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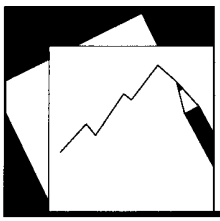

IMF Working Paper

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

Nicola Gennaioli, Alberto Martin, and Stefano Rossi

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

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Abstract

We analyze holdings of public bonds by over 20,000 banks in 191 countries, and the role of these bonds in 20 sovereign defaults over 1998-2012. Banks hold many public bonds (on average 9% of their assets), particularly in less financially-developed countries. During sovereign defaults, banks increase their exposure to public bonds, especially large banks and when expected bond returns are high. At the bank level, bondholdings correlate negatively with subsequent lending during sovereign defaults. This correlation is mostly due to bonds acquired in pre-default years. These findings shed light on alternative theories of the sovereign default-banking crisis nexus.

JEL Classification Numbers: F34, F36, G15, H63

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1. Introduction

Recent events in Europe have illustrated how government defaults can jeopardize domestic bank stability. Growing concerns of public insolvency since 2010 caused great stress in the European banking sector, which was loaded with Euro-area debt (Andritzky (2012)). Problems were particularly severe for banks in troubled countries, which entered the crisis holding a sizeable share of their assets in their governments' bonds: roughly 5% in Portugal and Spain, 7% in Italy and 16% in Greece (2010 EU Stress Test, authors' calculations). As sovereign spreads rose, moreover, these banks greatly increased their exposure to the bonds of their financially distressed governments (2011 EU Stress Test, authors' calculations; see also Brutti and Sauré (2013)), leading to even greater fragility. As *The Economist* put it, "Europe's troubled banks and broke governments are in a dangerous embrace."[1] These events are not unique to Europe: a similar relationship between sovereign defaults and the banking system has been at play also in earlier sovereign crises (IMF (2002)).

Despite the relevance of these phenomena, there is little systematic evidence on them. This paper fills this gap by documenting the link between public default, bank bondholdings, and bank loans. We use the BANKSCOPE dataset, which provides us with information on the bondholdings and characteristics of over 20,000 banks in 191 countries and 20 sovereign default episodes between 1998 and 2012. We address two broad questions:

1. Does banks' exposure to sovereign risk affect lending? In particular, do the banks that hold more public bonds exhibit a larger fall in loans when their government defaults?
2. Why do banks buy public bonds, becoming exposed to default risk in the first place?

[1] *The Economist*, December 17th 2011.

The goal of our analysis is to document robust stylized facts regarding these questions, not to identify causal patterns, which our data does not allow us to do. These stylized facts can shed light on the presumption that sovereign defaults damage banks, and thus the real economy, through their bondholdings. Moreover, our analysis allows us to assess whether the dangerous embrace between banks and sovereigns comes about because banks buy and hold public bonds well before sovereign default materializes, or because banks buy many public bonds during the default event itself. Our main findings are:

- Holdings of public bonds are large in normal times, particularly for banks that make fewer loans and are located in financially less developed countries. In non-defaulting countries, banks hold on average 9% of their assets in public bonds. Among countries that default at least once (which are financially less developed), average bank bondholdings in non-default years are 13.5%. In both groups of countries, bondholdings in non-default years are decreasing in bonds' expected return.

- During default years, average bondholdings increase from 13.5% to 14.5% of bank assets. Critically, this increase is concentrated in large banks. Moreover, during default years, bondholdings are increasing in bonds' expected return.

- During sovereign defaults, there is a large, negative and statistically significant correlation between banks' bondholdings and subsequent lending activity. A one dollar increase in bonds is associated with a 0.60 dollar decrease in bank loans during defaults. Strikingly, about 90% of this decline is accounted for by the average bonds held by banks before the default takes place; only 10% of this decline is explained by the additional bonds bought in the run-up to and during default.

These results are very robust to alternative specifications and controls. In particular, results on within country, cross-bank variation are robust to adjusting for *any* time-varying country-wide shocks. Within *the same* defaulting country and default year, it is the banks most loaded with government bonds that subsequently cut their lending the most.

Our results support the notion that banks' holdings of public bonds are an important transmission mechanism of sovereign defaults to bank lending. As we discuss in Section 5, these findings are broadly consistent with the following narrative. Public bonds are very liquid assets (e.g., Holmstrom and Tirole (1998)) that play a crucial role in banks' everyday activities, like storing funds, posting collateral, or maintaining a cushion of safe assets (Bolton and Jeanne (2012), Gennaioli, Martin, and Rossi (2014)). Because of this, banks hold a sizeable amount of government bonds in the course of their regular business activity, especially in less financially developed countries where alternatives are fewer. When default strikes, banks experience losses on their public bonds and subsequently decrease their lending. During default episodes, moreover, some banks deliberately hold on to their risky public bonds while others accumulate even more bonds. This behavior could reflect banks' reaching for yield (Acharya and Steffen (2013)), or it could be their response to government moral suasion or bailout guarantees (Livshits and Schoors (2009), Broner et al. (2013)). Whatever its origin, this behavior is largely concentrated in a set of large banks and is associated with a further decrease in bank lending.

Our data suggests that all bondholdings, regardless of whether they are accumulated before or during sovereign default events, contribute to transmitting the effects of defaults to private loans. Critically, though, our analysis also shows the bulk of the drop in lending that takes place during defaults is associated with bond purchases that take place well before the

defaults themselves. In Section 5 we discuss the broad implications of these results for recent research on the European crisis and for the design of policy.

Our paper is related to the literature studying the costs of sovereign defaults. Quantitative models like Arellano (2008) typically find that, when calibrated to match the data, exclusion from financial markets is too short to account for the observed low frequency of defaults. In line with her findings, recent work posits that sovereign default is costly because it inflicts a "collateral damage" to the domestic economy. This damage arises because default is assumed to be nondiscriminatory, so that it hurts domestic bondholders as well as foreign ones and this has consequences for domestic financial markets. Some examples of this work are Broner and Ventura (2011), where nondiscriminatory default destroys domestic risk sharing, and Brutti (2011), where it reduces entrepreneurial wealth and investment.

In Gennaioli, Martin, and Rossi (2014), we built a model where nondiscriminatory defaults reduce the net worth of banks holding public bonds and hamper financial intermediation.[2] We also provided cross-country evidence that, following a public default, the decline in private credit is larger in those countries where the banking system holds more public bonds.[3] In this paper, we substantially extend the evidence by using bank-level data, which enables us to take a granular look at bondholdings and their effect on lending during defaults.

[2] Mengus (2013) has used a related model with nondiscriminatory default to study bank bailouts; Acharya and Rajan (2013) study the incentives of myopic governments to service their debts.

[3] Other work documents the link between public defaults and private credit. Arteta and Hale (2008) show that defaults are accompanied by a decline in syndicated foreign credit to domestic firms. Borensztein and Panizza (2008) show that defaults are accompanied by larger contractions in GDP when they happen together with banking crises. To the best of our knowledge, ours is the first empirical exercise to highlight the role of bank bondholdings. In ongoing research, Baskaya and Kalemli-Ozcan (2014) also study the link from government solvency to the banking sector. In particular, they find that the 1999 Marmara earthquake in Turkey had a larger effect on lending by banks that were highly exposed to government debt.

Our paper is also related to a recent strand of work that, largely motivated by the European crisis, has studied the two-way link between banking sector fragility and public defaults. Acharya, Drechsler, and Schnabl (2013) study "Irish-style" crises, in which banking sector bailouts raise the likelihood of public defaults. They show that bailouts are associated with subsequent spikes in sovereign spreads and with declines in banks' stock returns. Other work focuses on how bank bondholdings may expose the financial system to public defaults. Acharya and Steffen (2013) examine holdings of troubled bonds by Eurozone banks in recent years, finding evidence that banks have engaged in 'carry trade' by borrowing short-term to invest in risky bonds. Brutti and Saure (2013) study holdings of European bonds by Eurozone banks during the recent sovereign debt crisis, and document that the share of troubled bonds held by domestic banks has been increasing in the bonds' risk. Battistini, Pagano, and Simonelli (2013) also study Eurozone banks and obtain similar results. Finally, Reinhart and Sbrancia (2011) study the increase in aggregate bondholdings around defaults and attribute it to financial repression. All of these papers focus on specific crisis episodes and find support for the view that banks have incentives to accumulate bonds precisely when they are risky.[4]

Our paper contributes to these works by providing a panoramic view of bank-level bondholdings around the world, both during normal times and during default episodes. Moreover, while these works focus on the behavior of bank bondholdings in periods of high risk, we are also interested in the implications of these bondholdings for lending once a sovereign default takes place.

[4] Although very different in scope, our paper is also related to work estimating the demand for government bonds (e.g. Krishnamurthy and Vissing-Jorgensen (2012), and Greenwood and Vayanos (2014)). This work, however, does not specifically consider the role of banks.

The paper proceeds as follows. Section 2 describes the data. Section 3 analyzes the patterns of bondholdings and Section 4 studies the relationship between bondholdings and lending during sovereign defaults. Section 5 discusses our findings in light of alternative hypotheses and concludes.

2. Data

We build a dataset that includes bondholdings and lending activity at the bank level, as well as a large set of bank-level characteristics and macroeconomic indicators that are meant to capture the state of a country's economy. We explain each of our data sources below.

We obtain bank-level data from the BANKSCOPE dataset, which contains information on the holdings of public bonds for 20,337 banks in 191 countries over the period 1998-2012 (99,328 bank-year observations). This dataset, which is provided by Bureau van Dijk Electronic Publishing (BvD), provides 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. We shall return to this last issue later on. The information in BANKSCOPE is suitable for international comparisons because BvD harmonizes the data.

All items are reported at book value, including bonds.[5] This implies that variations in the bonds-to-assets ratio, both within and across countries, to a large extent capture variations in the relative quantity of public bonds held by banks, particularly in country-years away from sovereign crises. During sovereign crises, however, large declines in the prices of bonds and of other bank assets can contaminate the bonds-to-assets ratio that we use as a measure of

[5] Bonds are typically recorded at the historic cost of purchase. Fair value adjustments have been limited to a few developed countries in more recent years, and we understand they are not a systematic feature of the data.

bondholdings. For instance, if the price of bonds drops more (less) than the price of other bank assets, book value reporting may overstate (understate) the market value of the bonds-to-assets ratio. This aspect should be borne in mind when interpreting our results. It should be noted, though, that book value estimates significantly shape the actions and beliefs of regulators, markets, and bank managers, so they provide a good measure of bondholdings for our purposes.[6]

We start with the full sample of banks in BANKSCOPE and examine their unconsolidated accounts. We construct our dataset by assembling the annual updates of BANKSCOPE.[7] 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.[8] This procedure results in 99,328 observations of the bondholdings variable at the bank-year level over 1998-2012. For our regression analysis, we impose two additional requirements on the remaining banks: first, that we observe at least two consecutive years of data, so that we can examine the banks' changes in lending activity; and second, that data is available on all of the other main variables such as leverage, profitability, cash and short term securities, exposure to Central Banks, and interbank balances. Our constant-continuing sample for the regression analysis then consists of 7,391 banks in 160 countries for a total 36,449 bank-year observations. We take the location of banks to be the one reported in Bankscope, which coincides with the location of the bank's headquarters. Commercial banks account for 33.2% of

[6] The relevance of book value reporting is also confirmed by our regression results, both those dealing with bondholdings and with loans, which are economically intuitive.

[7] This strategy yields two advantages relative to obtaining all data at once from the web interface. First, we avoid the survivorship bias that would occur because the web interface does not retain accounting information on banks after they delist. Second, our strategy allows us to obtain a time series of all relevant variables, while in some cases the BANKSCOPE interface only keeps the most recent information. For example, the web interface reports only the most recent ownership structure (including any government ownership), and by assembling the annual updates we are thus able to obtain time variation in the ownership structure.

[8] Importantly, by filtering out banks with total assets smaller than $100,000 we are effectively filtering out also the banks with incomplete accounting information on the most basic variables such as loans.

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.

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 AI in the Appendix describes these 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.

We follow the existing literature and proxy for sovereign default with a dummy variable based on Standard & Poor's, which defines default as the failure of a debtor (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, a debt restructuring under which the new debt contains less favorable terms to the creditors is coded as a default. The Greek bond swap that was launched in February of 2012, for instance, is identified as a default by Standard & Poor's because the retroactive insertion of collective action clauses was deemed to materially change the original contract terms. According to this definition, our sample contains 20 sovereign defaults of different duration in 17 countries, which are listed in Table AI of the Appendix.[9]

[9] To preserve space, Table AI only reports defaults for which we observe bank-level information in the constant-continuing sample. BANKSCOPE starts covering some defaulting countries such as Nicaragua, Paraguay and others only after their default events. For some other defaulting countries (Antigua in 2002-2003, Dominican Republic in 2005, Iraq in 2004, Madagascar in 1998-2002, Moldova in 2002, Pakistan in 1998-1999, and Yemen in 1999-2001), we do observe bondholdings for a number of banks but we do not observe other bank characteristics. For a full list of countries in default up to 2005 see Gennaioli et al. (2014) and Borensztein and Panizza (2008).

In our robustness tests, we complement our analysis by using two alternative measures of sovereign default, 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 if it is in default according to S&P, or if its sovereign bond spreads relative to the U.S. or German bonds exceed a given threshold (using extreme value theory, Pescatori and Sy (2007) identify such a threshold to be approximately 1000 basis points). These measures cover dimensions of sovereign risk that are not captured by the S&P default dummy, such as spikes in credit spreads and the economic magnitude of creditors' losses. As we show in Section 4, our results are robust to these alternative measures. In our main analysis, however, we stick to the S&P default dummy because these measures have problems of their own. In particular, measures of haircuts depend heavily on the assumptions one makes about counterfactuals (e.g., Sturzenegger and Zettelmeyer (2008)), and measures based on sovereign bond spreads require observing reliable data on secondary market trading, which limits our sample size.

Table AI shows that the default episodes included in our sample contain large variations both in the size of defaulting countries and in the extent of bank coverage. A few countries such as Argentina, Russia, Nigeria, Kenya and Honduras have the lion's share of banks; at the other end of the spectrum, there are eight defaulting countries in which our data covers five banks or less. One concern is that countries that are small and have few banks might drive our results. In our robustness tests we re-estimate our regressions focusing on large defaulting countries and discarding countries with fewer than five (or ten, or fifteen) banks during a default episode, respectively, and we show that our results are unaffected.

Before concluding, we comment on two other important data series that we use, those measuring the realized and the expected returns of sovereign bonds. Realized bond returns in emerging countries are obtained from the J.P. Morgan's Emerging Market Bond Index Plus file (EMBIG+). For developed countries, we use 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)). These indices aggregate 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. This data on returns 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), so that any exercise involving bond returns reduces sample size.

Obtaining data for expected returns is more problematic, because this variable is not directly observable, and standard proxies such as yield-to-maturity are clearly not appropriate for studying default episodes. We construct our series of expected returns using a two-step process. In the first step, we regress returns on a set of country-specific economic, financial, and political risk factors:

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

where $R_{c,t}$ is the realized return of public bonds in country c at time t, γ_t are time dummies, which capture 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. These ratings provide a comparable measure of political stability and of economic and financial strengths in many countries, and they have been shown to be strong predictors of bond returns (see e.g.

Comelli (2012)). In the second stage, we define expected returns as the fitted values of this first-stage regression. We describe this data, as well as all variables used in the analysis, in Table AII in the Appendix.[10]

2.1 Bondholdings and Returns Data

The BANKSCOPE dataset is widely used and has an established track record, but there is one important dimension along which its reliability has not been scrutinized: its measure of government bondholdings.[11] To check the quality of this measure, we compare it to other data sources on bondholdings: the country-level measure of "banks' net claims on the government" from the IMF, and the bank-level data from the recent European Stress Test.

[Table I here]

Table I compares the BANKSCOPE data on bondholdings with the IMF measure. Panel A contains the mean, the median, and the standard deviation of bondholdings (as a share of total assets) in the full BANKSCOPE sample. Mean bondholdings are at 9.3% of assets, while median bondholdings are approximately half as high. The standard deviation of bondholdings in the sample is also high.[12] Panel B reports somewhat lower figures for the constant-continuing sample, where we observe also the covariates and that we use in our regression analysis. Panel C reports the same information, but only for the subset of countries for which the IMF also reports banks' bondholdings. Panel D reports the IMF measure of "financial institutions' net claims to

[10] More details are found at www.prsgroup.com.

[11] See, for instance, Classens and Laeven (2004), and Kalemli-Ozcan, Sorensen, and Yesiltas (2012).

[12] The highest bondholdings in the sample are above 65% for selected banks in Argentina, Japan, and Venezuela in 2003; the lowest bondholdings are 0% (e.g., several U.S. banks).

the government," computed as a share of total assets.[13] Mean, median and standard deviation of the IMF measure are close to the BANKSCOPE data. The IMF data gives a slightly higher mean bondholdings, but measurement in the two datasets converges towards the end of the sample, particularly when examining the subsample of banks in countries covered by IMF. Any discrepancy between IMF and BANKSCOPE data is likely due to the fact that the former also captures non-bond finance and to the fact that the banks used to compute the IMF measure may differ from those in BANKSCOPE.

The IMF data cannot address the quality of the BANKSCOPE data on a bank-by-bank basis. We thus compare our measure of bondholdings to the one reported by the European stress test of 2010. This also allows us to evaluate the mismeasurement that may arise because, differently from the stress test, BANKSCOPE does not break down bonds by nationality.

Table II reports bondholdings from the European stress tests of 2010 and 2011. Panel A of the table reports bondholdings for the full sample contained in the stress test, whereas Panel B reports bondholdings for the subset of the banks in the stress test sample that is contained in BANKSCOPE. The bondholdings reported by BANKSCOPE are shown in Panel C. The data from both sources are highly comparable. The bank-by-bank correlation between the bondholdings reported by BANKSCOPE and by the stress test is 80%. The small discrepancies between our measure and the stress test measure are thus most likely due to differences in the time at which the measurement itself took place.[14]

[13] This variable reports the net positions of commercial banks, defined as holdings of securities plus direct lending minus government deposits, and it can be interpreted as a proxy for the bondholdings of banks. Other papers using this measure are Gennaioli et al. (2014) and Kumhof and Tanner (2008).

[14] While BANKSCOPE also counts non-EU bonds, the bondholdings of European banks consist primarily of EU bonds – the very reason of the stress test in the first place.

[Table II here]

The evidence is reassuring. Even in highly integrated European markets, where domestic and foreign bonds are in many cases treated symmetrically by the regulatory framework, more than 75% of bank bondholdings correspond to domestic bonds. This share is in all likelihood much larger in the subset of developing countries that provide most of our observations on sovereign defaults. In sum, the BANKSCOPE measure is a good proxy for the domestic public bonds held by banks around the world, and we use it as such in the rest of the paper.

Table III reports descriptive statistics on these bondholdings around the world. Panel A shows that in the full sample, in non-defaulting countries banks hold on average 9% of their assets in public bonds. Among countries that default at least once in our sample, this average is 13.5% in non-default years, and increases to 14.5% of bank assets during default years. Panel A further shows that bondholdings are much larger in financially less developed countries, as the average bondholdings is 8.4% of assets in OECD countries and 12.4% in non-OECD countries. Panel B reports similar, albeit somewhat smaller figures in the constant-continuing sample that we use in our regression analysis.

[Insert Table III Here]

To conclude, consider our data on the realized returns of public bonds. Table AIII in the Appendix contains descriptive statistics on these returns. The average annual return of public bonds is 9.81%, with a large standard deviation of 21.37%. Countries that experience at least one default episode in the sample have average annual returns of 14.46%, as compared with 9.70% for countries that do not experience any defaults. OECD countries have average annual returns of 7.62%, much lower than the non-OECD annual returns of 11.61%.

Bond returns vary substantially over time. To show this, Figure 1 plots sovereign bond prices for six countries that experienced at least one default over 1998-2012. The Figure depicts a window centered on the day of the default, and bond prices are standardized to begin at 100.

[Insert Figure 1 Here]

Across these six countries, bond prices exhibit the characteristic V-shaped pattern: in particular, prices deteriorate steadily in the year prior to the default, they reach a minimum in the months immediately after the default, and they pick up thereafter.

Finally, we comment briefly on our two-stage process for the construction of a series of expected returns. Table AIV in the Appendix shows the results of the first-stage estimation of Equation (1), in which we regress bond returns on country risk-ratings. As the first three columns of the table shows, there is a strong negative correlation between the risk ratings at time *t* and realized returns at time $t + 1$.[15] Taking into account that these ratings are decreasing in risk, this result is exactly what one would expect from theory: the positive coefficients are consistent with the notion that high bond returns compensate investors for economic, financial, and political risk. In the second stage, we define expected returns as the fitted values of this first-stage regression.[16] This is the series that we use in our regressions.

[15] All three risk scores are suitable instruments for expected returns, as the F-test in the univariate regressions are close to 10 or above, mitigating concerns that the instruments are weak (see Stock and Yogo (2005)). By comparison, column (4) in Table AIV presents the result of regressing government bond returns at t on 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 likely to be a weak instrument. As a result, we do not use it in our analysis.

[16] Specifically, 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. Column 5 of Table AIV presents the results for the specification that we use in the empirical analysis as the first-stage estimation of the expected returns used in Table V, columns 3 and 5. Our results in Table V are not sensitive to the choice of instruments within the three risk scores of the ICRG.

2.2 Summary Statistics of other Bank-Level Variables

We consider the distribution of bank characteristics in BANKSCOPE, focusing on: (i) bank size as measured by total assets, (ii) non-cash assets, measured as the investment in assets other than cash and other liquid securities, (iii) leverage as measured by one minus shareholders' equity as a share of assets, (iv) 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. Table IV provides descriptive statistics for these variables in our sample.

[Table IV here]

Panel A shows that there is a fairly large variation in bank characteristics within the BANKSCOPE sample. The average bank invests roughly 96% of its resources in non-cash assets (60% of which are loans, and the rest includes government bonds, debentures and other securities), obtains 91% of its financing in the form of debt, which includes deposits (for an average leverage ratio assets/equity of about 10), and holds 3% of its assets in central bank reserves.[17] Table AV in the appendix reports the correlations between different bank characteristics in our sample. All correlations are statistically significant. Bank profitability is positively correlated with size, exposure to the central bank and interbank balances, while it is negatively correlated with non-cash assets, leverage, and loans outstanding.

[17] Panel B of Table III shows the characteristics of banks involved in the stress test. These banks are much larger and extend more loans than the median BANKSCOPE bank. They also have lower exposure to the Central Bank and to other banks. Leverage and cash are instead of similar magnitude to those observed in BANKSCOPE.

3. Determinants of Banks' Bondholdings

This section addresses our first question: what determines bank bondholdings? We have already mentioned that average bondholdings are high in our data: they account for 9.3% of bank assets in the entire sample. Moreover, there is also substantial variation in bondholdings over time. In countries that experience at least one default, average bondholdings during default years represent 14.5% of assets as opposed to 13.5% in non-default years. Figure 2 illustrates this by depicting the average evolution of bondholdings across six defaulting countries, during a seven-year window centered on the year of default.

[Insert Figure 2 here]

The figure shows that bondholdings follow a V-shaped pattern. Starting from their initial level, they first decrease gradually as the default is approached. From there, bondholdings rise after reaching a minimum on the year of the default itself.

Thus, the raw data already provides two interesting facts regarding bondholdings: banks hold substantial amounts of public bonds in non-default years and they hold even more bonds during sovereign defaults. To delve deeper into these facts and see how they relate to bank- and country-characteristics, we turn to regression analysis.

3.1. Methodology

Let $B_{i,c,t}$ denote the ratio of government bonds over assets held at time t by bank i located in country c. We think of $B_{i,c,t}$ as being chosen by banks in period $t-1$, so that bondholdings at

time *t* are a function of the bank's balance sheet and of the state of the economy at time $t-1$.[18] We then run the following regression:

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

$$+\alpha_5 \cdot Def_{c,t-1} \cdot X_{c,t-1} + \epsilon_{i,c,t}, \qquad (2)$$

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, $X_{i,c,t-1}$ is a vector of bank characteristics, and $X_{c,t-1}$ is a vector of country characteristics. We run this regression in specifications that include country dummies, time dummies, and also their interaction. Standard errors are clustered at the bank level throughout.[19]

Coefficients α_1 and α_2 respectively capture the effect of bank- and country-factors on a bank's holdings of public bonds when the government is not in default (i.e., in "normal times"). Coefficient α_3 captures the average impact of default on bondholdings, while α_4 and α_5 indicate whether the association between default and bonds is heterogeneous across banks and countries. Equation (2) thus allows us to test whether bondholdings behave differently in years of default relative to all other years. For example, if $\alpha_3 > 0$, all banks tend to increase their bondholdings during default events.

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,

[18] The use of lagged independent variables is preferable to the use of independent variables that are contemporaneous to bondholdings 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 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 or by the market at time t will depend on the state of the economy as measured at time $t-1$.

[19] In a previous draft we clustered standard errors at the country level and obtained very similar results.

exposure to central bank, interbank balances, profitability, size, whether or not the bank is owned by the government, and lagged bondholdings to control for persistence. Vector $X_{c,t-1}$ includes instead country-level factors that may affect the demand for bonds, such as a country's financial development (as measured by Private Credit to GDP and banking crises), GDP growth, and inflation. One interesting variable to consider is the expected return of public bonds denoted by $R^e_{c,t}$, which captures the expectation (at time $t-1$) of the time-t return of public bonds of country c. As explained in Section 2, we proxy this variable with the fitted value of realized returns when regressed on lagged country-specific risk factors, and we estimate the two-stage model with GMM.

3.2. Results

Table V reports the estimates of different specifications of Equation (2). Columns (1)-(3) assess the patterns of bondholdings without accounting for the interactive effects of default and by using only time dummies. Column (4) includes interactive effects, column (5) includes country dummies, and finally column (6) includes country*time dummies. The inclusion of dummies is important because it allows us to control – among other things – for variations in the supply of government bonds in a country.[20] Table V only reports coefficients of variables that are systematically significant.

[Table V here]

Consider first columns (1) and (2). Bondholdings decrease with outstanding loans, while they increase with bank size and government ownership. In terms of country factors,

[20] 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.

bondholdings fall with private credit and GDP growth, and increase with banking crises. The variables with greatest explanatory power in terms of marginal R^2 are private credit and outstanding loans. Column (3) adds expected returns to the regression.[21] We do so in a separate column because bond returns are available only for a subset of countries, so the number of observations drops accordingly. Over the full sample, expected bond returns are negatively and significantly correlated with bondholdings. If we think of expected returns as a compensation for risk, this means that bondholdings are higher when bonds are safest.

Next, we examine whether these patterns differ in default relative to non-default years. To assess the importance of default, we include our default dummy in columns (4)-(6). These columns teach us two critical features of the data.

First, columns (4)-(6) show that the accumulation of bonds during default years is very unequal across banks. Relative to non-default years, large banks are systematically more likely to increase their exposure to public bonds, while banks with more outstanding loans are less likely to do so. The non-interacted default dummy is often insignificant (or even negative in column (6)), implying that the average increase in bondholdings during defaults entirely comes from a selected set of banks. Column (6) shows that these results hold when controlling also for country and country*year fixed effects. Quite strikingly, this indicates that within-country-year bank heterogeneity is critical in explaining the variations in the data. Quantitatively, this heterogeneity across banks is large. During a default year, for instance, banks in the lowest size

[21]Table AIV in the appendix reports the first stage estimation used to compute expected government returns, as well as a detailed discussion of the estimation results.

decile decrease their bondholdings by 4.2% of assets, while banks in the highest decile increase their bondholdings by 4.5% of assets.[22]

The second and perhaps most interesting message of columns (4)-(6) is that bondholdings behave differently during default and non-default years. Consider the role of expected returns in column (5). While in non-default years expected bond returns are associated with lower bondholdings, this correlation is reversed during default years. A similar reversal arises with respect to Private Credit to GDP. Columns (4) and (5) show that banks in countries with more developed financial markets, as measured by Private Credit to GDP, hold fewer bonds in normal times but pile up more bonds during default events.

How can we interpret Table V? The evidence suggests a simple narrative. In non-default years, the demand for bonds is consistent with their role as providers of liquidity. Banks that already have many good investment opportunities available (i.e., banks with many outstanding loans) do not need safe and liquid public bonds to 'store' their funds. Banks that operate in financially developed economies do not need to buy many public bonds because private alternatives are available. Finally, bondholdings are low when expected bond returns are high, because high-risk, high-return bonds do not provide a good store of liquidity.

One caveat to this interpretation is that bondholdings in the year immediately before default need not necessarily represent banks' "normal" demand for bonds. Indeed, they may already reflect some risk taking if signs of future default have already materialized. Prima facie, this possibility seems unlikely. As shown in Figure 1, the main defaults that we consider are

[22] This implies that it is crucial to control for bank characteristics when assessing the link between bondholdings and subsequent lending. We have shown that large banks are the most likely to accumulate public bonds during defaults; they are also the ones that lend the most. Thus, without controlling for bank size, we might spuriously find a positive correlation between bondholdings and loans during defaults. We shall return to this important point in Section 4.

characterized by abrupt drops in bond prices that take place when the defaults are just 3-4 months away, on average. Additionally, as Figure 2 shows, average bondholdings tend – if anything – to slightly decrease as a default approaches (consistent with them being decreasing in expected bond returns in normal times). In this respect, our representative default is very different from the Greek default of 2012, as Greek bond spreads started to rise already in 2009 and Greek banks accumulate public bonds during these years. Figure 3 indeed shows the different paths of bondholdings in Greece with respect to the main defaulters in our sample.[23]

[Insert Figure 3 here]

As Table V and Figure 3 show, in fact, during default episodes bondholdings change behavior. In those times, high expected returns correlate with higher bondholdings, implying that demand for high-risk, high-return bonds is higher during years of default. Moreover, higher bondholdings in default years are largely concentrated in the hands of large banks. This is consistent with the possibility that these banks have an incentive to take risk in the sovereign bond market owing to implicit government bailout guarantees or to direct moral suasion.[24]

The analysis of this provides a general overview of the behavior of bank bondholdings. But do these bondholdings matter for bank lending? We turn to this question next.

[23] In Section 4 we further mitigate this concern by analyzing the behavior of average bondholdings outside of default episodes, which are presumably more representative of banks' normal business activities. As we discuss in the next section and show in the Appendix, average bondholdings in non-default years behave very similarly to total bondholdings in the same years: they are larger in financially less developed countries, when expected bond returns are smaller, and for banks that have fewer outstanding loans.

[24] One important caveat here is that the effect of the default dummy in columns (4)-(6) should be viewed as capturing a lower bound on the role of risk taking during crises. Indeed, even if bank bondholdings did not increase at all during sovereign crises (so that the estimated effects of default were all zero), banks could still be taking on excessive risk by maintaining their pre-crisis bondholdings despite the increase in sovereign risk.

4. Default, Bondholdings and Loans

Equipped with the results of the previous section, we now address our second question: what is the relationship between bondholdings and lending during default events?

4.1. Methodology

Let $\Lambda_{i,c,t}$ denote the change in loans over assets made by bank i in country c between time $t-1$ and t. We run the following regression:

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

$$+\gamma_5 \cdot Def_{c,t-1} \cdot X_{i,c,t-1} + \gamma_6 \cdot X_{c,t-1} + \gamma_7 \cdot Def_{c,t-1} \cdot X_{c,t-1} + \mu_{i,c,t}. \qquad (3)$$

Coefficient γ_2 captures the average effect of default on bank loans. A negative value of γ_2 suggests that, all else equal, sovereign defaults are associated with a subsequent reduction in bank lending. The main focus of our analysis is on coefficient γ_3. A negative value of γ_3 is consistent with the hypothesis that default reduces bank lending through government bondholdings: it implies that, when governments are in default, banks that hold more public bonds are the ones that reduce their lending the most.

Once again, controlling for vectors $X_{i,c,t-1}$ and $X_{c,t-1}$ and for their interactions with the sovereign default dummy allows us to control for cross-bank and cross-country variation in the proclivity of banks to make loans. Together with country and country*time dummies, these controls reduce the likelihood that our results are due to omitted variables, like recession-induced drops in the demand for loans by firms. They also reduce the likelihood of identifying spurious correlations, like the ones that would arise if larger banks both hold more bonds *and* make more loans during default years.

The interpretation of coefficient γ_3 raises an interesting question. If higher bonds are indeed associated with a stronger drop in loans (i.e. $\gamma_3 < 0$) in default years, is this drop related to the bonds that banks normally purchase in non-default years or to the bonds purchased during the default events themselves? As we discuss in Section 5, this distinction is important: shedding light on whether the dangerous embrace between the government and banks originates in normal times or in the proximity of sovereign defaults has important positive and normative implications. We address this question in three alternative ways.

First, we run a cross sectional version of Equation (3) focusing on the change in loans around default episodes. In this regression, the dependent variable is the change in a bank's loan-to-asset ratio occurring in the first two years of default, while the main explanatory variable is the bank's bondholdings in the year prior to default. This is the simplest way to check whether pre-default bondholdings matter. One shortcoming here is that bondholdings in the year before default may be influenced by the anticipation of default by the bank. As a result, we perform a second test in which the explanatory variable is a bank's *average bondholdings in the three years prior to the default*. This test allows us to establish whether or not the change in a bank's lending behavior around a default event is related to the public bonds that the bank has *well before* the default event, before sovereign risk materializes.

While useful, this last test has still two shortcomings. First, its cross sectional nature does not allow us to control for a full set of country*time dummies. Second, by considering only bonds accumulated for the most part well before default, this test does not allow us to properly assess the impact of bondholdings accumulated in the run-up to and during the default itself, which may be an important part of the story.

We address these concerns by running yet another specification of Equation (2), in which we decompose a bank's holdings of public bonds $B_{i,t}$ into: (i) a "normal-times" average component $b_{i,n,t}$ measuring a bank's average bondholdings in all non-default years up to year *t*, and; (ii) a "residual" component $b_{i,t} = B_{i,t} - b_{i,n,t}$, which captures any differential take-up in public bonds relative to the normal-times average. We then use these components as separate explanatory variables in Equation (2). Because this regression uses the full panel structure of our data, it can include a full set of country*time dummies.

To interpret this regression, we view the component $b_{i,n,t}$ as capturing a bank's average demand for bonds in the course of its everyday business activity. Hence, the interaction of $b_{i,n,t}$ with the default dummy proxies for the effect of sovereign defaults that is transmitted through the bonds that are normally held by bank *i* for its regular operations.[25] According to this interpretation, the residual $b_{i,t}$ captures any discrepancy between observed bondholdings and typical bondholdings in normal times. This discrepancy may be due to a number of reasons, including – as we have mentioned – distorted incentives to accumulate bonds precisely when they are risky.

4.2. Results

Table VI reports our estimates. Columns (1)-(4) include as explanatory variables the total bondholdings of bank *i* in year $t-1$, $B_{i,c,t-1}$, as well as our sovereign default dummy, various bank-level controls, the realized return of bonds,[26] and their interactions. Column (1) report

[25] The effect of $b_{i,n,t}$ on loans during defaults could capture both the fact that default exerts an adverse balance sheet effect on banks with higher average bondholdings in normal times, and the fact that defaults reduce the appeal of bonds as liquid assets and this is costly for banks that normally use bonds for that reason.

[26] We do not include other country-level controls because doing so drastically reduces the number of observations. To control for all country-level, time-varying factors, columns (4) and (5) also include country*year dummies.

results of a specification without any fixed effects. It shows that bondholdings have a large negative effect on subsequent lending during default years.

[Table VI here]

Column (2) presents estimation results with year dummies but without country dummies; column (3) presents results with year and country dummies, to control for time-invariant country-level differences in the quality of economic policy and other institutional differences; column (4) presents estimation results with year, country, and country*year dummies, to control for uniform demand shocks at the country-year level. The results confirm a strong negative effect of bondholdings on subsequent lending during default years. Column (5) repeats this test in the full sample, i.e., including also the countries for which we do not observe sovereign bond returns, and shows that our result is, if anything, stronger. Remarkably, columns (4) and (5) show that within *the same* defaulting country-year, it is the banks most loaded with government bonds that reduce their lending the most. This is the basic result of this section. This raises a question: is this association driven by the bonds accumulated in non-default years or by those accumulated during the default event itself?

Columns (6) and (7) address this question by looking at the cross-sectional variation in changes in loans around a default and seeing how it correlates with bonds held before the default. Column (6) shows that the bonds held in the year before the default have a strong negative association with the subsequent decrease in lending during the first two years of a default event. This finding suggests that the bonds accumulated prior to default matter for the decrease in lending. However, it could still be that bank purchases of bonds in the year prior to default reflect the deteriorating prospects of sovereign risk and not their regular business activity.

To address this possibility, in column (7) we focus on the average bondholdings held by the banks in the three years prior to the beginning of default, to attempt to better capture the effect of bondholdings held during the course of banks' 'normal' business activity. Column (7) shows a strong negative association between a bank's *average* bondholdings in the three years prior to a default and its change in loans during the first two years of a default event. The effects are quantitatively large: a 10% increase in the average level of bondholdings in the three years before default is associated with a 3.6% cumulative reduction in loans during the first two years in default. This result is consistent with a standard balance sheet effect, whereby losses on pre-existing government bonds reduce bank capital, forcing the bank to deleverage and thus reducing its ability to intermediate funds towards investment. It is important to stress that these tests require bank data for a five-year window around a default, so that they effectively focus on large banks in large defaulting countries such as for example Argentina, Greece, and Ecuador. These results suggest that the effects of bondholdings on lending are pervasive, long-lasting and not limited to small banks that may go bust during the crisis.

Finally, columns (8) and (9) address this question in an alternative way, by splitting bonds into their "normal-times" and "residual components" as defined in Section 4.1. Column (8) introduces both variables while controlling for country dummies, time dummies, bank controls, and expected returns, as well as for their interactions with default. Thus, column (8) effectively amounts to a 'decomposed version' of column (3). Column (9) then adds country*year fixed effects, so it effectively amounts to a decomposed version of columns (5). We obtain two important results.

First, higher normal-times bonds are indeed associated with significantly fewer loans during default events. Second, the interaction of the residual component of bonds and the default

dummy is also negative and significant, indicating that banks holding abnormally many bonds during default years are systematically less likely to make new loans. This negative association is interesting because, as we documented in Section 3, it is the large banks that are most likely to accumulate bonds during default years. Presumably, these banks also face strong investment opportunities. As a result, the drop in their loans during default seems likely to be induced by the bonds that they hold, and not by a drop in their relative demand for credit.

The estimates of column (7) may be contaminated by country-level unobserved shocks, though, such as a pre-existent decline in demand for credit by firms in the country. To rule out this possibility, column (8) adds a full set of country*time dummies. The coefficients of both components of bondholdings remain economically large and strongly statistically significant.

The economic effects of both the normal-time and residual component of bondholdings are large. A 10% annual increase in the normal-time component of bondholdings within a defaulting country is associated with a 2.1% decrease in lending; and a 10% annual increase in the residual component of bondholdings within a defaulting country is associated with a 2.0% decrease in lending.

The estimated marginal effects of the normal-time and the residual component of bondholdings on loans are thus similar in magnitude. To properly assess the contribution of these components, however, one needs to consider that in our sample banks tend to accumulate a much larger proportion of bonds in the years prior to default relative to those accumulated in the default years. In particular, in our sample of defaulting countries, average bank bondholdings during non-default years (13% of assets) represent 87% of their average bondholdings during default years (14.9% of assets). Coupled with the fact that in our sample banks loans as a share

of assets are four times larger than bondholdings (in particular, loans represent approximately 53% of total assets), our estimates imply that a one-dollar increase in bonds translate into a 60-cent decrease in lending during default years; and that about 90% of this effect is due to the normal-time component of bondholdings, i.e. to the average bondholdings held by banks before the default took place.

Our data thus shows that, when a default takes place, there is a strong negative correlation between a bank's bondholdings and the loans that it extends. In our sample, though, the bulk of the correlation is explained by the bonds accumulated in normal times. We discuss the economic implications of these findings in Section 5.

Before concluding our statistical tests, we mention two robustness tests that address important concerns regarding the results of this section. A first concern is that these results may be driven by relatively "unimportant" defaults, because approximately one half of the default episodes in our sample involve either small countries, or countries with a small banking sector, or both. We address this concern thoroughly by redoing our estimation in various possible ways: (i) we exclude the smaller defaulting countries in our sample, both as measured by GDP per capita, and by the economic magnitude of the debt defaulted, and; (ii) we exclude the defaulting countries with fewer than 5, 10, and 15 banks, respectively in our sample. As Table VII shows in columns (1)-(10), these exercises strongly confirm our main results, which – if anything – become both statistically and economically stronger. A second concern is that our default dummy is too blunt a variable to capture default crises. We repeat our analysis using the haircut measure of default constructed by Cruces and Trebesch (2013) and Zettelmeyer et al. (2012), which capture the severity of a default. As Table VII, columns (11)-(11) show, our main results are again confirmed and if anything the economic magnitude of the results is stronger. Finally,

we repeat our analysis using the augmented measure of default that, in addition to the default identified by S&P, includes defaults identified as situations in which sovereign spreads exceed 1,000 basis points.[27] As Table VII, columns (13)-(14) show, our main results are again confirmed.

[Table VII here]

5 Interpretations and Implications of our Findings

What do we learn from our empirical analysis? While the main goal of our paper is descriptive, the correlations that we document are consistent with a simple narrative of the sovereign default-banking crisis nexus. As we already discussed at the end of Section 3, the demand for public bonds behaves differently in default and non-default years. During non-default years, banks' bondholdings are consistent with the liquidity services of public bonds (Holmstrom and Tirole (1998)): banks demand low-risk public bonds when they have few investment opportunities, particularly in less financially-developed countries. During sovereign crises, instead, bondholdings patterns change. In those times, it is predominantly large banks that accumulate high-risk public bonds, consistent with an important role of bailout guarantees or moral suasion.

The evidence analyzed in Section 4 then seems to indicate that all bondholdings, regardless of their origin, hurt the ability or willingness of banks to extent new loans when sovereign default materializes. On the one hand, banks holding on average more bonds in the pre-default years significantly contract their loans during the default event. These banks may be

[27] As discussed before, for this exercise we are limited by the availability of data on spreads, so we are effectively limited to examining the larger, economically more important defaults. In addition to the defaults in Argentina in 2001-2004, Russia in 1998-2000, Ukraine in 1998-2000, Greece in 2012, and Seychelles in 2010 identified also by S&P, the additional defaults we examine here are Ireland in 2011, Portugal in 2011 and 2012, Greece in 2011, and Ukraine in 2001.

cutting their loans for one or more of the following reasons: (i) losses on their existing public bonds force them to deleverage, or relatedly; (ii) they deliberately choose to remain exposed to sovereign risk, or finally because; (iii) the unavailability of safe public bonds prevents them from efficiently managing their liquidity. Either way, this correlation suggests that banks' regular demand for bonds during normal times induces an adverse effect on bank lending once default strikes. On the other hand, banks with high bondholdings during the default years also significantly contract their loans. Regardless of whether these high bondholdings are due to banks reaching for yield or to government intervention, this correlation suggests that the banks' demand for bonds during sovereign defaults is also detrimental to lending. The typical explanation for this effect is that purchases of bonds crowd out new loans on the asset side of banks.

One important feature of our dataset is that, by covering a wide sample of default and non-default years, it allows us to quantitatively evaluate the relative importance of these different bondholdings in transmitting sovereign defaults. In this respect, our data provide a rather clear result: in the countries and periods that we consider, average bondholdings in non-default years, which reflect banks' normal activity, play a significantly larger role than bonds accumulated in the run-up to and during default years. First, the marginal adverse effect of bonds accumulated in non-default years is slightly larger than the marginal adverse effect of bonds bought during crises. Second, and most important, banks in our sample of defaulting countries hold many bonds in normal times (13.0%), and the average increase in bondholdings during crises is rather small by comparison (less than 2%).

These results provide a new perspective on the mechanisms whereby the sovereign default-banking crisis nexus comes into existence and operates. Fueled by the recent European

sovereign crisis, much of the work on this nexus has focused on risk-taking by European banks (e.g., see Acharya and Steffen (2013)). Although this may well be the right strategy for the European context, our panoramic view of sovereign debt crises calls for paying close attention also to the bonds held by banks in normal times: average bondholdings of banks during non-default years appear to play a very important role in sovereign crises, and neglecting them might be problematic. This insight has both positive and, potentially, normative implications.

From a positive standpoint, our analysis suggests that the unfolding of sovereign crises is qualitatively different in emerging and advanced economies. In emerging economies, financial markets are less developed and banks hold a large amount of bonds in normal times (12.7% of assets in non-OECD countries). It is only natural that these bondholdings generate a large fraction of the adverse effects of sovereign defaults on bank lending. In developed economies, banks hold substantially fewer bonds in normal times (5% of assets in OECD countries). As a result, in these countries, banks' take-up of public bonds during crises is likely to be more important relative to their total bondholdings. The patterns of bondholdings in our sample confirm this hypothesis. In the defaults by emerging countries in our sample, such as for example Argentina and Russia, banks hold many bonds before the default; if anything, they slightly decrease their bondholding as default approaches and, after default happens, large banks accumulate even more bonds. By contrast, banks in Europe's more troubled economies held few bonds before 2008, but they accumulated large quantities of them as sovereign risk increased. In our sample, bondholdings between 2008 and 2010 went from 4.4% to 12.3% in Greek banks; from 6.7% to 11% in Irish banks; and from 3% to 8.1% in Portuguese banks.[28] It thus seems highly likely that, in more advanced economies, the accumulation of bonds during crises (either

[28] Over the same period, the increase in bondholdings was much smaller in Spanish (from 4.6% to 6%) and Italian (from 11.8% to 12.4%) banks.

due to a search for yield or to moral suasion) is responsible for a substantially larger portion of the adverse costs of default.

Our results also carry some potentially important normative implications. In the context of recent events, conventional wisdom holds that the European sovereign crisis became a banking crisis due to the specifics of bank regulation. In particular, the fact that regulation assigns a low risk weight to sovereign bonds even in times of crisis made it possible for banks to gamble in the sovereign bond market without being penalized by the regulator. This consideration is important, but our results suggest that the link between sovereign risk and banking crisis might result from deeper forces. If banks demand a sizeable amount of government bonds to carry out their normal business activities, as seems to be particularly the case in emerging economies but also in developed ones, sovereign defaults will undermine the functioning of the banking sector and bank lending over and above its risk taking during the crisis itself. In this context, proposed regulations to increase the risk weight of government bonds during sovereign crises may backfire, because they might exacerbate the pro-cyclicality of bank balance sheets without having much of an effect on the link between sovereign risk and the banking sector.

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Table I – Bank's Holdings of Government Bonds in Bankscope and IMF data, by year

The table reports summary statistics of bank bondholdings as a percentage of total assets for various samples over 1998-2012. Panel A reports statistics on the full Bankscope universe; Panel B reports statistics on the constant-continuing sample from Bankscope, defined as the sample for which data on other bank characteristics is available; Panel C reports bank-level statistics for the countries covered by the IMF; Panel D reports aggregate country-level statistics from the IMF.

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Overall
Panel A – Bankscope data by bank																	
Mean	8.63	7.14	7.39	7.06	7.08	7.93	8.33	8.24	8.50	8.11	7.69	7.86	8.42	11.13	11.31	11.45	9.28
Median	5.40	4.08	4.02	3.34	3.15	3.13	3.54	3.83	4.13	3.96	3.58	3.62	4.40	7.54	7.68	7.75	5.15
Std Dev	9.81	9.05	9.52	9.94	10.59	11.73	12.38	11.40	11.34	10.93	10.37	10.33	10.67	11.63	11.73	11.86	11.24
No banks	3,610	4,306	4,412	4,258	4,043	3,821	3,753	4,015	5,111	5,202	5,141	5,337	5,822	13,706	12,144	14,647	20,337
No countries	114	111	118	122	127	130	133	136	141	147	157	165	158	171	159	176	191
Panel B – Bankscope data by bank, Constant-Continuing Sample																	
Mean		6.74	6.24	5.79	5.49	6.21	6.94	6.39	6.48	6.06	5.57	5.65	6.82	6.39	7.79	8.59	6.67
Median		4.25	3.63	2.69	2.04	1.95	1.83	1.96	2.15	2.11	1.90	1.64	2.36	2.37	4.33	4.93	2.81
Std Dev		7.55	7.47	8.35	8.96	10.11	11.39	9.92	9.71	9.09	8.52	8.74	9.93	9.27	9.49	10.06	9.37
No banks		2,005	2,109	2,071	1,998	1,875	1,841	1,783	1,914	2,421	2,442	2,341	2,332	2,592	4,344	4,381	36,449
No countries		55	57	59	70	73	73	84	103	116	118	123	137	131	115	120	160
Panel C – Bankscope data by bank, countries covered by IMF																	
Mean		7.75	6.94	6.54	6.61	7.37	7.87	7.85	8.29	7.84	7.44	7.37					7.44
Median		4.35	3.93	3.19	3.01	2.93	3.26	3.72	4.04	3.82	3.41	3.31					3.51
Std Dev		9.65	8.95	9.35	10.07	11.24	12.05	11.10	11.21	10.74	10.23	10.00					10.48
No banks		1,544	4,092	3,962	3,782	3,535	3,457	3,662	4,663	4,739	4,653	4,683					42,772
No countries		53	64	65	116	118	118	120	120	121	121	120					128
Panel D – IMF data, by country																	
Mean		8.53	10.79	11.42	11.53	10.85	10.78	9.67	8.12	7.31	6.69	5.71	.				9.06
Median		7.05	8.17	8.38	8.44	7.37	7.90	7.15	6.16	5.10	4.51	3.78	.				6.22
Std Dev		11.63	14.16	14.56	15.44	15.79	14.86	14.11	14.02	12.51	11.50	11.51					13.85
No countries		53	64	65	116	118	118	120	120	121	121	120	.				128

Table II – Banks' Holdings of Government Bonds – Comparing the EU Stress Tests and Bankscope

The table reports summary statistics of bank bondholdings as a percentage of total assets for various samples over 2010-2011. Panel A reports statistics from the EU stress tests of 2010 and 2011 on the full sample of banks involved in the EU stress tests; Panel B reports statistics from the EU stress tests of 2010 and 2011 on the constant sample, defined as the sample for which data is available from both Bankscope and the EU stress tests; Panel C reports statistics from Bankscope on the constant sample; Panel D reports statistics from both Bankscope and EU stress tests on the constant sample for selected countries.

	Mean	Median	Std Deviation	No Countries	No Banks	No Obs.
Panel A – Full Sample						
E.U. Bonds	7.11	6.26	4.94	20	79	119
Own Bonds	5.39	4.61	4.78	20	79	119
PIIGS Bonds	3.52	2.02	4.15	20	79	119
Panel B –Constant Sample						
E.U. Bonds	6.75	6.06	4.57	18	57	79
Own Bonds	5.37	4.46	4.68	18	57	79
PIIGS Bonds	4.09	3.38	4.67	18	57	79
Panel C – Bankscope data, Constant Sample						
Bondholdings Bankscope	7.94	7.42	4.84	18	57	79
Panel D – Banks in Selected Countries, Constant Sample						
Greece						
E.U. Bonds	13.72	11.64	6.37	1	6	9
Own Bonds	12.87	10.78	6.84	1	6	9
PIIGS Bonds	12.90	10.78	6.83	1	6	9
Bondholdings Bankscope	16.05	14.89	6.43	1	6	9
Ireland						
E.U. Bonds	4.59	5.03	1.39	1	3	2
Own Bonds	2.32	2.18	0.43	1	3	2
PIIGS Bonds	2.83	2.89	0.81	1	3	2
Bondholdings Bankscope	8.12	7.59	1.49	1	3	2
Italy						
E.U. Bonds	7.06	7.00	1.94	1	5	10
Own Bonds	6.13	6.44	2.28	1	5	10
PIIGS Bonds	6.24	6.47	2.28	1	5	10
Bondholdings Bankscope	8.58	7.52	2.22	1	5	10
Portugal						
E.U. Bonds	5.58	4.74	2.75	1	4	5
Own Bonds	4.00	4.08	2.20	1	4	5
PIIGS Bonds	5.01	4.34	3.21	1	4	5
Bondholdings Bankscope	8.46	7.31	3.97	1	4	5
Spain						
E.U. Bonds	4.39	4.93	2.16	1	15	20
Own Bonds	4.04	4.75	2.03	1	15	20
PIIGS Bonds	4.27	4.93	2.16	1	15	20
Bondholdings Bankscope	5.48	6.09	3.02	1	15	20

Table III – Banks' Holdings of Government Bonds Around the World

The table reports summary statistics of the banks' holdings of government bonds, computed as a percentage of total assets. Panel A reports statistics on the Bankscope universe and Panel B on the constant-continuing sample.

Panel A – Bondholdings – Bankscope population

	Overall	Non-Defaulting Countries	Defaulting Countries		OECD	Non-OECD
			Non-Default Yrs	Default Yrs		
Mean	9.28	9.06	13.49	14.49	8.43	12.39
Median	5.15	5.02	8.94	9.15	4.47	8.11
Std Deviation	11.24	11.03	13.90	15.35	10.60	12.85
No Banks	20,337	19,714	542	501	16,401	3,976
No Countries	191	157	34	24	34	157
No Bank-Year Ob	99,328	94,744	3,161	1,225	78,118	21,210

Panel B – Bondholdings – Constant-Continuing Sample

	Overall	Non-Defaulting Countries	Defaulting Countries		OECD	Non-OECD
			Non-Default Yrs	Default Yrs		
Mean	6.67	6.19	12.96	14.87	4.61	12.63
Median	2.81	2.57	8.89	11.17	1.92	8.79
Std Deviation	9.37	8.84	12.94	13.87	7.13	12.12
No Banks	7,391	6,935	414	264	5,334	2,058
No Countries	160	144	26	17	32	128
No Bank-Year Obs.	36,449	34,030	1,784	635	27,074	9,375

Table IV – Descriptive Statistics

The table reports summary statistics of the main variables used in the empirical analysis. Assets is the total book value in million $ of intangible, tangible and other fixed 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. Panel A reports statistics on the Bankscope universe and Panel B on banks involved in the EU stress test of 2010. For details on the construction of all variables see Table AI in the Appendix.

Panel A – Bankscope, Constant-continuing sample

	Mean	Median	Std Deviation	No Countries	No Observations
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 B – 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 V – 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. Standard errors (in parentheses below the coefficient estimates) are adjusted for heteroskedasticity 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)	(5)	(6)
$Size_{t-1}$	0.001*	0.001***	0.001	0.001***	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
$Loans_{t-1}$	-0.020***	-0.026***	-0.030***	-0.027***	-0.045***	-0.041***
	(0.003)	(0.005)	(0.007)	(0.004)	(0.007)	(0.004)
Government $Owned_{t-1}$	0.008***	0.003	0.005	0.002	-0.003	0.003
	(0.002)	(0.004)	(0.006)	(0.004)	(0.005)	(0.002)
Expected Sov. Bond $Return_{t-1}$			-0.015**		-0.029***	
			(0.006)		(0.009)	
GDP $Growth_{t-1}$		-0.243***	-0.204***	-0.164**	-0.208**	
		(0.052)	(0.053)	(0.066)	(0.101)	
Banking $Crisis_{t-1}$		0.036***	0.026***	0.030***	0.025	
		(0.004)	(0.006)	(0.005)	(0.020)	
Private $Credit_{t-1}$		-0.022***	-0.007*	-0.021***	0.018	
		(0.004)	(0.004)	(0.004)	(0.016)	
Sovereign $Default_{t-1}$				-0.123	-0.242	-0.091*
				(0.158)	(0.247)	(0.055)
Sovereign $Default_{t-1}$ *				0.009***	0.012***	0.007***
$Size_{t-1}$				(0.003)	(0.003)	(0.003)
Sovereign $Default_{t-1}$ *				-0.013	-0.056	-0.041
$Loans_{t-1}$				(0.032)	(0.038)	(0.029)
Sovereign $Default_{t-1}$ *				0.008	0.033	0.016
Government $Owned_{t-1}$				(0.022)	(0.024)	(0.021)
Sovereign $Default_{t-1}$ *					0.067**	
Expected Sov. Bond $Return_{t-1}$					(0.027)	
Sovereign $Default_{t-1}$ *				0.027	0.224	
GDP $Growth_{t-1}$				(0.170)	(0.226)	
Sovereign $Default_{t-1}$ *				0.035*	0.018	
Banking $Crisis_{t-1}$				(0.021)	(0.035)	
Sovereign $Default_{t-1}$ *				0.448*	0.730**	
Private $Credit_{t-1}$				(0.230)	(0.321)	
Other controls?	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies?	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies?					Yes	Yes
Country x Year Dummies?						Yes
No Observations	36,449	13,082	5,341	13,082	5,341	26,549
No Banks	7,391	2,912	2,103	2,912	2,103	5,124
No Countries	160	40	29	40	29	157
R-squared	0.772	0.797	0.715	0.801	0.735	0.814

Table VI – Bondholdings 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; pre-default bank bondholdings, coimputed 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; 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. Standard errors (in parentheses below the coefficient estimates) are adjusted for heteroskedasticity 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)	(5)	(6)	(7)	(8)	(9)
Bank Bondholdings$_{t-1}$ *	-0.126**	-0.129**	-0.095*	-0.148**	-0.133***				
Sovereign Default$_{t-1}$	(0.057)	(0.057)	(0.058)	(0.060)	(0.045)				
Pre-Default Bank Bondholdings						-0.281***			
						(0.080)			
Avg Pre-Default Bank Bondholdings							-0.361***		
							(0.028)		
Bank avg non-default years Bonds$_{t-1}$ *								-0.201**	-0.213**
Sovereign Default$_{t-1}$								(0.100)	(0.088)
Bank time-varying Bondholdings$_{t-1}$ *								-0.197***	-0.206***
Sovereign Default$_{t-1}$								(0.072)	(0.068)
Sovereign Bond Return$_{t-1}$ *	0.072***	0.068***	0.071***					0.128***	
Sovereign Default$_{t-1}$	(0.014)	(0.015)	(0.015)					(0.031)	
Bank Bondholdings$_{t-1}$	0.032***	0.034***	0.009	0.009	0.002				
	(0.009)	(0.009)	(0.011)	(0.011)	(0.016)				
Bank avg non-default years Bonds$_{t-1}$								0.035	-0.006
								(0.022)	(0.017)
Bank time-varying Bondholdings$_{t-1}$								0.029	-0.002
								(0.026)	(0.020)
Sovereign Default$_{t-1}$	-0.038	-0.035	-0.019	-0.057	0.122**			0.052	0.075
	(0.026)	(0.025)	(0.024)	(35.69)	(0.055)			(0.070)	(0.143)
Sovereign Bond Return$_{t-1}$	0.005	0.011*	0.004					0.003	
	(0.005)	(0.006)	(0.007)					(0.007)	
Bank-Level Controls and Interactions?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies?		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies?			Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country x Year Dummies?				Yes	Yes				Yes
Constant	0.041**	0.030*	-0.026	-0.069	-0.280	0.780**	0.874**	-0.052*	0.027
	(0.018)	(0.018)	(0.021)	(283.3)	(178.6)	(0.275)	(0.272)	(0.028)	(93.0)
No Observations	14,074	14,074	14,074	14,074	27,408	105	105	13,347	26,006
No Banks	3,722	3,722	3,722	3,722	5,218	105	105	3,553	4,972
No Countries	60	60	60	60	158	5	5	60	158
R-squared	0.061	0.072	0.106	0.204	0.224	0.439	0.442	0.113	0.229

Table VII – Bondholdings 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; Large defaults are Argentina's, Russia's Ukraine's, Greece's, Ecuador's, Nigeria,'s, and Kenya's. Standard errors (in parentheses below the coefficient estimates) are adjusted for heteroskedasticity 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.

	Largest defaults only		Large 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 avg non-default years Bonds$_{t-1}$ *	-0.263**	-0.268**	-0.223**	-0.259**	-0.222**	-0.224**	-0.219**	-0.223**	-0.219**	-0.260**	-0.321**	-0.334**	-0.211*	-0.224*
Sovereign Default$_{t-1}$	(0.123)	(0.123)	(0.107)	(0.108)	(0.107)	(0.090)	(0.107)	(0.090)	(0.107)	(0.108)	(0.160)	(0.159)	((0.122))	((0.122))
Bank time-varying Bondholdings$_{t-1}$ *	-0.236***	-0.260***	-0.189***	-0.234***	-0.190***	-0.210***	-0.190***	-0.211***	-0.193***	-0.234***	-0.286***	-0.322***	-0.216***	-0.244***
Sovereign Default$_{t-1}$	(0.072)	(0.071)	(0.073)	(0.070)	(0.073)	(0.069)	(0.073)	(0.069)	(0.073)	(0.070)	(0.093)	(0.092)	(0.073)	(0.071)
Sovereign Bond Return$_{t-1}$ *	0.117***		0.142***		0.127***		0.109***		0.109***		0.162***		0.118***	
Sovereign Default$_{t-1}$	(0.031)		(0.032)		(0.031)		(0.032)		(0.032)		(0.040)		(0.031)	
Bank avg non-default years Bonds$_{t-1}$	0.008	0.017**	0.006	0.015*	0.009	0.017**	0.008	0.017**	0.007	0.015*	-0.008	0.005	-0.011	0.004
	(0.011)	(0.009)	(0.012)	(0.009)	(0.011)	(0.008)	(0.011)	(0.008)	(0.011)	(0.008)	(0.009)	(0.007)	(0.009)	(0.007)
Bank time-varying Bondholdings$_{t-1}$	0.010	0.025*	0.001	0.022	0.003	0.019	0.002	0.021	0.005	0.022	-0.006	0.013	0.000	0.018
	(0.019)	(0.014)	(0.019)	(0.014)	(0.018)	(0.014)	(0.018)	(0.014)	(0.018)	(0.014)	(0.017)	(0.013)	(0.017)	(0.014)
Sovereign Bond Return$_{t-1}$	0.006		0.000		0.003		0.015**		0.015**		0.002		0.005	
	(0.008)		(0.008)		(0.007)		(0.007)		(0.007)		(0.006)		(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	-0.042*	0.211	-0.039*	0.411	-0.027	0.378	-0.050**	-1.259	-0.071**	0.580**	-0.015	0.163***	-0.008	0.150***
	(0.023)	(.)	(0.023)	(0.292)	(0.023)	(0.286)	(0.023)	(.)	(0.028)	(0.292)	(.)	(0.023)	0.022	(0.021)
No Observations	12,742	25,017	12,951	25,371	13,312	25,857	12,957	25,501	12,827	25,307	17,048	29,899	16,470	28,956
No Banks	3,388	4,729	3,425	4,795	3,532	4,923	3,445	4,835	3,396	4,784	5,343	6,768	5,175	6,525
No Countries	55	147	56	148	58	151	55	148	54	147	61	160	56	149
R-squared	0.118	0.229	0.112	0.221	0.113	0.226	0.118	0.227	0.117	0.227	0.112	0.221	0.115	0.220

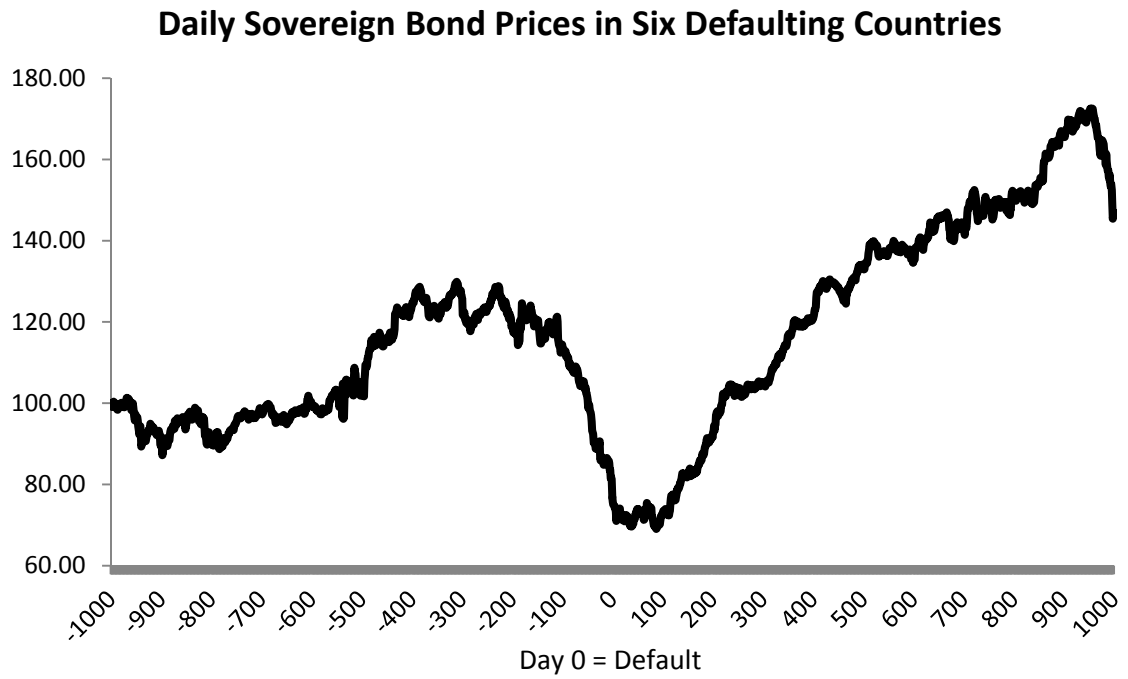

Figure 1. Sovereign Bond Prices in Defaulting Countries. The figure plots the average bond prices over 7 default episodes in 6 countries (Argentina 2001-2004, Russia 1998-2000, Cote d'Ivoire 2000-2004, Ecuador 1998-2000, Ecuador 2009, Nigeria 2002, Greece 2012), from day -1,000 to +1,000, whereby day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

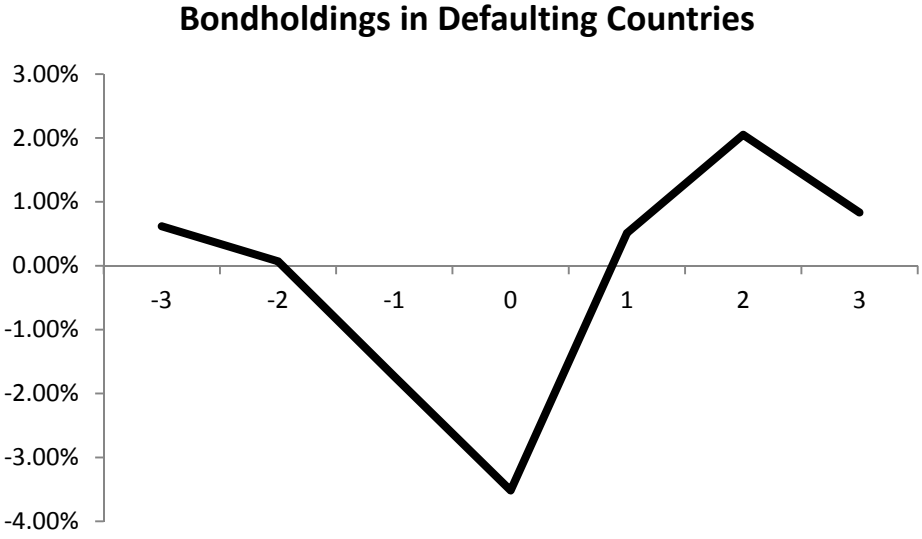

Figure 2. Bondholdings in Defaulting Countries. The figure plots the average annual bondholdings in seven default episodes in six countries (Argentina 2001-2004, Russia 1998-2000, Cote d'Ivoire 2000-2004, Ecuador 1998-2000, Ecuador 2009, Nigeria 2002, Greece 2012), from three years prior to default to three years after. The within-country averages are normalized at 0. Year 0 is the first year of default.

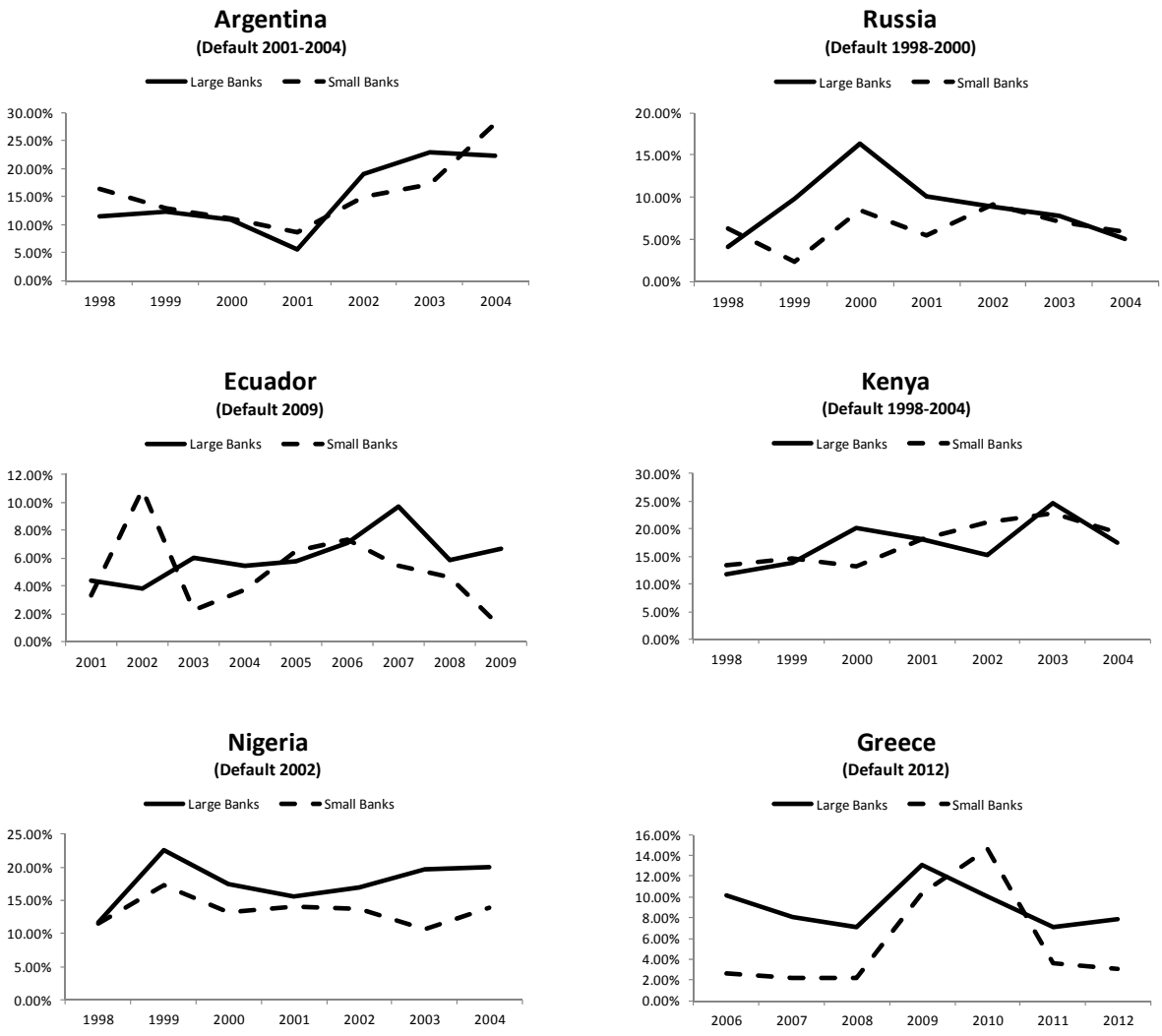

Figure 3. Bondholdings in Selected Defaulting Countries by Bank Size. The figure plots the average bondholdings by large (above-median total assets) and small (below-median total assets) banks in selected countries.

Appendix

This Appendix reports tables that are referred to in the main text. Table AI lists the default events that we consider in our empirical analysis. Table AII describes our variables and their sources. Table AIII reports descriptive statistics on realized sovereign bond returns.

Table AIV 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 that in the literature have been found to predict sovereign 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 AIV 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 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.

Finally, Table AV presents pair-wise correlations among the variables used in the analysis.

Table AI – 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	No Banks
Argentina	2001-2004	76.8%	2001-2004	231	87
Ecuador	1998-2000; 2009	38.3%		8	8
Ethiopia	1998-1999	92.0%		2	1
Greece	2012	64.8%	2011-2012	12	9
Guyana	1998-2004	91.0%		20	3
Honduras	1998-2004	82.0%		79	21
Ireland			2011	7	7
Indonesia	1998-2000; 2002			17	13
Jamaica	2010			5	5
Kenya	1998-2004	45.7%		160	33
Nigeria	2002			41	41
Portugal			2011-2012	24	15
Russia	1998-2000	51.1%	1998-2000	40	31
Serbia	1998-2004	70.9%		2	2
Seychelles	2000-2002; 2010	56.2%	2010	1	1
Sudan	1998-2004			2	1
Tanzania	2004	88.0%		1	1
Ukraine	1998-2000	14.8%	1998-2001	17	8
Zimbabwe	2000-2004			6	3
No Banks				675	290
No Countries	17	12	7		
No Episodes	20	13	7		

Table AII – Definition of the Variables used in the Analysis

Variable	Definition
Bank-level variables	
Assets	Total book value of intangible, tangible and other fixed 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.
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).
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, International Financial Statistics (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 AIII – 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 AIV – 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 heteroskedasticity 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 AV – 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-cash Assets	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***