Bank Crises and Sovereign Defaults: Exploring the Links[1]

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WORK IN PROGRESS

This paper uses a large sample of emerging economies over three decades to study the mechanisms through which sovereign and bank problems feed into each other. While the transmission mechanisms between sovereign and bank distress have long been recognized, the large theoretical and empirical literature looking at how different types of crises occur and combine (the so-called "twin crises" literature) has not, until recently, studied the links between sovereign debt and banking crises in a systematic way. We first define twin crises as either those banking crises that end up in sovereign debt crises ("twin bank-debt" crises), or vice-versa ("twin debt-bank" crises). We then ask what differentiates "single" crises from "twin" ones. To answer this question we use an event analysis methodology: we focus on a time window of six years around crisis episodes and study the behavior of variables that describe the cross-exposures of banking and public sector, the financial sector, public finances, and the macroeconomic context. We find that there are systematic differences between single and twin crisis events, across many dimensions. A key difference is the existence of large and increasing balance-sheet interrelations between banks and the public sector during twin events. Another important difference regards the role of external financing in twin events. We also find that banking crises that compound into twin events feature a late policy response by the central bank and the government. Finally, the aftermath of "twin debt-bank" crises is characterized by sharper contractions of credit and economic growth and a tighter fiscal stance than the aftermath of single episodes.

KEYWORDS: Banking crises, Sovereign Defaults, Balance Sheets.

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1. Introduction

Due to the expansion of balance sheets, product innovation and falling capital ratios, risks in the banking system have increased steadily in the last decades, leading to an increase in the frequency and scale of public intervention after financial crises (Alessandri and Haldane, 2009). This, in turn, threats the sustainability of public debt[2], as illustrated by the recent wave of banking crises which have put severe strains on governments. Still, historically, the transmission of distress often went in the opposite direction, with sovereign defaults triggering bank crises (Caprio and Honohan, 2008).

The two-way relationship between distress in the banking and public sector is attracting increased attention since 2007, as the recent crisis has engulfed the advanced economies into a perverse spiral of fiscal and financial distress. On the one hand, a number of economies have faced severe banking crises which, in turn, have led to fiscal troubles. Arguably this is what happened to Iceland, where the banking crisis was compounded by a currency one[3]. The materialization of contingent claims, in the form of deposit guarantees, brought havoc to the sovereign's balance sheet, as bank failures directly increased net public debt by 13% of GDP (see Carey, 2009)[4]. On the other hand, debt accumulation, pro-cyclical fiscal policy, a lack of competitiveness and data misreporting, among others, have led to a sovereign crisis in Greece. At the end of 2009 debt reached 115% of GDP and the budget deficit stood at 13.6%. Fears of default prompted capital outflows and deposit flights. Successive sovereign downgrades contributed to the deterioration of the domestic banking sector, as banks were major holders of public debt. After the downgrade of Greek bonds to junk status, the ECB had to further support domestic banks by accepting those bonds as collateral, despite their rating. Fears of an international contagion followed, as the high exposure to Greece of some large European banks raised concerns about the balance sheet effect of the lower value of Greek bonds[5].

As emerging economies know too well, these intertwined fiscal-financial crises are nothing new. In the mid nineties, Ecuador accumulated so much debt trying to sort out a sequence of banking crises that was forced to default on its foreign obligations in 1999. The Dominican Republic suffered a similar experience in the early 2000s. In turn, during their latest crises, the Argentinean (2001) and Russian (1998) governments relied heavily on domestic banks as a source of financing. Their eventual defaults led their heavily exposed banking systems to suffer large losses, triggering bank crises[6].

Surprisingly, the large literature looking at how different types of crises occur and combine (the so-called "twin crises" literature), have only recently begun to focus on the links between fiscal and financial distress. Still, few papers address the *two-way* nature of the relationship between banking and sovereign debt crises. Indeed, most papers focus on

[2] See Reinhart and Rogoff (2011).
[3] From January 2008 to July 2009 the devaluation of the Icelandic krona against the euro reached 96%.
[4] The situation in Ireland could be seen as similar although they have not reached a default point.
[5] See Bolton and Jeanne (2010)
[6] Diaz-Cassou et al. (2008a and b) provide a detailed account of these episodes.

one direction of transmission or the other[7]. Two notable exceptions are the empirical contributions by Panizza and Borenzstein (2008) and Reinhart and Rogoff (2011). Panizza and Borenzstein (2008) study a sample of 149 countries during the period 1975-2000 and find that the probability of a banking crisis conditional on a default is much higher than the unconditional probability of a banking crisis, while the probability of a default conditional on a banking crisis is just slightly higher than the unconditional one. Reinhart and Rogoff (2011) analyze the cycles underlying serial debt and banking crises using long time-series on public and external debt. They obtain exactly the opposite result: it is the banking crises which turn out to be significant predictors of sovereign debt distress, but not the other way around[8]. While these papers do provide a discussion of the possible channels through which distress transmits both ways, none of them study these channels formally.

Our paper contributes to the literature by digging into the transmission channels of fiscal and financial distress. We present a detailed analysis of the balance sheet data of domestic depository institutions and keep track of the balance sheet interrelation between banks and the public sector (Central Bank and Government) around periods of fiscal and/or financial stress.

New to the literature, we isolate the following types of events: (i) "single" banking crises i.e. banking crises that are not followed by sovereign distress; (ii) "single" sovereign debt crises i.e. sovereign defaults not followed by banking crises; (iii) "twin bank-debt" crises, that start with a banking crisis, followed by a sovereign one and (iv) "twin debt-bank" crises, where a sovereign crisis is followed by a banking one. We ask what differentiates "single" crises from episodes that degenerate into twin crises. Our aim is to identify those factors that are systematically linked to one or the other type of crises.

To answer this question we use a sample of 117 emerging and developing countries over three decades, from 1975-2007. We use an event analysis methodology as in Broner et al. (2011) and Gourinchas and Obstfeld (2011) to study the behavior of key variables before and after our different types of crisis events. We focus on a six-year time window around each crisis episode and track the dynamics of key variables capturing the macroeconomic context, the state of public finances and the policy stance, the financial sector and the cross-balance sheet exposures of the banking and the public sectors. We find systematic differences between single crises and twin events, across many dimensions.

Ahead of banking crises that bring down the sovereign, the average banking sector is larger and more leveraged than ahead of single episodes. It is interesting that banks in "single" episodes start sizing down already a year ahead of the crisis and continue to do so as the crisis unfolds. This contrasts with twin bank-debt episodes, in which the banking sector keeps expanding and deleveraging begins only when the sovereign itself gets into trouble. Another important difference is that in twin bank-debt episodes the support from the central bank to the banking sector arrives mostly after the crisis has

[7] We provide a more detailed discussion of the literature in the next section, when describing the channels through which bank distress transmits to the sovereign, and vice-versa.

[8] These diverging results might be partly explained by the use of different samples and econometric strategies. In a narrower sample, Erce and Diaz-Cassou (2011) document both types of feedback episodes.

actually erupted, while in single events, central bank resources are deployed mostly upfront. On the other hand, twin bank-debt crises are accompanied by relatively more expansionary fiscal policies[9].

The environment ahead of single banking crises is characterized by low growth, high inflation, and worsening budget deficits. Nevertheless, the bulk of worsening in public finances takes place before the crisis, and already in the second year after the crisis, the economy rebounds. In contrast, there is a boom-bust pattern in growth around banking crises that are part of twin events, making them very disruptive for the economy. Relatively high growth rates and moderate inflation rates ahead of these crises are followed by negative growth, high inflation, widening deficits, large deposit runs, drops in private sector credit and a sudden stop in capital inflows – all these contributing to bringing down also the sovereign. In contrast to banking crises, where debt and deficits remain flat after the crisis, twin bank-debt episodes witness a sharp worsening of deficits and an increase in government debt after the crisis, translating into higher strains on government finances.

Regarding the differences between the single debt and twin debt-bank crises, we find that the average banking sector ahead of twin episodes is more exposed to the government, and that the pace of increase in exposure in the run-up to the default is also faster. This results in a larger shock to banks' assets after the defaults that are part of twin events.

Banks receive an additional negative shock through the impact of the default on the economy. Twin bank-debt crises are accompanied by larger negative growth shocks, higher inflation and a sudden stop of capital inflows, with destabilizing consequences for the banking sector. Moreover, in the aftermath of defaults leading to twin events there is a sharper change in the fiscal policy stance (strong fiscal adjustment), with likely negative consequences for economic activity and the banking system. These features explain the marked differences in the dynamics of the average banking sector around the two types of episodes. To start with, the average banking sector ahead of single debt crises is larger (and less exposed to the government) that the one ahead of twin episodes, allowing it to better withstand the crisis. Secondly, in contrast to single debt events, there is a boom-bust pattern in the behavior of banking assets, deposits and credit in twin episodes: high growth rates ahead of the default are followed by a collapse in assets and deposits and a deposit run in aftermath.

We believe this event study is useful in terms of uncovering important stylized facts, particularly in revealing nonlinear relationships. Moreover, by distinguishing between single and twin events, we find that a number of empirical facts usually associated with either "bank" or "debt" crises in general are to be found in twin events only, and not in single crisis episodes. Still, the results should not be interpreted as having any causal implications. To take up the issue of causality more seriously, a structural model is needed, which is the next step on our research agenda.

[9] We interpret this as evidence that twin bank-debt episodes are characterized by a late response from the banking and public sector. The delayed deleveraging of oversized banks' balance sheets accompanied by expansionary fiscal policies until the crisis has already engulfed the public sector as well.

The paper is organized as follows. The following section provides a discussion on the main channels through which bank distress transmits to the sovereign, and vice-versa, as identified so far in the literature. This will guide our choice of variables for the subsequent event analysis. Section 3 introduces the data and methodology, while section 4 discusses the main results of this paper. Section 5 concludes.

2. How does distress transmit?

In order to guide our choice of variables, we briefly discuss the main channels though which financial stress may lead to public stress, and vice versa. These channels include the balance sheet one, as well as other indirect ways through which underlying vulnerabilities in either the banking or public sector may materialize into twin crises.

2.1. Channels through which banking crises may affect the sovereign

Regarding the potential impact of financial turmoil on the sovereign, this is nicely described by Reinhart (2009) as the four *deadly D's*: *"*Sharp economic downturns follow banking crises; with government revenues dragged down, fiscal deficits worsen; deficits lead to debt; as debt piles up rating downgrades follow. For the most fortunate, the crisis does not lead to the deadliest D: default, but for many it has*".* Reinhart and Rogoff (2011) present a set of four stylized facts. First, private and public debt booms ahead of banking crises. Second, banking crises, both home-grown and imported, usually accompany or lead sovereign debt crises. Third, public borrowing increases sharply ahead of sovereign debt crises, and, moreover, it turns out that the government has additional "hidden debts"[10] (domestic public debt and contingent private debt)[11]. Fourth, the composition of debt shifts towards the short-term before both debt and banking crisis. Furthermore, a default may also take place if the financial crisis ignites a currency crash that impairs the sovereign's ability to repay foreign currency debt. Indeed, according to Buiter (2008), the risk of a triple banking-currency-sovereign crisis is always there for small countries with a large internationally exposed banking sector, a currency that is not a global reserve currency and limited fiscal capacity[12].

According to Candelon and Palm (2010) there are three main transmission channels from banking to debt crises. First, rescue plans may impair the sustainability of public finances.[13] Second, if contingent liabilities materialize, fiscal costs are likely to be substantial. Moreover, the risk premium increases even if guarantees are not exercised[14], raising borrowing costs for both the sovereign and the private sector (sovereign ceiling).

[10] Hidden debt might include (i) explicit guarantees, (ii) implicit guarantees which could extend to all kinds of private sector debts, (iii) central bank debt, (iv) off-balance sheet debts that arise from transactions in derivative markets and (v) any liability of the government not included in official debt statistics.

[11] In fact keeping domestic debt in the picture explains why governments default at low external debt levels or resort to inflation to reduce the debt burden (Reinhart and Reinhart, 2009).

[12] http://blogs.ft.com/maverecon/2008/11/how-likely-is-a-sterling-crisis-or-is-london-really-reykjavik-on-thames/

[13] Rosas (2006) studies the drivers of government intervention after banking crises. He finds that authorities are more likely to bailout failing institutions in open and rich economies or if the financial turmoil was caused by regulatory issues. On the other hand, electoral constraints and central bank independence seem to favor bank closure.

[14] Laeven and Valencia (2008b) show that blanket guarantees increase the fiscal costs of banking crises, but this can also be due to the fact that they are used with liquidity support and set in place during big crises.

Last, the downturn leads to a fall in public revenues and an increase in public expenditure, deepening the deficit and driving up debt.

The costs of banking crises are well documented[15]. Direct fiscal costs include bailout money, government deposits, liquidity provisioning by the central bank, public recapitalization and the execution or materialization of public guarantees and contingent liabilities. These costs can be exacerbated by the impact of the crisis on tax collection and public expenditure and, thus, public deficits and debt, as the financial turmoil has a negative impact on asset prices, unemployment and output. Reinhart and Rogoff (2010) and Baldacci and Gupta (2009) argue that sovereign debt distress (deterioration of the fiscal position) after a banking crisis 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). These effects are specific to each episode, but estimated fiscal costs of the median systemic banking crisis stand at 15.5% of GDP (Honohan, 2008). According to Honohan (2008), banking crises last 2.5 years on average and public debt increases by around 30% of GDP during these episodes.

According to Baldacci and Gupta (2009) using fiscal policy as an exit strategy may lead, even in a favorable external environment, to sharp rises in debt and deficit.[16] Similarly, distress can transmit even if ex-ante levels of debt are relatively low. Over half of the default episodes surveyed by Reinhart and Reinhart (2009) took place with debt levels below 60% of GDP. As argued in Goldstein (2003), a low debt to GDP level is not indicative of sustainable debt positions because it fails to take into account the fact that private sector debt may become public.

The transmission of bank distress to the broader economy and the fiscal and monetary authorities will partially occur as a result of the credit crunch created by the banking system distress. As credit falls or becomes more expensive, the economy is likely to suffer a drop in GDP growth and even GDP. The output loss after a banking crisis is determined by pre-crisis conditions and by the size of the shocks (WEO, 2009)[17]. This might put additional pressure on the fiscal position through its impact on tax revenues, likely to be lower as activity falls[18].

Additionally, the banking crisis may ignite a currency crash that makes public authorities unable to repay foreign currency debt (Reinhart and Rogoff, 2010, Feenstra and Taylor, 2008, De Paoli et al., 2009, European Commission, 2009). This is more likely to happen if the central bank uses reserves to finance bailouts. Significant exchange rate corrections could be expected if the government uses monetization to overcome the crisis. Moreover this could come at the cost of higher inflation. Finally, if confidence in the country is reduced or uncertainty augments significantly, the crisis could lead to a drop in external financing or sudden stop of capital inflows.

[15] See Feenstra and Taylor (2008), Reinhart and Rogoff (2010) or Arellano and Kocherlakota (2008).
[16] Baldacci and Gupta (2009) argue that the composition of fiscal stimulus determines the length of financial crises. Fiscal expansions do not improve the growth outlook by themselves and lead to higher interest rates on long-term government debt. The authors identify a trade-off between boosting aggregate demand (short-run) and productivity growth (long-run).
[17] Cecchetti et al. (2009) find that output losses are lower in twin banking-sovereign crises than in sovereign-currency ones.
[18] See De Paoli et al. (2009) or Feenstra and Taylor (2008).

All these can be worsened by too much foreign debt and too much short term debt. Indeed, as argued by Obstfeld (2011) when discussing the role of international liquidity in the recent debt crisis, "…gross liabilities, especially those short-term, are what matter".

Finally, Reinhart and Rogoff (2008a) argue that banking crises are often preceded by credit booms and high capital inflows. Moreover, they find that periods of high international capital mobility gave rise to banking crises in the past. 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). Cavallo and Izquierdo (2009) provide further evidence showing that, after financial crises in emerging markets, capital flows may collapse for months or years potentially triggering a solvency crisis.

2.2. Channels through which sovereign distress may affect the banking sector

Many transmission channels of a sovereign default on the broader economy can be traced through the domestic financial system [19]. Whenever assets need to be written off or rescheduled, banks are usually the first in line to take a hit. Noyer (2010), among others, argue that banks' holdings of defaulted government bonds might lead to large capital losses and threaten the solvency of different elements of the banking sector. In addition, authorities often react to debt problems by coercing domestic creditors to hold government bonds (frequently in non-market terms), aggravating the situation in the event of a default (Erce and Díaz- Cassou, 2010). For instance, prior to the 2001 crisis half of Argentina's bank assets were public sector liabilities. In Russia, the severe banking crisis had a much weaker effect on overall wealth and activity than what could have been expected in more typical cases because financial intermediation was so small. Indeed, Erce and Diaz-Cassou (2010) suggests that the degree of bank intermediation strongly affects a debt restructuring's ripple effect on the real economy. The disruptions caused by Ecuador's bigger and more developed banking system were comparatively larger. In contrast, one could expect a smaller effect in financial systems where firms have a variety of non-bank sources of financing.

Reinhart and Rogoff (2008c) show that defaults often go hand in hand with inflation, currency devaluations and crashes, and banking crises. De Paoli et al. (2009) find that two thirds of sovereign defaults overlap with banking crises, and almost half of these episodes overlap with both banking and currency crises. The probability of a banking crisis occurring in the same year or after a default is 0.46 in their sample of crises. Output losses after a default last about 10 years, and are larger in the event of a triple crisis.

IMF (2002) provides a comprehensive overview of the effects of four sovereign restructurings (Ecuador, Pakistan, Russia and Ukraine) on the banking sector. The paper shows that crisis spreads through the impact of debt restructuring on the balance sheets of banks, households and the corporate sector. The debt restructuring generates direct

[19] See Reinhart and Rogoff (2010), IMF (2002) or Erce and Diaz-Cassou (2010).

losses for banks' holdings of government securities. In addition, interest rates on liabilities rise, due to the higher risk, but this is not matched by increased returns on assets (on the contrary, in this context government securities usually offer non-market rates). The rate of nonperforming loans increases, as higher financing costs lead to corporate bankruptcies.

Meissner and Bordo (2006) look at the composition of a country's debt. They find that foreign currency debt *per se* leads to a higher likelihood of debt and banking crisis. However, financial fragility can be reduced by sound institutions and a strong reserve position.

A few theoretical papers have highlighted channels through which sovereign distress may translate into financial distress[20]. The literature on sovereign risk has recently started to focus on the impact of a default on other agents in the economy. Corporate borrowers and banks may face a sudden stop after a sovereign default even if they are not overexposed to government bonds. Brutti (2008) focuses on the role of financial institutions as major holders of government debt. The government's incentive to repay ex-post is largely given by the risk of triggering a financial crisis. Gennaioli et al. (2010) show that sovereign defaults tend to trigger capital outflows and credit crunches. In their view strong financial institutions amplify the costs of default, disciplining the government. Erce and Diaz-Cassou (2010) shows how sovereign defaults can be designed to minimize their impact on domestic banks. In Livshits and Schoors (2009), when public debt becomes risky, the government has incentives to not adjust prudential regulation. While this keeps borrowing costs low, a government default may trigger a banking crisis.[21]

Beyond that direct effect, public contraction may lead to reduced activity affecting banks profits. Moreover, the economic downturn may be reinforced by a credit crunch, which is the result of banks reducing lending due to capital losses, as well due to uncertainty about creditor rights and confidence drop that comes with the default (Panizza and Borenzstein, 2008). Sovereign ratings downgrades further limit banks' access to foreign financing, leading to sudden stops or higher borrowing costs (Reinhart and Rogoff, 2010).

Still an additional pressure to curtail lending might come from the fact that uncertainty regarding the economic prospects may lead to a run on the banks' deposits (as it happened in Argentina ahead of the "corralito"), or a collapse of the inter-bank market. The banking system also is not able to operate normally if the government imposes deposit freezes.

3. Data and methodology

Our sample contains 117 emerging and developing countries and covers three decades, from 1975 to 2007. Data is of annual frequency. We have excluded from our analysis all banking and sovereign episodes linked to the current global crisis.

[20] See Acharia et al. (2011) or Sosa-Padilla (2011).

[21] As identified in Diaz-Cassou et al. (2008), this may also occur when governments facing debt troubles force or coerce banks to hold bonds in non-market terms. IMF (2002) also found that banks did not hold capital against sovereign credit risk. Prudential regulation in place considered government bonds risk-free even when default expectations were not zero.

3.1. Definition and incidence of events

To identify and date sovereign debt crises we rely on the information provided by Standard & Poor´s (S&P). 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) in less favorable terms than the original issue.[22] With regard to banking crises, we use the "systemic" events identified by Laeven and Valencia (2008) as situations in which: (i) a country's corporate and financial sectors experience a large number of defaults; (ii) and firms and financial institutions face great difficulties repaying contracts on time. Thus, this definition does not include minor banking events, in which only isolated banks are in distress. Because ending dates of both sovereign and banking crises are hard to establish, we mark the first year of each crisis only. Crises of the same type that occur at less than three years of distance are considered a single event. Finally, we define "twin crises" as pairs of debt and banking crises that take place at intervals of less than three years.

Accordingly, we isolate the following types of events: (i) "single" banking crises i.e. banking crises that are not followed by sovereign distress; (ii) "single" sovereign debt crises i.e. sovereign defaults that are nor followed by banking crises; (iii) "twin bank-debt" crises, that start with a banking crisis, followed by a sovereign one during the following three years; and (iv) "twin debt-bank" crises, where a sovereign crisis is followed by a banking one during the following three years.

Using these definitions we obtain 121 sovereign debt crises and 113 banking crises. Of these, 36 are twin events - that is, around 30% of either banking or debt crises compound into twin crises. Further distinguishing the twin crises according to the sequence of events, we find that 17 are "twin bank-debt" crises and 19 are "twin debt-bank". Tables A.1(a) and A.1(b) in Appendix 1 list the twin episodes. Table A.2 offers an overview of all episodes. Single episodes account for the bulk of our crises; there are 77 single banking crises and 87 single sovereign defaults. All countries in our sample experienced at least one crisis of some kind. About half experienced only one crisis, whereas one third experienced two crises; four countries (Argentina, Bolivia, Venezuela and Nigeria) experienced four crises each. A quarter of our sample countries went through at least one twin event.

Figure A.1 shows that most of the crises took place during the 1980s and the 1990s. Banking crises were rare in the 1970s, due to heavy financial regulation worldwide and then again in the 2000s, up until 2007. In turn, they were heavily bunched in the 1990s, when almost 60% of the banking crises in our sample took place. Sovereign episodes are slightly more smoothly distributed than banking crises, with a peak in 1980s, when about half of them took place. Crises were more likely to combine into twin events during the 80s and 90s, a feature resurfacing nowadays. About 30% of the sovereign crises and more than half of the banking crises occurring during the 1980s compounded into twin

[22] 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 tougher view and focus on explicit defaults.

events. In the following decade, 40% of the sovereign defaults, but only 18% of the banking crises, were part of twin events.

Finally, in Table A.3 we compute the unconditional probabilities of banking and debt crises, as well as the conditional probability of one type of crisis given the other up to three years before. The unconditional probability of a banking crisis is 2.9%, whereas the unconditional probability of a default is 3.1%. In turn, the conditional probability of a banking crises taking place within three years of a sovereign crisis is 15.7%, whereas the conditional probability of a sovereign crisis given a banking one stands at 15%.

3.2. Variables: definitions and sources

To uncover the balance sheet interrelations between the public and banking sectors of the economy we use balance sheet data of domestic depository institutions and the public sector (the central bank and the general government). As a first step, Table A.4 describes in a simple and stylized way the standard banking sector balance sheet as reported in the IMF's International Financial Statistics.[23] Table A.4 shows how the balance sheet interconnection between the banking system and the Central Bank can be decomposed in two parts. On the asset side of the balance sheet we find:

- Reserves: Including domestic currency holdings and deposits with the Central Bank (line 20); and
- Claims on Monetary Authorities, which comprise Securities and Claims other than reserves (lines 20c and 20n).

On the liability side of the balance sheet:

- Credit provided by monetary authorities to the banking system (line 26g).[24]

This last entry is likely to reflect much of the financial aid that banks get from the Central Bank during turbulent times.

In turn, the balance sheet connections between the banking system and the general government are given by the following series. On the asset side of the aggregate banking sector balance sheet:

- Banks' holdings of claims on Central Government (line 22a)
- Banks' holdings of claims on State and Local Governments (line 22b)
- Banks' holdings of claims on non-financial Public Enterprises (line 22c).

On the liability side:

- Central Government Deposits (line 26d).[25]

[23]The balance sheet information is not based on SRF. Long time series are unavailable under this new methodology.
[24] This can be observed from the perspective of the Central Bank balance sheet (Claims on Deposit Money Banks, IFS line 12e). For robustness, we measure banks´ liabilities to the Central Bank using their own balance sheet data, but the two measures should be similar. Differences may be due to coverage issues, recording transactions at different times or errors.
[25] 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 here.

Banking system's exposure to the government is computed as the sum of all bank claims on the Central, State and Local governments and non-financial public enterprises. In turn, the banking system exposure to the Central Bank is computed as the sum of reserves and claims on Monetary Authorities. Similarly, the exposure of the Central Bank to the banking system is simply reflected by the line 26g, Credit provided by monetary authorities to the banking system, and the exposure of the Government by line 26d, Central Government Deposits. There are two important categories which cannot be recovered from out dataset, recapitalization expenditures and the provision of guarantees.

Unfortunately there is no comprehensive cross-country dataset on banks recapitalization costs, is one of the main public outlays during banking crises. Public recapitalization of troubled banks can come from the Central Bank or the Central Government, and consist of loans or buying of new shares.[26] In Laeven and Valencia's (2008a) sample, bank recapitalization accounts for around half of the fiscal costs. The other half is made up of assets purchases and debt relief programs.

Each of this balance sheet measures can be measured against either indicators of the banks' size or indicators of the country size. When measured against banking sector's assets or liabilities, this indicator provides an idea of the Central Bank involvement in terms of the size of the banking system. When measured in terms of GDP, it provides a measure of the cost for the sovereign.

Given that our aim is to identify those factors that are systematically linked to one or the other type of crises, we also study the behavior around crises of variables describing the macroeconomic context, the financial sector and government finances. Table A.5 lists all variables we use, together with their definitions and sources. Specifically, we are interested in four categories of variables. Primarily, we are interested in balance sheet variables capturing the linkages between the banking sector and the sovereign, as discussed above (see the first panel of table 5). Secondly, we are interested in following the evolution of the banking sector around crises. Therefore, we add measures of banks' total assets and foreign liabilities, as well as credit to the private sector and deposits. Thirdly, we gather information on public finances and policy stance: budget balances, government revenues and spending, as well as public debt and its composition. Fourthly, we complement our dataset with key macroeconomic variables: real output growth, inflation, and capital flows.

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 expense. However, this dataset only starts in 1980. Therefore, for those countries with crises before 1980 or for countries with missing EIU data, we collect data from a variety of alternative sources: the IFS; Mitchell's (2007) series on "International Historical Statistics";

[26] A significant amount of this cash is accounted for in some of the balance sheet items we use in the analysis. Notice that, 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 CB, (ii) holdings of CB securities, (iii) cash or (iv) holdings of central government securities. On the liability side, "loans from the Central Bank/Government" or "shares and other equities" will increase.[26] Unfortunately there is no way to discern what part of the increase in this last line is due to public recapitalization and what reflects private recapitalization.

World Economic Outlook; and individual Article IV reports. Data on debt and debt composition come from the World Bank's *World Development Indicators (WDI)*. Finally, our macroeconomic variables come from either *WDI* or *IFS*.

3.3. Methodology

Following the work of Broner et al. (2011) and Gourinchas and Obstfeld (2011) we implement an event analysis methodology, which allows us to perform comparisons both across countries and across time, while controlling for common and country specific characteristics by using adequate controls (country fixed effects and country trends). Specifically, we estimate how the conditional expectation of each variable depends on temporal distance from each of our crises types, given the proximity of other crises.

Consider a variable of interest Z_{it}, where subscripts *i* and *t* refer to the country and the period respectively. Our approach is to estimate its conditional expectation as a function of the temporal distance from various types of crises, relative to a "tranquil times" baseline. 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 crisis of type *e* in period *t*. The index *e* denotes, respectively, debt crises (D), systemic banking 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 before and three years after a crisis. The regression allows for country fixed effects, α_i and, in some specifications, for country-specific trends. The error term e_{it} captures all the remaining variation.

Our sample is very heterogeneous. In order to minimize its effect and that of the most extreme observations, we normalize our variables by dividing each series by country-specific standard deviations. Due to significant data gaps, we excluded from the sample all low-income countries (39, mostly African, countries).

The coefficients β_{ep} measure the conditional effect of a crisis of type e on variable Z over the event window, relative to "tranquil times". Since the "tranquil times" baseline is common to all types of crisis, the coefficients measure the impact of different crises relative to a common reference level, which makes the comparison among coefficients straightforward.

This allows us to plot the estimated coefficients throughout the crisis window and compare the dynamics of variables across different types of crises. Given that we are working with normalized data, a transformation is necessary so as to be able to gauge the economic significance of the regression coefficients. Similar to the approach in Broner et al. (2011) we depict the economic significance of our coefficients, defined as the product

of the estimated coefficient and the median standard deviation of the non-standardized version of the dependent variable across countries with the same type of crisis.

A caveat of the event analysis methodology is that, while this can be very useful in terms of uncovering important stylized facts – particularly revealing nonlinear relationships- the results should not be interpreted as having any causal implications.

4. Banking crises and sovereign defaults: Stylized facts

In this section we provide a set of stylized facts on the behavior of key economic variables around each of the four types of crisis events we define above. We focus on the variables identified in section 2 as capturing direct and indirect channels through which distress transmits between the banking sector and the sovereign.

In Appendix 2, we plot the estimated coefficients obtained from each regression and contrast the behavior of our variables of interest around the different types of crisis events[27]. First, we look at the dynamics around bank crises, distinguishing between "single" systemic banking crises and those that degenerate into sovereign debt crises. We then repeat the analysis for our set of debt crises, distinguishing between "single" debt crises and those that compound into twin debt-bank ones.

4.1. Banking crises versus twin bank-debt crises

As our aim is to understand the transmission of distress from banks to the sovereign, we focus first on the direct costs that the banking crises have for the public authorities.

Figures 1 and 2 in Appendix 2 present our estimates of the behavior of liquidity support from the Central Bank, measured as credit to the banking sector provided by the Central Bank[28]. Our results show that, as one would expect, Central Bank support is significantly higher than in tranquil times both during bank (B for short) and bank-to-debt crises (BD for short). Interestingly, official lending ahead of single banking crises is larger than that ahead of twin bank-to-debt events. Moreover, while in B crises liquidity support reaches a peak at t and then gradually declines, reaching levels similar to the ones in "normal times" two years after the crisis, there is no liquidity support above normal up to the year before the crisis in *BD* events. In *BD* episodes liquidity support increases significantly above normal in t and t+1. The story is similar regardless of using GDP or the total size of the banking sector. Liquidity support is higher than tranquil times well ahead of the *B* crises, peaks at the time of the crisis, and the starts to decrease gradually, approaching "normal" levels from t+2 onwards. In contrast, liquidity support is very low up until the *BD* crises, and then starts to increase.[29] To sum, these graphs tell the same story: large and early

[27] Appendix 3 contains detailed tables with the econometric results of the event analysis outlined above.
[28] This measure captures not only policy decisions, but also the demand of banks for funds, and this demand need not be due only to failure in the interbank markets.
[29] We have also looked at the behavior of liquidity support against liabilities. The story is similar. The coverage of banks' liabilities with official money is significantly higher in *B* – with a peak at the time of the crisis, and then decreasing. The ratio is not significantly different from "normal" around *BD* episodes.

support in B crises and smaller and last-minute support in *BD* crises. In *B* countries, the government afforded to offer larger support relative to the economy and the size of the banking sector, whereas in *BD* countries there was relatively smaller support, but which substantially stretched the sovereign.

These different patterns could be due to different sizes of the underlying problem, of the fiscal space available or, most likely, a combination of both. Thus, in *B* crises it is difficult to say whether there is no support after t because the problem is solved, or because the government prefers not to further support the banking sector, at the risk of default. A static indicator of the relevance of the size of the problem can be gauged by using the data collected by Laeven and Valencia (2008) in their study on the fiscal costs of banking crises. Some of those indicators are summarized in Table 1 below.

Table 1. Intensity of banking crises. LV (2008) static indicators

Crises types	NPL at peak	Change in number of banks (T to T+3)	Fiscal costs	Recap. costs (Gross)	Recap. costs (Net)
Bank 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
Total average*	30.02	-23.31	14.21	6.94	5.24

* Source Laeven and Valencia (2008). The total average includes episodes identified as being originated by a Sovereign default.

According to Laeven and Valencia's dataset the difference between *B* and *BD* episodes seems to be not that much the in intensity of the banking sector problem, as non-performing loans and bank closures were similar in both types of events. Interestingly, the main difference is in the fiscal costs. Fiscal costs during compounded crises are almost double, including a much higher amount deployed to recapitalize the banks. This difference in fiscal costs could indeed be associated with a lack of fiscal space but also with different strategies for resolving banking crises.

Still, the fact that banking sectors in both types of events are facing challenges of commensurable size does not preclude the fact that banking sectors could be of significantly different size. Indeed our results show that, ahead of crises, banking sectors in *BD* countries are larger than those in *B* countries, in terms of assets. This could signal that a significantly higher amount of resources is needed to handle banking crises that then degenerate into twin ones. As shown in Figure 3, banking sector assets to GDP in and ahead of *B* crisis are actually significantly below those in *BD* episodes.[30] Still, it should be noted that in the run-up to the crisis this difference in size becomes smaller. Indeed, at time t-1 the difference in size is not found to be significant anymore. One aspect which might have had a significant role in the evolution of the crises regards the behavior of the banking sector size's as the crises hit the economies. While in *B* crises the deleveraging is apparent since t-1 and leads to a banking system size significantly lower than normal

[30] Moreover, we find that the size of the banking sector ahead of *B* crises is significantly smaller than in normal times.

times by time t+2, in the case of *BD* there is no deleveraging until the point in which the sovereign begins to be in troubles. In fact, from time t to time t+3, *BD* is the only type of crisis with a banking sector significantly larger than in normal times.

This late reaction to the crisis is also apparent when looking at the evolution of the banking sector's foreign liabilities (Figure 4). While in bank crises the banking sector reliance on foreign liabilities starts to fall as the crisis starts, in *BD* events there is a large accumulation of foreign liabilities up until t+1, when the process abruptly reverses, probably with the implosion of the sovereign. As a caveat, the behavior of this ratio is influenced by possible valuation effects due to different exchange rate dynamics.

We interpret this as evidence that *BD* episodes are characterized by a late response from the banking sector, which postpones the deleveraging of a (likely) oversized balance sheet until the crisis has already engulfed the public sector as well.

Another potential cost for the public sector may come from the need to support their banking sectors as these suffer of financing problems. More specifically, the banking sector could suffer from deposit runs, which could add additional costs to the sovereign if in the process deposits are a lost while they were guaranteed. Indeed, Figure 5 shows that in both *B* and *BD* crises the banking sector faced serious drains on deposits, although these were more accentuated in *BD* crises.

Yet another indication of the cost of a banking crisis to the sovereign can be traced through the dynamics of the banking system's claims on government. These may reflect beefing up the asset side of the banking sector with the government paper (sometimes in exchange for bad assets). Figures 6 and 7 show the large increase in the share of claims on government to GDP and assets during both episodes. In both cases, the share of claims on government went from significantly below tranquil times before the crisis (so no big exposures to the government before the banking crises) to significantly above in the aftermath. The increase was particularly steep during *BD* episodes.

As detailed in the discussion of section 2, there are a number of (indirect) additional channels through which a banking crisis can affect the sovereign. These indirect costs, via the impact on the economy, are likely to be relevant.[31] A first channel is the impact of the banking crisis on economic activity that, as detailed above, will affect both public revenues and expenses, and thus the budget balances and public debt. The behavior of economic growth around the events is depicted in Figure 8.

Growth is significantly below normal levels already ahead of *B* and worsens the year after the crisis. Nevertheless, growth rates return to pre-crisis levels already at time t+2. In turn, the *BD* crises are the only type among our crises that have growth rates above the "tranquil times" before the event (although not significantly so). At time t, there is a collapse of growth rates (the median growth rate is actually negative) and these remain lower than tranquil times and below growth rates in *B* crises in the aftermath. Thus, there is a boom-bust pattern in growth around banking crises that are part of *BD* events, making them very disruptive for the economy and eventually bringing down the

[31] This is especially relevant in light of the fact that only two of our 17 twin *BD* crises occurred within the same year, while for most the transmission took place in the subsequent two years.

government. This growth pattern is accompanied by a large jump in inflation in the aftermath of the banking crises (see Figure 9). This might represent the authorities' attempts to monetize the problem, or the impact of abrupt changes in the exchange rate, as the confidence in the sovereign is lost.

The behavior of fiscal variables is depicted in Figures 10 to 12. Budget deficits are similar before both types of crises and are worsening during the crisis window, reaching levels significantly below tranquil times in the aftermath of both banking crises. Nevertheless, while this worsening is gradual in *B*, in *BD* there is a larger drop in the year after the banking crisis, reflecting higher strains on the government finances. As shown in Figure 11 and 12, the bulk of worsening in *B* crises happens before the crisis, up to time t, driven mainly by the increase in government expenditure. After t, revenues and expenses remain flat. In the case of *BD*, the worsening after the banking crisis is due to the large increase in public spending.

We assess next to what extent the collapse in economic activity and the worsening of fiscal balances might be due to an accompanying credit boom-bust pattern. Indeed, as shown in Figure 13, there is an increase in credit to the private sector ahead of both events. Moreover, credit to GDP ahead of *BD* crises is higher not only than tranquil times, but also higher than the levels ahead of *B* crises. Still, the expansion of credit is faster ahead of *B* than ahead of *BD*, just like the expansion of assets and deposits. Credit falls significantly from t onwards in both crises, although the credit crunch is significantly stronger during *BD* events. Interestingly, in line with our previous observation regarding the delay in the re-sizing of the banking sector, during *BD* crises private credit remains at levels significantly higher than in normal times until t+2.

The tightening of credit conditions is also apparent when looking at price indicators instead. Figure 14 looks at the behavior of lending rates set by the domestic banking institutions. Consistent with the rapid expansion of credit and assets in these countries, lending interest rates are significantly below tranquil times ahead of *B*. The tightening in the aftermath is, however, much more pronounced in *BD* than in *B*. This is again, consistent with the more pronounced drop in credit observed during the *BD* episodes.

As a counterpart to these diverging fiscal patterns and the different fiscal costs of the crises, our event analysis of the behavior of government debt (Figure 15) presents a flat evolution (slow increase, but not explosion) of government debt/GDP in *B* events, that contrasts with the sharp increase in *BD* from t-1 onwards. Moreover, this comes against levels of debt to GDP that were significantly lower before *BD* events than before *B* events. Indeed, debt keeps increasing in t+2 and t+3 as, even as growth returns to positive.

Figure 16 tracks the behavior of government debt as a share of total debt (measured as the sum of public debt and credit to the private sector) and tells the same story. After *B* events there is a moderate increase in the share of government debt, which contrasts with the sustained increase in this share starting one year ahead of *BD* events and continuing thereafter. In this case, the increase accelerates after T, due to a combination of increasing government debt and collapsing credit to the private sector.

Another interesting factor to analyze relates to the term structure of the debt. Reinhart and Rogoff (2008) point out that short term debt tends to increase dramatically ahead of crises. Figure 17 shows that there is a shift toward short-term in the external borrowing ahead of *BD*, at levels significantly higher than normal, followed by a sharp decrease, to levels significantly below tranquil times. This shift towards shorter maturities is not apparent though during *B* crises.

One source of instability widely documented and which is likely to have a strong impact on the banking sector relates to the behavior of international flows. We construct an aggregate measure, which collects non-FDI capital inflows. Figure 18 shows that portfolio capital inflows are above tranquil times ahead of both B and *BD*. While there is a small decrease in the aftermath for *B*, there is a true sudden stop after the banking crisis in *BD* – capital inflows decrease from significantly above tranquil levels to significantly below tranquil levels - suggesting a loss of confidence from foreign investors, which is very damaging for the economy.

Overall, we find that the environment ahead of B crises is characterized by low growth and high inflation (indeed, growth is significantly below "tranquil times" and inflation significantly above "tranquil times"), and worsening budget deficits. Nevertheless, already in the second year after the crisis the economy rebounds.

While in *B*, initially, the banking sector is smaller than ahead of *BD* (and even significantly below "normal" levels), there is an asset and credit expansion ahead of T that leads to banking systems not that far apart in size in the immediate run-up to the crises. In *B* crises, the Central Bank's liquidity support is high in terms of the size of the economy and the banking sector, starts early and quickly goes down as the crisis unfolds.

In contrast, ahead of banking crises that lead to sovereign defaults, growth is at normal levels, if not higher. The banking sector is larger, and credit and assets keep expanding up until T. Unlike in *B*, there is little support to the banking sector until the crisis actually happens. In contrast with *B*, in the aftermath of *BD* crises, growth collapses, inflation shoots up, the deficit widens, there is a larger deposit run (costs for the sovereign) and private sector credit collapses – all these contributing to bringing down the sovereign.

One interesting aspects that distinguishes *B* crises from twin *BD* crises is the fact that in the former events we observe that the banking sector scales down already ahead of the crisis and continues to do so as the crisis unfolds. In contrast, during *BD* events, it takes one to two years after the beginning of the crisis to observe a reduction in the size of the banking sector. This could indicate that the policy response to the unfolding crisis is to try to sustain the banking sector as it is. Ultimately, as the crisis engulfs the sovereign itself, this strategy proves unfeasible and leads to a sharper and potentially more damaging deleveraging.

There are also diverging patterns in the behavior of both fiscal and monetary variables around the two types of crises. To what extent this is a policy choice or the mechanical outcome of an economy that collapses is open to discussion.

Finally, in line with the findings in Reinhart and Rogoff (2008) our event analysis highlights that during compounded events there is a clear shift towards shorter debt maturities.

Moreover, we are also able to highlight the significant increase in the currency mismatch of banks' balance sheet.

4.2. Sovereign debt crises versus twin debt-bank crises

The main direct channel through which sovereign distress in the form of a default might transmit to the banking system is the balance sheet interrelation between the two sectors. Indeed, our event analysis shows interesting dynamics regarding the behavior of banking system's exposure to the public sector. As shown in Figure 24 and 25, banks' holdings of government claims as a share of assets are larger ahead of debt crises that degenerate into banking crises (*DB* crises) than ahead of single debt crises (*D* crises). Banks' holdings of public debt increase ahead both types of events, but are going up more rapidly before *DB* crises, suggesting the government is increasingly using the banking sector to finance itself. This higher exposure makes banks vulnerable to changes in the value of government paper. Indeed, the asset side of the average banking sector in *DB* takes a big hit at the time of the default. This large hit is, in part, due to the losses and write-downs associated with the debt restructuring.[32]

Figures 19 and 20 show that support from the Central Bank is significantly higher than in "tranquil times" before and after both *D* and *DB* events. This suggests turbulences in the banking sector, including before the default. However, the size of the damage to banks' balance sheets after defaults in *DB* events prompts the Central Bank to step in and provide liquidity to the banking sector on a significantly larger scale than after *D* events.

In addition to this impact, the banking system is likely to suffer from the impact that the default has for the broader economy. Figures 26 and 27 show the dynamics of growth rates and inflation around the two types of crises. *D* crises take place in periods of low growth, but, nevertheless, there is no big drop in growth at the time of the crisis. Growth remains depressed up to t+1 and then starts recovering. This lackluster growth is accompanied by inflation rates that stay mostly flat. This stands in contrast with *DB* events, which are characterized by a large negative impact on growth at the time of the crisis. Before *DB* events, growth is sluggish, at levels similar to the ones ahead of D. The difference is in the shock to growth at time t – much larger in *DB* than in *D*. These growth dynamics in *DB* are accompanied by rising inflation ahead of the default (and probably hyperinflation) at t. These results indicate that defaults more damaging to the economy end up in banking crises.

We next inspect the behavior of the public finances. The results are presented in Figures 28 to 30. Figure 28 shows that, ahead of *D* crises budget deficits are significantly larger than normal but without worsening (stay flat). There is a slight improvement at the time of the crisis, but no big fiscal adjustment afterwards. Budget deficits are similarly large ahead of *DB*, but, unlike ahead of *D*, they are worsening in the run-up to the crisis. Moreover,

[32] An interesting point that we have not explored thus far regards to the composition of the assets included in the default. While in our D events only 1 out of 7 crises featured a restructuring of domestically issued instrument in the DB events the proportion is significantly higher as 1 out of 3 cases features a domestic default.

there is a sharp adjustment starting the year of the default (probably due to a stabilization program), that sees the budget balance improving sharply in t and t+1.

Figures 29 and 30 separate the dynamics into its two components: public expenditures and public revenues. In both cases, ex-ante budget deficits are in part due to public expenditure consistently above "normal" level. However, while both expenditure and revenues stay flat ahead of *D* and public spending is not cut until two years after the crisis, budget revenues are decreasing ahead of *DB* and, moreover, there is a sharp adjustment in expenditure starting the year of the default, which underpins the improvement in the budget balance in t and t+1.

These results describe a situation with public finances in a similar initial shape before both types crises (the levels of public debt to GDP are also similar ahead of the two crises). However, as the crisis approaches the behavior of fiscal variables starts diverging: while deficits stay large and flat ahead of *D*, they are worsening ahead of *DB*, due mainly to decreasing revenues. Moreover, at the time of the crisis, there is a small adjustment in *D*, while the adjustment in *DB* is large and coming almost entirely from a sharp reduction in public spending, probably as part of an austerity/stabilization program.

As a result of these fiscal patterns, government debt accumulates ahead of both crises, although at a more rapid pace ahead of *DB* (see Figure 33). Thus, the sovereign is more burdened going into the *DB* crisis, although only three years before its debt was at similar levels with the ones ahead of *D*. In the wake of *DB* events, debt is reduced more drastically. The same dynamics are in place when looking at the share of government debt as total debt (Figure 34); this share increase dramatically starting the year before banking crises in *DB*, reaching a peak one year after the beginning of these crises (due also to the collapse of private credit).

This public debt dynamics are accompanied by diverging short term debt dynamics, as shown in Figure 35. Indeed, while ahead of *D* events short-term debt seems to be somehow higher than ahead of *DB* events, the subsequent dynamics are so different that, soon after the default the situation is drastically reversed, with an ever increasing proportion of short term debt in the wake of *DB* crises. This finding is in line with previous evidence presented by Reinhart and Rogoff (2008).[33]

An additional channel of transmission triggered by a default has to do with the effects it has on the banking system. We study how the two types of crises affect the banking system, especially its size, its financing sources and its lending behavior. The latest aspect is especially important due to the strong feedback effects between credit tightening and economic activity highlighted in the literature.

We begin by studying the impact of a default on the size of the banking sector. Figure 21 shows various interesting facts. First, the banking sector is larger ahead of the *D* episodes than ahead of *DB* ones. This might have helped banks in the former countries to better withstand the impact of the sovereign default. Second, there is a striking difference in the

[33] We have also investigated the dynamics of public foreign debt. The results indicate that *DB* events are characterized by larger ex-ante dependence on foreign debt. Data gaps prevented us from analyzing the dynamic behavior of this variable.

dynamics of bank assets around the two types of crises. While the dynamics are "normal" in *D* events, they are of a clear boom-bust pattern in *DB* episodes.

The dramatic boom-bust pattern accompanying *DB* events is also clearly seen when looking at deposits and at the provision of credit to the private sector (Figures 23 and 31). The banking sector expands ahead of *D* and decreases after the default, but not dramatically so; there is no deposit run and the credit to the private sector, significantly above normal levels ahead of *D*, takes a hit, but does not collapse. In contrast, ahead of *DB* the rapid accumulation of assets is accompanied by an increase in both deposits and credit to the private sector. The default is then followed by a collapse in assets, a deposit run, and a sharp drop in the credit to the economy. Indeed, lending rates (Figure 32) increase sharply in *DB* crises.

A final remark regards the use of external financing by banks. As shown in Figure 22, in *DB* events there is a marked increase in the degree of dependence on foreign financing. This is consistent with a situation in which a significant portion of the banks' asset expansion became to be funded using resources from non-residents. Still, it is true that both types of crises occur in environments of high external indebtedness and that as a result of the default this dependence is curtailed sharply.

Interestingly, these dynamics are not directly evident when one looks at the behavior of portfolio capital inflows. As shown in Figure 36, there is a gradual but constant decrease in capital inflows around *D* crises, from levels significantly above normal, to levels significantly below. Investors start retrenching already several years before the crisis, and continue to do so after the default, but without changing pace.[34] The dynamics are different for *DB*. Capital keeps flowing in up until the crisis, but drops sharply the year of the default (and drops further the years after the default). Thus there is a gradual retrenchment in *D* versus a sudden stop in *DB*, with destabilizing consequences for the banking sector in the later episodes.

Overall, we find that the average banking sector ahead of *DB* crises is more exposed to the government than the one ahead of *D* crises and, moreover, the pace of the increase in exposure in the run-up to the default is much faster in *DB*. This translates into a larger shock to banks' assets after the default in DB events. The magnitude of the damage to banks' balance sheets after defaults in *DB* can also be judged by the much larger intervention needed from the Central Bank to prop up the banking system.

Additionally, the banking sector in *DB* countries receives a bigger shock via the impact of the default on the economy, than in *D* cases. The defaults that bring down the banking system are much more damaging to the economy than single defaults; they are accompanied by larger negative shocks to the economy, and by very high inflation.

In *D* events, there is no large tightening of the fiscal stance, which comes to the help of the banking sectors. In contrast, budget deficits are improving sharply after defaults in *DB*, due to drastic cuts in spending (probably as part of a stabilization program), with negative short-run consequences on the banking system. In *DB* countries, the sovereign

[34] Interestingly we find no difference between *D* and *DB* crises in the behavior of resident investors, who seem to send their money away as the crisis hits in both scenarios

is more indebted going into the crisis. In the wake of the default, it witnesses a dramatic increase in short-term external debt, as well as a sudden stop in capital inflows, with destabilizing consequences for the banking sector.

All these features explain the dramatic differences in the dynamics of the banking sector around the two types of episodes. To start with, the average banking sector ahead of *D* is larger (and, as seen above, less exposed to the government) that the one ahead of *DB*, allowing it to better withstand the crisis. Secondly, in contrast to *D* events, there is a boom-bust pattern in the behavior of banking assets, deposits and credit in *DB* episodes: high growth rates ahead of the default are followed by a collapse in assets and deposits and a deposit run in aftermath.

5. Conclusions

In light of the current turmoil in a number of advanced countries, understanding the channels through which financial distress transmits from public balances to financial institutions and vice versa is of utmost importance. In this paper we have analyzed past episodes of banking and sovereign distress in emerging economies, with a focus on the systematic differences between single episodes and those in which banking and sovereign debt crises combine. Although our results so far are preliminary, a few stylized fact show up with remarkable strength. We find that there are systematic differences between single crises and twin events, across many dimensions.

Ahead of banking crises that bring down the sovereign, the average banking sector is larger and more leveraged than ahead of single episodes. It is interesting that banks in "single" episodes start sizing down already a year ahead of the crisis and continue to do so as the crisis unfolds. This contrasts with twin bank-debt (*BD*) episodes, where the banking sector keeps expanding and the deleveraging begins only when the sovereign itself turns into deep trouble. Another important difference is that in *BD* episodes the support from the central bank to the banking sector arrives mostly after the crisis has actually erupted, while in single events, central bank resources are deployed mostly upfront. This contrasts with the relatively more expansionary fiscal policy that seems to accompany *BD* crises.[35]

The environment ahead of single banking (*B*) crises is characterized by low growth, high inflation, and worsening budget deficits. Nevertheless, the bulk of worsening in public finances takes place before the crisis, and already in the second year after the crisis, the economy rebounds. In contrast, there is a boom-bust pattern in growth around banking crises that are part of twin events, making them very disruptive for the economy. Relatively high growth rates and moderate inflation rates ahead of these crises are followed by negative growth, high inflation, widening deficits, large deposit runs, drops in private sector credit and a sudden stop in capital inflows – all these contributing to bringing down also the sovereign. In contrast to *B* crises, where debt and deficits remain

[35] This is evidence that *BD* episodes are characterized by a late response from banks and public sector. The delayed deleveraging of banks is accompanied by expansionary fiscal policies until the crisis absorbs the public sector.

flat after the crisis, twin episodes witness a sharp worsening of deficits and an increase in government debt after the crisis, translating into higher strains on the government finances.

Regarding the differences between the single debt (*D*) and twin debt-bank (*DB*) crises, we find that the average banking sector ahead of *DB* crises is more exposed to the government, and that the pace of increase in exposure in the run-up to the default is also faster. This results in a larger shock to banks' assets after the default in twin events.

DB crises countries' banks receive a larger negative shock also through the impact of the default on the economy. Twin bank-debt crises are accompanied by larger negative growth shocks, higher inflation and a sudden stop of capital inflows, with destabilizing consequences for the banking sector. Moreover, in the wake of defaults leading to twin events there is a sharper change in fiscal policy stance (strong fiscal adjustment) with likely negative consequences for activity and the banking system. These features explain the marked differences in the dynamics of the average banking sector around the two types of episodes. To start with, the average banking sector ahead of *D* crises is larger (and less exposed to the government) that the one ahead of twin episodes, allowing it to better withstand the crisis. Secondly, in contrast to *D* events, there is a boom-bust pattern in the behavior of banking assets, deposits and credit in *DB* episodes: high growth rates ahead of the default are followed by a collapse in assets and deposits and a deposit run in aftermath.

We believe this event study is useful in terms of uncovering important stylized facts, particularly in revealing nonlinear relationships. Moreover, by distinguishing between single and twin events, we find that a number of empirical facts usually associated with either "bank" or "debt" crises in general are to be found in twin events only, and not in single crisis episodes. Still, the results should not be interpreted as having any causal implications. To take up the issue of causality more seriously, a structural model is needed, which is the next step on our research agenda.

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Appendix 1: Data description

TABLE A.1. Twin crises: Bank to Debt			
Country	**Bank crisis**	**Debt crisis**	**Source**
Algeria	1990	1991	S&P and L&V
Argentina	1980	1982	S&P and L&V
Chile	1981	1983	S&P and L&V
Dominican Republic	2003	2005	S&P and L&V
Ecuador	1982	1982	S&P and L&V
Ecuador	1998	1999	S&P and L&V
Guinea	1985	1986	S&P and L&V
Indonesia	1997	1998	S&P and L&V
Kenya*	1992	1994	S&P and L&V
Mexico	1981	1982	S&P and L&V
Morocco	1980	1983	S&P and L&V
Philippines	1983	1983	S&P and L&V
Nigeria	1991	1992	S&P and L&V
Senegal	1988	1990	S&P and L&V
Uruguay	1981	1983	S&P and L&V
Uruguay	2002	2003	S&P and L&V
Venezuela, R.B.	1994	1995	S&P and L&V

Source: Laeven and Valencia (2008), S&P (2009)

*Lowest income country (according to World Bank)

TABLE A.2. Twin crises: Debt to Bank			
Country	**Debt crisis**	**Bank crisis**	**Source**
Albania	1991	1994	S&P and L&V
Argentina	1989	1989	S&P and L&V
Argentina	2001	2001	S&P and L&V
Bolivia	1986	1986	S&P and L&V
Brazil	1990	1990	S&P and L&V
Costa Rica	1981	1987	S&P and L&V
Cameroon	1985	1987	S&P and L&V
Ghana	1979	1982	S&P and L&V
Guinea*	1991	1993	S&P and L&V
Jordan	1989	1989	S&P and L&V
Macedonia	1992	1993	S&P and L&V
Niger*	1983	1983	S&P and L&V
Panama	1987	1988	S&P and L&V
Peru	1976	1983	S&P and L&V
Tanzania*	1984	1987	S&P and L&V
Turkey	1982	1982	S&P and L&V
Togo*	1988	1993	S&P and L&V
Russian Federation	1998	1998	S&P and L&V
Ukraine	1998	1998	S&P and L&V

Source: Laeven and Valencia (2008), S&P(2009)

* Lowest income country (according to World Bank)

TABLE A.2. SUMMARY STATISTICS: CRISIS INDICATORS					
	1970s	**1980s**	**1990s**	**2000s**	**Total**
Indep.banking	3	17	55	2	77
Indep.debt	11	43	17	14	85
Twin	2	19	12	3	36
Twin bank-debt	0	9	6	2	17
Twin debt-bank	2	10	6	1	19
TOTAL	**16**	**79**	**84**	**19**	**198**
Total:banking crises	5	36	67	5	113
Total: debt crises	13	62	29	17	121

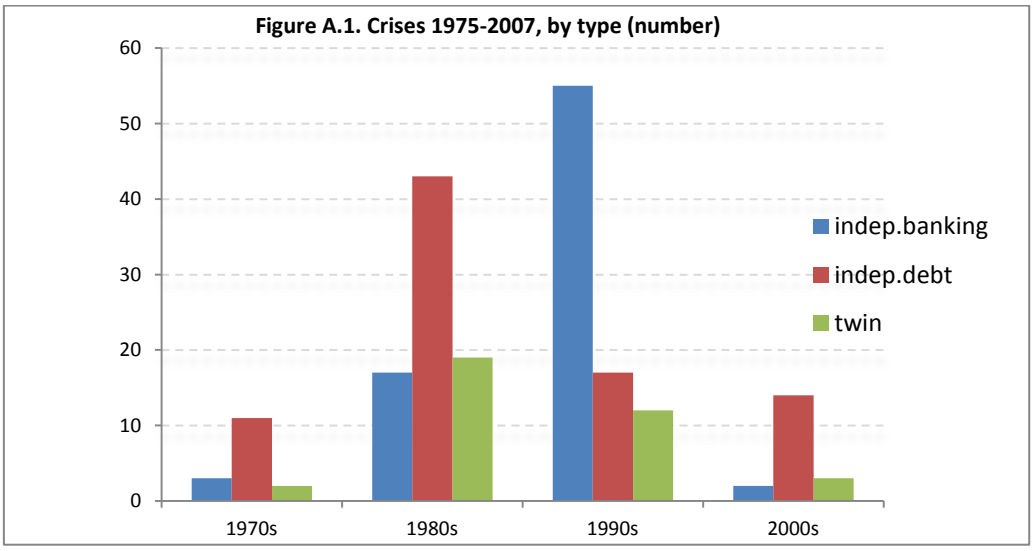

TABLE A.3. Unconditional vs. conditional probabilities of crises	
P(bank)	2.93
P(debt)	3.13
P(bank/debt in t-3 - t)	15.70
P(debt/bank in t-3 to t)	15.04

TABLE A.4. The aggregate balance sheet of the banking sector

DEPOSIT MONEY BANKS (as in former IFS monetary statistics classification)

ASSETS	LIABILITIES
Reserves (line 20)	Demand Deposits (line 24)
Claims on Monetary Authorities	Time, Savings and For. Cur. Deposits (line 25)
Securities (line 20c)	Money Market Instruments (line 26aa)
Other Claims on Monetary Authorities (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 Governments (line 22b)	Liabilities to Other Banking Institutions (line 26i)
Nonfinancial Public Enterprises (line 22c)	Liabilities to Nonbank Fin. Instit. (line 26j)
Private Sector (line 22d)	Capital Accounts (line 27a)
Other Banking Instititutions (line 22f)	
Nonbank Financial Institutions (line 22g)	

TABLE A.5. Variables: definitions and sources

Variable	Definition	Source
"Exposure" variables		
Banking sector's claims on the central bank	Reserves (line 20) + securities (line 20c) + other claims on monetary authorities (20n)	International Financial Statistics
Banking sector's claims on government	Claims on central government (line 22a) + Claims on local government (line 22b) + Claims on non-financial public enterprises (line 22c)	International Financial Statistics
Banking sector's liabilities to the central bank	Credit from Monetary Authorities (line 26g)	International Financial Statistics
Banking sector's liabilities to government	Central Government Deposits (line 26d)	International Financial Statistics
Financial sector variables		
Credit to the private sector	Claims to the private sector (line 22d)	International Financial Statistics
Banking sector's total assets	Sum of all items on the asset side (line 20+line 20c +line 20n+line 21+line 22)	International Financial Statistics
Banking sector's deposits	Demand Deposits (line 24) + Time, Savings and For. Cur. Deposits (line 25) + Restricted Deposits (line 26b)	International Financial Statistics
Banking sector's foreign liabilities	Foreign liabilities (line 26c)	

Fiscal variables		
Government balance	Government revenues – government expense	EIU; IFS; WEO; Mitchell (2007); Art.IV reports.
Government revenues	General government total revenues	EIU; IFS; WEO; Mitchell (2007); Art.IV reports.
Government expense	General government total expense	EIU; IFS; WEO; Mitchell (2007); Art.IV reports.
Government debt	General government debt	World Development Indicators
Short-term debt/Total external debt	Ratio of short-term external debt over total external debt	World Development Indicators
Macroeconomic variables		
Real GDP growth	Annual change of real GDP	World Development Indicators
Inflation	Annual change of the Consumer Price Index	World Development Indicators
Portfolio capital flows	Sum of “portfolio investment liabilities” and “other investment liabilities”	International Financial Statistics
Lending interest rate	Interest rate charged by banks on loans to prime customers.	International Financial Statistics

APPENDIX 2: BANK vs BANK TO DEBT

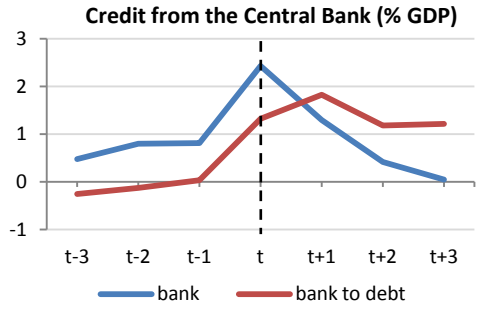

Figure 1. Liquidity support (% of GDP)

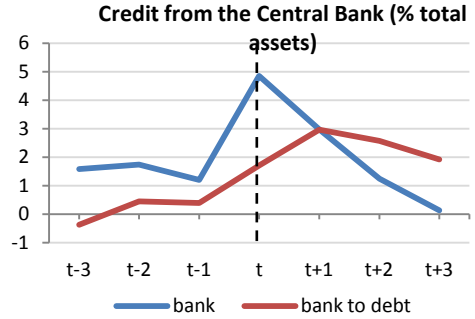

Figure 2. Liquidity support (% of assets)

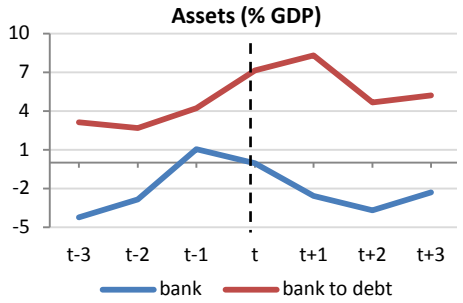

Figure 3. Banking sector assets (%GDP)

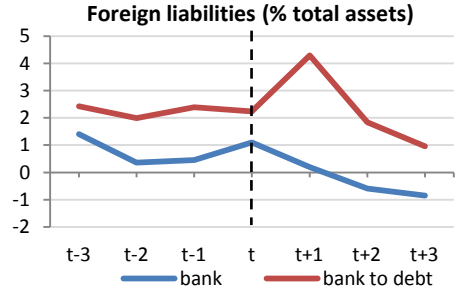

Figure 4. Foreign liabilities (% total assets).

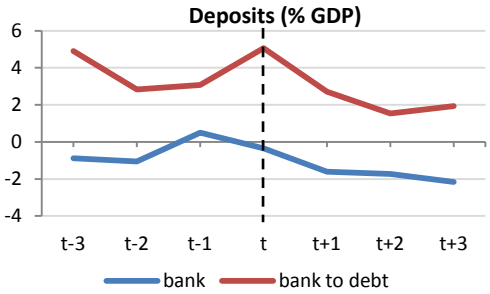

Figure 5. Banking sector deposits (% of GDP)

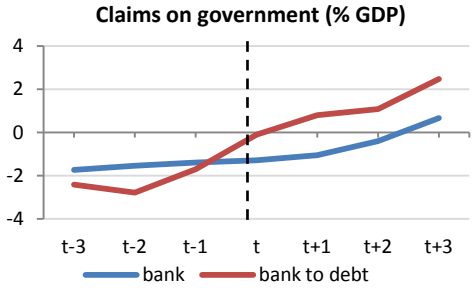

Figure 6. Banking sector claims on government (% of GDP)

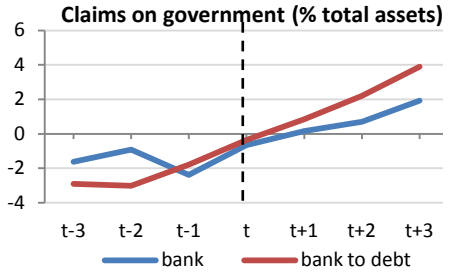

Figure 7. Banking sector claims on government (% total assets)

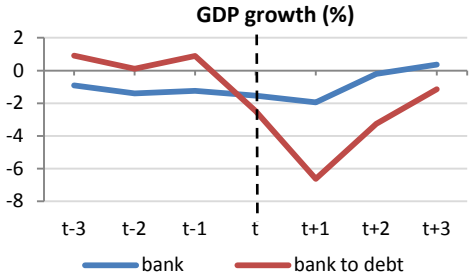

Figure 8. Real economic growth

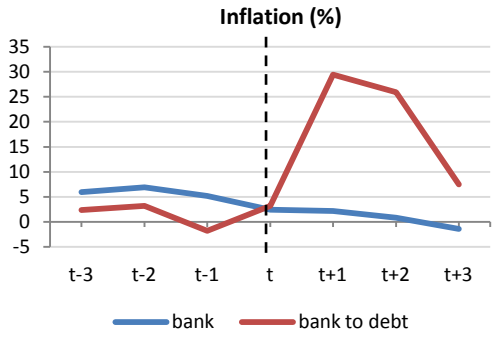

Figure 9. Inflation dynamics

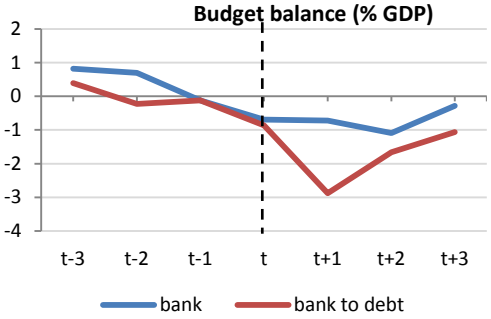

Figure 10. Budget balance (% GDP)

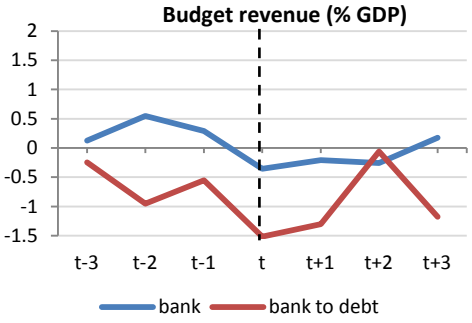

Figure 11. Budget revenues (% GDP)

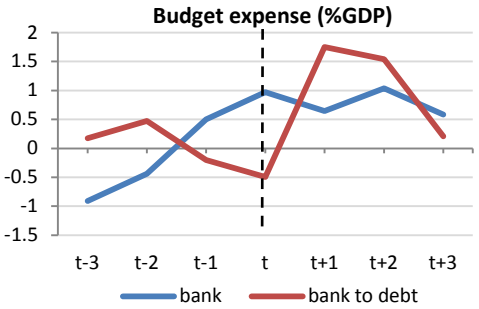

Figure 12. Budget expenditures (% GDP)

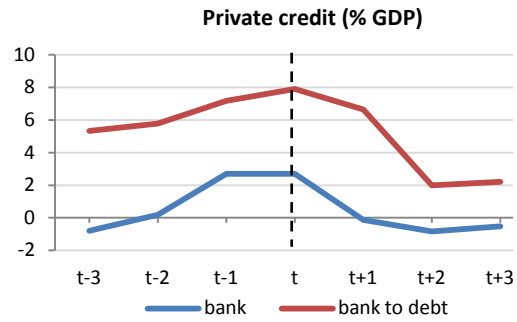

Figure 13. Domestic credit to the private sector

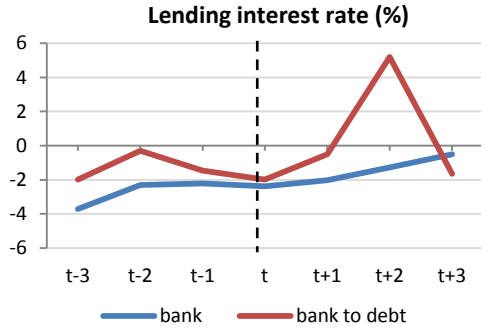

Figure 14. Lending rate to the private sector

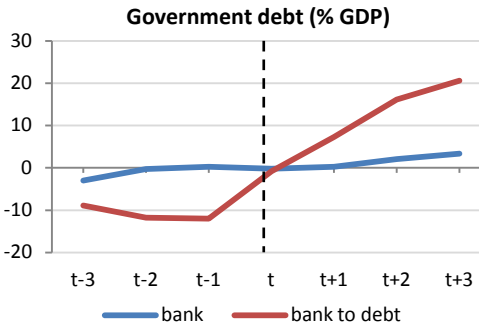

Figure 15. Public debt (% GDP)

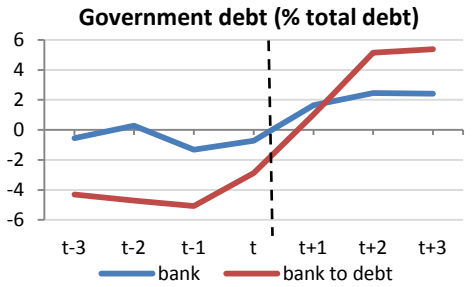

Figure 16. Governement debt (% total debt)

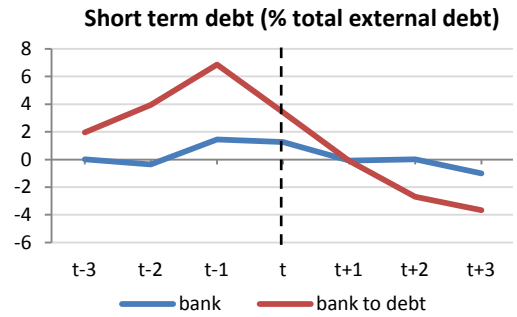

Figure 17. Short term debt

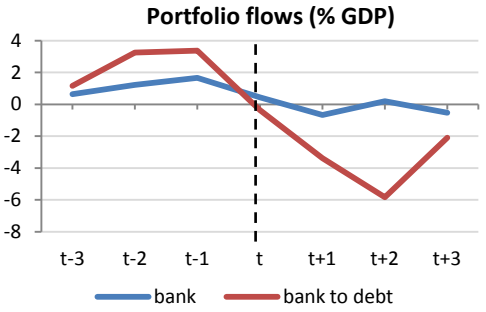

Figure 18. Capital inflows by foreigners

DEBT vs DEBT TO BANK

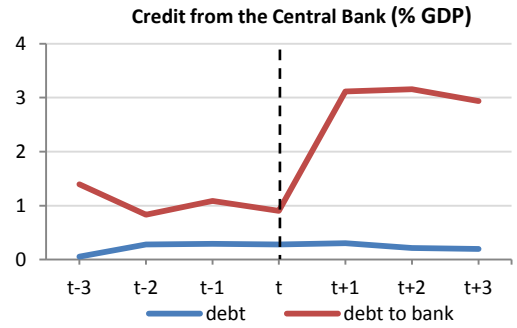

Figure 19. Liquidity support (% of GDP)

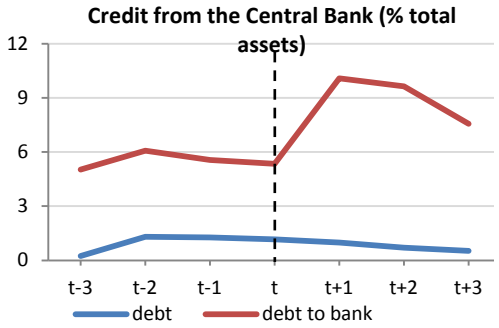

Figure 20. Liquidity support (% of assets)

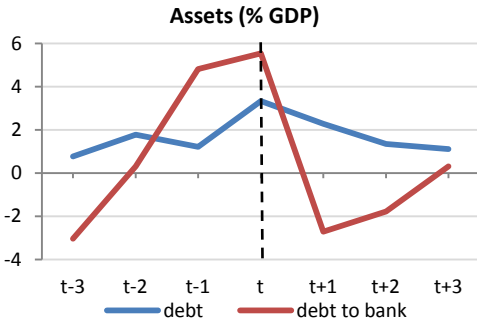

Figure 21. Banking sector's assets (% GDP)

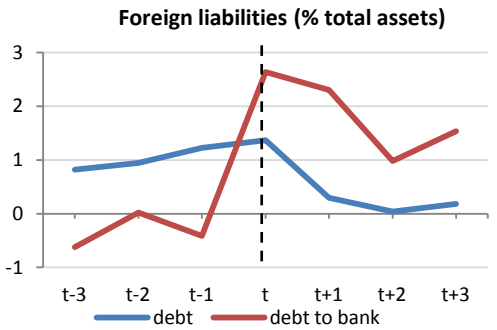

Figure 22. Foreign liabilities (% total assets)

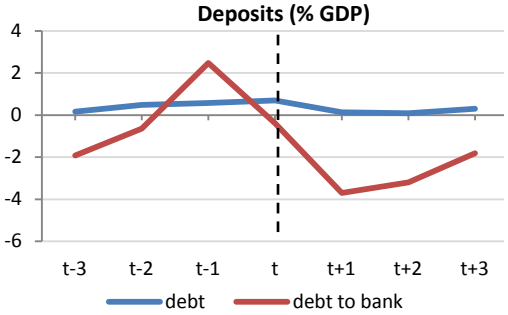

Figure 23. Banking sector deposits (% GDP)

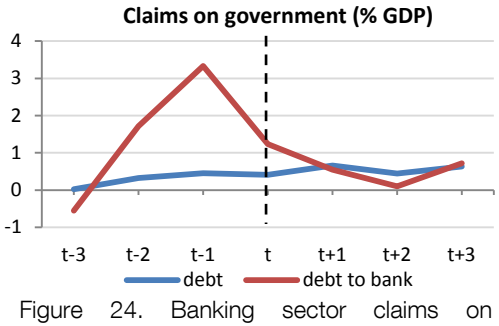

Figure 24. Banking sector claims on government (% of GDP).

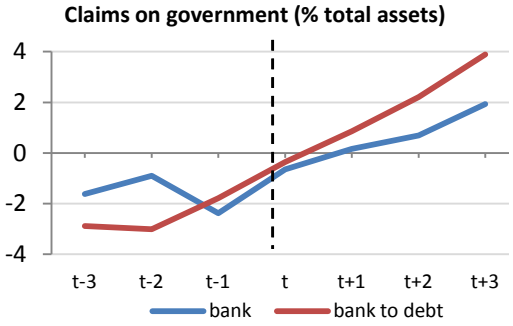

Figure 25. Banking sector claims on government (% of total assets).

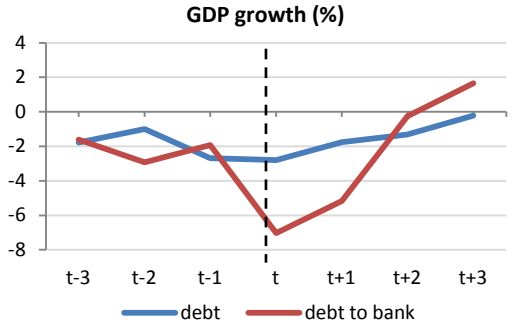

Figure 26. Real economic growth.

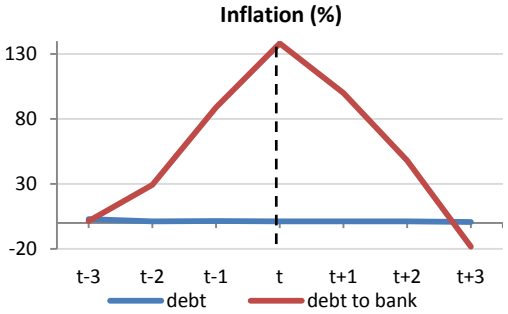

Figure 27. Inflation dynamics

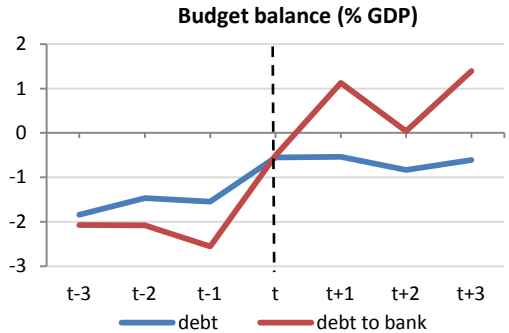

Figure 28. Budget Balance (%GDP)

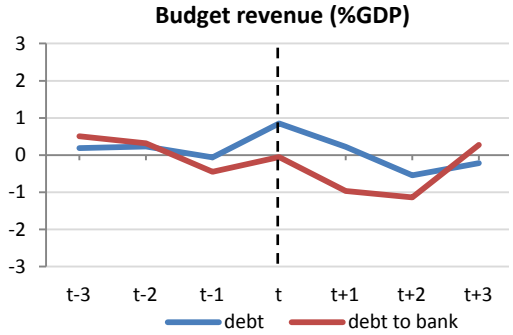

Figure 29. Budget revenues (% GDP)

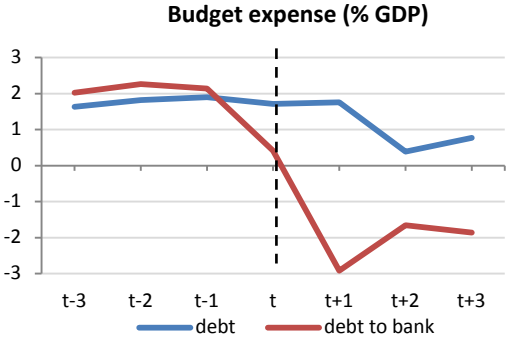

Figure 30. Budget expenditures (% GDP)

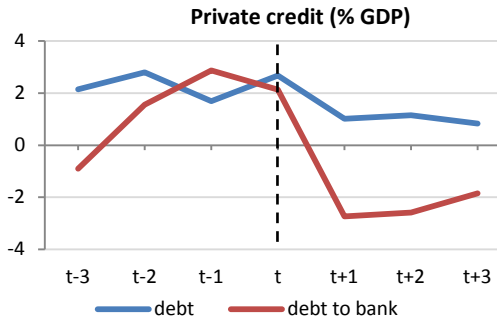

Figure 31. Domestic credit to the private sector

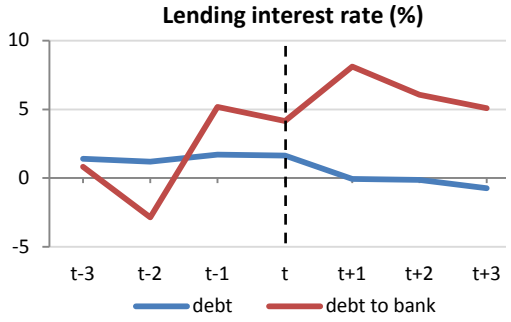

Figure 32. Lending rate to the private sector

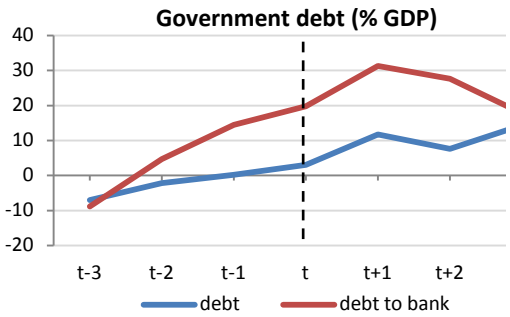

Figure 33. Public debt (% GDP)

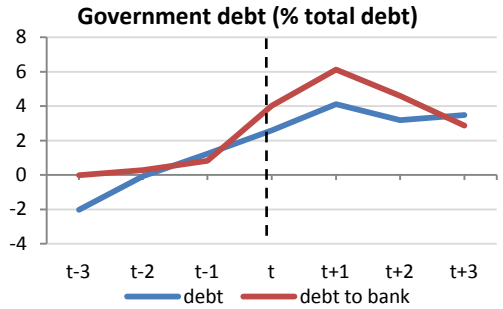

Figure 34. Governement debt (% Total debt)

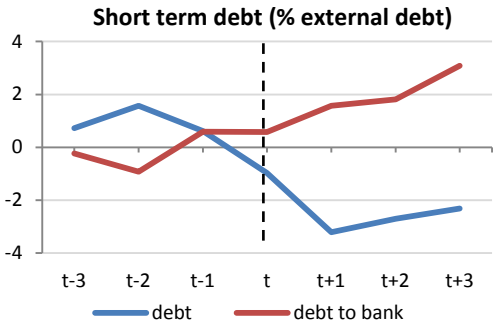

Figure 35. Short-term debt

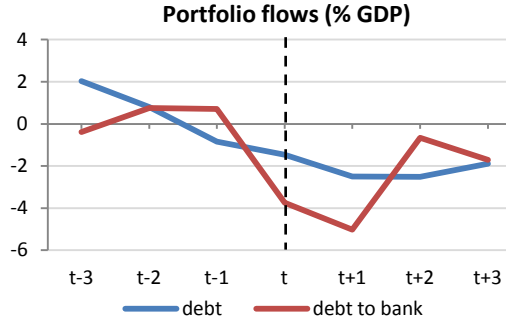

Figure 36. Capital inflows by foreigners

APPENDIX 3: ECONOMETRIC RESULTS

Table A.6. Credit from the Central Bank (% GDP)

	Debt crises	Debt to bank crises	Bank crises	Bank to debt crises
Year t-3	0.056	0.369	0.188	-0.097
	[0.146]	[0.615]	[0.138]	[0.266]
Year t-2	0.271	0.220	0.314*	-0.048
	[0.214]	[0.490]	[0.175]	[0.266]
Year t-1	0.285*	0.287	0.319*	0.012
	[0.168]	[0.526]	[0.175]	[0.210]
Year Event	0.274	0.239	0.957***	0.508*
	[0.219]	[0.247]	[0.248]	[0.285]
Year t+1	0.296	0.822*	0.510**	0.701***
	[0.208]	[0.470]	[0.202]	[0.244]
Year t+2	0.210	0.833**	0.164	0.452
	[0.204]	[0.370]	[0.169]	[0.307]
Year t+3	0.194	0.775**	0.018	0.466
	[0.215]	[0.309]	[0.171]	[0.424]
Observations	1512	1512	1512	1512
R-squared	0.05	0.05	0.05	0.05
No. Of Countries	70	70	70	70
No. of Events	40	9	40	14
Country dummies	Yes	Yes	Yes	Yes
Country trends	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 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 A.7. Credit from the Central Bank (% total assets)

	Debt crises	Debt to bank crises	Bank crises	Bank to debt crises
Year t-3	0.070	0.647*	0.314**	-0.069
	[0.152]	[0.360]	[0.147]	[0.289]
Year t-2	0.364	0.782*	0.346**	0.084
	[0.224]	[0.417]	[0.162]	[0.302]
Year t-1	0.353**	0.715	0.239	0.074
	[0.167]	[0.429]	[0.172]	[0.259]
Year Event	0.323	0.687***	0.961***	0.320
	[0.217]	[0.252]	[0.226]	[0.252]
Year t+1	0.274	1.297***	0.589***	0.554**
	[0.183]	[0.361]	[0.204]	[0.253]
Year t+2	0.195	1.240***	0.247	0.481
	[0.193]	[0.266]	[0.175]	[0.327]
Year t+3	0.147	0.972***	0.026	0.359
	[0.198]	[0.323]	[0.166]	[0.373]
Observations	1512	1512	1512	1512
R-squared	0.07	0.07	0.07	0.07
No. of Countries	72	72	72	72
No. of Events	37	9	39	14
Country dummies	Yes	Yes	Yes	Yes
Country trends	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 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 A.8. Credit from the Central Bank (% total liabilities)

	Debt crises	Debt to bank crises	Bank crises	Bank to debt crises
Year t-3	0.121	0.463	0.210	-0.123
	[0.159]	[0.365]	[0.142]	[0.352]
Year t-2	0.490**	0.705*	0.443**	-0.070
	[0.234]	[0.394]	[0.171]	[0.364]
Year t-1	0.430**	0.640	0.218	-0.234
	[0.184]	[0.393]	[0.167]	[0.286]
Year Event	0.314	0.663***	0.973***	0.325
	[0.220]	[0.210]	[0.225]	[0.340]
Year t+1	0.335*	1.265***	0.597***	0.287
	[0.200]	[0.384]	[0.199]	[0.250]
Year t+2	0.232	1.160***	0.174	0.183
	[0.206]	[0.281]	[0.169]	[0.355]
Year t+3	0.137	0.953***	0.041	0.108
	[0.204]	[0.351]	[0.162]	[0.439]
Observations	1436	1436	1436	1436
R-squared	0.07	0.07	0.07	0.07
No. of Countries	70	70	70	70
No. of Events	38	10	40	11
Country dummies	Yes	Yes	Yes	Yes
Country trends	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 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 A.9. Claims on Government (% total assets)

	Debt crises	Debt to bank crises	Bank crises	Bank to debt crises
Year t-3	-0.039	0.241	-0.240	-0.591***
	[0.162]	[0.368]	[0.188]	[0.153]
Year t-2	-0.019	0.646	-0.134	-0.615***
	[0.181]	[0.465]	[0.197]	[0.189]
Year t-1	0.102	0.602	-0.353**	-0.365**
	[0.199]	[0.446]	[0.175]	[0.181]
Year Event	0.073	0.010	-0.097	-0.074
	[0.186]	[0.315]	[0.177]	[0.298]
Year t+1	0.123	0.225	0.023	0.174
	[0.196]	[0.397]	[0.147]	[0.355]
Year t+2	0.075	-0.000	0.103	0.451**
	[0.203]	[0.378]	[0.159]	[0.222]
Year t+3	0.087	0.066	0.285*	0.794**
	[0.195]	[0.328]	[0.152]	[0.343]
Observations	1729	1729	1729	1729
R-squared	0.03	0.03	0.03	0.03
No. of Countries	77	77	77	77
No. of Events	43	11	42	14
Country dummies	Yes	Yes	Yes	Yes
Country trends	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 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 A.10. Assets (% GDP)

	Debt crises	Debt to bank crises	Bank crises	Bank to debt crises
Year t-3	0.081	-0.238	-0.339**	0.300
	[0.156]	[0.297]	[0.139]	[0.240]
Year t-2	0.186	0.024	-0.227	0.259
	[0.176]	[0.347]	[0.157]	[0.282]
Year t-1	0.126	0.377	0.084	0.406
	[0.196]	[0.431]	[0.184]	[0.275]
Year Event	0.347	0.434	-0.003	0.686**
	[0.252]	[0.417]	[0.177]	[0.281]
Year t+1	0.237	-0.212	-0.206	0.797***
	[0.232]	[0.237]	[0.171]	[0.242]
Year t+2	0.141	-0.139	-0.296**	0.448
	[0.175]	[0.234]	[0.138]	[0.288]
Year t+3	0.115	0.024	-0.184	0.500**
	[0.150]	[0.289]	[0.146]	[0.248]
Observations	1659	1659	1659	1659
R-squared	0.47	0.47	0.47	0.47
No. of Countries	75	75	75	75
No. of Events	42	10	42	14
Country dummies	Yes	Yes	Yes	Yes
Country trends	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 and country trends. 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 A.11. Deposits (% GDP)

	Debt crises	Debt to bank crises	Bank crises	Bank to debt crises
Year t-3	0.029	-0.246	-0.116	0.568**
	[0.159]	[0.281]	[0.145]	[0.253]
Year t-2	0.084	-0.082	-0.140	0.328
	[0.182]	[0.313]	[0.182]	[0.271]
Year t-1	0.102	0.316	0.066	0.356*
	[0.210]	[0.428]	[0.166]	[0.196]
Year Event	0.123	-0.050	-0.045	0.586***
	[0.254]	[0.306]	[0.189]	[0.198]
Year t+1	0.024	-0.473*	-0.211	0.314
	[0.237]	[0.253]	[0.178]	[0.243]
Year t+2	0.016	-0.409	-0.228	0.177
	[0.179]	[0.299]	[0.140]	[0.190]
Year t+3	0.053	-0.232	-0.284*	0.223
	[0.146]	[0.263]	[0.145]	[0.167]
Observations	1724	1724	1724	1724
R-squared	0.45	0.45	0.45	0.45
No. of Countries	75	75	75	75
No. of Events	46	11	44	14
Country dummies	Yes	Yes	Yes	Yes
Country trends	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 and country trends. 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 A.12. Private Credit (% GDP)

	Debt crises	Debt to bank crises	Bank crises	Bank to debt crises
Year t-3	0.254**	-0.097	-0.082	0.576**
	[0.126]	[0.272]	[0.147]	[0.230]
Year t-2	0.332**	0.168	0.020	0.625**
	[0.151]	[0.257]	[0.169]	[0.271]
Year t-1	0.200	0.310	0.279	0.777***
	[0.171]	[0.304]	[0.188]	[0.287]
Year Event	0.317	0.231	0.279	0.856**
	[0.224]	[0.326]	[0.201]	[0.325]
Year t+1	0.120	-0.296*	-0.014	0.720**
	[0.182]	[0.173]	[0.184]	[0.308]
Year t+2	0.136	-0.280	-0.086	0.215
	[0.143]	[0.260]	[0.148]	[0.363]
Year t+3	0.098	-0.200	-0.054	0.240
	[0.136]	[0.312]	[0.137]	[0.308]
Observations	1717	1717	1717	1717
R-squared	0.48	0.48	0.48	0.48
No. of Countries	75	75	75	75
No. of Events	46	11	44	14
Country dummies	Yes	Yes	Yes	Yes
Country trends	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 and country trends. 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 A.13. Foreign Liabilities (% total assets)

	Debt crises	Debt to bank crises	Bank crises	Bank to debt crises
Year t-3	0.215	-0.112	0.294	0.386
	[0.169]	[0.300]	[0.220]	[0.306]
Year t-2	0.247	0.004	0.074	0.318
	[0.205]	[0.279]	[0.198]	[0.279]
Year t-1	0.320*	-0.074	0.094	0.382
	[0.183]	[0.318]	[0.171]	[0.272]
Year Event	0.358	0.474	0.229	0.357
	[0.226]	[0.472]	[0.177]	[0.353]
Year t+1	0.078	0.414	0.040	0.685*
	[0.192]	[0.426]	[0.166]	[0.388]
Year t+2	0.010	0.176	-0.124	0.293
	[0.215]	[0.249]	[0.137]	[0.372]
Year t+3	0.047	0.276	-0.178	0.152
	[0.187]	[0.378]	[0.130]	[0.315]
Observations	1698	1698	1698	1698
R-squared	0.02	0.02	0.02	0.02
No. of Countries	76	76	76	76
No. of Events	43	11	41	14
Country dummies	Yes	Yes	Yes	Yes
Country trends	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 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 A.14. Budget Balance (%GDP)

	Debt crises	Debt to bank crises	Bank crises	Bank to debt crises
Year t-3	-0.472**	-0.616**	0.290	0.149
	[0.196]	[0.307]	[0.179]	[0.304]
Year t-2	-0.375*	-0.617	0.248	-0.087
	[0.214]	[0.470]	[0.191]	[0.361]
Year t-1	-0.396**	-0.759	-0.041	-0.046
	[0.184]	[0.462]	[0.192]	[0.317]
Year Event	-0.141	-0.152	-0.243	-0.328
	[0.202]	[0.266]	[0.177]	[0.319]
Year t+1	-0.138	0.335*	-0.253	-1.092***
	[0.251]	[0.195]	[0.164]	[0.356]
Year t+2	-0.213	0.011	-0.385**	-0.630**
	[0.226]	[0.204]	[0.163]	[0.314]
Year t+3	-0.156	0.414	-0.101	-0.401
	[0.264]	[0.294]	[0.165]	[0.313]
Observations	1526	1526	1526	1526
R-squared	0.05	0.05	0.05	0.05
No. of Countries	74	74	74	74
No. of Events	36	11	41	12
Country dummies	Yes	Yes	Yes	Yes
Country trends	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 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 A.15. Budget Revenue (%GDP)

	Debt crises	Debt to bank crises	Bank crises	Bank to debt crises
Year t-3	0.052	0.159	0.040	-0.075
	[0.174]	[0.310]	[0.237]	[0.270]
Year t-2	0.064	0.099	0.177	-0.292
	[0.226]	[0.465]	[0.182]	[0.325]
Year t-1	-0.017	-0.140	0.094	-0.170
	[0.197]	[0.446]	[0.165]	[0.358]
Year Event	0.237	-0.017	-0.115	-0.464
	[0.228]	[0.336]	[0.179]	[0.339]
Year t+1	0.062	-0.302	-0.067	-0.398
	[0.203]	[0.341]	[0.192]	[0.318]
Year t+2	-0.151	-0.356	-0.083	-0.019
	[0.208]	[0.365]	[0.169]	[0.324]
Year t+3	-0.061	0.085	0.057	-0.360
	[0.200]	[0.368]	[0.173]	[0.380]
Observations	1526	1526	1526	1526
R-squared	0.01	0.01	0.01	0.01
No. of Countries	74	74	74	74
No. of Events	36	11	41	12
Country dummies	Yes	Yes	Yes	Yes
Country trends	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 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 A.16. Budget Expense (%GDP)

	Debt crises	Debt to bank crises	Bank crises	Bank to debt crises
Year t-3	0.352*	0.494	-0.191	0.050
	[0.206]	[0.328]	[0.187]	[0.332]
Year t-2	0.392*	0.552	-0.092	0.134
	[0.206]	[0.338]	[0.180]	[0.354]
Year t-1	0.410*	0.522	0.105	-0.057
	[0.226]	[0.381]	[0.187]	[0.389]
Year Event	0.369	0.102	0.204	-0.140
	[0.224]	[0.326]	[0.195]	[0.364]
Year t+1	0.379	-0.711**	0.135	0.493
	[0.266]	[0.286]	[0.201]	[0.460]
Year t+2	0.084	-0.403	0.217	0.434
	[0.171]	[0.295]	[0.181]	[0.439]
Year t+3	0.167	-0.454	0.122	0.059
	[0.185]	[0.294]	[0.164]	[0.356]
Observations	1526	1526	1526	1526
R-squared	0.03	0.03	0.03	0.03
No. of Countries	74	74	74	74
No. of Events	36	11	41	12
Country dummies	Yes	Yes	Yes	Yes
Country trends	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 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% respectivel

Table A.17. Real GDP Growth (%)

	Debt crises	Debt to bank crises	Bank crises	bank to debt crises
Year t-3	-0.353*	-0.289	-0.222	0.238
	[0.189]	[0.266]	[0.184]	[0.274]
Year t-2	-0.198	-0.527***	-0.341**	0.030
	[0.171]	[0.163]	[0.157]	[0.230]
Year t-1	-0.535***	-0.347	-0.303	0.230
	[0.196]	[0.217]	[0.200]	[0.181]
Year Event	-0.558***	-1.262***	-0.374**	-0.641**
	[0.172]	[0.290]	[0.183]	[0.253]
Year t+1	-0.350**	-0.928**	-0.478**	-1.722***
	[0.145]	[0.432]	[0.222]	[0.407]
Year t+2	-0.262	-0.046	-0.051	-0.848***
	[0.165]	[0.338]	[0.125]	[0.316]
Year t+3	-0.043	0.298	0.091	-0.298
	[0.186]	[0.383]	[0.105]	[0.222]
Observations	1855	1855	1855	1855
R-squared	0.07	0.07	0.07	0.07
No. of Countries	76	76	76	76
No. of Events	47	12	46	14
Country dummies	Yes	Yes	Yes	Yes
Country trends	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 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 A.18. Inflation rate (%)

	Debt crises	Debt to bank crises	Bank crises	Bank to debt crises
Year t-3	0.289	0.011	0.701***	0.118
	[0.204]	[0.169]	[0.211]	[0.273]
Year t-2	0.121	0.226	0.820***	0.158
	[0.148]	[0.271]	[0.219]	[0.229]
Year t-1	0.138	0.689	0.610***	-0.089
	[0.126]	[0.539]	[0.194]	[0.171]
Year Event	0.117	1.071**	0.286*	0.157
	[0.161]	[0.489]	[0.149]	[0.239]
Year t+1	0.128	0.774	0.254	1.457**
	[0.141]	[0.498]	[0.173]	[0.557]
Year t+2	0.120	0.371	0.097	1.283***
	[0.132]	[0.308]	[0.168]	[0.420]
Year t+3	0.066	-0.141	-0.164	0.370
	[0.137]	[0.193]	[0.116]	[0.285]
Observations	1656	1656	1656	1656
R-squared	0.07	0.07	0.07	0.07
No. of Countries	73	73	73	73
No. of Events	44	12	39	14
Country dummies	Yes	Yes	Yes	Yes
Country trends	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 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 A.19. Government Debt (% GDP)

	Debt crises	Debt to bank crises	Bank crises	Bank to debt crises
Year t-3	-0.272	-0.286	-0.204	-0.408
	[0.218]	[0.301]	[0.178]	[0.261]
Year t-2	-0.085	0.152	-0.018	-0.541**
	[0.242]	[0.389]	[0.190]	[0.257]
Year t-1	0.009	0.468	0.016	-0.551**
	[0.267]	[0.508]	[0.211]	[0.255]
Year Event	0.117	0.640	-0.013	-0.038
	[0.218]	[0.430]	[0.203]	[0.303]
Year t+1	0.456**	1.012**	0.019	0.335
	[0.199]	[0.487]	[0.170]	[0.236]
Year t+2	0.296**	0.893*	0.143	0.745**
	[0.145]	[0.449]	[0.169]	[0.319]
Year t+3	0.558***	0.574	0.230	0.951***
	[0.177]	[0.395]	[0.153]	[0.342]
Observations	1652	1652	1652	1652
R-squared	0.05	0.05	0.05	0.05
No. of Countries	74	74	74	74
No. of Events	41	9	43	13
Country dummies	Yes	Yes	Yes	Yes
Country trends	No	No	No	No

The table repts 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 A.20. Short-term debt (% External Debt)

	Debt crises	Debt to bank crises	Bank crises	Bank to debt crises
Year t-3	0.090	-0.029	0.002	0.246
	[0.171]	[0.223]	[0.169]	[0.246]
Year t-2	0.195	-0.116	-0.047	0.495*
	[0.210]	[0.270]	[0.172]	[0.252]
Year t-1	0.077	0.075	0.187	0.862**
	[0.197]	[0.360]	[0.206]	[0.329]
Year Event	-0.120	0.073	0.165	0.427
	[0.200]	[0.333]	[0.202]	[0.344]
Year t+1	-0.398***	0.199	-0.011	-0.013
	[0.145]	[0.361]	[0.163]	[0.309]
Year t+2	-0.335**	0.229	0.003	-0.337
	[0.146]	[0.279]	[0.211]	[0.304]
Year t+3	-0.287*	0.390	-0.130	-0.460**
	[0.169]	[0.273]	[0.146]	[0.222]
Observations	1615	1615	1615	1615
R-squared	0.03	0.03	0.03	0.03
No. of Countries	66	66	66	66
No. of Events	43	12	40	14
Country dummies	Yes	Yes	Yes	Yes
Country trends	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 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 A.21. Portfolio Flows (%GDP)

	Debt crises	Debt to bank crises	Bank crises	Bank to debt crises
Year t-3	0.370**	-0.074	0.137	0.205
	[0.182]	[0.404]	[0.162]	[0.319]
Year t-2	0.147	0.144	0.260	0.568**
	[0.183]	[0.350]	[0.192]	[0.252]
Year t-1	-0.155	0.135	0.356*	0.589***
	[0.173]	[0.353]	[0.179]	[0.194]
Year Event	-0.269	-0.717**	0.093	-0.062
	[0.230]	[0.328]	[0.131]	[0.453]
Year t+1	-0.458**	-0.961**	-0.143	-0.590
	[0.202]	[0.364]	[0.194]	[0.411]
Year t+2	-0.461**	-0.126	0.042	-1.020**
	[0.213]	[0.454]	[0.183]	[0.386]
Year t+3	-0.345**	-0.327**	-0.110	-0.367**
	[0.151]	[0.156]	[0.150]	[0.169]
Observations	1622	1622	1622	1622
R-squared	0.05	0.05	0.05	0.05
No. of Countries	72	72	72	72
No. of Events	44	12	39	14
Country dummies	Yes	Yes	Yes	Yes
Country trends	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 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 A.22. Lending Interest Rate

	Debt crises	Debt to bank crises	Bank crises	Bank to debt crises
Year t-3	0.296	0.135	-0.806***	-0.156
	[0.268]	[0.528]	[0.243]	[0.301]
Year t-2	0.251	-0.478	-0.498	-0.023
	[0.219]	[0.301]	[0.341]	[0.428]
Year t-1	0.358	0.862	-0.478	-0.115
	[0.238]	[1.509]	[0.312]	[0.442]
Year Event	0.344	0.693	-0.517**	-0.156
	[0.345]	[1.420]	[0.193]	[0.417]
Year t+1	-0.013	1.355***	-0.438***	-0.039
	[0.292]	[0.225]	[0.144]	[0.369]
Year t+2	-0.030	1.010***	-0.275	0.408
	[0.370]	[0.225]	[0.196]	[0.450]
Year t+3	-0.157	0.847***	-0.111	-0.130
	[0.251]	[0.225]	[0.169]	[0.209]
Observations	714	714	714	714
R-squared	0.06	0.06	0.06	0.06
No. of Countries	48	48	48	48
No. of Events	18	2	15	7
Country dummies	Yes	Yes	Yes	Yes
Country trends	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 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 A.23. Real Interest Rate

	Debt crises	Debt to bank crises	Bank crises	Bank to debt crises
Year t-3	-0.094	-0.770	-0.215	0.119
	[0.215]	[0.757]	[0.197]	[0.243]
Year t-2	-0.131	-0.467	-0.337	-0.342
	[0.171]	[0.813]	[0.225]	[0.211]
Year t-1	-0.020	-0.747	0.124	0.237
	[0.226]	[0.599]	[0.188]	[0.278]
Year Event	-0.027	-0.015	0.259	0.283
	[0.249]	[0.545]	[0.187]	[0.408]
Year t+1	-0.265	-0.576	0.353*	-0.609
	[0.168]	[0.570]	[0.203]	[0.707]
Year t+2	-0.070	-0.454	0.204	-0.292
	[0.138]	[0.487]	[0.189]	[0.300]
Year t+3	0.235	-0.256	0.215	-0.174
	[0.163]	[0.321]	[0.144]	[0.405]
Observations	1322	1322	1322	1322
R-squared	0.03	0.03	0.03	0.03
No. of Countries	69	69	69	69
No. of Events	32	7	39	12
Country dummies	Yes	Yes	Yes	Yes
Country trends	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 spiltinto 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.