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Banks, government bonds, and default: what do the data say?

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Banks, Government Bonds, and Default: What do the Data Say?

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We analyze empirically the holdings of sovereign bonds by over 20,000 banks in 191 countries, and the role of these bonds in 20 sovereign defaults over 1998-2012. We document two robust facts. First, banks hold many government bonds (on average 9% of their assets) in normal times, particularly banks that make fewer loans and operate in less financially-developed countries. Second, within a country and during a default year, bank's holdings of sovereign bonds correlate negatively with subsequent lending. Quantitatively, the average exposure to bonds is approximately associated with a 7-percentage point lower growth rate of loans relative to a bank holding no bonds. This negative correlation is stronger in defaulting countries that are economically and institutionally more developed. These results indicate that the "dangerous embrace" between banks and their government plays a key role in many sovereign defaults around the world, and its strength depends on local conditions.

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1. Introduction

Recent theory shows that when banks hold large amounts of sovereign bonds, sovereign default may hurt their balance sheets, causing a decrease in lending, a banking crisis, and thus an economic collapse (e.g., Gennaioli, Martin, and Rossi 2014). This mechanism was center stage during the recent European crisis. Systematic evidence of it, however, is scant. This paper aims to fill this gap by documenting basic facts from many default episodes around the world.

Existing bank level evidence on the "dangerous embrace" between banks and governments faces two main limitations.[1] First, it focuses on the European debt crisis (e.g., Popov and Van Horen 2014, De Marco 2016, Battistini, Pagano, and Simonelli 2015), which limits its scope. It would be useful to know how this mechanism works around the world, including in poor and emerging economies, which account for the lion's share of default episodes. Second, existing work does not analyze how banks become exposed to their government in the first place. Acharya and Steffen (2014) and Drechsler et al. (2014) stress banks' excessive risk taking in government bonds during the European crisis. It remains to be seen how general this channel is when compared to banks' demand for government bonds in normal times.

To address these issues, we analyze how bank holdings of government bonds shape the sovereign default-banking crisis nexus in many countries, time periods, and crises. We use the BANKSCOPE dataset, which has the advantage – relative to the European Stress tests – of

[1] Gennaioli et al. (2014) show that countries where banks hold more domestic public bonds exhibit a sharper reduction in aggregate lending during government default. Arteta and Hale (2008) show that defaults are followed by a drop in foreign credit to domestic firms. Borensztein and Panizza (2008) show that defaults are followed by larger GDP contractions when they occur with banking crises. Baskaya and Kalemli-Ozcan (2014) offer evidence from Turkey. Becker and Ivashina (2014) find that public bond purchases by European banks crowd-out corporate lending.

reporting the holdings of government bonds (alternatively, "bondholdings" or "bonds") and characteristics of over 20,000 banks in 191 countries between 1998 and 2012. Crucially, our dataset covers 20 sovereign default episodes, 19 of which occurred in emerging markets.[2]

Despite its richness, our data does not allow us to identify causal patterns. Instead, our goal is to unveil robust stylized facts on the cross-country patterns of sovereign crises that can inform future theoretical work. Our analysis delves around two questions:

i. Which banks, and in which countries, hold government bonds? Do banks hold bonds all of the time, or do they mostly buy bonds in the run-up to and during sovereign defaults?
ii. Do the banks that hold more government bonds exhibit a larger decrease in lending when their government defaults?

We address these questions by running a large battery of tests. In particular, we control in our regressions for many aggregate economic shocks, for differential exposure of banks to such shocks, and for a host of bank characteristics. We document two robust facts:

1. There is a negative and statistically significant correlation between a bank's holdings of domestic government bonds during a sovereign default and its ratio of loans to assets. This result holds within the same defaulting country and default year. A bank holding the average amount of bonds reduces its loans-to-assets ratio by about one extra percentage

[2] One shortcoming of BANKSCOPE is that it reports a bank's aggregate public bond exposure, without separating domestic from foreign sovereign bonds. To assess the severity of this problem, we focus on a subsample of banks where we perfectly observe the nationality of banks' bondholdings and we thoroughly compare it with our BANKSCOPE data. The exercise confirms the presumption of strong home bias in sovereign exposures, indicating that – while imperfect – the BANKSCOPE measure is a good proxy for a bank's exposure to its domestic government.

points relative to a bank holding zero bonds. In addition, for a given loans-to-assets ratio, the bank holding bonds exhibits lower asset growth during default. As a result, in default years the average exposure to government bonds is associated with a roughly 7 percentage point lower growth rate of loans relative to a bank holding no bonds.

2. During normal times, banks' holdings of government bonds are large (around 9% of assets), particularly for banks that make fewer loans and are located in less financially developed countries. During default episodes, bondholdings go up only slightly and their increase is concentrated in larger (and more profitable) banks. Government bonds held ahead of crises have a strong predictive power for the reduction in bank lending.

Although these findings cannot fully address causality, they do shed light on the two main hypotheses behind the sovereign default-banking crisis nexus. The "demand channel" hypothesis holds that it is other adverse shocks that occur jointly with default (recessions, devaluations, etc.), rather than default per se, which reduce the demand for credit and thus bank lending. The alternative "supply channel" hypothesis holds instead that defaults directly hinder bank lending by damaging the balance sheets of banks that hold government bonds.[3]

Fact 1 above is already suggestive of a supply channel at play because it implies that a bank's bondholdings predict its decline in lending during sovereign defaults, conditional on any aggregate shock. If the decline in lending was *only* caused by adverse demand shocks, there

[3] This channel relies on the assumption of 'imperfect discrimination' (Broner, Martin, and Ventura 2010; Broner and Ventura 2011), whereby governments cannot spare domestic creditors when defaulting on foreign ones. Conventional models of sovereign default assume perfect discrimination instead (e.g., Eaton and Gersovitz 1981).

would be no particular reason for it to be stronger among banks holding more government bonds.

Perhaps banks highly exposed to their government expect or happen to face low credit demand during defaults, for instance because they are more pro-cyclical. However, we find that the lending policy of highly exposed banks is not disproportionately sensitive to recessions or devaluations. Hence, differential sensitivity to major shocks is unlikely to account for our results. In addition, our results are robust to controlling for bank characteristics and their interaction with default. Finally, we also document that bonds held well before sovereign defaults strongly predict the post-default decline in credit, which is also consistent with the supply channel. Arguably, pre-crisis bonds are held for reasons that have little to do with the crisis itself.

Together with Fact 2, this last finding sheds new light on the origins of the sovereign default-banking crisis nexus. Because banks' sovereign exposure is mostly built well before defaults, the "dangerous embrace" in our data seems largely due to banks' demand for bonds in normal times. This is not to say that the risk-taking channel, much discussed in the European context, is not a contributing factor. Rather, our data indicates that this is not an essential or even an important part of the story in emerging markets.

The cross-country nature of our data also allows us to document important country level differences in the unfolding of sovereign crises. We find that the negative association between bank bondholdings and lending tends to be stronger in defaulting countries that have a fixed exchange rate regime, that are more economically developed, and that have stronger political and financial institutions. These findings are obtained by comparing countries with low versus

medium scores of institutions and development, because there are very few defaults among countries with highest scores (perhaps precisely because the cost of default is too large there).

The paper proceeds as follows. Section 2 describes the data. Section 3 studies the basic correlation between bank bondholdings and loans during default (subsection 3.1) and the demand for public bonds by banks (subsection 3.2). Section 4 concludes.

2. Data

We build a dataset that includes banks' holdings of public bonds and lending activity at the bank-year level, as well as a large set of bank-level characteristics and macroeconomic indicators that capture the state of a country's economy.

2.1 BANKSCOPE Accounting Data

We obtain all the bank-level accounting data from the BANKSCOPE dataset, which contains information on the holdings of government bonds for 20,337 banks in 191 countries between 1998 and 2012 (99,328 bank-year observations). This dataset, which is provided by Bureau van Dijk Electronic Publishing (BvD), contains balance sheet information on a broad range of bank characteristics: bondholdings, size, leverage, risk taking, profitability, amount of loans outstanding, balances with the Central Bank, and other interbank balances. The nationality of the bonds is not reported, an issue to which we return below. The information in BANKSCOPE is suitable for international comparisons because BvD harmonizes the data.

All items are reported at book value, including bonds.[4] Arguably, since they play a key role in bank regulation, book-value estimates influence banks' lending decisions. Indeed, as we will see, the book value of bonds does appear to matter for lending. One important implication of book-value accounting is that – to a large extent – variations in the bonds-to-assets ratio capture variations in the relative quantity, as opposed to the market price, of bonds held by banks.[5]

We construct our dataset by assembling all annual updates of the unconsolidated accounts of banks in BANKSCOPE. We filter out duplicate records, banks with negative values of all types of assets, banks with total assets smaller than $100,000, and years prior to 1997 when coverage is less systematic. This procedure yields 99,328 observations of bondholdings at the bank-year level over 1998-2012. We impose two additional requirements on the remaining banks. First, each bank must have at least two consecutive years of data, so that we can examine changes in lending. Second, each bank must have data on the other main variables: leverage, profitability, cash and short-term securities, exposure to the Central Bank, and interbank balances. The constant-continuing sample for our regressions includes 7,391 banks in 160 countries for a total 36,449 bank-year observations. We take the location of banks to be the one of its headquarters, as reported in BANKSCOPE. Commercial banks account for 33.2% of our sample; cooperative banks for 38.2%; savings banks for 20.6%; investment banks for 1.6%; the rest includes holdings, real estate banks, and other credit institutions.

[4] Even in developed economies, banks hold a large fraction of their government bonds in the banking book (which reports book values) rather than in their trading book (which is marked to market). Acharya, Drechsler, and Schnabl (2014) report that EU banks hold on average 85% of their bonds in their banking book.

[5] Book and market value are close to one another during normal times, when bond prices are close to parity. The Online Appendix shows that our book-value measure approximates fairly well banks' exposure to government bonds at market value and that, if anything, it underestimates in many cases the exposure computed at market values.

2.2 Bondholdings Data

Because BANKSCOPE does not break down bonds by nationality, we now check whether the BANKSCOPE measure of government bonds is a good enough proxy for domestic bonds. To be sure, home bias – the tendency of investors to prefer domestic securities – is widespread in international financial markets (see Karolyi and Stulz 2003 for a survey), so it is reasonable to conjecture that there is home bias in banks' sovereign exposures as well. To assess whether this is the case, we compare our data with other sources that report the nationality of bonds: the country-level measure of "banks' net claims on the government" from the IMF, the bank-level data from the European Stress Tests of 2010-2012 for the subsample of EU banks, and proprietary data from the Central Bank of Argentina for the subsample of Argentine banks during 1997-2004.

[Figure 1 here]

Figure 1 plots averages by country-year of bank bondholdings as a share of total bank assets from BANKSCOPE and from the IMF measure of "financial institutions' net claims to the government," also computed as a share of total assets.[6] The mean of the IMF measure is very close to the BANKSCOPE data throughout the sample. The difference between both measures is quite small, less than 0.5% of assets in more than half of the sample. The BANKSCOPE measure is either equal or slightly larger than the IMF one in most of the years, as can be expected given that it includes also foreign bondholdings.[7]

[6] This variable reports commercial banks' holdings of securities plus direct lending minus government deposits. An equivalent measure has been used by Gennaioli, Martin, and Rossi (2014) and by Kumhof and Tanner (2008).

[7] Exceptions are 1999, 2000 and 2002 where the IMF measure overshoots the BANKSCOPE one by 1-1.7% of assets, which is probably due to the fact that the former includes direct lending.

Country level IMF data can give us a sense of the reliability of the BANKSCOPE measure of bonds at the country level, but not at the bank level. We therefore consider two alternative sources of bank -level data: the EU stress tests of 2010, 2011, and 2012, and; proprietary data from the Argentina's Central Bank during 1997-2004.

[Table I here]

Table I reports the mean and the median of the bonds-to-assets ratio according to BANKSCOPE and to these alternative data sources. It also reports the bank-level correlations between the ratios reported in these different datasets.

The European stress test data is reassuring. Mean bondholding as a share of assets in the stress test (5.12%) is fairly close to the BANKSCOPE measure (8.16%), suggesting that domestic bonds capture the bulk of sovereign exposure. This is also true for GIIPS banks, for which the stress test reports mean bondholdings of 6.22% against 9.43% of BANKSCOPE. The bank-by-bank correlation between the BANKSCOPE and stress test measures is sizeable (0.69 overall and 0.76 for GIIPS banks). Consider next the data on Argentine banks. Around the Argentine crisis and default (1997-2004), Argentine banks held 11.34% of their assets in domestic bonds, while BANKSCOPE reports bondholdings of 14.49% of assets.[8] The bank-level correlation is higher than that of the EU Stress Test (0.77), moreover, which again confirms the validity of our BANKSCOPE measure. Insofar as noise in the BANKSCOPE measure represents classical measurement error, it should bias our empirical analysis against finding any results. In the case of Argentina, we can

[8] Importantly, our Argentine data clearly distinguishes between bondholdings held by banks "on their own" and new bond issues, which were used to compensate banks in the aftermath of the 2001 Argentine default. We exclusively use the former measure in our analysis, which if anything biases our results against us.

precisely quantify even non-classical measurement error, which also appears to dampen our results, at least in the sub-sample of Argentine banks.[9]

The comparison of the BANKSCOPE data with both IMF country-level data and with the bank-level data of the EU Stress Tests and the Central Bank of Argentina confirms the presumption of a strong home bias in banks' bondholdings, and it also indicates that the BANKSCOPE measure is strongly and significantly correlated with domestic government exposure. As such, we believe the BANKSCOPE measure is a valid proxy for domestic bondholdings and we use it in our analysis.

[Table II here]

Panel A of Table II reports descriptive statistics on these bondholdings around the world. In non-defaulting countries banks hold on average 9% of their assets in government bonds. Among countries that default at least once in our sample, this average is 13.5% in non-default years, and increases slightly to 14.5% of bank assets during default years.

2.3 Summary Statistics

We consider the distribution of bank characteristics in BANKSCOPE, focusing on: (i) bank size as measured by total assets, (ii) non-cash assets (i.e. assets other than cash and other liquid securities), (iii) leverage as measured by one minus shareholders' equity as a share of assets, (iv)

[9] To quantify the role of non-classical measurement error, write our bondholdings measure as $b = b^* + \delta$, where b^* is true bonds and δ is measurement error. Denote by Δl the change in lending suring a given year of default. Measurement error is classical when $Cov(\Delta l, \delta) = Cov(b^*, \delta) = 0$. In the Argentine default (2001-2004, 223 bank year obs.) measurement error is not purely classical as $Cov(\Delta l, \delta) = 0.001781$ and $Cov(b^*, \delta) = 0.001669$. In Section 3 we quantify the direction and the magnitude of the estimation distortions for the Argentine sub-sample.

loans outstanding as a share of assets, (v) profitability as measured by operating income over assets, (vi) exposure to the Central Bank as measured by deposits in the Central Bank over assets, (vii) balances in the interbank market, and (viii) government ownership, a dummy that equals one if the government owns more than 50% of the bank's equity. To neutralize the impact of outliers, all variables are winsorized at the 1st and 99th percentile. Panel B of Table II provides descriptive statistics for these variables in our sample.[10] Table AI in the appendix reports the correlations between different bank characteristics in our sample.

[Table III here]

2.4 Sovereign Default and Macroeconomic Conditions

We proxy for sovereign defaults with a dummy variable based on Standard & Poor's, which defines default as the failure of a government to meet a principal or interest payment on the due date (or within the specified grace period) contained in the original terms of the debt issue. According to this definition, our sample contains 20 defaults in 17 countries.

In our robustness tests, we complement our analysis by using two alternative measures of sovereign defaults, namely: (i) a monetary measure of creditors' losses given default, i.e., "haircuts", from the work of Cruces and Trebesch (2013) and Zettelmeyer, Trebesch, and Gulati (2012), and; (ii) a market-based measure, whereby a country is defined to be in default either if satisfies the S&P definition or if its sovereign bond spreads relative to the U.S. or German bonds exceed a given threshold (following the methodology of Pescatori and Sy 2007).

[10] Panel C of Table II shows the characteristics of banks involved in the stress test. These banks are larger and extend more loans than the median BANKSCOPE bank. Leverage and cash are instead similar to the BANKSCOPE ones.

Table AII of the Appendix reports the defaults in our constant-continuing sample. There is a large variation in the size of defaulting countries and in the extent of bank coverage. To avoid picking up idiosyncratic features of default in countries that are small and have few banks, we show that our results are very similar across many subsamples.[11]

Data on the macroeconomic conditions of the different countries is obtained from the IMF's International Financial Statistics (IFS) and the World Bank's World Development Indicators (WDI). Table AIII in the Online Appendix describes all variables. To measure the size of financial markets we use the ratio of private credit provided by money deposit banks and other financial institutions to GDP, which is drawn from Beck et al. (2000). This widely used measure is an objective, continuous proxy for the size of the domestic credit markets.

2.5 Sovereign Bond Returns

Realized sovereign bond returns are obtained from the J.P. Morgan's Emerging Market Bond Index Plus file (EMBIG+) and from the J.P. Morgan's Global Bond Index (GBI) file (see Kim (2010) for a detailed description; see also Levy-Yeyati, Martinez-Peria, and Schmukler (2010)).[12] Figure 2 plots sovereign bond prices around default for the subsample of defaulting countries. It shows that bond prices drop very fast, just two-three months prior to the day of the default.

[Figure 2 here]

[11] One concern here is that some small countries with few banks may drive our results (in eight defaulting countries our data covers five banks or less.). The second is that our results may only hold in large countries like Argentina and Russia. Our extensive robustness exercises show that our results do not depend on these particularities.

[12] These indices aggregate the realized dollar returns of sovereign bonds of different maturities and denominations, assuming that coupons or pay downs are reinvested. This data is available for 68 countries in our sample and it covers 7 default episodes in 6 countries (Argentina, Russia Greece, Cote d'Ivoire, Ecuador, and Nigeria). Thus, using bond returns reduces sample size. Table AIV in the Online Appendix contains descriptive statistics on bond returns.

We use this J.P. Morgan data to construct expected returns, which are not directly observable. We follow a standard two-step process. In the first step, we regress bond returns on a set of country-specific economic, financial, and political risk factors:

$$R_{c,t} = \gamma_t + \beta_0 + \beta_1 Z_{c,t-1} + u_{i,c,t}, \quad (1)$$

where $R_{c,t}$ is the realized return of government bonds in country *c* at time t, γ_t are time dummies (capturing variations in the global risk-free rate), and $Z_{c,t-1}$ is a vector of political, economic and financial risk ratings compiled by the International Country Risk Guide (see Comelli (2012) for a similar method). In the second stage, we define expected returns as the fitted values of this first-stage regression. We report the results of the first-stage estimation of Equation (1) in Table AV in the Online Appendix. There is a strong negative correlation between the risk ratings at time *t* and realized returns at time $t + 1$. Because these ratings are decreasing in risk, this result is consistent with theory: higher bond returns compensate investors for higher risk.

3. Estimation Results

We present results from our regression analysis. Section 3.1 reports results on the relationship between sovereign defaults, bondholdings and loans. Section 3.2 analyzes banks' demand for bonds, in particular the extent to which these are purchased in normal times or in default years.

3.1 Defaults, Bondholdings and Loans

As a first step, we use our data to assess the correlation between a bank's bondholdings and its lending during default events. Let $\Lambda_{\mathrm{i,c,t}}$ denote the change in the loans-to-assets ratio of bank i,

in country c, between years $t-1$ and t, and; let $B_{i,c,t-1}$ denote the bonds to assets ratio of bank i, in country c, in year $t-1$. Our most basic test consists in running the regression:

$$\Lambda_{\mathrm{i,c,t}} = \gamma_0 + \gamma_1 \cdot B_{i,c,t-1} + \gamma_2 \cdot Def_{c,t-1} + \gamma_3 \cdot Def_{c,t-1} \cdot B_{i,c,t-1} + \gamma_4 \cdot L_{i,c,t-1}$$

$$+\gamma_5 \cdot Def_{c,t-1} \cdot L_{i,c,t-1} + \mu_{i,c,t}, \qquad (3)$$

where $Def_{c,t-1}$ is a dummy variable taking value 1 if country c is in default at $t-1$ and value 0 otherwise, and $L_{i,c,t-1}$ is the bank's loan-to-asset ratio that controls for the initial level of lending. This specification offers our minimal benchmark for quantification. We also run versions of Equation (3) that include country dummies, time dummies, and their interaction, as well as a large set of bank characteristics (alone and interacted with default) to control for banks' potentially different business models. Standard errors are clustered at the bank level throughout (clustering errors at the country level yields very similar results).

The coefficient of interest is γ_3. A negative value of γ_3 indicates that, ceteris paribus, banks holding more sovereign bonds extend fewer loans during sovereign defaults. Table IV reports our estimates. Column (1) reports our baseline estimate of Equation (3). The estimate for γ_3 is negative and significant, indicating that a bank's holdings of sovereign bonds are negatively associated with its lending during sovereign defaults.

[Table III here]

The results do not change when we introduce time dummies in column (2) and country dummies in column (3). Column (4) presents a more stringent test, which includes in our regressions also the interaction of country and time dummies. By doing so, we effectively control

for *any* country specific shocks such as recessions, exchange rate devaluations, etc., that may cause both a government default and a drop in the demand for credit. The inclusion of country*time dummies more than doubles the R-squared. Consistent with intuition, country-specific time-varying shocks are important determinants of bank lending. At the same time, our main coefficient remains robust. Within *the same* defaulting country-year, it is the banks most loaded with government bonds that reduce their lending the most. This is confirmed in column (5) when we control for a large set of bank level characteristics.[13]

One remaining concern is that, within the same country-year, banks holding more government bonds may happen to have greater exposure to the country-level, time-varying macroeconomic shocks. For instance, these banks may be unhedged against macroeconomic shocks like currency devaluations, so their lending might drop because of the devaluation and not because of the bonds they hold. To assess this possibility, Table IV includes in the regressions of column (5) of Table III the interaction between bank bondholdings and two major macroeconomic factors: a country's GDP growth and its exchange rate devaluation relative to the U.S. dollar. The interaction between bank bondholdings and sovereign default remains negative, statistically significant, and its magnitude is stable. The R-squared in all columns is very

[13] We can quantify the role of non-classical measurement error for the data in the Argentine default sub-sample (2001-2004, 223 bank-year obs.). As before, write our bondholdings measure as $b = b^* + \delta$, where b^* is true bonds and δ is measurement error. Denote by Δl_t the change in lending experienced by a bank over *t–1* to t during a default episode. The coefficient β of b_{t-1}, obtained from regressing Δl_t on b_{t-1} and l_{t-1}, is equal to:

$$\beta = \beta^* \frac{var(l_{t-1})var(b^*_{t-1}) - cov(b^*_{t-1}, l_{t-1})^2}{var(l_{t-1})var(b_{t-1}) - cov(b_{t-1}, l_{t-1})^2} + \frac{var(l_{t-1})cov(\Delta l_t, \delta_{t-1}) - cov(l_{t-1}, \delta_{t-1})cov(\Delta l_t, l_{t-1})}{var(l_{t-1})var(b_{t-1}) - cov(b_{t-1}, l_{t-1})^2}$$

where β^* is the true coefficient. In the sub-sample of Argentine banks during the 2001-2004 default, the coefficient estimated with Bankscope data is $\beta = -0.152$, while the coefficient estimated using the "true" bondholdings measure of the Central Bank Argentina is $\beta^* = -0.774$. Intuitively, in the Argentine data the effect of classical measurement dominates and it results in a significant downward bias of our estimate.

close to that of column (5) of Table III. Of the two macroeconomic shocks, only GDP growth has a significant (positive) effect on lending by banks holding more bonds.

[Table IV here]

We perform further robustness checks by considering different subsamples and definitions of default. Table V reports this analysis. Columns (1) and (2) show that our results are unchanged if we exclude government owned banks from our sample, for the behavior of these banks may be distorted by politics. We show that our results are not driven by "unimportant" defaults or by defaulting countries with just a few banks by excluding the smaller defaulting countries in our sample, both as measured by GDP per capita, and by the size of default (columns 3 and 4). We also exclude defaulting countries with fewer than 5, 10, and 15 banks, respectively (columns 5-10). The results are robust and point estimates are stable, suggesting that our results are unlikely to be driven by severe omitted variables or special subsamples. Our results survive under alternative definitions of defaults such as: (i) the haircut measure of default constructed by Cruces and Trebesch (2013) and Zettelmeyer et al. (2012), which measures the severity of a default (columns 11 and 12), and; (ii) the augmented measure that adds to the S&P default dummy also events in which sovereign spreads exceed 1,000 basis points (columns 13 and 14).[14]

[Table V here]

[14] The paucity of data on spreads limits this exercise to the larger, economically more important defaults. The additional defaults examined here are Ireland in 2011, Portugal 2011 and 2012, Greece in 2011, and Ukraine in 2001.

We also consider alternative measures of bank lending. Because changes in the loans-to-assets ratio may reflect changes in total assets, our previous results may pick up deleveraging. We thus estimate two alternatives to Equation (3), where the dependent variable is, respectively:

$$\left(\frac{L_{i,c,t} - L_{i,c,t-1}}{A_{i,c,t-1}}\right) \quad \text{and} \quad \Delta\log\left(L_{i,c,t}\right),$$

i.e., the change in loans divided by lagged assets and the growth rate of loans. All right-hand side variables are the same as in specification (3). Kashyap and Stein (2000) use a similar specification. We present the results from these alternative specifications in Panels A and B of Table AVI in the Online Appendix, respectively. Our results are confirmed. If anything, they become stronger.

In sum, consistent with the supply channel hypothesis, a bank's holding of sovereign bonds is robustly associated with a decline in its lending during sovereign defaults. Our results are quantitatively large. Consider the following back-of-the-envelope calculation based on our baseline specification in column (1) of Table III: relative to a bank that holds no public bonds, a bank with the average bonds-to-assets ratio of 14.49% experiences an additional fall in the loans-to-assets ratio of one percentage point. For a given growth rate of assets, this implies a bank with average bondholdings experiences a 2 percentage points lower lending growth relative to banks with no bonds. But since the assets of banks with average bondholdings also grow less than those of banks that hold no bonds during default years, our estimates imply that banks with average bondholdings experience an overall 7 percentage points lower lending growth.[15]

[15]To see the logic of the quantification, note that in column (1) of Table III the drop in the loans to assets ratio for a bank holding the average amount of bonds relative to a banking holding no bonds is equal to (0.038 –0.1) $*$ (0.145) = –0.009 (where 0.145 are the bonds held by the average bank in default). This effect alone corresponds to a lower

Having established that our baseline results are robust and large, we now exploit the cross-country dimension of our data to examine how they depend on key country-characteristics, like the type of exchange rate regime, the level of development, and the quality of financial, economic and legal institutions. To assess the role of the exchange rate regime, we separately estimate Equation (3) in countries that have a hard exchange-rate peg, a soft exchange-rate peg, and no peg, according to the classification proposed by Shambaugh (2004).[16] To assess the role of economic development, we split the sample between countries with high ($35K per year, measured in 2010 USD), middle (between $7K and $35K), and low (below $7K) average per capita income. To assess the role of financial institutions, we use the Djankov et al.'s (2007) measure of creditor rights, which ranges between 0 (lowest) and 4 (highest), and split the sample into countries that exhibit on average a high (an average score above 2), medium (an average score of 2), or low (an average score below 2) score on this index. To assess the role of economic and political institutions we use the ICRG (2013) scores of economic and political risk, which range from 0 to 50 (lowest economic risk) and 100 (lowest political risk), respectively. For each type of risk, we split the sample in three sub-samples of countries, with high (score above 40 or 80, respectively), medium or low (score below 35 or 65, respectively) institutional quality.[17]

growth rate of loans of $0.009 * \left(\frac{A_t}{L_{t-1}}\right) = 0.009 * 2.2 = 0.02$. Then, because exposed banks exhibit - for a given loans to asset ratio - a 5 percentage points lower growth rate of assets during default, they experience a 2+5=7 percentage points lower growth rate of loans. These estimates line up well with our regression results in Table AVI where the dependent variable is the percent change in lending. From column (1) of Table AVI, we find that in default years total lending of banks holding average bonds grows by 5.5 percentage points less than that of banks with no bonds.

[16] In our defaulting countries the exchange rate regime is stable in the years before, during and after default.

[17] These subsamples were designed to have a roughly equal number of observations in the middle and bottom group. The top category of developed economies is the largest group, as it contains between 60% and 66% of all observations. These countries are in a separate category because there is virtually no default there. Two exceptions are Kenya and Nigeria in the creditor rights split: they both default and attain a maximum score of 4. On the other hand, the medium and low sub-samples in which most sovereign defaults occur roughly correspond to middle income versus poor countries. These two groups have similar numbers of bank-year observations.

Table VI below reports, for each policy or institutional variable, the coefficient γ_3 of the default-bondholdings interaction estimated within each of the three groups of countries. Once again, these exercises cannot provide causal identification but offer stylized facts that quantitative theories may seek to target.

[Table VI here]

The association between post-default decline in lending and bank bondholdings appears to be stronger in countries that have pegged exchange rates relative to countries that have a soft peg or no peg at all. Regarding economic, financial, and political variables, this association also tends to be stronger in countries with medium (as opposed to low) economic and institutional development, as measured through all our indicators except for creditor rights (where the difference between groups is not significant). This is consistent with the notion that in these middle-income countries financial intermediation may play a larger economic role, making these countries more vulnerable to disruption by sovereign crises, consistent with the mechanism explored in Gennaioli, Martin and Rossi (2014).

To conclude, we wish to note that our findings on the association between bank lending and bondholdings could be due to both the bonds bought by a bank well before a sovereign default and those potentially bought in the run-up to the crisis and during the crisis itself. The latter "risk-taking during the crisis" mechanism has been emphasized during the recent European crisis. To assess this possibility, we run modified versions of Equation (3), in which we replace our measure of a bank's bondholdings $B_{i,c,t-1}$ with alternative measures that reflect the bonds held by the bank in normal times, before default occurs.

We first run a cross sectional version of Equation (3) in which we regress the change in a bank's loans to assets ratio occurring during the first two years of default on its bondholdings in the year *before* default. The regression includes country and year dummies. Estimation results are reported in column (1) of Table VII. Bonds held in the year before default have a negative association with changes in lending during the first two years of the default episode. The point estimate is slightly more than twice as large as the one obtained in Table IV, so that – on a per-year basis – the result is close to the upper bound of our previous estimates.

[Table VII here]

One concern with the specification of column (1) is that a bank's holdings of sovereign bonds in the year prior to default may already reflect an increase in sovereign risk. This seems unlikely, given that – as shown by Figure 2 – bond returns spike in close proximity to the moment of default. In any event, column (2) addresses this concern by using a more conservative proxy of normal-times bonds: the average holdings in the three years prior to the onset of default. The previous results are confirmed.[18]

In sum, there is a strong and negative correlation between a bank's bondholdings at the time of default and its subsequent lending. Although this evidence is strongly consistent with the supply channel, it falls short of perfectly identifying it. First, although we control for all aggregate shocks, our bank-level data does not allow us to control for all heterogeneity among banks in reaction to these shocks. A recent literature relies on natural experiments and on matched bank-

[18] As these tests require consecutive bank data for a five-year window around a default, they effectively focus on large banks in large defaulting countries such as for example Argentina, Greece, and Ecuador.

firm-loan level data to precisely identify supply effects, although often at the cost of focusing on a single (emerging) country.[19] The fact that our results are very robust to accounting for all observable bank characteristics, however, is reassuring. Second, we saw that the BANKSCOPE data does not allow us to measure banks' domestic exposure in a precise manner. Our analysis of Section 2.2, however, indicates that the BANKSCOPE measure is a very good proxy for cross-bank variation in domestic exposure, at least for two recent and important episodes of heightened sovereign risk (the EU during 2010-2012, and Argentina 1997-2004). Often, moreover, home bias tends to increase in times of crisis, in which case our bondholdings measure – and its association with lending, which is the main object of this section – should be most accurate precisely during default episodes.[20]

But what determines a bank's bondholdings in the first place? This question speaks to: (i) the origins of the "dangerous embrace" of banks and governments, and to; (ii) the endogeneity of bondholdings to bank characteristics and country shocks. We now address this question.

3.2. Determinants of Banks' Bondholdings

Let $B_{i,c,t}$ denote the ratio of government bonds over assets held in year t, by bank i located in country c. We think of $B_{i,c,t}$ as being chosen by bank *i* at $t-1$ and, to study its determinants, we run the following regression:[21]

[19] See, e.g., Khwaja and Mian (2008) on Pakistan, Paravisini (2008) on Argentina, Schnabl (2012) on Peru, Jimenez, Ongena, Peydro, and Saurina (2012) on Spain, Amiti and Weinstein (2012) on Japan, Paravisini, Rappoport, Schnabl, and Wolfenzon (2014) on Peru, Iyer, Lopes, Peydro and Schoar (2014) on Portugal.

[20] For evidence of increases in home bias during crises, see Broner, Didier, Erce, and Schmukler (2013).

[21] The use of lagged independent variables is preferable to the use of contemporaneous ones for two reasons. First, bank-level explanatory variables are determined jointly with bondholdings within each year. As a result, a contemporaneous formulation of Equation (1) would suffer from severe endogeneity problems. Second, the bank

$$B_{i,c,t} = \alpha_0 + \alpha_1 \cdot X_{i,c,t-1} + \alpha_2 \cdot X_{c,t-1} + \alpha_3 \cdot Def_{c,t-1} + \alpha_4 \cdot Def_{c,t-1} \cdot X_{i,c,t-1} +$$

$$+\alpha_5 \cdot Def_{c,t-1} \cdot X_{c,t-1} + \epsilon_{i,c,t}, \quad (4)$$

where $Def_{c,t-1}$ is our default dummy. We estimate (4) in specifications that include country dummies, time dummies, and their interaction. Standard errors are clustered at the bank level.

Vector $X_{i,c,t-1}$ includes bank characteristics that may affect the demand for bonds, such as loans outstanding (which proxies for a bank's investment opportunities), non-cash assets, exposure to central bank, interbank balances, profitability, size, and whether or not the bank is owned by the government. Lagged bondholdings are also included to control for persistence. Vector $X_{c,t-1}$ includes country-level factors such as financial development (as measured by Private Credit to GDP and banking crises), GDP growth, inflation, and exchange rate depreciation. We also control for the expected return of domestic bonds $R^e_{c,t}$, which captures the expectation (at time $t-1$) of the time-t return of government bonds of country c. As explained in Section 2, we fit this variable by using GMM to regress realized returns on country-specific risk factors.

Coefficients α_1 and α_2, respectively, capture the effect of bank- and country-factors on a bank's holdings of government bonds outside of default episodes (i.e., in "normal times"). Coefficients α_3, α_4 and α_5 capture the change in the demand for bonds during default episodes, allowing such change to be heterogeneous across banks and countries. Equation (4) allows us to test whether bondholdings behave differently in years of default relative to all other years. If $\alpha_3 > 0$, for instance, all banks tend to increase their bondholdings during default events.

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does not observe the aggregate final state of the economy at t until the end of period t itself. As a result, the forecast of macro variables performed by the bank will depend on the state of the economy at time $t-1$.

Table VIII reports the estimates of different specifications of Equation (4). Column (1) includes only time dummies. The demand for bonds in normal times exhibits two features. First, it is decreasing in outstanding loans, presumably because banks with more investment opportunities do not need to store their funds in public bonds. Second, bondholdings are also lower in more financially-developed countries (i.e. those sustaining a high Private Credit/GDP ratio and not experiencing a banking crisis). This is consistent with the view that, in economies with low financial development, banks demand public bonds as stores of liquidity. Finally, larger banks seem to hold more bonds in normal times, but this result is not robust across specifications.

Consider next how the patterns of bondholdings change during default events. This is captured by the coefficients of the default dummy, both alone and interacted with bank and country characteristics. The default dummy is insignificant, and it is bank- and country-characteristics that determine which banks purchase bonds during crises. The interaction between bank size and the default dummy suggests that large banks disproportionally accumulate government bonds during default. In fact, it is the concentration of bonds into large banks that accounts for the slight increase in bondholdings that is observed in our sample during defaults. Finally, the increase in bonds during default years is more pronounced in countries with more developed financial sector, as proxied by a high Private Credit/GDP ratio.

[Table VIII here]

These estimates may be contaminated by country level omitted factors, such as the supply of government bonds by the local government.[22] In Column (2) we thus introduce country dummies. We also include expected returns, which is an interesting variable to consider even though it reduces our sample size. Our main findings on the demand for bonds during sovereign default are confirmed.[23] The fact that banks with fewer outstanding loans do not increase their bondholdings during default years suggests that, at these times, public bonds do not end up being concentrated in "bad" banks, which further reinforces the supply hypothesis.

Finally, Column (3) includes in our regression the interaction between country and time dummies to control for any country-specific shock. The main findings remain robust.

Overall, this section indicates that banks demand a sizeable amount of government bonds in normal times, particularly banks that have few investment opportunities and that operate in less financially developed countries. These results lend support to theories in which government bonds are held by banks in the regular course of their business activity, perhaps because they are good stores of value (e.g., Gennaioli et al. (2014)) or because they can be used as collateral in repo agreements (e.g., Bolton and Jeanne (2011)).

In line with recent work on Europe, banks in our sample also appear to accumulate some bonds during sovereign defaults. In our data, though, this effect is quite small (about 3% of banks'

[22] It could be, for instance, that governments in poorer and less financially-developed countries have higher debt levels for reasons that have nothing to do with the demand of bonds by banks. The inclusion of country dummies and country*time dummies allows us to mitigate these and other omitted variables concerns.

[23] Higher financial development is now positively correlated with bondholdings because, after controlling for country dummies, this variable now captures country-specific credit booms. In Column (2) expected bond returns are negatively correlated with bondholdings, suggesting that bondholdings during normal times tend to be higher when bonds are safest. The opposite is true during default events. Caution however is needed in interpreting this result, because it does not control for all country-level shocks.

assets on average) and it occurs mostly in large banks, which happen to be more profitable. Thus, our data do not support the notion that "bad" banks self-select themselves into buying bonds, as it seems to have been the case in the recent European crisis.[24]

The caveat here is that our data does not precisely measure holdings of domestic bonds. Hence, the increase in bondholdings during default years need not reflect greater domestic exposure. It is possible that, at such times, banks are actually purchasing foreign bonds. As we saw in Section 2.2, however, our data are quite informative about cross-bank variation in exposure to domestic government bonds. In this sense, although imperfect, our findings are likely to provide an accurate description of banks' heterogenous exposures to their government.

4 Concluding Remarks

We use a large bank-level sample containing 20 default episodes in 17 countries between 1998 and 2012 to document two robust facts. First, there is a strong negative correlation between a bank's holdings of government bonds and its lending during sovereign defaults. Second, bondholdings are large during normal times, particularly for banks that make fewer loans and are located in financially undeveloped countries.

Our findings are consistent with theories of imperfect creditor discrimination (e.g. Broner et al. (2010)) and in particular with theories in which sovereign defaults damage domestic banks (Gennaioli et al. (2014)). They indicate, moreover, that the sovereign default-banking crisis nexus

[24] See Acharya and Steffen (2014) and Brutti and Saure (2013) for evidence in this regard.

is a feature of many countries around the world. Standard theories, in which the costs of default are only external, are thus bound to understate governments' incentives to repay their debts.

Despite these similarities, our results also point to important differences between emerging and developed economies. The post-default decrease in bank lending appears to be stronger in countries with middle (as opposed to low) levels of economic and financial development, where financial intermediation plays an important role. There is little we can say about highly developed economies, since they simply do not default often enough in our sample.

But a more general comparison between more- and less-developed economies shows that banks in emerging economies hold a large amount of bonds in normal times (12.7% of assets in non-OECD countries). It is only natural to expect that these "normal-times" holdings should account for the bulk of the adverse effects of sovereign defaults on bank lending. In developed economies, by contrast, banks hold fewer bonds in normal times (5% of assets in OECD countries) and their take-up of bonds during crises is more important in relative terms. This difference may have significant implications for bank regulation. When setting the risk-weights of government bonds, for instance, authorities should take into account that they can be an important part of banks' portfolios in normal times. More generally, regulatory efforts to curb banks' holdings of public bonds may impose sizeable costs without adding much in terms of improved incentives, particularly in countries where banks rely heavily on the liquidity services of public debt.

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Table I – Bank's Holdings of Government Bonds from BANKSCOPE and Other Sources

The table reports summary statistics of bank bondholdings as a percentage of total assets for selected samples.

Sample	EU Banks		GIIPS Banks		Argentine Banks	
Source	BANKSCOPE	Stress Test	BANKSCOPE	Stress Test	BANKSCOPE	Central Bank
Mean	8.16	5.12	9.43	6.22	14.23	11.34
Median	7.68	4.44	8.22	5.64	10.73	8.09
Correlation	0.69		0.76		0.77	
Sample Period	2010-2012		2010-2012		1997-2004	
No Obs.	126		65		589	
No Banks	66		33		142	

Table II – Descriptive Statistics

The table reports summary statistics of the main variables. Panel A reports summary statistics of the banks' holdings of government bonds, computed as a percentage of total assets. *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level. Panel B reports statistics on the BANKSCOPE universe and Panel C on banks involved in the EU stress test of 2010. Assets is the total book value in million $ of the assets side of the bank's balance sheet; non-cash assets is total assets minus cash and due from banks, divided by total assets; leverage is one minus book value of equity (issued share capital plus other shareholders fund) divided by total assets; loans is total loans outstanding divided by total assets; profitability is operating income divided by total assets; exposure to central bank is total exposure to central bank divided by total assets; interbank balances is interest-earning balances with central and other banks divided by total assets; government owned is a dummy that equals one if the government owns more than 50% of the bank's equity. For details on the construction of all variables see Table AI in the Online Appendix.

Panel A – BANKSCOPE, Banks' Holdings of Government Bonds, Full Sample

	Overall	All Countries			Defaulting Countries			Overall		
		Non-Default	Default	Diff.	Non-Default Yrs	Default Yrs	Diff.	OECD	Non-OECD	Diff.
Mean	9.28	9.06	13.77	-4.71***	13.51	14.49	-0.98**	8.43	12.39	-3.96***
Median	5.15	5.02	9.04		9.02	9.15		4.47	8.11	
Std Deviation	11.24	11.03	14.23		13.79	15.35		10.60	12.85	
No Banks	20,337	19,714	623		571	501		16,401	3,976	
No Countries	191	157	34		34	24		34	157	
No Bank-Year Obs.	99,328	94,744	4,584		3,359	1,225		78,118	21,210	

Panel B – BANKSCOPE, Constant-continuing sample

	Mean	Median	Std Deviation	No Countries	No Observations
Bondholdings	6.7	2.8	9.4	160	36,449
Assets ($/M)	9,922.0	725.6	81,400.0	160	36,449
Non-cash assets	95.8	97.6	5.6	160	36,449
Leverage	91.0	93.3	8.4	160	36,449
Loans	57.1	60.0	17.0	160	36,449
Profitability	0.9	0.7	2.1	160	36,449
Exposure to Central Bank	3.3	1.5	4.9	160	36,449
Interbank Balances	12.2	9.2	12.5	160	36,449
Government Owned	2.5	0.0	15.7	160	36,449

Panel C – EU banks involved in the EU stress test 2010

	Mean	Median	Std Deviation	No Countries	No Observations
Assets ($/M)	394,000.0	130,000.0	618,000.0	18	79
Non-cash assets	97.6	98.3	1.9	18	79
Leverage	93.3	93.8	4.2	18	79
Loans	64.8	67.2	13.9	18	79
Profitability	-0.1	0.3	1.9	18	79
Exposure to Central Bank	1.7	1.0	1.9	11	40
Interbank Balances	5.9	4.7	4.7	18	79
Government Owned	0.0	0.0	0.1	18	79

Table III – Bondholdings, Sovereign Default, and Changes in Loans

The table presents coefficient estimates from pooled OLS regressions. The dependent variable changes in loans is computed as loans outstanding divided by total assets in year t minus loans outstanding divided by total assets in year t-1. The main independent variables are bank bondholdings, computed as bondholdings divided by total assets, and an indicator for sovereign default. Standard errors (in parentheses below the coefficient estimates) are adjusted for heteroscedasticity using the Huber (1967) and White (1980) correction, as well as clustering at the bank level using the Huber (1967) correction. *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

	(1)	(2)	(3)	(4)	(5)
Bank Bondholdings$_{i,c,t-1}$ *	-0.100***	-0.098***	-0.085***	-0.116***	-0.133***
Sovereign Default$_{c,t-1}$	(0.031)	(0.031)	(0.029)	(0.035)	(0.045)
Bank Bondholdings$_{i,c,t-1}$	0.038***	0.037***	0.023***	0.015**	0.018**
	(0.005)	(0.005)	(0.007)	(0.007)	(0.008)
Sovereign Default$_{c,t-1}$	0.061***	0.061***	0.063***		
	(0.015)	(0.015)	(0.015)		
Loans$_{i,c,t-1}$ *	-0.117***	-0.117***	-0.139***	-0.162***	-0.189***
Sovereign Default$_{c,t-1}$	(0.026)	(0.026)	(0.027)	(0.032)	(0.041)
Loans$_{i,c,t-1}$	-0.047***	-0.048***	-0.057***	-0.052***	-0.049***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Bank Size$_{i,c,t-1}$ *					-0.001
Sovereign Default$_{c,t-1}$					(0.003)
Non-cash assets$_{i,c,t-1}$ *					0.030
Sovereign Default$_{c,t-1}$					(0.107)
Leverage$_{i,c,t-1}$ *					0.028
Sovereign Default$_{c,t-1}$					(0.048)
Profitability$_{i,c,t-1}$ *					-0.087
Sovereign Default$_{c,t-1}$					(0.099)
Exposure to Central Bank$_{i,c,t-1}$ *					-0.155
Sovereign Default$_{c,t-1}$					(0.095)
Interbank Balances$_{i,c,t-1}$ *					-0.009
Sovereign Default$_{c,t-1}$					(0.053)
Government Owned$_{i,c,t-1}$ *					-0.008
Sovereign Default$_{c,t-1}$					(0.017)
Bank Size$_{i,c,t-1}$					0.001***
					(0.000)
Non-cash assets$_{i,c,t-1}$					-0.021
					(0.016)
Leverage$_{i,c,t-1}$					-0.003
					(0.009)
Profitability$_{i,c,t-1}$					-0.087**
					(0.042)
Exposure to Central Bank$_{i,c,t-1}$					0.047***
					(0.016)
Interbank Balances$_{i,c,t-1}$					0.004
					(0.005)
Government Owned$_{i,c,t-1}$					-0.001
					(0.003)
Year Dummies?	No	Yes	Yes	Yes	Yes
Country Dummies?	No	No	Yes	Yes	Yes
Country x Year Dummies?	No	No	No	Yes	Yes
Constant	0.025***	0.025***	0.022	-0.080	-0.078
	(0.002)	(0.003)	(0.010)	(.)	(177.873)
No Observations	27,408	27,408	27,408	27,408	27,408
No Banks	5,218	5,218	5,218	5,218	5,218
No Countries	158	158	158	158	158
R-squared	0.037	0.042	0.081	0.221	0.224

Table IV – Bondholdings, Country Shocks, and Changes in Loans

The table presents coefficient estimates from pooled OLS regressions. The dependent variable changes in loans is computed as loans outstanding in year t minus loans outstanding in year t-1, divided by total assets. The main independent variables are bank bondholdings, computed as bondholdings divided by total assets, an indicator for sovereign default, GDP annual percent growth, and exchange rate devaluation, computed as percent change in the exchange rate with the US dollar. Standard errors (in parentheses below the coefficient estimates) are adjusted for heteroscedasticity using the Huber (1967) and White (1980) correction, as well as for clustering at the bank level using the Huber (1967) correction. *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

	(1)	(2)	(3)	(4)
Bank Bondholdings$_{t-1}$ *	-0.144**	-0.117**	-0.131*	-0.107*
Sovereign Default$_{t-1}$	(0.062)	(0.047)	(0.068)	(0.064)
Bank Bondholdings$_{t-1}$ *	0.156	0.285**		
GDP Growth$_{t-1}$	(0.140)	(0.137)		
Bank Bondholdings$_{t-1}$ *			-0.027	-0.025
Exchange Rate Devaluation$_{t-1}$			(0.040)	(0.039)
Sovereign Bond Return *	0.091		-0.010	
Sovereign Default$_{t-1}$	(0.077)		(0.059)	
Bank Bondholdings$_{t-1}$	0.001	0.003	0.008	0.013
	(0.012)	(0.009)	(0.011)	(0.008)
Bank-Level Controls and Interactions with Sovereign Default?	Yes	Yes	Yes	Yes
Bank-Level Controls and Interactions with GDP Growth?	Yes	Yes		
Bank-Level Controls and Interactions with Exchange Rate Devaluation?			Yes	Yes
Year Dummies?	Yes	Yes	Yes	Yes
Country Dummies?	Yes	Yes	Yes	Yes
Country * Year Dummies?	Yes	Yes	Yes	Yes
Constant	0.229	-0.040	-0.118	0.141
	(0.147)	(3.715)	(0.087)	(130.540)
No Observations	13,873	26,467	13,908	24,982
No Banks	3,649	4,967	3,646	4,645
No Countries	56	129	54	97
R-squared	0.205	0.214	0.205	0.204

Table V – Bondholdings, Sovereign Default, and Changes in Loans: Robustness Tests

The table presents coefficient estimates from pooled OLS regressions. The dependent variable changes in loans is computed as loans outstanding in year t minus loans outstanding in year t-1, divided by total assets. The main independent variables are bank average non-default years bondholdings, computed as the average of bank bondholdings in all the non-default years prior to and including year *t–1* , bank time-varying bondholdings, computed as bank bondholdings minus bank average non-default years bondholdings. Largest defaults are Argentina's, Russia's Ukraine's and Greece's. Standard errors (in parentheses below the coefficient estimates) are adjusted for heteroscedasticity using the Huber (1967) and White (1980) correction, as well as for clustering at the bank level using the Huber (1967) correction. *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

	Exclude government owned banks		Largest defaults only		No defaults with <5 banks		No defaults with <10 banks		No defaults with <15 banks		Haircut measure of default		Spread or Default measure of default	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Bank Bondholdings$_{t-1}$ *	-0.101*	-0.128***	-0.195***	-0.231***	-0.096*	-0.132***	-0.150***	-0.160***	-0.150***	-0.179***	-0.242***	-0.256***	-0.129**	-0.156***
Sovereign Default$_{t-1}$	(0.058)	(0.047)	(0.060)	(0.060)	(0.058)	(0.046)	(0.057)	(0.046)	(0.057)	(0.047)	(0.081)	(0.067)	(0.052)	(0.054)
Sovereign Bond Return$_{t-1}$ *	0.075***		0.062***		0.071***		0.046***		0.045***		0.130***		0.062***	
Sovereign Default$_{t-1}$	(0.016)		(0.015)		(0.015)		(0.014)		(0.014)		(0.026)		(0.015)	
Sovereign Default$_{t-1}$	-0.021		0.002		-0.007		0.023		0.023		-0.044		-0.006	
	(0.023)		(0.032)		(0.031)		(0.035)		(0.035)		(0.265)		(0.131)	
Sovereign Bond Return$_{t-1}$	0.003		0.008		0.003		0.016**		0.017**		0.001		0.007	
	(0.007)		(0.008)		(0.007)		(0.007)		(0.007)		(0.007)		(0.007)	
Bank-Level Controls and Interactions?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country x Year Dummies?		Yes		Yes		Yes		Yes		Yes		Yes		Yes
Constant	-0.006	-0.032	-0.031	-0.109***	-0.025	0.040	-0.066**	0.089*	-0.056**	-0.154***	-0.035	-0.081	-0.024	0.191***
	(0.021)	(101.8)	(0.022)	(0.040)	(0.021)	(0.057)	(0.027)	(0.054)	(0.027)	(0.017)	(0.029)	(106.077)	(.)	(0.020)
No Observations	13,726	26,570	13,415	26,059	14,035	27,218	13,624	26,786	13,494	26,576	17,923	31,431	17,296	30,076
No Banks	3,634	5,049	3,388	4,729	3,532	4,923	3,445	4,835	3,396	4,784	5,343	6,768	5,396	6,770
No Countries	60	158	55	147	58	151	55	148	54	147	61	160	56	160
R-squared	0.106	0.225	0.119	0.226	0.105	0.220	0.119	0.222	0.119	0.221	0.110	0.216	0.119	0.218

Table VI – Bondholdings, Sovereign Default, and Changes in Loans: Cross-Country Variation

The table presents coefficient estimates of the main independent variable from pooled OLS regressions. The dependent variable changes in loans is computed as loans outstanding divided by total assets in year t minus loans outstanding divided by total assets in year t-1. The main independent variables are bank bondholdings, computed as bondholdings divided by total assets, and an indicator for sovereign default. The other independent variable are loans divided by assets, and the interaction of sovereign default and loans. Regression specifications include also year and country fixed effects. Standard errors (in parentheses below the coefficient estimates) are adjusted for heteroscedasticity using the Huber (1967) and White (1980) correction, as well as for clustering at the bank level using the Huber (1967) correction. *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level. N/A indicates no default observations for the corresponding group of countries. Exchange rate policy data use the Shambaugh (2004) definitions of peg and soft peg. GDP per capita is obtained from the World Development Indicator; High corresponds to an average annual income above $35K (measured in 2010 USD), Medium to an average annual income between $7K and $35K, and Low to an average annual income below $7K. Creditor Rights is the score of Djankov et al (2007), where High is a score above 2, Medium is a score of 2, and Low is a score below 2. Economic Institutions is the economic score from ICRG (2013): High is a score above 40, Medium is a score between 35 and 40, Low is a score below 35. Political Institutions is the political score from ICRG (2013): High is a score above 80, Medium is a score between 65 and 80, Low is a score below 65.

	Exchange Rate Policy	
Peg	Soft Peg	No Peg
-0.230**	-0.085**	-0.085*
(0.106)	(0.040)	(0.049)
	GDP per capita	
High	Medium	Low
N/A	-0.190***	-0.042
	(0.054)	(0.029)
	Creditor Rights	
High	Medium	Low
-0.072**	-0.169***	-0.159***
(0.033)	(0.065)	(0.052)
	Economic Institutions	
High	Medium	Low
N/A	-0.129**	-0.043
	(0.060)	(0.030)
	Political Institutions	
High	Medium	Low
N/A	-0.122**	-0.059*
	(0.056)	(0.031)

Table VII – Bondholdings and Changes in Loans: Normal Times v Default Years Bonds

The table presents coefficient estimates from pooled OLS regressions. The dependent variable changes in loans is computed as loans outstanding in year t minus loans outstanding in year t-1, divided by total assets. The main independent variables are pre-default bank bondholdings, computed as bondholdings in the year prior to the first year of a sovereign default, divided by total assets; average pre-default bank bondholdings, computed as the average of bondholdings divided by total assets in the last three years prior to the first year of a sovereign default. Standard errors (in parentheses below the coefficient estimates) are adjusted for heteroscedasticity using the Huber (1967) and White (1980) correction, as well as for clustering at the bank level using the Huber (1967) correction. *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

	(1)	(2)
Pre-Default Bank Bondholdings	-0.281***	
	(0.080)	
Avg Pre-Default Bank Bondholdings		-0.361***
		(0.028)
Bank-Level Controls and Interactions?	Yes	Yes
Year Dummies?	Yes	Yes
Country Dummies?	Yes	Yes
Country x Year Dummies?		
Constant	0.780**	0.874**
	(0.275)	(0.272)
No Observations	105	105
No Banks	105	105
No Countries	5	5
R-squared	0.439	0.442

Table VIII – Banks' Demand for Government Bonds

The table presents coefficient estimates from pooled OLS regressions. The dependent variable is bank bondholdings, and it is computed as bondholdings divided by total assets. Size is the natural logarithm of total assets; non-cash assets is total assets minus cash and due from banks, divided by total assets; leverage is one minus book value of equity (issued share capital plus other shareholders fund) divided by total assets; loans is total loans outstanding divided by total assets; profitability is operating income divided by total assets; exposure to central bank is total exposure to central bank divided by total assets; interbank balances is interest-earning balances with central and other banks divided by total assets; government owned is a dummy that equals one if the government owns more than 50% of the bank's equity. Sovereign default is a binary variable that equals 1 if the sovereign is in default in year t-1 and 0 otherwise; GDP growth is natural logarithm of GDP in year t minus natural logarithm of GDP in year t-1; aggregate leverage is the country-year average of bank leverage; banking crisis is a binary variable that equals 1 if the country is in a banking crisis in year t-1 and 0 otherwise; private credit is the ratio of credit from deposit taking financial institutions to the private sector to GDP, expressed as a percentage; exchange rate devaluation is the percent change in the exchange rate with the US dollar. Standard errors (in parentheses below the coefficient estimates) are adjusted for heteroscedasticity using the Huber (1967) and White (1980) correction, as well as for clustering at the bank level using the Huber (1967) correction. *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

	(1)	(2)	(3)
Sovereign Default$_{t-1}$*	0.009***	0.011***	0.007***
Size$_{t-1}$	(0.003)	(0.003)	(0.003)
Sovereign Default$_{t-1}$*	-0.013	-0.042	-0.041
Loans$_{t-1}$	(0.032)	(0.037)	(0.029)
Sovereign Default$_{t-1}$ *		0.107***	
Expected Sovereign Bond Return$_{t-1}$		(0.029)	
Sovereign Default$_{t-1}$ *	0.027	1.758***	
GDP Growth$_{t-1}$	(0.170)	(0.432)	
Sovereign Default$_{t-1}$ *	0.035*	0.172***	
Banking Crisis$_{t-1}$	(0.021)	(0.045)	
Sovereign Default$_{t-1}$ *	0.448*	2.048***	
Private Credit$_{t-1}$	(0.230)	(0.438)	
Sovereign Default$_{t-1}$	-0.123	-1.501***	-0.091*
	(0.158)	(0.344)	(0.055)
Size$_{t-1}$	0.001***	0.001	0.000
	(0.000)	(0.000)	(0.000)
Loans$_{t-1}$	-0.027***	-0.047***	-0.041***
	(0.004)	(0.007)	(0.004)
Expected Sovereign Bond Return$_{t-1}$		-0.027***	
		(0.008)	
GDP Growth$_{t-1}$	-0.164**	-0.134	
	(0.066)	(0.096)	
Banking Crisis$_{t-1}$	0.030***	0.022	
	(0.005)	(0.019)	
Private Credit$_{t-1}$	-0.021***	0.038**	
	(0.004)	(0.018)	
Other controls?	Yes	Yes	Yes
Year Dummies?	Yes	Yes	Yes
Country Dummies?		Yes	Yes
Country x Year Dummies?			Yes
No Observations	13,082	5,341	26,549
No Banks	2,896	2,103	5,124
No Countries	38	29	157
R-squared	0.801	0.739	0.814

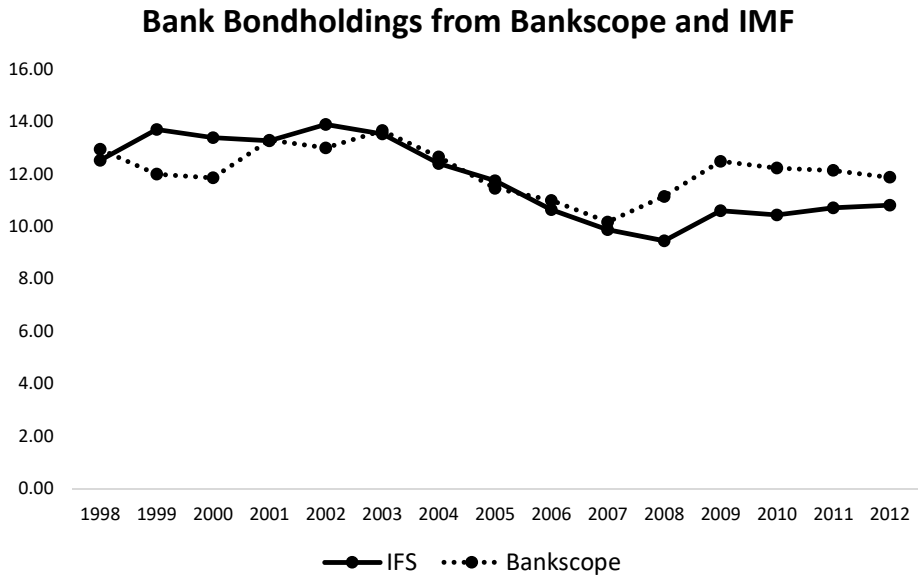

Figure 1. Bank Bondholdings from BANKSCOPE and IMF. The figure plots bank bondholdings over 1998-2012 for all country-years covered by both BANKSCOPE and the IMF.

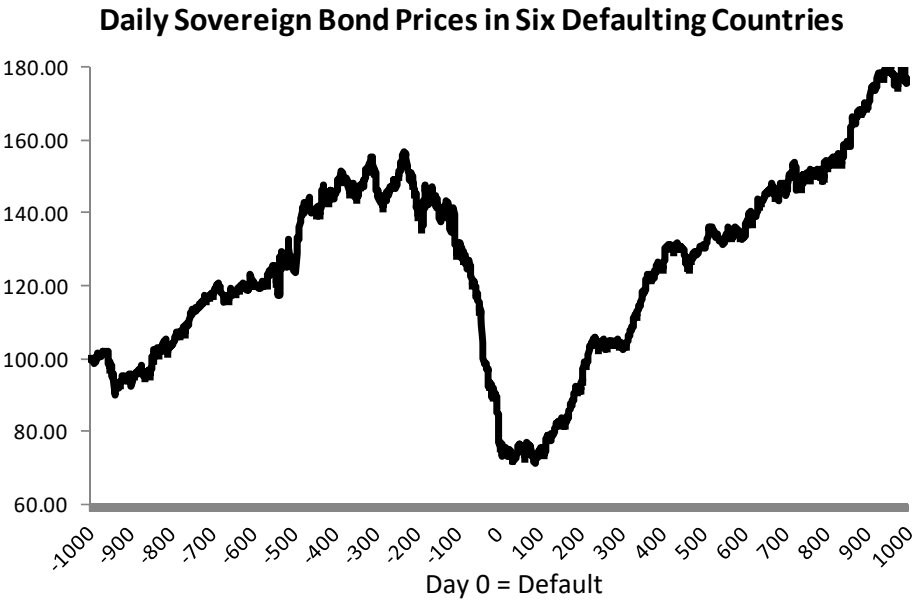

Figure 2. Sovereign Bond Prices in Defaulting Countries. The figure plots the average bond prices over 7 default episodes in 6 countries (Argentina 2001-2004, Russia 1998-2000, Cote d'Ivoire 2000-2004, Ecuador 1998-2000, Ecuador 2009, Nigeria 2002, Greece 2012), from day -1,000 to +1,000, whereby day 0 is the day in which default is announced.

Online Appendix

This Online Appendix presents the details of a number of analyses and robustness tests that are referred to in the main paper. Section A1 analyses the implication of measuring bonds at book value, as it is done by our data source BANKSCOPE, as opposed to market value. Section A2 reports additional statistical analyses and robustness tests.

A.1 Book Value v. Market Value Measures of Bonds

As we pointed out, BANKSCOPE measures bondholdings at book value. It is important to discuss the effects that this may have on our empirical exercise. First, book values are critical for regulation and for bank operations and they are likely to be important determinants of bank lending. As a result, they are highly relevant for their own sake. Second, book value data is arguably better than market value data for analyzing the relationship between bondholdings and lending. Using market value data, it would be impossible to tell whether the negative correlation between bondholdings and bank lending is due to changes in the relative price of government bonds and loans or whether it actually reflects a decline in lending. It is true, though, that market values provide a more accurate economic measure of a bank's true exposure to government defaults. Insofar as we wish to assess the role of such exposure (rather than the role of book values per se), it is important to understand under what specific circumstances book values can be viewed as providing a good proxy for market values.

In normal times, away from default episodes, the price of bonds is fairly stable. As a result, book and market value measures during these times are likely to be similar to one another, both providing an accurate description of a bank's exposure to government default. This is important. It suggests that our measures of bonds purchased outside of crises are not significantly contaminated by fluctuations in the market value of bonds. In Section 3.3 we show that our coefficient estimates are very robust when we restrict our analysis to the bonds that banks bought well before sovereign crises. This indicates that our results are not due to the discrepancy between the market and book value of bonds.

Around default episodes, book and market values can in principle be far apart, because in these periods the prices of government bonds and of other assets in the bank´s balance sheet vary substantially. Here book value measurement may over- or under-state the exposure of banks relative to market value measurement. In particular, the book value of bonds will tend to overstate the market value of bonds if during crises bond prices drop more than the price of other bank assets. Book values will instead understate market values if the reverse is true.

To see this formally, let q_t and p_t respectively denote the average market price of bonds and the average market price of all bank assets in year t. Suppose that time t is the time at which sovereign default risk materializes. Until time $t-1$, the economy is instead assumed to be in tranquil times. Then, the book value measure of bonds at t is $BV_t = \frac{q_{t-1}b_{t-1}+q_t\Delta b}{p_{t-1}a_{t-1}+p_t\Delta a}$. In this expression, b_{t-1} and a_{t-1} denote the quantities of bonds and bank assets in year $t-1$, while Δb and Δa are the quantity changes between years $t-1$ and t.[25] The bank's true risk exposure at t, measured using market values, is instead equal to

[25] Note that, precisely because until $t-1$ we are in tranquil times, we can safely assume that the average book values of bonds and other banks assets at $t-1$ are equal to the market prices q_{t-1} and p_{t-1} of these assets at $t-1$. In general terms, the average book value of assets is a weighted average of past market prices.

$MV_t = \frac{q_t(b_{t-1}+\Delta b)}{p_t(a_{t-1}+\Delta a)}$. Under market value accounting, all assets are evaluated using current market prices. After some algebra, one can find that the two measures are linked as follows:

$$MV_t = BV_t\left[\left(\frac{p_{t-1}-p_t}{a_{t-1}+\Delta a}\right)\frac{a_{t-1}}{p_t}+1\right]-\left(\frac{q_{t-1}-q_t}{a_{t-1}+\Delta a}\right)\frac{b_{t-1}}{p_t}.$$

Inspection of this equation allows us to formally derive our previous claims. First, if the price of bonds and assets is fairly stable (i.e., $q_{t-1} \approx q_t$ and $p_{t-1} \approx p_t$) the measures of book and market value will tend to be similar. Thus, as we already discussed, in tranquil times the book value measure will provide a good proxy of its market value counterpart. Second, whether the book market measure over- or under-estimates the market value measure during default episodes depends crucially on the fluctuation in the price of bonds relative to that of other assets held by banks. This allows us to compute an empirically implementable measure of the discrepancy between the book and the market value of bonds. To obtain such measure, note that if a bank's book and market values of bondholdings roughly coincide during normal times, i.e., $BV_{t-1} \approx MV_{t-1}$, and there is a sovereign default in period *t*, the book value of bonds over-estimates their market value ($BV_t > MV_t$) if and only if:

$$\frac{BV_t}{BV_{t-1}} < \frac{(q_{t-1}-q_t)/q_{t-1}}{(p_{t-1}-p_t)/p_{t-1}}. \quad (2)$$

Thus, book value of bonds over-estimates their market value when the growth of the book value is lower than the drop in bond prices relative to the drop in asset prices. Intuitively, if the drop in the price of government bonds is larger than the drop in the price of other bank assets, there is a tendency for the market value of bonds to drop more than their book value. In this case, equation (2) is likely to hold and book value over-states market value. If instead the drop in bond prices is lower than the drop in the price of other assets, Equation (2) is likely to be violated and book value under-states market value.

To assess the problems of book value measurement during default, we compute the empirical proxy to each side of Equation (2) in our data. For each bank, we use the BANKSCOPE measure of bondholdings to compute the left hand side of the expression for the first year of default. As for the right hand side, we compute the numerator using our bond return index, while we assess the denominator by using the change in the bank's (quasi-) market value of assets, which is the sum of the bank's stock market capitalization and the book value of its liabilities, during the first year of default. Theory tells us that this last measure should in fact depend on the change in the market value of all bank assets. The change in the (quasi-)market value of assets indeed proxies for the change in the market value of all bank assets (reliable data on the change in the market value of liabilities are unavailable for the main default episodes in our sample).[26]

Using this method, we compute empirical proxies for the right and left-hand sides of Equation (2) for a sample of 30 publicly listed banks in Argentina, Greece, Ecuador, and Indonesia in their first year of default. Figure AI plots the difference between the computed LHS and the RHS of Equation (2) for these 30 banks, as a function of their bond-to-assets ratio.

[Figure AI here]

Our quantification reveals two noteworthy aspects. First, according to our calculations, the LHS and RHS of the Equation (2) are fairly close to each other, indicating that the discrepancies between book

[26] While this proxy is imperfect, as market values of debt might fall more than book values in a sovereign default, it is a standard proxy in the corporate finance literature whenever market values of debt are not observed.

and market values are unlikely to be very large. In our sample, the average estimation error is 0.14% of the banks' bonds-to-assets ratio (median 0.62%, standard deviation 2.73%): these are very small numbers. Second, in about two thirds of the cases the above inequality is violated, implying that the book measure of bank bondholdings actually underestimates banks' exposure to government bonds at market value. In the remaining one third of the cases, the opposite is true.[27]

These considerations notwithstanding, we stress once again that – as will be shown in Section 3.3 – the negative correlation between bank bondholdings and lending during sovereign defaults is significant also when we restrict ourselves to average bondholdings held by banks in the years prior to a default. This is important because any discrepancies between book and market values are likely to be small when averaged over many "normal" or non-default years. As a result, as we conclude in Section 3.3, our findings on the relationship between bondholdings and bank lending are unlikely to be spuriously driven by our use of book values.

A.2 Additional Analyses and Robustness Tests

Table AI presents pair-wise correlations among the variables used in the analysis. Table AII lists the default events that we consider in our empirical analysis. Table AIII describes our variables and their sources. Table AIV reports descriptive statistics on realized sovereign bond returns.

Table AV presents results related to the estimation of Equation (1) in the paper, namely, the first stage of our estimation of expected sovereign bond returns, whereby realized sovereign returns are regressed on economic, financial, and political risk scores provided by the ICRG. High ICRG scores signal low risk, and the literature (e.g., Comelli 2012) has shown that they predict low subsequent returns.

The purpose of this exercise is very narrow, as we simply want to determine whether, in our sample, the country risk measures provided by the ICRG constitute valid instruments and can thus be used to construct our proxy of expected government bond returns. Our purpose is not to determine whether future government bond returns are predictable using current information publicly available to investors, which is discussed for example in Comelli (2012) and others. As a result, among other things, we are not concerned about the out-of-sample properties of our instruments.

Table AV present the results of the first stage estimation of sovereign returns. The first three columns present the univariate correlation of annual government bond returns at year t with the economic, political, and financial risk score measured at year t-1, respectively. The correlations are large and strongly statistically significant. A higher score implies less risk, so for example, a 1-percent increase

[27] Figure AII suggests that the inequality is mostly violated – and thus book values understate exposure to sovereign risk – for banks holding low levels of government bonds to begin with. Hence, book values mostly understate the exposure of banks having low levels of government bonds. As a result, dispersion in book values is likely to be larger than dispersion in market values of bondholdings. This suggests that, if anything, the coefficient on bondholdings in our loan regressions is likely to be lower than the one that would arise if loans were to be regressed on the market value of bonds. Importantly, the logic here also applies to the issue of bonds held in the trading or in the banking book of bonds. Indeed, when there is little difference between book value and market value then it is also of little consequence whether the bonds are held in the banking or in the trading book. In any event, as noted by Acharya, Drechsler and Schnabl (2014) in their Table I, EU banks on average hold 85% of them in their *banking book*, not in the trading book. The importance of the banking book is likely even larger in the developing economies, which represent the focus of our analysis and the bulk of defaults in our sample.

in the economic risk score translates into a 0.31% lower government return; and a 1-percent increase in the economic risk score translates into a 0.27% lower government return.

Importantly for our purposes, the F-test in these three columns is very high, around 10 or higher, which suggests that our instruments are unlikely to be weak according to the 'rule-of-thumb' proposed by Stock and Yogo (2005). By comparison, column (4) present the result of regressing government bond returns at t on past returns at t-1. While there is also a negative and significant univariate correlation, the F-test is around 3, indicating that past government bond returns is a likely weak instrument, and as a result we do not use it in our analysis.

Column (5) presents the specification that we use in the empirical analysis as the first stage of Table V, in Columns 3 and 5. We use as instruments the economic score and the political score, and we include time dummies to capture variations in the global riskless interest rate. It turns out that our results in Table V are not sensitive to the choice of any combination of instruments, within the three risk scores of ICRG.

The remainder of the Table shows that in-sample predictability comes from both the cross section and the time series, that is, our coefficients of interest remain strongly significant when adding time dummies and country dummies; and our main specification is also robust to the inclusion of past returns as an additional explanatory variable.

References for Online Appendix

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Stock, James, and Motohiro Yogo, 2005, Testing for Weak Instruments in Linear IV Regression. In: Andrews DWK Identification and Inference for Econometric Models. New York: Cambridge University Press; pp. 80-108.

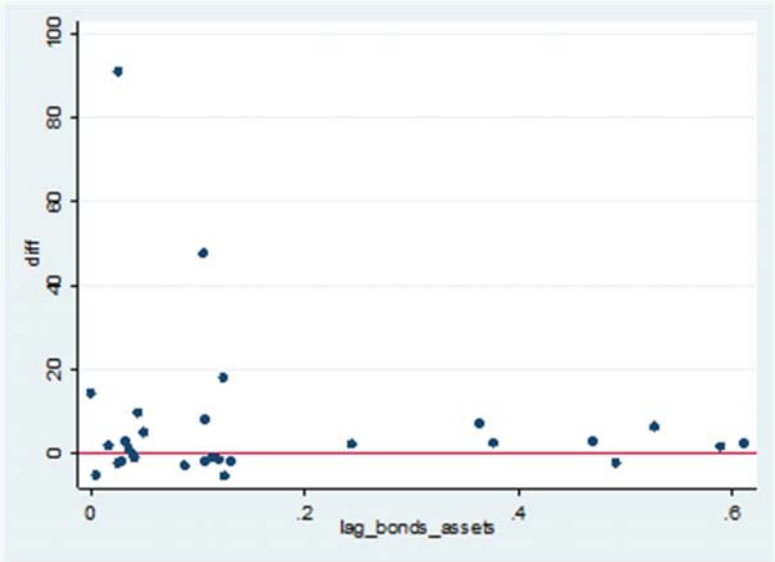

Figure AI. Book Value and Market Value Measurement in Default. The figure plots the empirical proxy for the quantity defined in Equation (2) for 30 banks in five defaulting countries (Argentina 2001-2004, Russia 1998-2000, Ecuador 1998-2000 and 2009, Greece 2012, Indonesia 1998-2000 and 2002). Above the horizontal line at 0 is the region where book value under-estimates the banks' exposure to government bonds at market value. Below the horizontal line at 0 the reverse occurs.

Table AI – Pair-wise Correlations

The table reports pair-wise correlations among the main variables used in the empirical analysis. *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

	Bonds	Bank Size	Non-cashAssets	Leverage	Loans	Profitability	Exposure	Balances
Banks size	-0.063***							
Non-cash assets	-0.835***	0.202***						
Leverage	-0.141***	0.335***	0.207***					
Loans	-0.376***	0.016***	0.202***	0.238***				
Profitability	0.102***	0.059***	-0.071***	-0.286***	-0.100***			
Exposure to Central Bank	0.096***	0.209***	-0.374***	-0.218***	-0.231***	0.140***		
Interbank Balances	-0.136***	-0.087***	0.117***	-0.173***	-0.553***	0.061***	0.367***	
Government Owned	0.082***	0.141***	-0.026***	-0.031***	-0.073***	0.009***	0.027***	0.022***

Table AII – Default Episodes and Bank-Years in Default in our Sample

The table reports episodes of sovereign defaults over 1998-2012 for which we observe bank-level data from BANKSCOPE. A default episode is an uninterrupted sequence of years in default by a country. Default S&P reports the years in which a country is in default according to the definition of sovereign default by Standard & Poor's, which is based on whether an outstanding debt issue is not repaid in full, or is renegotiated with worse terms for the creditors. Haircut is the average creditors' haircuts from the work of Cruces and Trebesch (2013) and Zettelmeyer, Trebesch, and Gulati (2012).Spread or Default considers countries with available data on sovereign spreads and reports the years in which a country is in default according to whether at least once in a given year the spreads of the sovereign bond with the corresponding U.S. or German bonds exceed a given threshold; or it is in default according to the S&P definition.

Country	Default S&P	Haircut	Spread or Default	No Bank-Years in any default	No Bank-Years In S&P Default	No Banks In any default
Argentina	2001-2004	76.8%	2001-2004	231	231	87
Ecuador	1998-2000; 2009	38.3%		8	8	8
Ethiopia	1998-1999	92.0%		2	2	1
Greece	2012	64.8%	2011-2012	12	6	9
Guyana	1998-2004	91.0%		20	20	3
Honduras	1998-2004	82.0%		79	79	21
Ireland			2011	7	0	7
Indonesia	1998-2000; 2002			17	17	13
Jamaica	2010			5	5	5
Kenya	1998-2004	45.7%		160	160	33
Nigeria	2002			41	41	41
Portugal			2011-2012	24	0	15
Russia	1998-2000	51.1%	1998-2000	40	40	31
Serbia	1998-2004	70.9%		2	2	2
Seychelles	2000-2002; 2010	56.2%	2010	1	1	1
Sudan	1998-2004			2	2	1
Tanzania	2004	88.0%		1	1	1
Ukraine	1998-2000	14.8%	1998-2001	17	14	8
Zimbabwe	2000-2004			6	6	3
Total				675	635	290
No Countries	17	12	7			
No Episodes	20	13	7			

Table AIII – Definition of the Variables used in the Analysis

Variable	Definition
Bank-level variables	
Assets	Total book value of assets. Source: BANKSCOPE.
Bondholdings	Total holding of government securities, including treasury bills, bonds and other government securities, divided by total assets. Source: BANKSCOPE.
Size	Natural logarithm of total assets. Source: BANKSCOPE.
Non-cash assets	Total assets minus cash and due from banks, divided by total assets. Source: BANKSCOPE.
Leverage	One minus book value of equity (issued share capital plus other shareholders fund) divided by total assets. Source: BANKSCOPE.
Loans	Total loans outstanding divided by total assets. Source: BANKSCOPE.
Profitability	Operating income divided by total assets. Source: BANKSCOPE.
Exposure to Central Bank	Total exposure to central bank divided by total assets. Source: BANKSCOPE.
Interbank Balances	Interest-earning balances with central and other banks, excluding impairment allowance, but including amounts due under reverse repurchase agreements, divided by total assets. Source: BANKSCOPE.
Government Owned	Dummy variable that equals 1 if the government owns more than 50% of the bank's equity. Source: BANKSCOPE.
Country-level variables	
Sovereign Default	Dummy variable that equals 1 if the sovereign issuer is in default. Sovereign default is defined as the failure to meet a principal or interest payment on the due date (or within the specified grace period) contained in the original terms of the debt issue. In particular, each issuer's debt is considered in default in any of the following circumstances: (i) For local and foreign currency bonds, notes and bills, when either scheduled debt service is not paid on the due date, or an exchange offer of new debt contains terms less favorable than the original issue; (ii) For central bank currency, when notes are converted into new currency of less than equivalent face value; (iii) For bank loans, when either scheduled debt service is not paid on the due date, or a rescheduling of principal and/or interest is agreed to by creditors at less favorable terms than the original loan. Such rescheduling agreements covering short and long term debt are considered defaults even where, for legal or regulatory reasons, creditors deem forced rollover of principal to be voluntary. Source: Standard & Poor's (2008).
Sovereign Bond Return	Index aggregating the realized returns of sovereign bonds of different maturities and denominations in each country. Returns are expressed in dollars. The index takes into account the change in the price of the bonds and it assumes that any cash received from coupons or pay downs is reinvested in the bond. Source: the J.P. Morgan's Emerging Market Bond Index Plus file (EMBIG+) for emerging countries; and the J.P. Morgan's Global Bond Index (GBI) file for developed countries.
GDP Growth	Logarithm of gross domestic product per capita (Atlas method). Source: World Development Indicators.
Exchange Rate Devaluation	Percent change in the exchange rate of the local currency relative to the U.S. Dollar. Source: International Monetary Fund, International Financial Statistics (September 2014).
Aggregate Leverage	Country-year average of bank-level leverage. Source: BANKSCOPE.
Banking Crisis	Dummy variable that equals 1 if the country is experiencing a banking crisis. Banking crisis is defined as a situation in which the net worth of the banking system has been almost or entirely eliminated. Source: Caprio and Klingebiel (2001) and the updated data by Caprio et al. (2005).
Unemployment Growth	Annual percentage change in unemployment. Source: World Development Indicators (September 2008).
Inflation	Annual percentage inflation, GDP deflator. Source: World Development Indicators (September 2008).
Creditor Rights	An index aggregating creditor rights, following La Porta et al. (1998). A score of one is assigned when each of the following rights of secured lenders are defined in laws and regulations: First, there are restrictions, such as creditor consent or minimum dividends, for a debtor to file for reorganization. Second, secured creditors are able to seize their collateral after the reorganization petition is approved, i.e., there is no automatic stay or asset freeze. Third, secured creditors are paid first out of the proceeds of liquidating a bankrupt firm, as opposed to other creditors such as government or workers. Finally, if management does not retain administration of its property pending the resolution of the reorganization. The index ranges from zero (weak creditor rights) to four (strong creditor rights) and is constructed as of January for every year from 1978 to 2003 following Djankov et al. (2007).
Private Credit	Ratio of credit from deposit taking financial institutions to the private sector (International Financial Statistics lines 22d and 42d) to GDP (International Financial Statistics line 99b), expressed as a percentage. Line 22d measures claims on the private sector by commercial banks and other financial institutions that accept transferable deposits such as demand deposits. Line 42d measures claims on the private sector given by other financial institutions that do not accept transferable deposits but that perform financial intermediation by accepting other types of deposits or close substitutes for deposits (e.g., savings and mortgage institutions, post office savings institutions, building and loan associations, certain finance companies, development banks, and offshore banking institutions). Source: International Monetary Fund, IFS (September 2008).
Economic Score	Rating of economic risk that reflects indicators such as GDP, GDP growth, inflation, and current account balance. It ranges between 0 and 50, where 0 represents the highest risk. Source: ICRG (2013).
Political Score	Rating of political risk that reflects sociopolitical indicators including government stability, socioeconomic conditions, internal or external conflict, corruption, law and order, and public accountability. It ranges between 0 and 100, where 0 represents the highest risk. Source: ICRG (2013).
Financial Score	Rating of financial risk that combines variables such foreign debt as a share of GDP, foreign debt services as a share of exports, and exchange rate stability. It ranges between 0 and 50, where 0 represents the highest risk. Source: ICRG (2013).

Table AIV – Sovereign Bond Returns in Defaulting and non-Defaulting Countries

The table presents descriptive statistics of realized government bond returns.

	Default	No Default	OECD	No OECD	Overall
Mean	14.46%	9.70%	7.62%	11.61%	9.81%
Std Deviation	58.61%	19.76%	12.34%	26.47%	21.37%
Variance	34.35%	3.90%	1.52%	7.01%	4.57%
No Countries	6	70	27	43	70
No Country-year obs.	18	764	353	429	782

Table AV – First-Stage Estimation of Government Bond Returns

The Table presents results from the first stage estimation of government bond returns. The instruments are the economic score, a rating of economic risk provided by the ICRG and normalized to be between 0 and 1; the political score, a rating of political risk provided by the ICRG and normalized to be between 0 and 1; and the financial score, a rating of financial risk provided by the ICRG and normalized to be between 0 and 1. Standard errors (in parentheses below the coefficient estimates) are adjusted for heteroscedasticity using the Huber (1967) and White (1980) correction. *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Economic Score$_{c,t-1}$	-0.311***				-0.251**	-0.477**	-0.363*	-0.451**
	(0.090)				(0.110)	(0.202)	(0.224)	(0.196)
Political Score$_{c,t-1}$		-0.221***			-0.148*	-0.416**	-0.435**	-0.553***
		(0.075)			(0.081)	(0.185)	(0.184)	(0.205)
Financial Score$_{c,t-1}$			-0.270***				-0.198	
			(0.082)				(0.186)	
Return$_{c,t-1}$				-0.143*				-0.184**
				(0.078)				(0.076)
Constant	0.328***	0.257***	0.300***	0.121***	0.189**	0.515***	0.611***	0.896***
	(0.070)	(0.059)	(0.064)	(0.013)	(0.087)	(0.151)	(0.185)	(0.194)
Time dummies?					Yes	Yes	Yes	Yes
Country dummies?						Yes	Yes	Yes
F-test	12.02	8.69	10.91	3.37	11.37			
No Observations	766	766	766	719	766	766	766	712
R-squared	0.020	0.018	0.013	0.022	0.239	0.290	0.292	0.336

Table AVI – Bondholdings, Sovereign Default, and Changes in Loans – Alternative Specifications

The table presents coefficient estimates from pooled OLS regressions. The dependent variable in Panel A is computed as loans outstanding in year t minus loans outstanding in year t-1, divided by total assets in year t-1. The dependent variable in Panel B is computed as the log of loans outstanding in year t minus the log of loans outstanding in year t-1. The main independent variable is bank bondholdings, computed as bondholdings divided by total assets. Standard errors (in parentheses below the coefficient estimates) are adjusted for heteroscedasticity using the Huber (1967) and White (1980) correction, as well as for clustering at the bank level using the Huber (1967) correction. *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

Panel A – Dependent variable: changes in loans divided by lagged assets

	(1)	(2)	(3)	(4)	(5)
Bank Bondholdings$_{i,c,t-1}$ *	-0.397***	-0.434***	-0.207***	-0.252***	-0.164**
Sovereign Default$_{c,t-1}$	(0.061)	(0.066)	(0.057)	(0.066)	(0.076)
Bank Bondholdings$_{i,c,t-1}$	0.157***	0.164***	-0.013	-0.030**	-0.027*
	(0.012)	(0.012)	(0.014)	(0.014)	(0.014)
Sovereign Default$_{c,t-1}$	0.183***	0.179***	0.104***		
	(0.030)	(0.032)	(0.028)		
Loans$_{i,c,t-1}$ *	-0.258***	-0.243***	-0.256***	-0.252***	-0.194***
Sovereign Default$_{c,t-1}$	(0.047)	(0.049)	(0.044)	(0.052)	(0.059)
Loans$_{i,c,t-1}$	0.050***	0.058***	0.043***	0.048***	0.053***
	(0.007)	(0.006)	(0.006)	(0.006)	(0.008)
Other Controls and Interactions?					Yes
Year Dummies?		Yes	Yes	Yes	Yes
Country Dummies?			Yes	Yes	Yes
Country x Year Dummies?				Yes	Yes
Constant	0.023***	0.023***	0.041**	-0.406	-0.108
	(0.004)	(0.006)	(0.018)	(.)	(.)
No Observations	27,971	27,971	27,971	27,971	27,971
R-squared	0.012	0.170	0.305	0.472	0.476

Panel B – Dependent variable: changes in log (loans)

	(1)	(2)	(3)	(4)	(5)
Bank Bondholdings$_{i,c,t-1}$ *	-0.658***	-0.716***	-0.434***	-0.630***	-0.565***
Sovereign Default$_{c,t-1}$	(0.141)	(0.150)	(0.133)	(0.148)	(0.166)
Bank Bondholdings$_{i,c,t-1}$	0.301***	0.310***	0.065**	0.026	0.043
	(0.025)	(0.025)	(0.029)	(0.030)	(0.031)
Sovereign Default$_{c,t-1}$	0.299***	0.289***	0.233***		
	(0.058)	(0.062)	(0.052)		
Loans$_{i,c,t-1}$ *	-0.485***	-0.455***	-0.530***	-0.529***	-0.487***
Sovereign Default$_{c,t-1}$	(0.087)	(0.092)	(0.079)	(0.089)	(0.110)
Loans$_{i,c,t-1}$	-0.112***	-0.100***	-0.118***	-0.101***	-0.086***
	(0.015)	(0.015)	(0.014)	(0.015)	(0.016)
Other Controls and Interactions?					Yes
Year Dummies?		Yes	Yes	Yes	Yes
Country Dummies?			Yes	Yes	Yes
Country x Year Dummies?				Yes	Yes
Constant	0.134***	0.133***	0.189***	0.297***	0.214**
	(0.010)	(0.013)	(0.024)	(0.024)	(0.083)
No Observations	27,917	27,917	27,917	27,917	27,917
R-squared	0.034	0.174	0.284	0.448	0.451