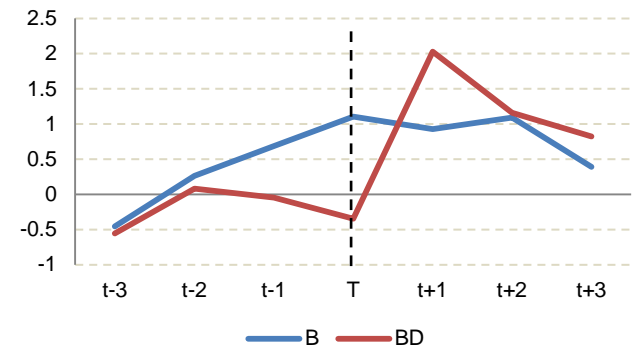


Figure 10. Budget balance (% of GDP)

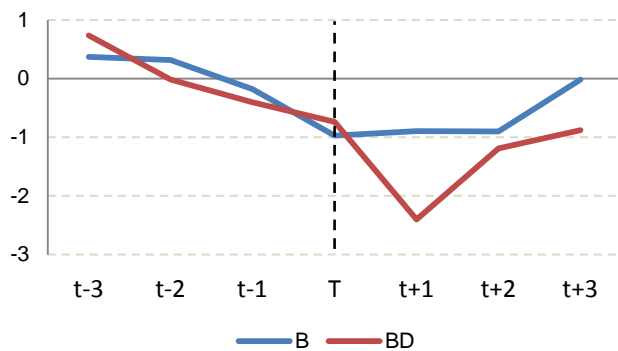


Figure 11. Public debt (% GDP)

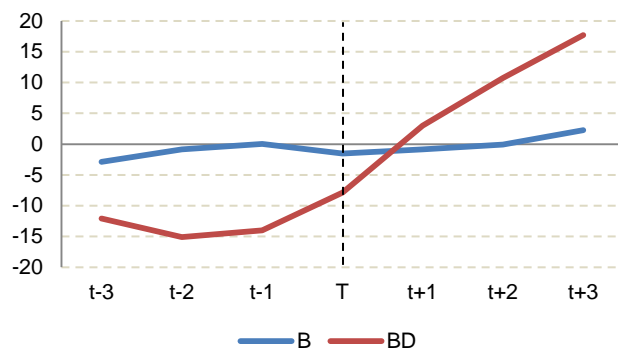


Figure 12. Real GDP growth (%)

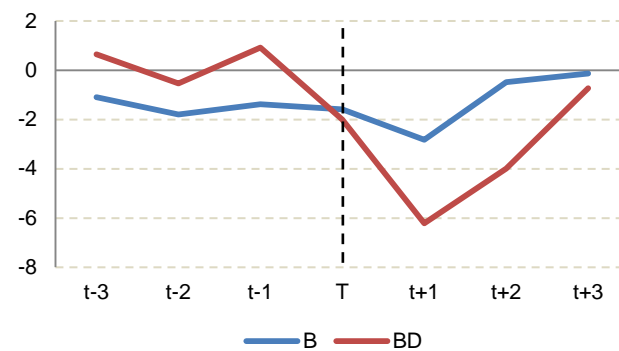


Figure 13. Inflation rate (%)

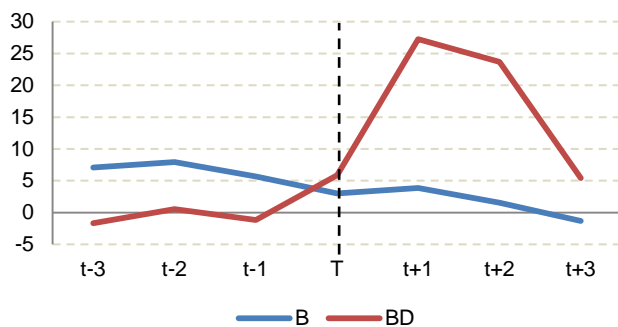


Figure 14. Real interest rate (%)

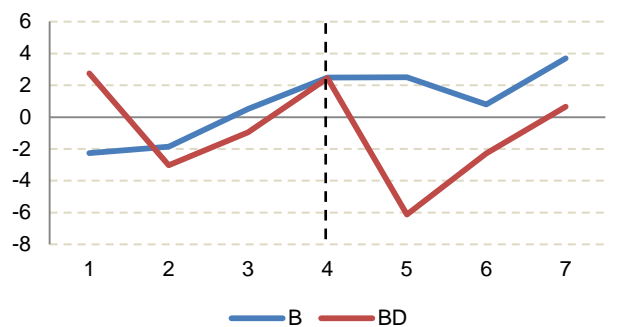


Figure 15. Total inflows (%GDP)

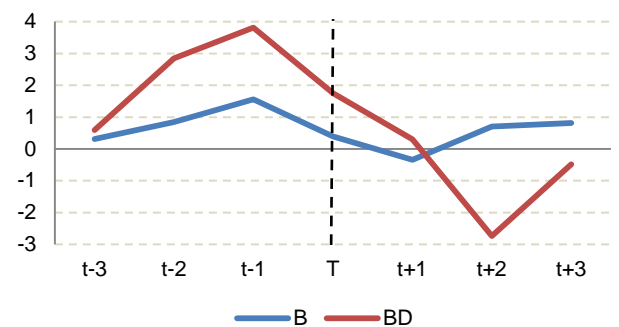


Figure 16. Net inflows (%GDP)

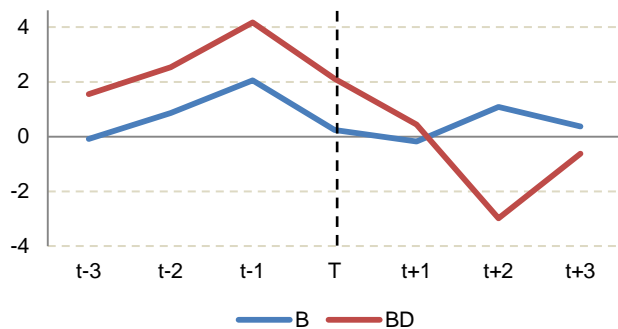


Figure 17. Short-term debt in total foreign debt (%)

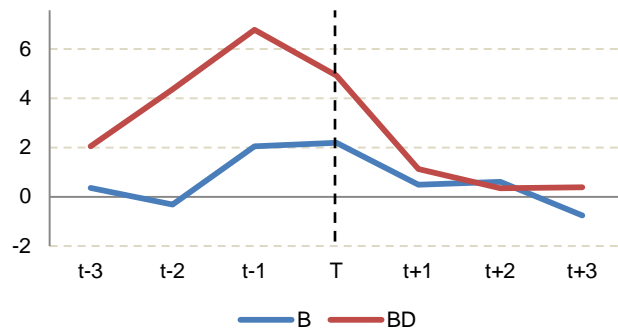


Figure 18. Real effective exchange rate

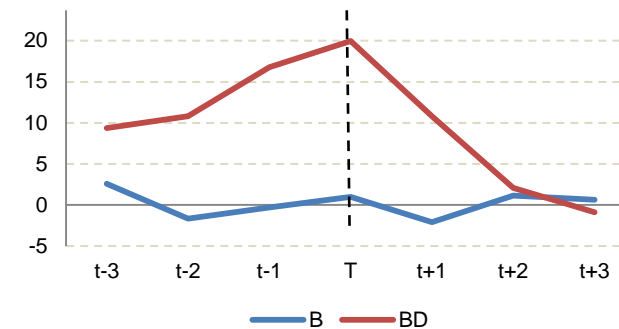
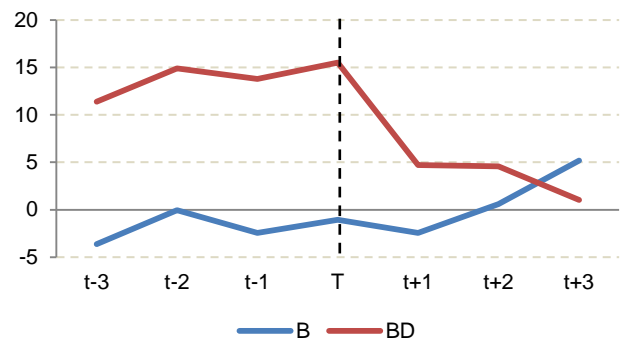


Figure 19. The Chinn-Ito index (%)



**“DEBT” vs. “DEBT-TO-BANK” CRISES**

Figure 20. Credit from the Central Bank (% GDP)

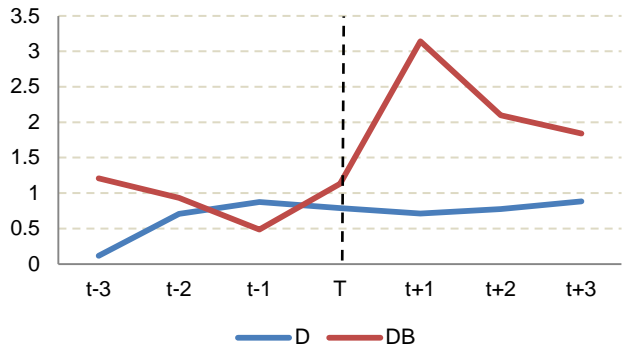


Figure 21. Credit from the Central Bank (% dom. assets)

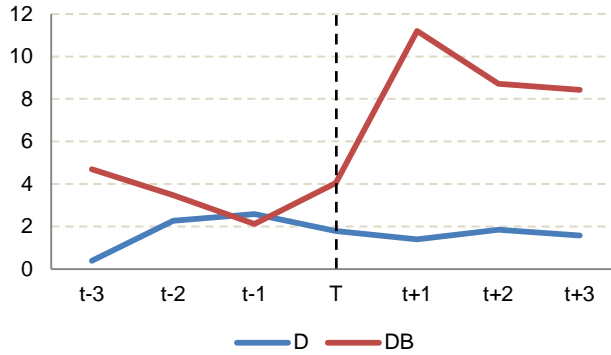


Figure 22. Claims on government (% GDP)

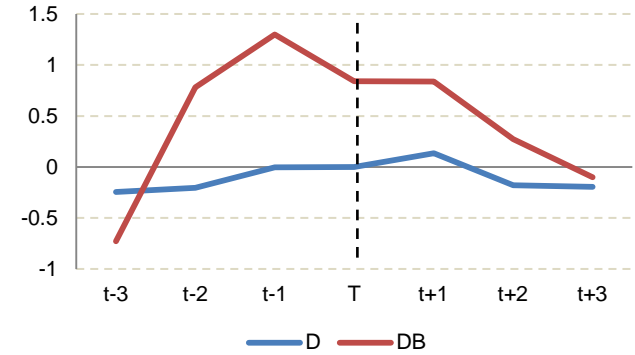


Figure 23. Claims on government (%dom. assets)

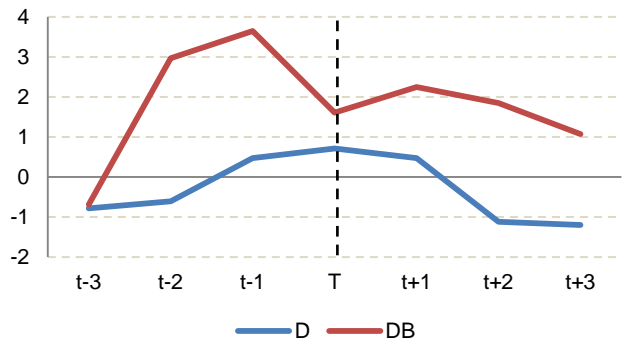


Figure 24. Domestic assets (% GDP)

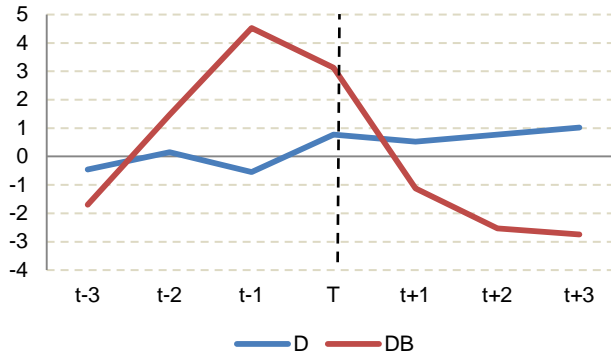


Figure 25. Credit to private sector (% GDP)

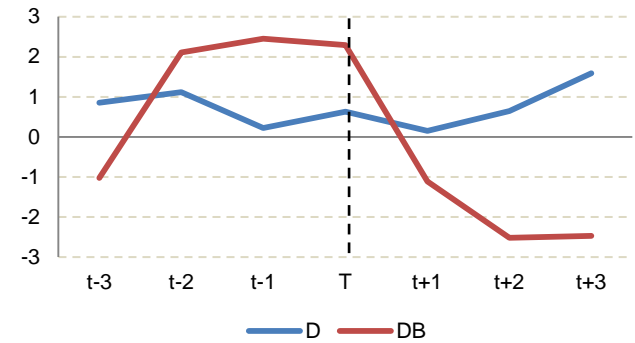


Figure 26. Deposits/assets (% GDP)

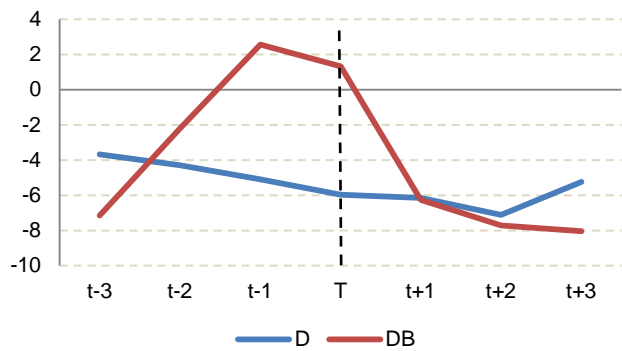


Figure 27. Foreign banks among total banks (%)

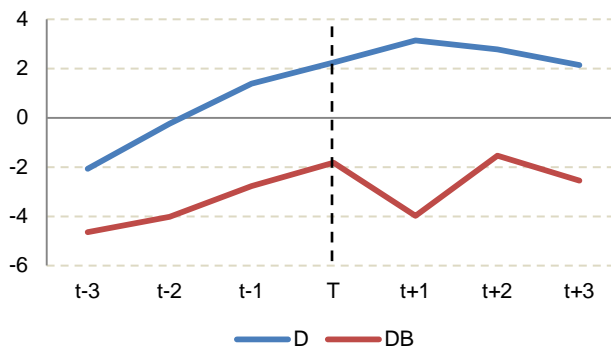


Figure 28. Budget expenditures (% GDP)

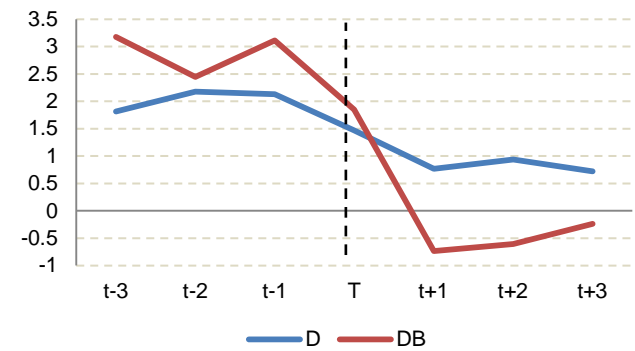


Figure 29. Budget balance (% GDP)

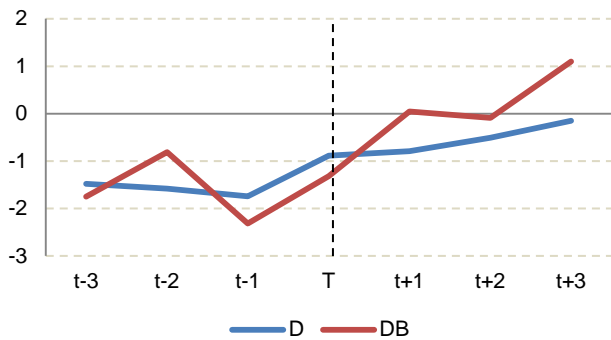


Figure 30. Public debt (% GDP)

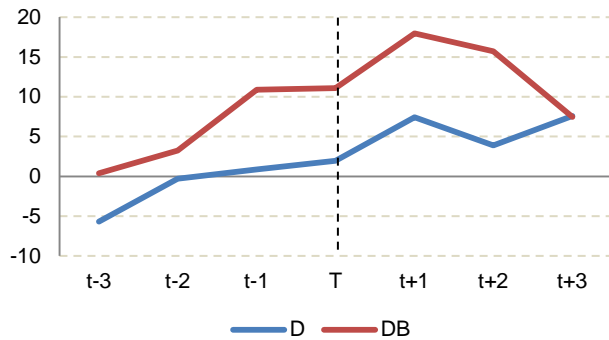


Figure 31. Real GDP growth (%)

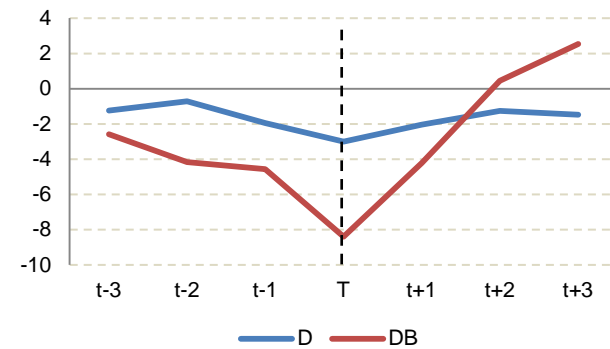


Figure 32. Inflation rate (%)

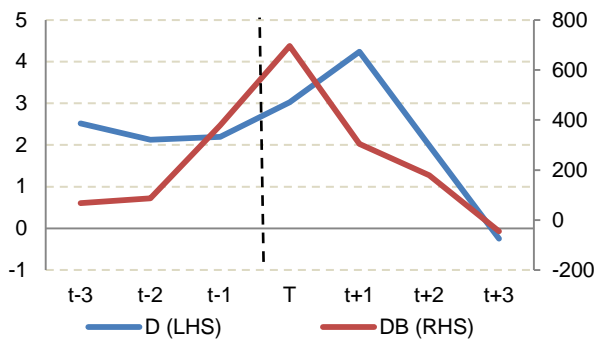


Figure 33. Real interest rate (%)

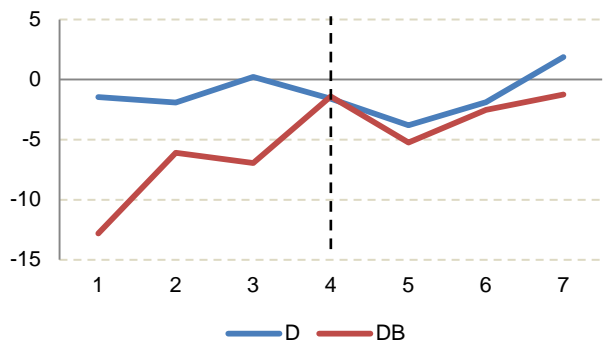


Figure 34. Total capital inflows (% GDP)

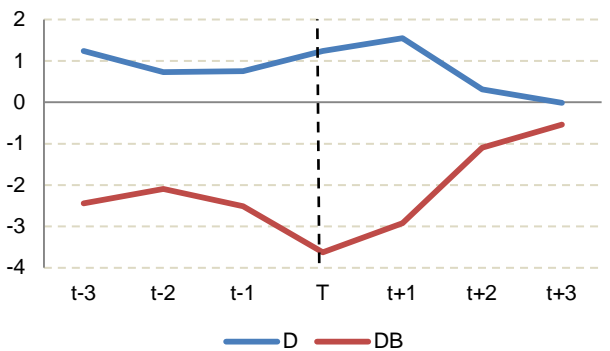


Figure 35. Net capital inflows (% GDP)

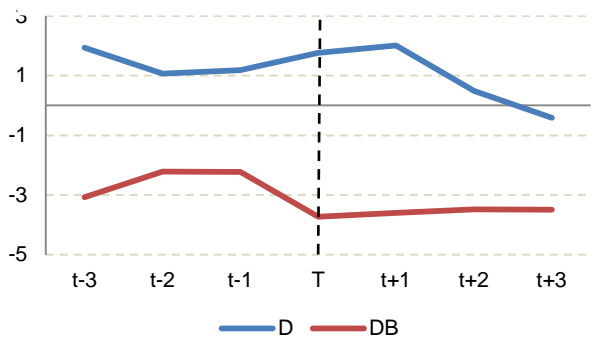


Figure 36. Short-term debt in total foreign debt (%)

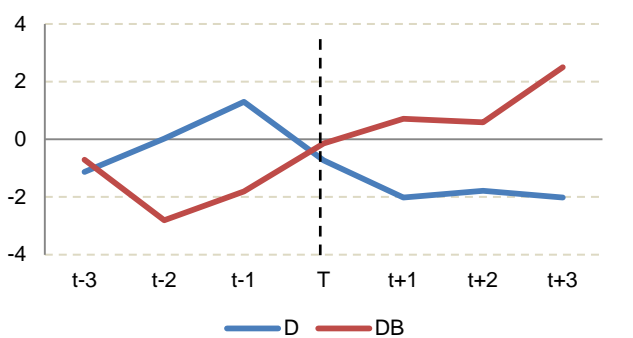


Figure 37. Real effective exchange rate

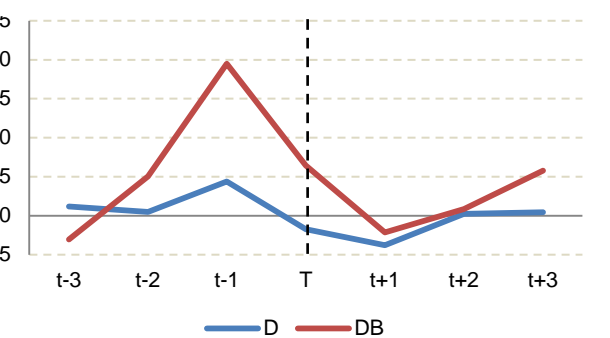
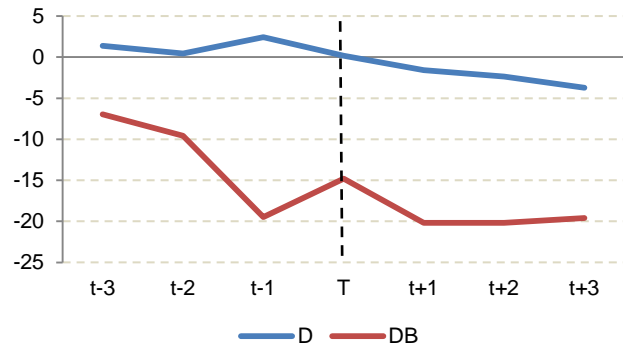


Figure 38. Chinn-Ito index. (%)



## APPENDIX 3: ECONOMETRIC RESULTS

**Table 7. Credit from the Central Bank (% GDP)**

	D crises	DB crises	B crises	BD crises
<b>Year t-3</b>	0.054 [0.163]	0.385 [0.435]	0.182 [0.184]	-0.047 [0.249]
<b>Year t-2</b>	0.336* [0.201]	0.298 [0.293]	0.397** [0.199]	-0.004 [0.274]
<b>Year t-1</b>	0.415** [0.211]	0.155 [0.298]	0.411** [0.194]	0.038 [0.188]
<b>Year Event</b>	0.376* [0.216]	0.360* [0.190]	1.007*** [0.246]	0.547* [0.238]
<b>Year t+1</b>	0.338* [0.197]	1.000*** [0.316]	0.524*** [0.185]	0.623*** [0.233]
<b>Year t+2</b>	0.369* [0.197]	0.670*** [0.241]	0.108 [0.161]	0.528 [0.319]
<b>Year t+3</b>	0.420** [0.185*]	0.588*** [0.231]	-0.012 [0.165]	0.160 [0.311]
<b>Observations</b>	1896	1896	1896	1896
<b>R-squared</b>	0.05	0.05	0.05	0.05
<b>No. of Countries</b>	89	89	89	89
<b>No. of Events</b>	45	13	40	16
<b>Country dummies</b>	Yes	Yes	Yes	Yes
<b>Country trends</b>				

**Table 8. Credit from the Central Bank (% domestic assets)**

	D crises	DB crises	B crises	BD crises
<b>Year t-3</b>	0.072 [0.163]	0.536* [0.285]	0.372** [0.176]	-0.024 [0.257]
<b>Year t-2</b>	0.431*** [0.209]	0.398* [0.231]	0.386** [0.194]	0.036 [0.301]
<b>Year t-1</b>	0.490** [0.201]	0.241 [0.287]	0.319 [0.201]	0.0052 [0.235]
<b>Year Event</b>	0.340* [0.199]	0.462*** [0.192]	0.962*** [0.238]	0.363* [0.217]
<b>Year t+1</b>	0.264 [0.164]	1.276*** [0.316]	0.611*** [0.203]	0.439* [0.245]
<b>Year t+2</b>	0.352* [0.199]	0.996*** [0.262]	0.141 [0.163]	0.401 [0.323]
<b>Year t+3</b>	0.301* [0.176]	0.963*** [0.288]	-0.033 [0.164]	0.070 [0.325]
<b>Observations</b>	1807	1807	1807	1807
<b>R-squared</b>	0.06	0.06	0.06	0.06
<b>No. of Countries</b>	88	88	88	88
<b>No. of Events</b>	41	12	37	16
<b>Country dummies</b>	Yes	Yes	Yes	Yes
<b>Country trends</b>				

The table reports the coefficients obtained from a fixed-effects panel regression of the variable in the title on a seven-year window around crisis events, controlling for country fixed effects. Crisis events are split into independent debt crises; independent bank crises; twin debt-bank crises; and twin bank-debt crises. The variable is first normalized by dividing by the standard deviation at the country level. The sample period is 1975 to 2007. Standard errors, clustered at the country-level, are reported in brackets. \*, \*\*, and \*\*\* mean significant at 10%, 5%, and 1% respectively

The table reports the coefficients obtained from a fixed-effects panel regression of the variable in the title on a seven-year window around crisis events, controlling for country fixed effects. Crisis events are split into independent debt crises; independent bank crises; twin debt-bank crises; and twin bank-debt crises. The variable is first normalized by dividing by the standard deviation at the country level. The sample period is 1975 to 2007. Standard errors, clustered at the country-level, are reported in brackets. \*, \*\*, and \*\*\* mean significant at 10%, 5%, and 1% respectively



**Table 9. Claims on Government (% GDP)**

	<b>D crises</b>	<b>DB crises</b>	<b>B crises</b>	<b>BD crises</b>
<b>Year t-3</b>	-0.106 [0.181]	-0.255 [0.266]	-0.258 [0.184]	-0.564*** [0.238]
<b>Year t-2</b>	-0.088 [0.182]	0.273 [0.380]	-0.339* [0.182]	-0.242 [0.316]
<b>Year t-1</b>	-0.001 [0.216]	0.454 [0.399]	-0.456** [0.183]	-0.112 [0.309]
<b>Year Event</b>	-0.000 [0.173]	0.294 [0.3374]	-0.373** [0.176]	0.180 [0.339]
<b>Year t+1</b>	0.059 [0.196]	0.293 [0.352]	-0.202 [0.144]	0.292 [0.296]
<b>Year t+2</b>	-0.078 [0.146]	0.095 [0.246]	-0.045 [0.150]	0.021 [0.284]
<b>Year t+3</b>	-0.085 [0.140]	-0.035 [0.183]	0.088 [0.146]	0.718* [0.373]
<b>Observations</b>	2246	2246	2246	2246
<b>R-squared</b>	0.40	0.40	0.40	0.40
<b>No. of Countries</b>	104	104	104	104
<b>No. of Events</b>	49	13	40	16
<b>Country dummies</b>	Yes	Yes	Yes	Yes
<b>Country trends</b>	Yes	Yes	Yes	Yes

**Table 10. Claims on Government (% domestic assets)**

	<b>D crises</b>	<b>DB crises</b>	<b>B crises</b>	<b>BD crises</b>
<b>Year t-3</b>	-0.103 [0.170]	-0.091 [0.308]	-0.136 [0.167]	-0.648*** [0.234]
<b>Year t-2</b>	-0.081 [0.167]	0.393 [0.408]	-0.183 [0.168]	-0.357 [0.355]
<b>Year t-1</b>	0.062 [0.201]	0.484 [0.445]	-0.409** [0.195]	-0.254 [0.316]
<b>Year Event</b>	0.094 [0.178]	0.213 [0.386]	-0.214 [0.196]	-0.075 [0.344]
<b>Year t+1</b>	0.062 [0.170]	0.298 [0.370]	0.118 [0.174]	0.079 [0.315]
<b>Year t+2</b>	-0.149 [0.134]	0.245 [0.277]	0.299 [0.184]	-0.055 [0.219]
<b>Year t+3</b>	-0.159 [0.141]	0.141 [0.211]	0.303** [0.140]	0.513* [0.288]
<b>Observations</b>	2238	2238	2238	2238
<b>R-squared</b>	0.42	0.42	0.42	0.42
<b>No. of Countries</b>	104	104	104	104
<b>No. of Events</b>	49	13	40	16
<b>Country dummies</b>	Yes	Yes	Yes	Yes
<b>Country trends</b>	Yes	Yes	Yes	Yes

The table reports the coefficients obtained from a fixed-effects panel regression of the variable in the title on a seven-year window around crisis events, controlling for country fixed effects. Crisis events are spilt into independent debt crises; independent bank crises; twin debt-bank crises; and twin bank-debt crises. The variable is first normalized by dividing by the standard deviation at the country level. The sample period is 1975 to 2007. Standard errors, clustered at the country-level, are reported in brackets. \*, \*\*, and \*\*\* mean significant at 10%, 5%, and 1% respectively

The table reports the coefficients obtained from a fixed-effects panel regression of the variable in the title on a seven-year window around crisis events, controlling for country fixed effects. Crisis events are spilt into independent debt crises; independent bank crises; twin debt-bank crises; and twin bank-debt crises. The variable is first normalized by dividing by the standard deviation at the country level. The sample period is 1975 to 2007. Standard errors, clustered at the country-level, are reported in brackets. \*, \*\*, and \*\*\* mean significant at 10%, 5%, and 1% respectively

**Table 11. Domestic assets (% GDP)**

	<b>D crises</b>	<b>DB crises</b>	<b>B crises</b>	<b>BD crises</b>
<b>Year t-3</b>	-0.050 [0.183]	-0.152 [0.207]	-0.231 [0.147]	0.242 [0.274]
<b>Year t-2</b>	0.017 [0.155]	0.131 [0.360]	-0.038 [0.183]	0.270 [0.265]
<b>Year t-1</b>	-0.060 [0.179]	0.406 [0.464]	0.243 [0.201]	0.389 [0.276]
<b>Year Event</b>	0.084 [0.205]	0.281 [0.376]	0.065 [0.179]	0.663** [0.277]
<b>Year t+1</b>	0.057 [0.192]	-0.100 [0.289]	-0.177 [0.175]	0.784*** [0.273]
<b>Year t+2</b>	0.085 [0.139]	-0.227 [0.270]	-0.311** [0.154]	0.505* [0.268]
<b>Year t+3</b>	0.112 [0.126]	-0.246 [0.322]	-0.210 [0.146]	0.563** [0.268]
<b>Observations</b>	2254	2254	2254	2254
<b>R-squared</b>	0.45	0.45	0.45	0.45
<b>No. of Countries</b>	104	104	104	104
<b>No. of Events</b>	49	13	41	16
<b>Country dummies</b>	Yes	Yes	Yes	Yes
<b>Country trends</b>	Yes	Yes	Yes	Yes

**Table 12. Credit to the private sector (% GDP)**

	<b>D crises</b>	<b>DB crises</b>	<b>B crises</b>	<b>BD crises</b>
<b>Year t-3</b>	0.098 [0.107]	-0.117 [0.156]	0.019 [0.150]	0.559** [0.210]
<b>Year t-2</b>	0.128 [0.125]	0.243 [0.352]	0.126 [0.187]	0.631*** [0.216]
<b>Year t-1</b>	0.025 [0.132]	0.281 [0.368]	0.388* [0.204]	0.777*** [0.221]
<b>Year Event</b>	0.072 [0.174]	0.263 [0.304]	0.370* [0.198]	0.812*** [0.267]
<b>Year t+1</b>	0.017 [0.165]	-0.127 [0.241]	0.014 [0.177]	0.685** [0.275]
<b>Year t+2</b>	0.074 [0.133]	0.289 [0.284]	-0.119 [0.151]	0.274 [0.281]
<b>Year t+3</b>	0.181 [0.138]	-0.284 [0.332]	-0.077 [0.135]	0.257 [0.252]
<b>Observations</b>	2350	2350	2350	2350
<b>R-squared</b>	0.46	0.46	0.46	0.46
<b>No. of Countries</b>	104	104	104	104
<b>No. of Events</b>	53	14	44	17
<b>Country dummies</b>	Yes	Yes	Yes	Yes
<b>Country trends</b>	Yes	Yes	Yes	Yes

The table reports the coefficients obtained from a fixed-effects panel regression of the variable in the title on a seven-year window around crisis events, controlling for country fixed effects. Crisis events are split into independent debt crises; independent bank crises; twin debt-bank crises; and twin bank-debt crises. The variable is first normalized by dividing by the standard deviation at the country level. The sample period is 1975 to 2007. Standard errors, clustered at the country-level, are reported in brackets. \*, \*\*, and \*\*\* mean significant at 10%, 5%, and 1% respectively

The table reports the coefficients obtained from a fixed-effects panel regression of the variable in the title on a seven-year window around crisis events, controlling for country fixed effects. Crisis events are split into independent debt crises; independent bank crises; twin debt-bank crises; and twin bank-debt crises. The variable is first normalized by dividing by the standard deviation at the country level. The sample period is 1975 to 2007. Standard errors, clustered at the country-level, are reported in brackets. \*, \*\*, and \*\*\* mean significant at 10%, 5%, and 1% respectively

**Table 13. Deposits/domestic assets (% GDP)**

	<b>D crises</b>	<b>DB crises</b>	<b>B crises</b>	<b>BD crises</b>
<b>Year t-3</b>	-0.265 [0.167]	-0.450 [0.331]	0.081 [0.231]	0.126 [0.374]
<b>Year t-2</b>	-0.309* [0.177]	-0.138 [0.334]	-0.143 [0.203]	-0.054 [0.336]
<b>Year t-1</b>	-0.367** [0.160]	0.161 [0.409]	0.193 [0.182]	-0.071 [0.323]
<b>Year Event</b>	-0.429** [0.170]	0.083 [0.258]	-0.144 [0.183]	-0.150 [0.272]
<b>Year t+1</b>	-0.443*** [0.167]	-0.393* [0.235]	-0.011 [0.178]	-0.221 [0.272]
<b>Year t+2</b>	-0.511*** [0.178]	-0.485** [0.191]	0.199 [0.162]	-0.153 [0.269]
<b>Year t+3</b>	-0.377** [0.179]	-0.506** [0.202]	0.214 [0.170]	-0.143 [0.250]
<b>Observations</b>	2246	2246	2246	2246
<b>R-squared</b>	0.03	0.03	0.03	0.03
<b>No. of Countries</b>	104	104	104	104
<b>No. of Events</b>	49	13	41	16
<b>Country dummies</b>	Yes	Yes	Yes	Yes
<b>Country trends</b>	No	No	No	No

**Table 14. Share of foreign banks among total banks**

	<b>D crises</b>	<b>DB crises</b>	<b>B crises</b>	<b>BD crises</b>
<b>Year t-3</b>	-0.322 [0.275]	-0.950 [0.604]	-1.662** [0.695]	-0.299 [0.388]
<b>Year t-2</b>	-0.037 [0.323]	-0.823 [0.707]	-1.170*** [0.406]	-0.326 [0.421]
<b>Year t-1</b>	0.215 [0.401]	-0.566 [0.601]	-1.212*** [0.244]	0.177 [0.401]
<b>Year Event</b>	0.348 [0.418]	-0.374 [0.522]	-1.180*** [0.298]	0.892* [0.459]
<b>Year t+1</b>	0.488 [0.469]	-0.815** [0.328]	-1.292*** [0.243]	0.770 [0.752]
<b>Year t+2</b>	0.432 [0.470]	-0.315 [0.381]	-0.886*** [0.229]	0.655 [0.705]
<b>Year t+3</b>	0.033 [0.484]	-0.523* [0.308]	-0.645*** [0.188]	0.261 [0.602]
<b>Observations</b>	720	720	720	720
<b>R-squared</b>	0.17	0.17	0.17	0.17
<b>No. of Countries</b>	72	72	72	72
<b>No. of Events</b>	10	3	19	5
<b>Country dummies</b>	Yes	Yes	Yes	Yes
<b>Country trends</b>	No	No	No	No

The table reports the coefficients obtained from a fixed-effects panel regression of the variable in the title on a seven-year window around crisis events, controlling for country fixed effects. Crisis events are split into independent debt crises; independent bank crises; twin debt-bank crises; and twin bank-debt crises. The variable is first normalized by dividing by the standard deviation at the country level. The sample period is 1975 to 2007. Standard errors, clustered at the country-level, are reported in brackets. \*, \*\*, and \*\*\* mean significant at 10%, 5%, and 1% respectively

The table reports the coefficients obtained from a fixed-effects panel regression of the variable in the title on a seven-year window around crisis events, controlling for country fixed effects. Crisis events are split into independent debt crises; independent bank crises; twin debt-bank crises; and twin bank-debt crises. The variable is first normalized by dividing by the standard deviation at the country level. The sample period is 1975 to 2007. Standard errors, clustered at the country-level, are reported in brackets. \*, \*\*, and \*\*\* mean significant at 10%, 5%, and 1% respectively

**Table 15. Budget Expense (% GDP)**

	<b>D crises</b>	<b>DB crises</b>	<b>B crises</b>	<b>BD crises</b>
<b>Year t-3</b>	0.372** [0.180]	0.776*** [0.289]	-0.098 [0.198]	-0.146 [0.322]
<b>Year t-2</b>	0.446** [0.210]	0.597* [0.303]	0.056 [0.194]	0.022 [0.325]
<b>Year t-1</b>	0.436** [0.214]	0.759* [0.434]	0.147 [0.190]	-0.012 [0.328]
<b>Year Event</b>	0.301 [0.205]	0.451 [0.373]	0.237 [0.217]	-0.091 [0.315]
<b>Year t+1</b>	0.157 [0.227]	-0.179 [0.336]	0.199 [0.180]	0.535 [0.425]
<b>Year t+2</b>	0.192 [0.150]	-0.147 [0.252]	0.234 [0.173]	0.307 [0.418]
<b>Year t+3</b>	0.148 [0.185]	-0.057 [0.287]	0.084 [0.168]	0.218 [0.346]
<b>Observations</b>	1921	1921	1921	1921
<b>R-squared</b>	0.03	0.03	0.03	0.03
<b>No. of Countries</b>	95	95	95	95
<b>No. of Events</b>	42	13	40	14
<b>Country dummies</b>	Yes	Yes	Yes	Yes
<b>Country trends</b>	No	No	No	No

**Table 16. Budget Balance (% GDP)**

	<b>D crises</b>	<b>DB crises</b>	<b>B crises</b>	<b>BD crises</b>
<b>Year t-3</b>	-0.395** [0.190]	-0.426 [0.276]	0.127 [0.182]	0.306 [0.281]
<b>Year t-2</b>	-0.422** [0.205]	-0.198 [0.366]	0.109 [0.206]	-0.006 [0.329]
<b>Year t-1</b>	-0.465** [0.191]	-0.565 [0.489]	-0.061 [0.196]	-0.167 [0.312]
<b>Year Event</b>	-0.237 [0.198]	-0.321 [0.318]	-0.333* [0.171]	-0.304 [0.318]
<b>Year t+1</b>	-0.212 [0.251]	0.011 [0.298]	-0.307** [0.140]	-0.994*** [0.330]
<b>Year t+2</b>	-0.136 [0.224]	-0.021 [0.192]	-0.309* [0.159]	-0.493 [0.306]
<b>Year t+3</b>	-0.040 [0.234]	0.268 [0.255]	-0.004 [0.152]	-0.363 [0.299]
<b>Observations</b>	1921	1921	1921	1921
<b>R-squared</b>	0.03	0.03	0.03	0.03
<b>No. of Countries</b>	95	95	95	95
<b>No. of Events</b>	42	13	40	14
<b>Country dummies</b>	Yes	Yes	Yes	Yes
<b>Country trends</b>	No	No	No	No

The table reports the coefficients obtained from a fixed-effects panel regression of the variable in the title on a seven-year window around crisis events, controlling for country fixed effects. Crisis events are split into independent debt crises; independent bank crises; twin debt-bank crises; and twin bank-debt crises. The variable is first normalized by dividing by the standard deviation at the country level. The sample period is 1975 to 2007. Standard errors, clustered at the country-level, are reported in brackets. \*, \*\*, and \*\*\* mean significant at 10%, 5%, and 1% respectively

The table reports the coefficients obtained from a fixed-effects panel regression of the variable in the title on a seven-year window around crisis events, controlling for country fixed effects. Crisis events are split into independent debt crises; independent bank crises; twin debt-bank crises; and twin bank-debt crises. The variable is first normalized by dividing by the standard deviation at the country level. The sample period is 1975 to 2007. Standard errors, clustered at the country-level, are reported in brackets. \*, \*\*, and \*\*\* mean significant at 10%, 5%, and 1% respectively

**Table 17. Public Debt (% GDP)**

	<b>D crises</b>	<b>DB crises</b>	<b>B crises</b>	<b>BD crises</b>
<b>Year t-3</b>	-0.270 [0.201]	0.022 [0.340]	-0.196 [0.179]	-0.486** [0.221]
<b>Year t-2</b>	-0.014 [0.212]	0.192 [0.396]	-0.059 [0.209]	-0.607*** [0.199]
<b>Year t-1</b>	0.041 [0.228]	0.639 [0.425]	0.004 [0.238]	-0.563** [0.230]
<b>Year Event</b>	0.093 [0.203]	0.651** [0.307]	-0.103 [0.240]	-0.317 [0.208]
<b>Year t+1</b>	0.352* [0.195]	1.055** [0.415]	-0.057 [0.191]	0.122 [0.193]
<b>Year t+2</b>	0.184 [0.166]	0.922** [0.371]	-0.005 [0.176]	0.433 [0.261]
<b>Year t+3</b>	0.359** [0.164]	0.438 [0.324]	0.156 [0.171]	0.712*** [0.279]
<b>Observations</b>	2138	2138	2138	2138
<b>R-squared</b>	0.04	0.04	0.04	0.04
<b>No. of Countries</b>	99	99	99	99
<b>No. of Events</b>	47	12	41	14
<b>Country dummies</b>	Yes	Yes	Yes	Yes
<b>Country trends</b>	No	No	No	No

**Table 18. Real GDP growth (%)**

	<b>D crises</b>	<b>DB crises</b>	<b>B crises</b>	<b>BD crises</b>
<b>Year t-3</b>	-0.246 [0.188]	-0.404* [0.209]	-0.261* [0.154]	0.168 [0.234]
<b>Year t-2</b>	-0.141 [0.168]	-0.651** [0.290]	-0.427** [0.166]	-0.140 [0.217]
<b>Year t-1</b>	-0.389*** [0.176]	-0.712*** [0.192]	-0.328* [0.195]	0.239 [0.199]
<b>Year Event</b>	-0.595*** [0.173]	-1.310*** [0.307]	-0.380** [0.147]	-0.521** [0.264]
<b>Year t+1</b>	-0.406** [0.145]	-0.658** [0.320]	-0.671*** [0.248]	-1.618*** [0.370]
<b>Year t+2</b>	-0.249* [0.147]	0.071 [0.201]	-0.116 [0.124]	-1.039*** [0.325]
<b>Year t+3</b>	-0.294* [0.168]	0.395* [0.222]	-0.032 [0.119]	-0.191 [0.210]
<b>Observations</b>	2336	2336	2336	2336
<b>R-squared</b>	0.07	0.07	0.07	0.07
<b>No. of Countries</b>	100	100	100	100
<b>No. of Events</b>	55	16	40	18
<b>Country dummies</b>	Yes	Yes	Yes	Yes
<b>Country trends</b>	No	No	No	No

The table reports the coefficients obtained from a fixed-effects panel regression of the variable in the title on a seven-year window around crisis events, controlling for country fixed effects. Crisis events are split into independent debt crises; independent bank crises; twin debt-bank crises; and twin bank-debt crises. The variable is first normalized by dividing by the standard deviation at the country level. The sample period is 1975 to 2007. Standard errors, clustered at the country-level, are reported in brackets. \*, \*\*, and \*\*\* mean significant at 10%, 5%, and 1% respectively

The table reports the coefficients obtained from a fixed-effects panel regression of the variable in the title on a seven-year window around crisis events, controlling for country fixed effects. Crisis events are split into independent debt crises; independent bank crises; twin debt-bank crises; and twin bank-debt crises. The variable is first normalized by dividing by the standard deviation at the country level. The sample period is 1975 to 2007. Standard errors, clustered at the country-level, are reported in brackets. \*, \*\*, and \*\*\* mean significant at 10%, 5%, and 1% respectively

**Table 19. Inflation rate (%)**

	<b>D crises</b>	<b>DB crises</b>	<b>B crises</b>	<b>BD crises</b>
<b>Year t-3</b>	0.258 [0.185]	0.119 [0.184]	0.767*** [0.28]	-0.075 [0.212]
<b>Year t-2</b>	0.218* [0.130]	0.153 [0.254]	0.857*** [0.215]	0.024 [0.165]
<b>Year t-1</b>	0.224* [0.121]	0.664 [0.505]	0.612*** [0.181]	-0.054 [0.165]
<b>Year Event</b>	0.309** [0.154]	1.223** [0.503]	0.323** [0.143]	0.264 [0.249]
<b>Year t+1</b>	0.434* [0.219]	0.534 [0.359]	0.416** [0.186]	1.225** [0.524]
<b>Year t+2</b>	0.203 [0.165]	0.313 [0.274]	0.167 [0.166]	1.064** [0.377]
<b>Year t+3</b>	-0.025 [0.132]	-0.078* [0.155]	-0.143 [0.122]	0.243 [0.201]
<b>Observations</b>	2258	2258	2258	2258
<b>R-squared</b>	0.06	0.06	0.06	0.06
<b>No. of Countries</b>	100	100	100	100
<b>No. of Events</b>	51	14	40	15
<b>Country dummies</b>	Yes	Yes	Yes	Yes
<b>Country trends</b>	No	No	No	No

**Table 20. Real interest rate (% GDP)**

	<b>D crises</b>	<b>DB crises</b>	<b>B crises</b>	<b>BD crises</b>
<b>Year t-3</b>	0.457** [0.180]	-0.628** [0.292]	0.127 [0.149]	0.152 [0.348]
<b>Year t-2</b>	0.238 [0.175]	-0.415 [0.253]	0.267 [0.186]	0.378 [0.273]
<b>Year t-1</b>	0.033 [0.166]	-0.364 [0.291]	0.376** [0.187]	0.529** [0.224]
<b>Year Event</b>	-0.096 [0.223]	-0.919*** [0.301]	0.143 [0.142]	-0.057 [0.450]
<b>Year t+1</b>	-0.268 [0.203]	-0.948*** [0.329]	-0.081 [0.186]	-0.504 [0.367]
<b>Year t+2</b>	-0.306 [0.213]	-0.310 [0.507]	0.127 [0.190]	-1.024*** [0.325]
<b>Year t+3</b>	-0.232 [0.144]	-0.352* [0.207]	0.012 [0.154]	-0.418*** [0.156]
<b>Observations</b>	1603	1603	1603	1603
<b>R-squared</b>	0.27	0.27	0.27	0.27
<b>No. of Countries</b>	71	71	71	71
<b>No. of Events</b>	46	11	40	15
<b>Country dummies</b>	Yes	Yes	Yes	Yes
<b>Country trends</b>	No	No	No	No

The table reports the coefficients obtained from a fixed-effects panel regression of the variable in the title on a seven-year window around crisis events, controlling for country fixed effects. Crisis events are split into independent debt crises; independent bank crises; twin debt-bank crises; and twin bank-debt crises. The variable is first normalized by dividing by the standard deviation at the country level. The sample period is 1975 to 2007. Standard errors, clustered at the country-level, are reported in brackets. \*, \*\*, and \*\*\* mean significant at 10%, 5%, and 1% respectively

The table reports the coefficients obtained from a fixed-effects panel regression of the variable in the title on a seven-year window around crisis events, controlling for country fixed effects. Crisis events are split into independent debt crises; independent bank crises; twin debt-bank crises; and twin bank-debt crises. The variable is first normalized by dividing by the standard deviation at the country level. The sample period is 1975 to 2007. Standard errors, clustered at the country-level, are reported in brackets. \*, \*\*, and \*\*\* mean significant at 10%, 5%, and 1% respectively

**Table 21. Total capital inflows (% GDP)**

	<b>D crises</b>	<b>DB crises</b>	<b>B crises</b>	<b>BD crises</b>
<b>Year t-3</b>	0.067 [0.165]	-0.084 [0.214]	-0.003 [0.172]	0.283 [0.243]
<b>Year t-2</b>	0.173 [0.198]	-0.195 [0.266]	-0.051 [0.173]	0.555** [0.236]
<b>Year t-1</b>	0.159 [0.195]	-0.069 [0.365]	0.182 [0.206]	0.950*** [0.314]
<b>Year Event</b>	-0.093 [0.185]	-0.035 [0.333]	0.161 [0.204]	0.582 [0.352]
<b>Year t+1</b>	-0.326** [0.140]	0.086 [0.355]	-0.016 [0.164]	0.157 [0.331]
<b>Year t+2</b>	-0.370*** [0.132]	0.220 [0.277]	-0.002 [0.211]	-0.119 [0.354]
<b>Year t+3</b>	-0.309** [0.154]	0.438* [0.252]	-0.133 [0.146]	-0.380* [0.214]
<b>Observations</b>	1602	1602	1602	1602
<b>R-squared</b>	0.03	0.03	0.03	0.03
<b>No. of Countries</b>	65	65	65	65
<b>No. of Events</b>	48	12	40	15
<b>Country dummies</b>	Yes	Yes	Yes	Yes
<b>Country trends</b>	No	No	No	No

**Table 22. Net capital inflows (% GDP)**

	<b>D crises</b>	<b>DB crises</b>	<b>B crises</b>	<b>BD crises</b>
<b>Year t-3</b>	0.067 [0.165]	-0.084 [0.214]	-0.003 [0.172]	0.283 [0.243]
<b>Year t-2</b>	0.173 [0.198]	-0.195 [0.266]	-0.051 [0.173]	0.555** [0.236]
<b>Year t-1</b>	0.159 [0.195]	-0.069 [0.365]	0.182 [0.206]	0.950*** [0.314]
<b>Year Event</b>	-0.093 [0.185]	-0.035 [0.333]	0.161 [0.204]	0.582 [0.352]
<b>Year t+1</b>	-0.326** [0.140]	0.086 [0.355]	-0.016 [0.164]	0.157 [0.331]
<b>Year t+2</b>	-0.370*** [0.132]	0.220 [0.277]	-0.002 [0.211]	-0.119 [0.354]
<b>Year t+3</b>	-0.309** [0.154]	0.438* [0.252]	-0.133 [0.146]	-0.380* [0.214]
<b>Observations</b>	1602	1602	1602	1602
<b>R-squared</b>	0.03	0.03	0.03	0.03
<b>No. of Countries</b>	65	65	65	65
<b>No. of Events</b>	48	12	40	15
<b>Country dummies</b>	Yes	Yes	Yes	Yes
<b>Country trends</b>	No	No	No	No

The table reports the coefficients obtained from a fixed-effects panel regression of the variable in the title on a seven-year window around crisis events, controlling for country fixed effects. Crisis events are split into independent debt crises; independent bank crises; twin debt-bank crises; and twin bank-debt crises. The variable is first normalized by dividing by the standard deviation at the country level. The sample period is 1975 to 2007. Standard errors, clustered at the country-level, are reported in brackets. \*, \*\*, and \*\*\* mean significant at 10%, 5%, and 1% respectively.

The table reports the coefficients obtained from a fixed-effects panel regression of the variable in the title on a seven-year window around crisis events, controlling for country fixed effects. Crisis events are split into independent debt crises; independent bank crises; twin debt-bank crises; and twin bank-debt crises. The variable is first normalized by dividing by the standard deviation at the country level. The sample period is 1975 to 2007. Standard errors, clustered at the country-level, are reported in brackets. \*, \*\*, and \*\*\* mean significant at 10%, 5%, and 1% respectively.

**Table 23. Short-term debt in total foreign debt (%)**

	<b>D crises</b>	<b>DB crises</b>	<b>B crises</b>	<b>BD crises</b>
<b>Year t-3</b>	0.067 [0.165]	-0.084 [0.214]	-0.003 [0.172]	0.283 [0.243]
<b>Year t-2</b>	0.173 [0.198]	-0.195 [0.266]	-0.051 [0.173]	0.555** [0.236]
<b>Year t-1</b>	0.159 [0.195]	-0.069 [0.365]	0.182 [0.206]	0.950*** [0.314]
<b>Year Event</b>	-0.093 [0.185]	-0.035 [0.333]	0.161 [0.204]	0.582 [0.352]
<b>Year t+1</b>	-0.326** [0.140]	0.086 [0.355]	-0.016 [0.164]	0.157 [0.331]
<b>Year t+2</b>	-0.370*** [0.132]	0.220 [0.277]	-0.002 [0.211]	-0.119 [0.354]
<b>Year t+3</b>	-0.309** [0.154]	0.438* [0.252]	-0.133 [0.146]	-0.380* [0.214]
<b>Observations</b>	1602	1602	1602	1602
<b>R-squared</b>	0.03	0.03	0.03	0.03
<b>No. of Countries</b>	65	65	65	65
<b>No. of Events</b>	48	12	40	15
<b>Country dummies</b>	Yes	Yes	Yes	Yes
<b>Country trends</b>	No	No	No	No

**Table 24. Real effective exchange rate (index, 2000=100)**

	<b>D crises</b>	<b>DB crises</b>	<b>B crises</b>	<b>BD crises</b>
<b>Year t-3</b>	0.067 [0.165]	-0.084 [0.214]	-0.003 [0.172]	0.283 [0.243]
<b>Year t-2</b>	0.173 [0.198]	-0.195 [0.266]	-0.051 [0.173]	0.555** [0.236]
<b>Year t-1</b>	0.159 [0.195]	-0.069 [0.365]	0.182 [0.206]	0.950*** [0.314]
<b>Year Event</b>	-0.093 [0.185]	-0.035 [0.333]	0.161 [0.204]	0.582 [0.352]
<b>Year t+1</b>	-0.326** [0.140]	0.086 [0.355]	-0.016 [0.164]	0.157 [0.331]
<b>Year t+2</b>	-0.370*** [0.132]	0.220 [0.277]	-0.002 [0.211]	-0.119 [0.354]
<b>Year t+3</b>	-0.309** [0.154]	0.438* [0.252]	-0.133 [0.146]	-0.380* [0.214]
<b>Observations</b>	1602	1602	1602	1602
<b>R-squared</b>	0.03	0.03	0.03	0.03
<b>No. of Countries</b>	65	65	65	65
<b>No. of Events</b>	48	12	40	15
<b>Country dummies</b>	Yes	Yes	Yes	Yes
<b>Country trends</b>	No	No	No	No

The table reports the coefficients obtained from a fixed-effects panel regression of the variable in the title on a seven-year window around crisis events, controlling for country fixed effects. Crisis events are split into independent debt crises; independent bank crises; twin debt-bank crises; and twin bank-debt crises. The variable is first normalized by dividing by the standard deviation at the country level. The sample period is 1975 to 2007. Standard errors, clustered at the country-level, are reported in brackets. \*, \*\*, and \*\*\* mean significant at 10%, 5%, and 1% respectively.

The table reports the coefficients obtained from a fixed-effects panel regression of the variable in the title on a seven-year window around crisis events, controlling for country fixed effects. Crisis events are split into independent debt crises; independent bank crises; twin debt-bank crises; and twin bank-debt crises. The variable is first normalized by dividing by the standard deviation at the country level. The sample period is 1975 to 2007. Standard errors, clustered at the country-level, are reported in brackets. \*, \*\*, and \*\*\* mean significant at 10%, 5%, and 1% respectively.



**Table 25. The Chinn-Ito index (%)**

	<b>D crises</b>	<b>DB crises</b>	<b>B crises</b>	<b>BD crises</b>
<b>Year t-3</b>	0.067 [0.165]	-0.084 [0.214]	-0.003 [0.172]	0.283 [0.243]
<b>Year t-2</b>	0.173 [0.198]	-0.195 [0.266]	-0.051 [0.173]	0.555** [0.236]
<b>Year t-1</b>	0.159 [0.195]	-0.069 [0.365]	0.182 [0.206]	0.950*** [0.314]
<b>Year Event</b>	-0.093 [0.185]	-0.035 [0.333]	0.161 [0.204]	0.582 [0.352]
<b>Year t+1</b>	-0.326** [0.140]	0.086 [0.355]	-0.016 [0.164]	0.157 [0.331]
<b>Year t+2</b>	-0.370*** [0.132]	0.220 [0.277]	-0.002 [0.211]	-0.119 [0.354]
<b>Year t+3</b>	-0.309** [0.154]	0.438* [0.252]	-0.133 [0.146]	-0.380* [0.214]
<b>Observations</b>	1602	1602	1602	1602
<b>R-squared</b>	0.03	0.03	0.03	0.03
<b>No. of Countries</b>	65	65	65	65
<b>No. of Events</b>	48	12	40	15
<b>Country dummies</b>	Yes	Yes	Yes	Yes
<b>Country trends</b>	No	No	No	No

The table reports the coefficients obtained from a fixed-effects panel regression of the variable in the title on a seven-year window around crisis events, controlling for country fixed effects. Crisis events are split into independent debt crises; independent bank crises; twin debt-bank crises; and twin bank-debt crises. The variable is first normalized by dividing by the standard deviation at the country level. The sample period is 1975 to 2007. Standard errors, clustered at the country-level, are reported in brackets. \*, \*\*, and \*\*\* mean significant at 10%, 5%, and 1% respectively.

**Table 26. Multinomial Logit Regressions**

VARIABLES	Bank		Debt		Bank-Debt		Debt-Bank	
	Full Sample	EMEs Only	Full Sample	EMEs Only	Full Sample	EMEs Only	Full Sample	EMEs Only
Δ GDP Growth (annual %)	-0.027 (0.035)	-0.041 (0.041)	-0.074 (0.057)	-0.069 (0.070)	-0.118*** (0.038)	-0.128*** (0.037)	-0.091 (0.063)	-0.157*** (0.052)
Δ Bank Exposure to the Government (% of banks' domestic assets)	4.620 (3.655)	7.048 (4.798)	-0.429 (4.194)	-3.491 (3.657)	-0.575 (4.996)	2.747 (6.410)	-0.578 (5.813)	-4.607 (6.741)
Δ Central bank liquidity provision (% of banks' assets)	11.464** (5.535)	15.218*** (5.301)	-0.780 (4.580)	0.229 (6.810)	21.440*** (6.764)	16.400** (6.840)	3.643 (6.314)	7.105 (9.280)
Δ General Government Balance (% of GDP)	-0.012 (0.045)	-0.013 (0.066)	0.056 (0.039)	0.080* (0.045)	-0.073 (0.064)	-0.079 (0.067)	-0.029 (0.086)	0.003 (0.087)
Δ Gross Public Debt (% of GDP)	-0.006 (0.018)	-0.035*** (0.013)	0.013 (0.008)	0.013 (0.015)	0.001 (0.017)	0.001 (0.026)	0.016 (0.021)	0.013 (0.022)
Δ Capital Inflows (% of GDP)	-0.007 (0.021)	-0.029 (0.029)	0.058* (0.032)	0.055 (0.042)	-0.049 (0.051)	-0.070 (0.052)	-0.089 (0.060)	-0.083 (0.071)
Δ Banks' Domestic Assets (% of GDP)	1.672 (4.348)	3.920 (4.129)	-2.768* (1.433)	-2.642 (1.899)	3.987* (2.278)	3.945* (2.135)	-13.367*** (3.462)	-12.969*** (3.235)
Δ Capital Account Openness <sup>†</sup>	3.529*** (1.115)	2.843** (1.121)	-3.541** (1.606)	-3.315* (1.744)	4.548 (3.127)	4.833* (2.806)	-6.187 (4.321)	-7.260 (4.955)
Lagged GDP Growth (annual %)	-0.022 (0.046)	-0.050 (0.048)	-0.113*** (0.043)	-0.162*** (0.040)	-0.034 (0.045)	-0.057 (0.041)	-0.115 (0.077)	-0.207*** (0.067)
Lagged Bank Exposure to the Government	-0.354 (1.639)	-0.040 (1.810)	0.958 (1.343)	0.603 (1.830)	-4.262 (6.365)	-2.772 (6.457)	2.501 (2.064)	2.620 (2.032)
Lagged Central bank liquidity provision	0.697 (2.096)	2.714 (2.355)	1.112 (1.962)	1.782 (2.602)	3.293 (2.045)	5.315** (2.083)	6.333*** (1.723)	5.725** (2.465)
Lagged General Government Balance (% of GDP)	0.005 (0.036)	-0.016 (0.034)	0.015 (0.023)	0.020 (0.032)	0.010 (0.056)	0.022 (0.067)	0.066 (0.064)	0.043 (0.054)
Lagged Gross Public Debt (% of GDP)	0.001 (0.003)	-0.002 (0.003)	0.001 (0.002)	0.001 (0.004)	-0.002 (0.007)	-0.012 (0.010)	-0.012 (0.012)	0.001 (0.011)
Lagged Capital Inflows (% of GDP)	0.030 (0.033)	0.036 (0.035)	0.050* (0.030)	0.050 (0.038)	0.055 (0.034)	0.045 (0.044)	0.033 (0.036)	0.021 (0.033)
Lagged Banks' Domestic Assets (% of GDP)	1.252*** (0.435)	1.362*** (0.424)	-1.671** (0.849)	-1.465 (1.076)	-1.382 (0.916)	-1.301 (0.948)	-5.479*** (2.060)	-6.812** (2.660)
Lagged Capital Account Openness <sup>†</sup>	-1.510** (0.623)	-1.593** (0.679)	-1.151* (0.642)	-1.604** (0.780)	1.658* (0.931)	0.931 (0.813)	-1.890** (0.934)	-3.122*** (1.022)
Constant	-4.387*** (0.496)	-4.477*** (0.553)	-2.841*** (0.516)	-2.684*** (0.608)	-5.625*** (0.995)	-4.885*** (0.783)	-3.257*** (1.159)	-3.057*** (1.097)
Observations	1,537	1,343	1,537	1,343	1,537	1,343	1,537	1,343

Dependent categorical variable is crisis type, whose level is denoted in the column header. <sup>†</sup>Normalized Chinn-Ito Index. Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 27. Bivariate Ordered Probit Regressions**

VARIABLES	Debt equation		Bank equation	
	Full Sample	EMEs Only	Full Sample	EMEs Only
Lagged GDP Growth (annual %)	-0.047*** (0.008)	-0.030*** (0.009)	-0.008 (0.008)	-0.007 (0.009)
Lagged Central Bank Liquidity Provision	0.831 (0.521)	0.822 (0.596)		
Lagged Bank Exposure to the Government			0.234 (0.244)	0.861*** (0.271)
Lagged General Government Balance (% of GDP)	0.038*** (0.008)	0.042*** (0.009)	0.027*** (0.007)	0.028*** (0.008)
Lagged Gross Public Debt (% of GDP)	0.011*** (0.001)	0.017*** (0.001)	0.002** (0.001)	-0.001 (0.001)
Lagged Capital Inflows (% of GDP)	-0.016** (0.007)	-0.015** (0.007)	-0.006 (0.006)	0.000 (0.007)
Lagged Banks' Domestic Assets (% of GDP)	-0.913*** (0.120)	-1.271*** (0.141)	0.544*** (0.111)	0.689*** (0.122)
Lagged Capital Account Openness <sup>†</sup>	0.085 (0.111)	0.028 (0.118)	0.672*** (0.105)	0.557*** (0.111)
$\Delta$ GDP Growth (annual %) * Bank Crisis	-0.038*** (0.010)	-0.023* (0.012)		
$\Delta$ Central Bank Liquidity Provision * Bank Crisis	1.559 (1.322)	-0.392 (1.893)		
$\Delta$ Banks' Domestic Assets * Bank Crisis	-0.892* (0.503)	-0.899 (0.553)		
$\Delta$ General Government Balance * Bank Crisis	-0.002 (0.016)	0.024 (0.018)		
$\Delta$ Gross Public Debt * Bank Crisis	0.001 (0.004)	0.008 (0.006)		
$\Delta$ Capital Inflows * Bank Crisis	0.008 (0.009)	-0.010 (0.012)		
$\Delta$ Capital Account Openness <sup>†</sup> * Bank Crisis	0.264 (0.434)	0.252 (0.452)		
$\Delta$ GDP Growth (annual %) * Debt Crisis			-0.011 (0.010)	-0.011 (0.010)
$\Delta$ Bank Exposure to the Government * Debt Crisis			1.610* (0.969)	2.013** (1.065)
$\Delta$ Banks' Domestic Assets * Debt Crisis			-0.062 (0.536)	0.496 (0.547)
$\Delta$ General Government Balance * Debt Crisis			0.006 (0.012)	0.009 (0.014)
$\Delta$ Gross Public Debt * Debt Crisis			-0.004 (0.003)	-0.009** (0.004)
$\Delta$ Capital Inflows * Debt Crisis			0.002 (0.007)	0.003 (0.009)
$\Delta$ Capital Account Openness <sup>†</sup> * Debt Crisis			1.256*** (0.400)	1.233*** (0.419)
Arc-hyperbolic tangent of $\rho$	-14.20*** (0.201)	-20.14*** (0.312)	-14.20*** (0.201)	-20.14*** (0.312)
Cut-off Point	-0.384*** (0.099)	-0.274** (0.108)	0.457*** (0.089)	0.490*** (0.094)
Observations	1,537	1,343	1,537	1,343

Dependent variable and sample listed in column header. <sup>†</sup> Normalized Chinn-Ito Index. Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

European Stability Mechanism



6a Circuit de la Foire Internationale  
L-1347 Luxembourg

Tel: +352 260 292 0

[www.esm.europa.eu](http://www.esm.europa.eu)

[info@esm.europa.eu](mailto:info@esm.europa.eu)