Domestic banks as lightning rods?
Home bias during Eurozone crisis[†]

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Abstract

Governments and domestic banks in Europe have attracted criticism lately due to heightening inclination of banks to hold more local sovereign debt in the midst of the crisis, which has been interpreted as an evidence of financial repression or moral suasion. By using a novel dataset on bank-level exposures of sovereign and private debt covering the entire Eurozone crisis, I first confirm that sovereign debt has been reallocated from foreign to domestic banks at the peak of the crisis. Furthermore, this reallocation has been especially visible for banks as opposed to other domestic private agents and cannot be explained by risk-shifting tendency of crisis-country banks. However, in contrast with the previous literature focusing only on sovereign debt, I show that banks' private sector exposures have (at least) equally suffered from a rising home bias. Finally, I present a clear information channel and demonstrate that foreign banks –free from moral suasion- located in informationally-closer territories had a relatively higher exposure to crisis-countries. Overall, the evidence is only compatible with the argument of rising informational asymmetries between domestic and foreign banks.

Keywords: Sovereign debt; Home bias; Information asymmetries; European banks; Eurozone.

JEL classification: F21, F34, F36, G01, G11, G21.

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1. Introduction

Can domestic banks act as lightning rods in the midst of a stormy financial climate? On the contrary, by now, the deathly loop between sovereign and bank credit risks has been very well documented, especially in the context of recent Eurozone crises. Increasing risk pressures in the banking sector put unnecessary burden on public finances due to potential future bailout costs and negative spillovers to the lending in real economy. In turn, a spike in the sovereign credit risk might trigger deterioration in the bank finances through losses on banks' government bond holdings and the loss of credibility for future government support (Acharya, Drechsler and Schnabl, 2014). Many studies have already pointed that European banks' relatively high exposure to sovereign debt has led them to decrease the loan supply in their respective territories, thus transferring the financial turmoil to the real economy (Acharya, Eisert, Eufinger and Hirsch, 2015a; Altavilla, Pagano and Simonelli, 2015; Popov and Van Horen, 2015).

One of the most seemingly-bizarre trends, however, was the banks' escalating home bias for sovereign debt, especially in crisis countries. That is, at the peak of the government debt problems, banks started accumulating the bonds of the country in which they were located. Figure 1 illustrates the initial rise and the gradual reversal of this trend –alongside with the respective bond yields- in periphery (crisis) part of the Eurozone whereas the corresponding bias in core (non-crisis) Euro countries seems to have been more or less stable. Intriguingly, the observation still stands in Figure 2 even after correcting for how much of the domestic debt the banks should hold in a standard Capital Asset Pricing Model (CAPM).[1]

With the devilish interaction between sovereign and banking crisis in the background, most of the recent literature attributed this observation to the argument of financial

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[1] As discussed later in the Data section, a simple asset pricing model would predict that banks must hold sovereign debt in proportion to the relative weight of their sovereign portfolio in the universe of total sovereign bond holdings.

repression/moral suasion (Becker and Ivashina, 2014; De Marco and Macchiavelli, 2015; Ongena, Popov and Van Horen, 2015). In other words, in order to gain relief from crisis and to be able to rollover their debts, governments may have (implicitly) forced the banks in their jurisdiction to increase domestic sovereign exposures. Pointing to the highly positive correlations between "government-relatedness"[2] and public bond holdings of the banks, these papers argue that there has been a clear tendency of troubled governments to impose moral suasion on the banks that they can control. From this perspective, the resulting home bias has been mostly involuntary for domestic banks and created an unnecessary burden on the financial health of the banking sectors in crisis countries.

Another competing argument for the repatriation of public debt from non-crisis to crisis countries is based on the assumption that governments would be less willing to default if their debt was held by the domestic agents rather than foreign ones due to the costs such a default would inflict on the domestic economy (Broner, Martin and Ventura, 2010; Gennaioli, Martin and Rossi, 2014a). Hence, in the existence of well-functioning secondary markets, sovereign debt should naturally be reallocated back to host countries as domestic agents will attach a higher value to these securities than their foreign counterparts. According to this view, the resulting home bias has been a dark side-effect of secondary markets and might have even benefited the creditors if it eventually decreased governments' willingness to default. With respect to this argument, Figure 3 illustrates the evolution of the home bias for different types of domestic agents in crisis (periphery) and non-crisis (core) Euro countries. Though it is clear that resident banks in the periphery accumulated a big portion of domestic debt, this is hardly true for other residents in the same countries, which goes against the intuition of Broner et al. (2010) and asks for a further link between resident banks and government debt.

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[2] Either through direct government ownership of the bank or political links in the board of directors.

In this paper, I propose an alternative channel and show that European banks' increasing sovereign home bias in crisis countries is not so surprising if one takes into account one of the most conventional (albeit lately-forgotten) theories of the home bias in asset markets: informational frictions (Brennan and Cao, 1997; Van Nieuwerburgh and Veldkamp, 2009; Dziuda and Mondria, 2012). As true for most asset classes, home bias usually exists when there is an informational advantage in favour of domestic agents. In tranquil periods and well-integrated markets such as in Europe, one would not expect to observe a high level of home bias. Nonetheless, in crisis episodes during which domestic agents are likely to gain an informational advantage over their foreign peers, one would expect the home bias to rise since foreign agents would be more likely to react negatively on bad news (Brennan, Cao, Strong and Xu, 2005). This is especially true if the crisis episodes are associated with large-scale market panic as illustrated by the recent studies for the Eurozone (De Grauwe and Ji, 2013; Saka, Fuertes and Kalotychou, 2015). If this view is correct, one would expect to see the sovereign debt to be especially reallocated to local banks rather than other domestic agents due to the strong informational linkages between banks and governments. In fact, if the information channel was operational, it is expected that the reallocation would be concentrated on banks that were closely linked to the government. Hence, the conclusions of above-mentioned studies arguing in favour of moral suasion hypothesis based on such empirical findings might be biased in the absence of an explicit control for the information channel.

By taking a global portfolio approach and using a novel bank-level dataset compiled from various stress-tests, transparency and capital exercises of the European Banking Authority (EBA), I first show that European banks' home bias increased and sovereign debt was indeed reallocated from foreign to domestic banks at the peak of the crisis. Consistent with Acharya and Steffen (2015) and Crosignani (2015), I also find evidence of risk-shifting

behaviour for banks located in crisis countries; however it is also shown that home bias goes much beyond this behaviour. Interestingly, and in contrast with "the secondary market theory" of Broner et al (2010), this reallocation does not seem to be visible at all for the domestic agents other than banks, which is compatible with the information asymmetry theory of home bias given the informational advantages that banks enjoy in comparison to other local agents over sovereign debt of their local governments. Additionally, I illustrate that, in response to crisis, private forms of debt (retail and corporate) in bank balance sheets have experienced an equally large (if not larger) increase in home bias, which is in sharp contradiction with the moral suasion story unless one assumes corporate/retail borrowers can somehow force the domestic banks to lend to them. On the other hand, this finding is exactly what one would expect from informationally more sensitive assets (such as private debt) if crisis episodes were associated with informational frictions. Finally, I present a clear information channel and demonstrate that foreign banks –free from moral suasion- with more branches in crisis countries have increased their exposures to these countries during crisis.

Overall, the evidence presented in this paper is only compatible with the conventional theory of increasing informational asymmetries between domestic and foreign agents during crisis. Thus, answering the question in the beginning, it is possible that domestic banks may have acted as lightning rods collecting the sovereign debt while the governments were suffering from information frictions as foreign banks left the market in panic, triggering a financial storm.

The rest of the paper is organized as follows. Next section briefly outlines the relevant background literature. Section 3 describes the data and methodology. The empirical results are presented in section 4. Final section concludes the paper.

2. The related literature

The main motivation of the paper comes from the recently-aroused interest in academic and policy circles on the causes of rising fragmentation -"home bias"- across Eurozone sovereign debt markets. One of the earlier contributions by Becker and Ivashina (2014) illustrates the positive association between country-level government ownership in the banking sector and domestic government bond holdings of the banks. They further extend this finding by showing the significance of the positive relationship between government-relatedness of the banks' board members and government bond holdings in crisis-country banks. De Marco and Macchiavelli (2015) follow a similar path to point out that, upon receiving liquidity injections, only politically-related European banks increased their exposure to domestic sovereign debt. Using a proprietary bank-level dataset from European Central Bank (ECB), Ongena et al. (2015) demonstrate that, compared to foreign ones, domestic banks were more inclined to increase their exposure when sovereigns had to rollover large chunks of outstanding public debt. Many other recent papers confirm these observations (Horváth, Huizinga and Ioannidou, 2015; Altavilla et al., 2015) and conclude that a moral suasion channel was in operation during Eurozone crisis; however all of these studies are silent about the possible information channel that might have been active between governments and related banks. I contribute to this literature by presenting evidence on the rising home bias for asset classes other than sovereign debt, which points out the rising informational asymmetries between domestic and foreign banks at the peak of the crisis and puts a cap on moral suasion hypothesis.

Another strand of home bias literature specific to sovereign debt underlines the assumption that it is harder for governments to default on their promises when most of the debt is held domestically. In such a case, government would rather not default since the benefits will be offset by its harm on the domestic economy. Hence, in expectation of this by

local agents, government debt will flow back to the host country in times of crisis (Broner et al., 2010). Analysing a vast database covering 191 countries, Gennaioli, Martin and Rossi (2014b) show empirical patterns consistent with this prediction although they cannot differentiate between domestic and foreign bonds at the bank-level. In a recent paper, Brutti and Sauré (2016) present confirming evidence in the context of Eurozone crisis by demonstrating that reallocation was more intense for sovereign debt than the private one. Furthermore, debt of the crisis governments tended toward those banks whose countries were politically more powerful in the Euro area. By using a dataset covering the entire Eurozone crisis episode for 30 European countries at the bank-level, I complement and challenge these findings: I find that reallocation of sovereign debt indeed occurred in the Eurozone crisis; however this only holds for domestic banks as opposed to other domestic agents, which goes against the earlier prediction of Broner et al. (2010). Furthermore, compared to government debt, retail and corporate debt in bank balance-sheets equally suffered (if not more) from an increase in home bias in response to crisis, which is hard to reconcile with the earlier finding of Brutti and Sauré (2016) who only focus on the first part of the Eurozone crisis in their sample period with a limited coverage of European countries.[3]

A related literature focuses on the risk-shifting tendency of the undercapitalized banks. According to this argument, banks with low capital ratios prefer high-risk instruments such as the government bonds of crisis countries so that the equity-owners would benefit from a resurrection of the country while their losses would be limited in case of a default. (Acharya and Steffen, 2015; Horváth et al., 2015). However, this argument does not necessarily explain why weak banks would especially risk-shift by accumulating domestic government bonds rather than the bonds of other governments struck by crisis. In line with Crosignani (2015), I find evidence that (potentially weak) banks located in crisis countries shift their sovereign

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[3] Their sample period goes from 2007 to late-2011 and is mainly restricted to Eurozone countries with also some non-European countries such as Brazil and Mexico.

portfolios more favourably towards other countries in crisis; but this behaviour is found to be much more prominent when it is the domestic government who is in crisis, indicating the need for a further investigation of the link between banks and domestic sovereign bond holdings.

Finally, this paper relates to the massive literature on home bias in portfolio holdings of different asset classes. Most of this literature focuses on equity holdings (French and Poterba, 1991) whereas some recent studies look at the regional biases in international bond portfolios of various country groups (Lane, 2006). Previous studies mainly revolve around three broad categorical explanations for home bias: exchange rate risk, transaction costs in financial markets and informational frictions (Coeurdacier & Rey, 2012). However, with the increasing financial integration and exchange rate stability over the years, informational asymmetries would be a more likely suspect for the recently skyrocketing home bias in Europe. Brennan and Cao (1997), for example, model the sensitivity to asset-related news when there is a difference between informational endowments of domestic and foreign agents. They illustrate that, in such a scenario, home bias would be positively associated with the negative news as foreign investors would try to infer the local information from past asset prices and react more to such news.[4] On a similar path, Van Nieuwerburgh and Veldkamp (2009) show that, in the existence of (even initially small) informational differences between foreign and domestic agents, costly information acquisition process may boost the agents' home bias. Lastly, Dziuda and Mondria (2012) demonstrate that, even in the existence of sophisticated investors such as fund managers, home bias may arise due to the fact that investors would be better at judging the performance of fund managers when they invest in local assets rather than foreign ones. Therefore, one might observe a home bias even in the portfolios of highly sophisticated institutions such as banks or mutual funds.

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[4] Inspired by Brennan and Cao (1997), there is a stream of studies in the asset-pricing literature that detect the foreign investors' trend-following behavior. See Choe, Kho and Stulz (1999, 2005); Grinblatt and Keloharju (2000); Froot, O'Connell and Seasholes (2001); Kim and Wei (2002); Griffin, Nardari and Stulz, (2003); Richards (2004); Edison and Warnock (2008).

Following the intuition that informational frictions might lie behind the widely-observed home bias for various asset classes,[5] many researchers have empirically studied the effects of several forms of informational-distance on portfolio holdings. For instance, Coval and Moskowitz (1999, 2001) find that geographical proximity is crucial for US investors' portfolio composition and the risk-adjusted returns, even within the same country. Grinblatt and Keloharju (2001) discover that investors might be biased towards firms that are close to them in terms of physical location, culture and language of communication. Hau (2001) exemplifies a case in which professional traders located in Germany or in German-speaking cities make more profit in German stocks. Finally, Portes and Rey (2005) conclude that geographical distance matters for cross-border capital flows; however it mostly proxies the effects of other informational variables such bank branches across countries or telephone call traffic. I contribute to this literature by demonstrating that banks with more branches in crisis countries have increased their exposures to these countries during crisis, which emphasizes the role of informational linkages as a potential channel for rising home bias in the Eurozone.

3. Data description and empirical methodology

3.1. Data

The main body of data that I use in the paper comes from various stress-tests, transparency and recapitalization exercises that are undertaken by the European Banking Authority (EBA) over the course of 5 years for a large set of European banks covering 30 members of the European Economic Area (EEA). The first of these disclosures was undertaken by the Committee of European Banking Supervisors (CEBS), which was comprised of senior representatives of bank supervisory authorities and central banks of the European Union and later succeeded by the EBA. Its results were made public by national regulators at the time;

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[5] For further evidence on the informational advantage that domestic investors may hold vis-à-vis foreign investors, see Kang and Stulz (1997); Frankel and Schmukler (2000); Kaufmann, Mehrez and Schmukler (2005).

however EBA does not provide the related data. Hence, this dataset was obtained from the Peterson Institute for International Economics while all other datasets were acquired from the EBA.

Table 1 lists these exercises and the disclosure dates for each of them together with how many banks and which information dates were covered. 10 data time-points start from the first quarter of 2010 and goes all the way to the second quarter of 2015, thus covering the start, rise and fall of the Eurozone crisis. Sovereign bond holdings are reported for each data time-point while private credit exposures (corporate, retail, etc.) can be found for 6 of these. In each disclosure, the full country-breakdown of each bank's debt portfolio for up to 200 countries can be found.[6] However, to focus on the debt reallocation across Europe, only exposures to 30 EEA countries are included in the sample.

The main banks involved in the exercises mostly stay the same even though some smaller banks are added and subtracted from one exercise to another. All exposures are consolidated at the parent bank level and each exercise involves banks with at least 65% of the total banking assets in Europe and 50% of the banking sector of each EEA member. Some studies have already explored the sovereign bond holdings in the datasets of earlier EBA disclosures (De Marco and Macchiavelli, 2015; Horváth et al., 2015); however, to the best of my knowledge, this is the most comprehensive dataset compiled with all the sovereign and private debt exposures of European banks in all the tests undertaken and made public by the EBA until now. Compared to other studies using proprietary datasets from European Central Bank (Ongena et al., 2015; Altavilla et al., 2015), EBA data covers banks from a wider range of countries (including non-Eurozone) and documents finer granularity in terms of full country-breakdowns of sovereign exposures at bank-level.

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[6] Except the first disclosure undertaken by CEBS in which exposures to only the 30 European countries can be found.

I am mainly interested in what portion of a sovereign's total bank-debt is held by a specific bank. Thus the main variable of interest ($SovereignPortion_{b,c,t}$) measures each bank's (b) nominal exposure to a certain country (c) at a certain time-point (t) divided by the total nominal exposure of all the banks for that country at that time. That is;

$$SovereignPortion_{b,c,t} = \frac{NominalExposure_{b,c,t}}{\sum_b NominalExposure_{b,c,t}}$$

In line with the mainstream literature on home bias (Ahearne, Griever and Warnock, 2004; Coeurdacier & Rey, 2012), I also create an alternative variable that takes into account an optimal portion of sovereign debt that should be held by a bank according to a standard Capital Asset Pricing Model (CAPM). This variable ($SovereignPortionBias_{b,c,t}$) takes the difference between our main variable of interest ($SovereignPortion_{b,c,t}$) and the portion that is suggested by the CAPM model ($SovereignPortionCAPM_{b,c,t}$). As conventional in the literature, this difference is standardized by the share of other banks' portfolios in the global portfolio ($1 - SovereignPortionCAPM_{b,c,t}$). That is;

$$SovereignPortionBias_{b,c,t} = \frac{SovereignPortion_{b,c,t} - SovereignPortionCAPM_{b,c,t}}{1 - SovereignPortionCAPM_{b,c,t}}$$

where:

$$SovereignPortionCAPM_{b,c,t} = \frac{\sum_c NominalExposure_{b,c,t}}{\sum \sum_{b,c} NominalExposure_{b,c,t}}$$

If bias variable ($SovereignPortionBias_{b,c,t}$) takes the value of 1, it means all of the country's debt is held by the specific bank, thus perfect home bias. If it is zero, that means the bank holds exactly the portion of the debt suggested by the CAPM model, thus no home bias.

For the later section of the study, I create the corresponding variables for retail ($RetailPortion_{b,c,t}$) and corporate ($CorporatePortion_{b,c,t}$) exposures separately (but exactly in the same way as described above) and then merge it with the sovereign exposure

variables under a single variable name ($DebtPortion_{d,b,c,t}$) where (d) denotes the type of debt in consideration.

To construct the dummy variable $Crisis_{c,t}$, the daily 10-month maturity bond yields for each of 30 European countries are obtained from *Datastream*.[7] In the next step, I follow a similar approach to Brutti and Sauré (2016) and categorize a country as "in crisis" ($Crisis_{c,t}$) if the country's average daily bond yields for the previous three months was above 6 percent.[8]

To be able to differentiate between different creditors of the governments, a measure of sovereign holdings for non-bank agents is needed. Unfortunately, EBA datasets only contain information about banks. Hence, I resort to a country-level dataset compiled from various national sources by Merler and Pisani-Ferry (2012), which gives the portion of a country's total debt held by resident banks and other residents.[9] Observations cover 11 European countries[10] at quarterly intervals, starting from 1990s. For consistency, I choose the same period covered by the EBA dataset, from 2010-Q1 to 2014-Q4.[11] For the panel regressions with this dataset, I create a dependent variable called $DomesticPortion_{c,k,t}$, which measures the portion of a country's (c) debt held by a certain domestic creditor (k: $ResidentsBanks$ or $OtherResidents$) at a certain time-point (t).

To control for time-varying bank characteristics, I get the balance-sheet items from Bankscope for the corresponding banks in EBA datasets. In line with the recent literature (De Marco and Macchiavelli, 2015; Horváth et al., 2015; Ongena et al., 2015), I include *LogAssets* which is the logarithm of the bank's total assets (originally in million Euros); *Tier1/RWA*

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[7] Bond yields for two countries (Estonia and Liechtenstein) are not available on *Datastream*; so these observations are dropped from the sample.

[8] Various robustness checks are conducted later by using different crisis definitions.

[9] Importantly for our purposes, "other residents" category does not include the public agencies or central banks, so we can assume that these are private non-bank residents.

[10] These are Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain and United Kingdom. Data for Belgium and Finland can only be found annually; so I linearly interpolated the data to get quarterly values for these two countries.

[11] Results on the full sample period are also estimated later as a robustness check.

which is the Tier 1 capital of the bank as a percentage of its risk-weighted-assets; *Loans/Deposits* which is the net loans divided by bank's customer deposits; *ROAA* which is the return on average assets computed as the net income of the bank divided by its average total assets; and *NPL* which denotes the non-performing loan ratio calculated as the impaired loans of the bank divided by its gross loans. All bank-level characteristics are end-of-the-year values and included with a year lag with respect to the observation date (t).

Finally, to proxy the informational linkages across countries or specifically between banks and exposure countries, I construct 4 different variables in line with the previous home bias literature (Portes, Rey and Oh, 2001; Portes and Rey, 2005). First one, *CrossCountryDistance*, measures the geographical distance (in thousand kilometers) between the capital city of the bank's home country and the capital city of the bank's exposure country. Second one, *BankCountryDistance*, is the geographical distance (in thousand kilometers) between the city in which the bank is located and the capital city of the bank's exposure country. Third, *CrossCountryBranches*, represents the total number of bank branches (in thousands) in the exposure country of the bank which ultimately belong to a bank from its home country.[12] Finally, *BankCountryBranches* is the total number of bank branches (in thousands) in the exposure country of the bank which ultimately belong to the bank itself. Geographical distance information is derived via MapQuest while the snapshot of banks' branch networks as of February, 2016, is acquired from SNL Financial.[13]

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[12] This variable is created by taking all of the ultimate-parent banks located in 30 EEA countries available in SNL database, independent of whether the bank is included in EBA dataset or not. The purpose here is to capture the non-time-varying banking linkages across countries. Hence, it is important to consider the full sample available rather than only the restricted EBA sample. This data covers 137,284 bank branches in total which is 92% of all bank branches (149,242) in these countries, estimated using World Bank data for 2014 (see http://data.worldbank.org/indicator/FB.CBK.BRCH.P5).

[13] Unfortunately, the branch information is not available historically and SNL Financial only provides the most current data available. However, to the extent that the current data is representative of the non-time-varying cross-country banking linkages, it is reasonable to assume that estimates would not be biased in any particular direction.

Table 2 gives summary statistics for these variables. It is important to note that for *SovereignPortion* variable, more than half of the observations contain zero values. However, these are meaningful zeros, implying that the bank does not have any exposure to that sovereign at that certain point in time. When the mean levels across general and *Domestic* samples are compared, one can clearly see the inclination of the banks to hold a higher fraction of the government debt of their own countries. The same can be said for *CorporatePortion* and *RetailPortion* variables. When we compare different debt categories for domestic bank samples, we see that a bank on average holds a higher fraction of its country's retail debt (0.164) than it holds its country's sovereign debt (0.126). This holds true for corporate debt as well, which is in line with the information asymmetry theory of home bias, predicting that -in general- informationally more sensitive assets (private debt) should suffer more from home bias than other more standardized assets (public debt) would do.

3.2. Methodology

The first thing to capture is the effect of the crisis on the sovereign home bias of the European banks. Hence, the first specification is:

$$SovereignPortion_{l,b,c,t} = B_1\big(Crisis_{c,t} * Domestic_{l,c}\big) + B_0\big(Domestic_{l,c}\big) \quad (1)$$

$$+ \delta\big(Controls_{b,c,t}\big) + \alpha + \varepsilon_{l,b,c,t}$$

where (b) identifies the specific bank, (l) denotes the home country of the bank, (c) is for the country of exposure and (t) specifies the time dimension. $Controls_{b,c,t}$ specify time-varying bank financials as well as various fixed effects at the levels of *Bank*, *HomeCountry x Time* and *ExposureCountry x Time*. Thus, the model controls for the overall effects of crisis both at the home country and exposure country levels and *Crisis* dummy can enter the regression only as an interaction term. All variables are constructed as described previously in the Data section. Additionally, $Domestic_{l,c}$ is a dummy variable which is equal to 1 if the bank's

country of location (l) is equal to the country of exposure (c). In this model, B_0 should give us an idea about the general level and significance of the sovereign home bias in European banks and B_1 measures the additional effect of the crisis on this home bias. Same model is also estimated with the alternative dependent variable ($SovereignPortionBias_{l,b,c,t}$).

To check for risk-shifting tendency of crisis-country banks, I estimate the following model and separate the home bias phenomenon from the risk-shifting story:

$$SovereignPortion_{l,b,c,t} = B_2(Domestic_{l,c} * Crisis_{c,t} * StressedBank_{l,t}) +$$

$$B_1(Crisis_{c,t} * StressedBank_{l,t}) + B_0(Domestic_{l,c}) + \delta(Controls_{b,c,t}) + \alpha + \varepsilon_{l,b,c,t} \quad (2)$$

where $StressedBank_{l,t}$ represents those observations in which the home country of the bank (l) is considered to be "in crisis" at a certain time (t). Due to time-varying fixed effects at the home country and exposure country levels, *Crisis* and *StressedBank* dummies can only enter the regression in interaction with other variables.

Model (2) checks for risk-shifting behaviour of (potentially weak) banks located in crisis countries, in line with Crosignani (2015). If the rising home bias in crisis countries is due to risk-shifting, one should observe a similar tendency of crisis-country banks ($StressedBank_{l,c}$) to shift their portfolios towards all crisis countries no matter if it is domestic or foreign. This is captured by B_1. On the other hand, B_2 measures the additional effect of crisis on domestic exposures that cannot be explained by the general level of risk-shifting in these crisis-country banks.

In the next step, I differentiate the effect of the crisis on the home bias of different domestic agents operating in the same economy. For this purpose, I use the Bruegel dataset at country-level and estimate the following model:

$$DomesticPortion_{c,k,t} = B_1\big(ResidentBanks_k * Crisis_{c,t}\big) + B_0\big(Crisis_{c,t}\big) \quad (3)$$

$$+ \delta\big(Controls_{c,k,t}\big) + \alpha + \varepsilon_{c,k,t}$$

where $ResidentBanks_k$ is a dummy variable that is equal to 1 if the creditor (k) of the country is its resident banks and zero if it is other private non-bank residents. The coefficient of interest is B_1, which signals whether or not domestic banks behaved somewhat differently compared to other domestic agents.

I would also like to compare the effect of the crisis on home bias across various assets classes held by the European banks. For this purpose, I use a more generalized model as in the following to be able to differentiate across asset classes in both normal and crisis times:

$$DebtPortion_{l,d,b,c,t} = B_3\big(Sovereign_d * Crisis_{c,t} * Domestic_{l,c}\big) + \quad (4)$$

$$B_2\big(Crisis_{c,t} * Domestic_{l,c}\big) + B_1\big(Sovereign_d * Domestic_{l,c}\big) +$$

$$B_0\big(Retail_d * Domestic_{l,c}\big) + \delta\big(Controls_{d,b,c,t}\big) + \alpha + \varepsilon_{l,d,b,c,t}$$

where $Sovereign_d$ and $Retail_d$ are dummy variables indicating the respective asset classes. The coefficients B_1 and B_0 should give us an idea about the home bias in these different asset classes in general. B_2 absorbs the overall effect of the crisis on the home bias for both asset classes and B_3 should tell us if the increase in home bias was stronger for sovereign debt, as would be suggested by the other competing theories of home bias (moral suasion and secondary market theory). Same exercise is also repeated for corporate debt ($Corporate_d$).

Finally, I estimate the effect of informational distance on European banks' behaviour towards crisis countries:

$$SovereignPortion_{l,b,c,t} = B_1\big(CrossCountryDistance_{l,c} * Crisis_{c,t}\big)$$

$$+ \delta\big(Controls_{b,c,t}\big) + \alpha + \varepsilon_{l,b,c,t} \quad (5)$$

where, in addition to the previous $Controls_{b,c,t}$, I also include fixed effects at the level of interaction between home country and exposure country so that all non-time-varying structural cross-country linkages can be implicitly controlled. Hence, $CrossCountryDistance_{l,c}$ only enters the regression in interaction. Alternatively, I use $BankCountryDistance_{b,c}$, $CrossCountryBranches_{l,c}$ and $BankCountryBranches_{b,c}$ as proxies that would capture the informational channel during crisis. As a final attempt, I drop all the domestic observations from the full sample, so that the moral suasion channel –which in theory can only be applied to domestic banks- would be muted and the informational channel would be clearly specified.

4. Results, Robustness Checks and Policy Implications

4.1. Results

Columns I-II in Table 3 confirm the previous literature that banks do have home bias in their sovereign debt holdings. It is economically meaningful as well at a level around 0.123, clearly illustrating that a bank holds a much bigger portion of a country's debt when it comes to its own country. Columns III-IV of the same table ratifies another observation that is compatible with the previous literature: crisis increases the sovereign home bias of domestic banks (Gennaioli et al., 2014b; Brutti and Sauré, 2016). The effect is economically huge: in response to crisis: there is almost 70 percent increase in the portion of a country's debt held by a representative domestic bank. Bank-level controls are mostly significant at the expected directions: larger banks (*LogAssets*) hold more sovereign debt; well-capitalised banks (*Tier1/RWA*) hold less; bank loans (*Loan/Deposits*) and sovereign debt act as substitutes. More interestingly, even though bank-level controls are no longer significant, main results hold even when we take into account the relative portfolio size of the banks according to a standard CAPM model (see columns V-VIII).

These findings are compatible with information frictions, secondary markets or moral suasion stories of the home bias. One may also argue that banks in crisis countries are especially weakly-capitalised, which drives them to invest more in their home country bonds to benefit from shifting the risk onto their creditors (Crosignani, 2015). However, if this is the case, one would expect these banks to invest also in other crisis countries. Columns I-II-V-VI in Table 4 confirm this prediction showing that crisis-country banks actually expand their exposure to all other crisis countries, potentially risk-shifting. However, as illustrated in columns III-IV-VII-VIII, this behaviour is much heavier for the home exposures of these banks, thus indicating that risk-shifting contributes to the rising home bias in crisis countries but is not even nearly a sufficient explanation. Crisis country banks have a special preference for their own government bonds which goes much beyond their risk-shifting incentives.

Table 5 compares the responses of two types of domestic agents during crisis. Columns I-II indicate that overall, crisis leads domestic agents to decrease their home bias, which is counter-intuitive with respect our earlier finding. However, when we separate the additional effect of being a resident bank, columns III-IV confirm that resident banks in crisis countries are more likely to increase their home bias whereas other non-bank residents seem to have moved in the opposite direction. The conclusion holds even when overall shocks at the country x time level are controlled (column V). Hence, this finding goes against the secondary market theory arguing that, during crisis times, government debt should flow back to the home country irrespective of the resident type since government would then prefer keeping its promise not to harm the domestic economy.

To get a better sense of whether sovereign debt was the only asset that has suffered from home bias during crisis, Table 6a draws a comparison across different asset classes: sovereign and retail debt. Columns I-II confirm that there is a significant home bias across both assets classes together. When we separate the home bias for different assets, columns III-

IV show that the magnitude of general home bias for retail debt is almost 40 percent higher than the one for sovereign debt, which is perfectly in line with the information asymmetry theory of home bias. Compared to standard products such as government securities, informationally more sensitive assets such as retail debt should be held more by the domestic agents who have an advantage in reaching the relevant information for such assets (Portes et al., 2001; Portes and Rey, 2005).

The remaining columns in Table 6a provide even more interesting results. Columns V-VI show that crisis has a positively significant effect on home bias for both asset classes. Columns VII-VIII shed light on the additional response of the sovereign debt to crisis, but there seems to be none. At best, this additional effect is negative, meaning that it was the retail debt that suffered more intensely from home bias in times of crisis. Obviously, this finding is again consistent with the expectation that, during crisis episodes that are usually associated with rising informational frictions, informationally sensitive assets should experience a much deeper reallocation from foreign to domestic agents. Same analysis is repeated with the corporate debt in Table 6b. Not surprisingly, results are very much in line; only a bit weaker since corporate debt could considered as a more transparent asset class compared to the retail debt (Portes et al., 2001).

Finally, Table 7 presents the effects of informational distance on banks' exposures to crisis countries. Although one could think of the geography as a noisy proxy for informational linkages across countries,[14] especially in Europe given the fully open borders and easy transportation, columns I-II illustrate that physical distance has a significant negative effect on bank exposures in times of crisis. Similarly, banks' branch networks, which is a much better proxy for information, is also significant and positively associated with the banks

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[14] One could also think that distance should be positively associated with asset holdings since more distant countries would offer better diversification benefits due to the lower correlation in business cycles across countries (Portes and Rey, 2005).

exposures to crisis countries. However, full sample in these estimations also contain domestic observations, which are highly correlated with geographical distance and number of branches; and thus may bias the results if there is a moral suasion or secondary market effect in these domestic observations. Thus, I take a much more conservative approach and drop all the domestic observations from the sample. All remaining observations denote the foreign exposures of the banks, hence –in theory- must be independent of moral suasion or secondary market effects. Notice that this is a very conservative approach in the sense that the informational linkages that this paper argued for so far has mostly emphasised the link between governments and their domestic banks. Thus, exclusion of these observations would severely underestimate the importance of information channel during crisis.

With the above concerns in mind, columns V-VI in Table 7 show that geographical distance becomes irrelevant when we only consider the exposures of foreign banks, which is not surprising given the noisy nature of this proxy. On the other hand, columns VII-VIII confirm that branch networks are influential in the behaviour of foreign banks towards crisis countries. That is, if a foreign bank has more branches in a crisis country, it uses this informational advantage and increases its relative exposure to that country. Independent of alternative explanations of home bias, this finding constitutes a direct and strong evidence for the role of informational frictions on debt reallocation in times of crisis.

4.2. Robustness Checks[15]

First thing to test is whether the estimations are robust to reasonable changes in crisis definition. So I increase and decrease the threshold by 1 percent to show that I am not cherry-picking a certain threshold. In addition, I use a fast-moving-crisis definition by employing 1-month daily averages instead of 3-month for bond yields. Finally, I adopt the exact crisis definition in Brutti and Sauré, (2016) and base the crisis dummy on bond spreads over

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[15] Results for robustness checks are not reported for the sake of brevity; but they are available upon request.

Germany, at the same restricting the crisis countries to only those from Euro area. The results still stand the same.

Since Bruegel data employed in Table 6 starts from 2000s, I estimate the equation (3) with a full sample period and confirm that results do not change qualitatively.

Additionally, I restrict the time dimension to 6 time-points in EBA datasets in which one can see both public and private debt for exactly the same banks (see Table 1). This does not challenge the previously-documented results either.

Various other robustness tests are on the way and will be added to the paper as the results come out.

4.3. Policy Implications

These findings clearly challenge the recent literature of Eurozone studies focusing solely on the home bias in sovereign debt. We point out that increase in home bias was not unique to sovereign debt and was even more intense for less standardized products such as corporate and retail debt, which signals that an information channel was at play contributing to rising home bias in the region. Even with a conservative approach of focusing only on foreign banks, there is evidence that information channel was active through branches of those banks in crisis countries.

One might argue that, in the age of technology and well-integrated markets such as in Europe, information must be cheap to attain; so huge asymmetries in the markets should not arise. However, the theoretical literature illustrates that even initially-small differences in informational standings of domestic and foreign agents may lead them to focus on these differences rather than spending effort to get the information related to foreign assets (Van Nieuwerburgh and Veldkamp, 2009). Furthermore, recent studies on the sovereign credit risk prices in the Eurozone provide evidence that, at the peak of the crisis, there were great

discrepancies between bond yields (or CDS spreads) and macro fundamentals of the countries in the Euro periphery, which is interpreted as a sign of market panic (De Grauwe and Ji, 2013; Saka et al., 2015). In such circumstances, it is not unreasonable to expect domestic or government-related banks to benefit from their superior informational position and collect sovereign bonds while foreign banks were leaving the debt market in rush. In fact, some studies already show that banks that loaded up periphery country bonds during crisis benefited from this as the crisis pressures eased (Acharya, Eisert, Eufinger and Hirsch, 2015b).

Another counter-argument might be that there is a growing literature on how increasing sovereign exposures had negative spillovers on private lending of the European banks, which may signal that sovereign exposure behaviour was partly involuntary for these banks (Acharya et al., 2015a; Altavilla et al., 2015; Popov and Van Horen, 2015). Still, Broner, Erce, Martin and Ventura (2014) clearly illustrate that, in the existence of frictions in financial markets, sovereign exposures may crowd out private lending without necessarily implying an involuntary or forced behaviour on the part of banks. Additionally, some recent studies that argue for moral suasion do not even find any negative effect of sovereign exposures on private lending (Ongena et al., 2015).

As a key policy conclusion: if information channel gets active between governments and their domestic banks in the midst of a crisis, this may be considered as a stabilizing force compared to a situation where even domestic banks would rush out of the market and governments would find it impossible to rollover their debt. Then further policy discussions may also focus on increasing transparency in the sovereign debt market, especially in times of crisis, rather than merely shifting the regulatory power from national to supranational institutions or coming up with various innovations of debt issuance in order to cut off the diabolic loop between sovereigns and their banks (see Brunnermeier et al., 2016).

5. Conclusion

In this paper, deviating from the recent literature on rising sovereign home bias across European banks, it is argued that this is not a surprising phenomenon if one takes into account one of the most conventional (albeit lately-forgotten) theories of the home bias in asset markets: informational frictions.

By taking a global portfolio approach and using a novel bank-level dataset compiled from various stress-tests, transparency and capital exercises of the European Banking Authority (EBA), I show that home bias increased and sovereign debt was indeed reallocated from foreign to domestic banks at the peak of the crisis. Though it cannot fully explain the rising home bias in response to crisis, risk-shifting tendency of crisis-country banks seems to have a contribution. In contrast with "the secondary market theory" of sovereign home bias, this reallocation was not visible at all for the domestic agents other than banks, which is compatible with the information asymmetry theory of home bias given the informational advantages that banks enjoy in comparison to other local agents over sovereign debt of their local governments. Additionally, I demonstrate that, in response to crisis, private forms of debt (retail and corporate) in bank balance sheets have experienced an equally large (if not larger) jump in home bias than the one observed for public debt, which is in sharp contradiction with the moral suasion story unless one assumes retail/corporate borrowers can somehow force the domestic banks to lend to them. On the other hand, this finding is exactly what one would expect from informationally more sensitive assets (such as private debt) if crisis episodes were associated with informational frictions. Finally, I present a clear information channel and demonstrate that foreign banks –free from moral suasion- with more branches in crisis countries have increased their exposures to these countries during crisis.

If the information channel was operational, as argued in this paper, it is expected that the reallocation would be concentrated on banks that were closely linked to the government.

Hence, the conclusions of the recent studies arguing in favour of moral suasion based on positive correlations between government-relatedness of the banks and their domestic bond holdings might be biased or simply wrong. More research is needed to differentiate these two channels. On the other hand, future policy discussions may benefit from focusing on increasing transparency in the sovereign debt market rather than merely trying to shift the regulatory mechanisms from national to supranational institutions or coming up with various innovations of debt issuance in order to overcome the so-called doom loop between sovereigns and banks.

References

Acharya, V., I. Drechsler and P. Schnabl, (2014), "A Pyrrhic Victory? Bank Bailouts and Sovereign Credit Risk", *The Journal of Finance*, Vol. 69, No. 6, pp. 2689-739.

Acharya, V., T. Eisert, C. Eufinger and C. W. Hirsch, (2015a), "Real effects of the sovereign debt crisis in Europe: Evidence from syndicated loans", *CEPR Discussion Paper* No. DP10108.

Acharya, V., T. Eisert, C. Eufinger and C. W. Hirsch, (2015b), "Whatever it takes: The real effects of unconventional monetary policy", *Working paper*.

Acharya, V. and S. Steffen, (2015), "The greatest carry trade ever? Understanding Eurozone bank risks", *Journal of Financial Economics*, Vol. 115, No. 2, pp. 215-36.

Ahearne, A. G., W. L. Griever, and F. E. Warnock (2004), "Information costs and home bias: An analysis of US holdings of foreign equities", *Journal of International Economics*, Vol. 62, No. 2, pp. 313–36.

Altavilla C., M. Pagano and S. Simonelli, (2015), "Bank exposures and sovereign stress transmission", *CSEF Working Paper* No. 410.

Becker, B. and V. Ivashina, (2014), "Financial repression in the European sovereign debt crisis", *Swedish House of Finance Research Paper* No. 14-13.

Brennan, M. J. and H. H. Cao, (1997), "International portfolio investment flows", *The Journal of Finance*, Vol. 52, No. 5, pp. 1851-80.

Brennan, M. J., H. H. Cao, N. Strong and X. Xu, (2005), "The dynamics of international equity market expectations", *Journal of Financial Economics*, Vol. 77, pp. 257-88.

Broner, F., A. Erce, A. Martin and J. Ventura, (2014), "Sovereign debt markets in turbulent times: Creditor discrimination and crowding-out effects", *Journal of Monetary Economics*, Vol. 61, pp. 114-42.

Broner, F., A. Martin and J. Ventura, (2010), "Sovereign Risk and Secondary Markets", *American Economic Review*, Vol. 100, No. 4, 1523–55.

Brunnermeier, M. K., L. Garicano, P. Lane, M. Pagano, R. Reis, T. Santos, D. Thesmar, S. Van Nieuwerburgh and D. Vayanos, (2016), "The Sovereign-Bank Diabolic Loop and ESBies", forthcoming in *American Economic Review*.

Brutti, F., and P. Sauré, (2016), "Repatriation of debt in the Euro crisis", *Journal of the European Economic Association*, Vol. 14, No. 1, pp. 145-74.

Choe, H., B. C. Kho and R. M. Stulz, (1999), "Do foreign investors destabilize stock markets? The Korean experience in 1997", *Journal of Financial Economics*, Vol. 54, pp. 227–64.

Choe, H., B. C. Kho and R. M. Stulz, (2005), "Do domestic investors have an edge? The trading experience of foreign investors in Korea", *Review of Financial Studies*, Vol. 18, No. 3, pp. 796-829.

Coeurdacier, N., and H. Rey, (2012), "Home bias in open economy financial macroeconomics", *Journal of Economic Literature*, Vol. 51, No. 1, pp. 63-115.

Coval, J. D. and T. J. Moskowitz, (1999), "Home bias at home: local equity preference in domestic portfolios", *The Journal of Finance*, Vol. 54, No. 6, pp. 2045–73.

Coval, J. D. and T. J. Moskowitz, (2001), "The geography of investment: informed trading and asset prices", *Journal of Political Economy*, Vol. 109, No. 4, pp. 811–41.

Crosignani, M., (2015), "Why are banks not recapitalized during crises?", *ONB Working Paper* No. 203.

De Grauwe, P., and Y. Ji, (2013), "Self-fulfilling crises in the Eurozone: An empirical test", *Journal of International Money and Finance*, Vol. 34, pp. 15–36.

De Marco, F. and M. Macchiavelli, (2015), "The political origin of home bias: The case of Europe", Working paper.

Dziuda, W. and J. Mondria, (2012), "Asymmetric information, portfolio managers, and home bias", *Review of Financial Studies*, Vol. 25, No. 7, pp. 2109-54.

Edison, H. J. and F. E. Warnock, (2008), "Cross-border listings, capital controls, and equity flows to emerging markets", *Journal of International Money and Finance*, Vol. 27, No. 6, pp. 1013-27.

Frankel, J. and S. Schmukler, (2000), "Country funds and asymmetric information", *International Journal of Finance and Economics*, Vol. 5, No. 3, pp. 177-95.

French, K. R. and J. M. Poterba, (1991), "Investor diversification and international equity markets", *American Economic Review Papers and Proceedings*, Vol. 81, pp. 222–26.

Froot, K., P. O'Connell and M. Seasholes, (2001), "The portfolio flows of international investors", *Journal of Financial Economics*, Vol. 59, pp. 151–93.

Gennaioli, N., A. Martin and S. Rossi, (2014a), "Sovereign default, domestic banks, and financial institutions", *The Journal of Finance*, Vol. 69, No. 2, pp. 819–66.

Gennaioli, N., A. Martin and S. Rossi, (2014b), "Banks, Government Bonds, and Default: What do the Data Say?", *European Corporate Governance Institute (ECGI) - Finance Working Paper* No. 425/2014.

Griffin, J. M., F. Nardari and R. M. Stulz, (2003), "Are daily cross-border equity flows pushed or pulled?", *The Review of Economics and Statistics*, Vol. 86, No. 3, pp. 641-57.

Grinblatt, M. and M. Keloharju, (2000), "The investment behaviour and performance of various investor types: a study of Finland's unique data set", *Journal of Financial Economics*, Vol. 55, pp. 43–67.

Grinblatt, M. and M. Keloharju, (2001), "How distance, language, and culture influence stockholdings and trades", *The Journal of Finance*, Vol. 56, No. 3, pp. 1053–74.

Hau, H., (2001), "Location matters: An examination of trading profits", *The Journal of Finance*, Vol. 56, No. 5, pp. 1959–83.

Horváth, B., H. Huizinga and V. Ioannidou, (2015), "Determinants and Valuation Effects of the Home Bias in European Banks' Sovereign Debt Portfolios", *CEPR Discussion Paper* No. DP10661.

Kang, J. K. and R. M. Stulz (1997), "Why is there a home bias? An analysis of foreign portfolio equity ownership in Japan", *Journal of Financial Economics*, Vol. 46, pp. 3-28.

Kaufmann, D., G. Mehrez and S. L. Schmukler, (2005), "Predicting currency fluctuations and crises: Do resident firms have an informational advantage?", *Journal of International Money and Finance*, Vol. 24, No. 6, pp. 1012–29.

Kim, W. and S.-J. Wei, (2002), "Foreign portfolio investors before and during a crisis", *Journal of International Economics*, Vol. 56, No.1, pp. 77–96.

Lane, P., (2006), "Global Bond Portfolios and EMU", *European Central Bank Working Paper* No. 553.

Merler, S. and J. Pisani-Ferry, (2012), "Who's afraid of sovereign bonds", *Bruegel Policy Contribution* 2012|02.

Ongena, S., A. Popov and N. Van Horen, (2015), "The invisible hand of the government: Moral suasion during the European sovereign debt crisis", Working paper.

Popov, A., and N. Van Horen, (2015), "Exporting sovereign stress: Evidence from syndicated bank lending during the euro area sovereign debt crisis", *Review of Finance*, Vol. 19, No. 5, pp. 1825-66.

Portes, R. and H. Rey, (2005), "The determinants of cross-border equity flows", *Journal of International Economics*, Vol. 65, No. 2, pp. 269-96.

Portes, R., H. Rey and Y. Oh, (2001), "Information and capital flows: The determinants of transactions in financial assets", *European Economic Review*, Vol. 45, No. 4-6, pp. 783-96.

Richards, A. J., (2004), "Big fish in small ponds: the trading behaviour and price impact of foreign investors in Asian emerging equity markets", *Journal of Financial and Quantitative Analysis*, Vol. 40, No. 1, pp. 1-27.

Saka, O., A-M. Fuertes and E. Kalotychou, (2015), "ECB policy and Eurozone fragility: Was De Grauwe right?", *Journal of International Money and Finance*, Vol. 54, pp. 168–85.

Van Nieuwerburgh, S. and L. Veldkamp, (2009), "Information immobility and the home bias puzzle", *The Journal of Finance*, Vol. 64, No. 3, pp. 1187-215.

Figure 1 – Home bias in core and periphery Euro countries during crisis
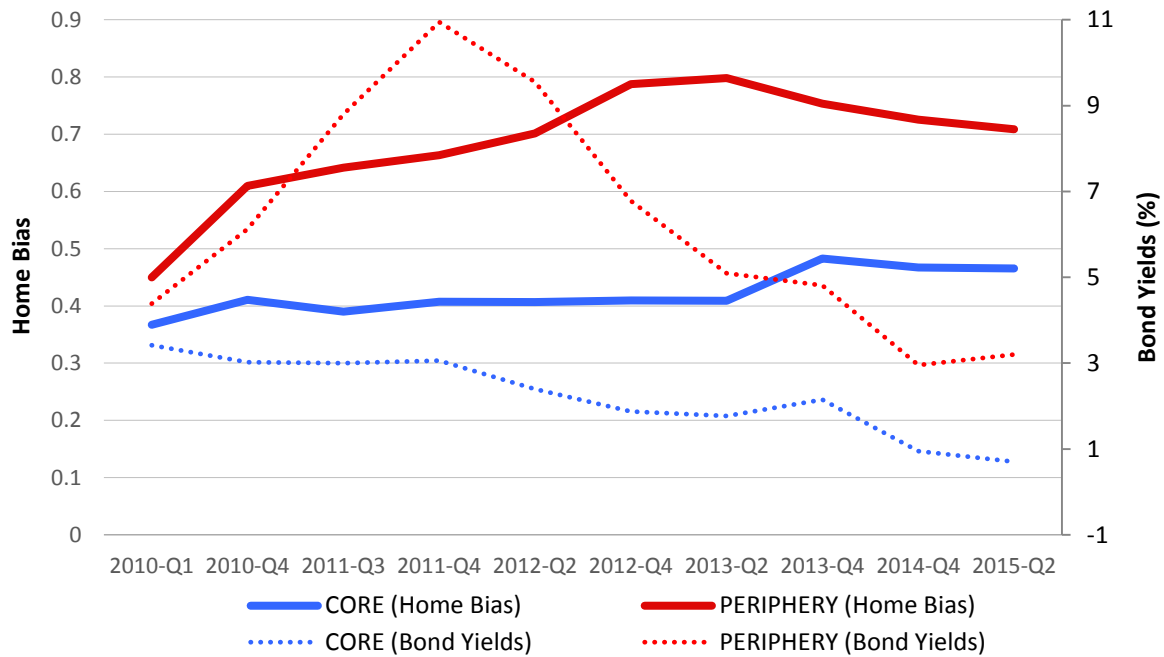
Note: The graph shows simple country averages of home bias and bond yields for each country group. Home Bias is defined as the portion of the total bank-debt of a country held by its domestic banks. Bond Yields are computed as the average daily bond yields for a country over the 3-month period before each observation date. Sovereign bond exposure data comes from various stress-tests, transparency and recapitalization exercises undertaken by European Banking Authority (EBA) and include 10 observation dates from 2010-Quarter1 to 2015-Quarter2 (see Table 1). Bond yields are obtained from Datastream. Core (non-crisis) countries: Austria, Belgium, Finland, France, Germany and Netherlands. Periphery (crisis) countries: Greece, Ireland, Italy, Portugal, Spain.

Figure 2 – Home bias (CAPM) in core and periphery Euro countries during crisis
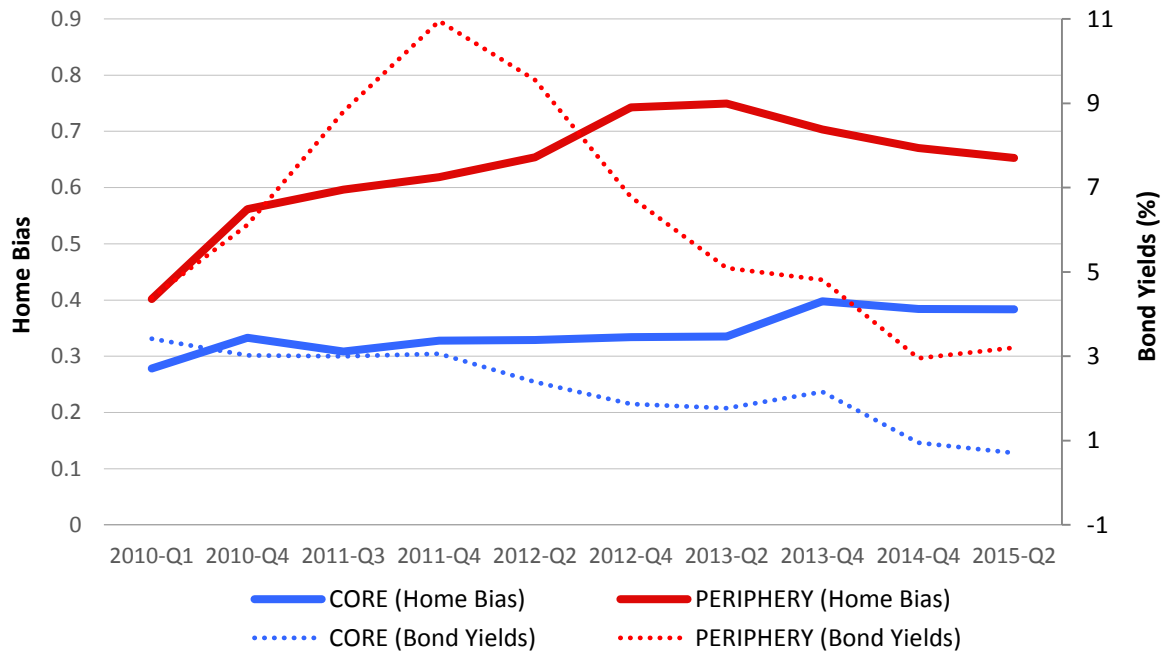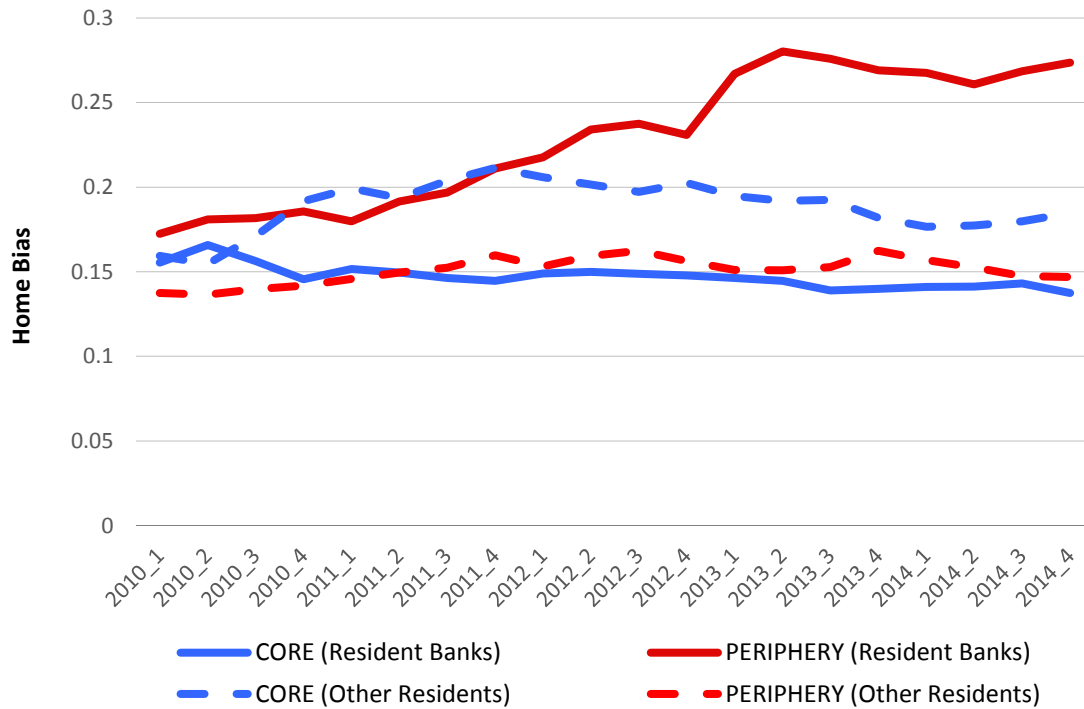

Note: The graph shows simple country averages of home bias and bond yields for each country group. Home Bias is defined as the portion of the total bank-debt of a country held by its domestic banks, after taking into account the portfolio size of these domestic banks according to a standard portfolio (CAPM) model (see Data section). Bond Yields are computed as the average daily bond yields for a country over the 3-month period before each observation date. Sovereign bond exposure data comes from various stress-tests, transparency and recapitalization exercises undertaken by European Banking Authority (EBA) and include 10 observation dates from 2010-Quarter1 to 2015-Quarter2 (see Table 1). Bond yields are obtained from Datastream. Core (non-crisis) countries: Austria, Belgium, Finland, France, Germany and Netherlands. Periphery (crisis) countries: Greece, Ireland, Italy, Portugal, Spain.

Figure 3 – Home bias for resident banks and other residents during crisis

Note: The graph shows simple country averages of home bias separately for resident banks and other non-public residents of each country in the group. Home Bias is defined as the portion of the total debt of a country held by a particular resident group. Sovereign debt exposures come from the dataset compiled from various national sources by Merler and Pisani-Ferry (2012) and include quarterly observations from 2010-Quarter1 to 2014-Quarter4. Core (non-crisis) countries: Belgium, Finland, France, Germany and Netherlands. Periphery (crisis) countries: Greece, Ireland, Italy, Portugal, Spain.

Table 1. Data disclosure details from European Banking Authority (EBA)

Disclosure date	Disclosure name	Information date	Number of banks covered	Type of credit disclosure
23/07/2010	2010 EU-wide stress testing exercise (CEBS)	2010-Q1	91	Sovereign
15/07/2011	2011 EU-wide stress testing exercise (EBA)	2010-Q4	90	Sovereign & Private
08/12/2011	EU Capital exercise 2011 (EBA)	2011-Q3	65	Sovereign
03/10/2012	EU Capital exercise 2012 (EBA)	2011-Q4 & 2012-Q2	62	Sovereign
16/12/2013	2013 EU-wide transparency exercise (EBA)	2012-Q4 & 2013-Q2	64	Sovereign & Private
26/10/2014	2014 EU-wide stress testing exercise (EBA)	2013-Q4	123	Sovereign & Private
24/11/2015	2015 EU-wide transparency exercise (EBA)	2014-Q4 & 2015-Q2	105	Sovereign & Private

Notes: The table lists the disclosures of various exercise results as announced by the European Banking Authority (EBA). CEBS refers to the Committee of European Banking Supervisors, which was comprised of senior representatives of bank supervisory authorities and central banks of the European Union and later succeeded by the EBA. 2010 EU-wide stress testing exercise was conducted by the CEBS and made public by national regulators; however EBA does not provide the related data. Hence, this dataset was obtained from the Peterson Institute for International Economics while all other datasets were acquired from the EBA. Private credit refers to the corporate and retail credit exposure of the banks covered in the respective datasets. Information date refers to the data time-points in each disclosure for which the values of bank credit positions can be found.

Table 2. Summary statistics for main variables

Variables	Mean	Median	Std. Deviation	Min	Max	Observations	Source
SovereignPortion	0.012	0	0.050	0	1	24,658	EBA
SovereignPortionBias	0	-0.003	0.050	-0.075	1	24,658	EBA
RetailPortion	0.012	0	0.071	0	1	14,408	EBA
CorporatePortion	0.012	0	0.069	0	1	14,408	EBA
SovereignPortion (Domestic)	0.126	0.092	0.128	0	0.841	831	EBA
SovereignPortionBias (Domestic)	0.115	0.072	0.128	-0.014	0.841	831	EBA
RetailPortion (Domestic)	0.164	0.075	0.208	0	1	497	EBA
CorporatePortion (Domestic)	0.162	0.089	0.207	0	1	497	EBA
DomesticPortion (ResidentBanks)	0.178	0.164	0.098	0.008	0.451	207	Bruegel
DomesticPortion (OtherResidents)	0.193	0.212	0.121	0.002	0.415	207	Bruegel
Bond Yields (percentage)	4.23	3.45	3.44	0.28	30.68	275	Datastream
Crisis (Yield>6)	0.20	0	0.40	0	1	275	Datastream
CrossCountryDistance (in thousand kms)	1.45	1.36	0.83	0	4.88	616	MapQuest
BankCountryDistance (in thousand kms)	1.41	1.32	0.78	0	4.88	4,094	MapQuest
CrossCountryBranches (in thousand branches)	0.22	0	1.86	0	28.72	616	SNL Financial
BankCountryBranches (in thousand branches)	0.03	0	0.25	0	5.80	3,019	SNL Financial
LogAssets	11.98	12.00	1.41	7.99	14.59	415	Bankscope
Tier1/RWA (percentage)	12.35	11.70	4.11	0.60	44.02	415	Bankscope
Loans/Deposits (percentage)	94.54	89.38	44.05	21.13	663.16	415	Bankscope
ROAA (percentage)	-0.03	0.21	1.38	-13.52	3.35	415	Bankscope
NPL (percentage)	7.66	5.41	7.35	0.09	53.77	415	Bankscope

Notes: The table lists the variables used in the main regressions. *SovereignPortion* is the portion of the total bank-debt of a sovereign held by a specific bank. *SovereignPortionBias* is the portion of total bank-debt of a sovereign held by a specific bank, after adjusting for a standard CAPM model (see the Data section). *RetailPortion* is the portion of the total retail bank-debt of a country held by a specific bank. *CorporatePortion* is the portion of the total corporate bank-debt of a country held by a specific bank. *DomesticPortion* is the portion of the overall debt of a country held by domestic agents, seperately for *ResidentBanks* and *OtherResidents*. *Domestic* denotes the observations where the country of exposure is the same as the home country of the bank. *Bond Yields* are the yields (denoted in percentages) on 10-year maturity bond for each country in the sample averaged over three-months daily values before each observation date. *Crisis* is a dummy variable which is equal to 1 if a country's bond yield is above 6 percent threshold at an observation date. *CrossCountryDistance* is the geographical distance (in thousand kilometers) between the city in which the bank is located and the capital city of the bank's exposure country. *BankCountryDistance* is the geographical distance (in thousand kilometers) between the capital city of the bank's home country and the capital city of the bank's exposure country. *CrossCountryBranches* is the total number of bank branches (in thousands) in the exposure country of the bank which ultimately belong to a bank from its home country. *BankCountryBranches* is the total number of bank branches (in thousands) in the exposure country of the bank which ultimately belong to the bank itself. *LogAssets* is the logarithm of the bank's total assets (originally in million Euros). *Tier1/RWA* is the Tier 1 capital of the bank as a percentage of its risk-weighted-assets. *Loans/Deposits* is the net loans divided by bank's customer deposits. *ROAA* is the return on average assets computed as the net income of the bank divided by its average total assets. *NPL* is the non-performing loan ratio calculated as the impaired loans of the bank divided by gross loans. All bank-level characteristics from Bankscope are reported with a year lag with respect to the observation date. The last column shows the source of the related data used for computations of each variable.

Table 3. Sovereign debt reallocation across European banks during crisis

Dependent Variable:	SovereignPortion				SovereignPortionBias			
	I	II	III	IV	V	VI	VII	VIII
Domestic*Crisis			0.082***	0.080***			0.081***	0.079***
			[3.05]	[2.89]			[3.02]	[2.85]
Domestic	0.123***	0.126***	0.114***	0.116***	0.124***	0.128***	0.116***	0.118***
	[10.52]	[10.14]	[9.39]	[8.79]	[10.59]	[10.22]	[9.46]	[8.87]
LogAssets		0.012***		0.012***		0.000		0.000
		[2.87]		[2.87]		[-0.03]		[-0.03]
Tier1/RWA		-0.001**		-0.001**		-0.000*		-0.000*
		[-2.42]		[-2.42]		[-1.94]		[-1.94]
Loans/Deposits		-0.000*		-0.000*		-0.000		-0.000
		[-1.82]		[-1.82]		[-0.23]		[-0.23]
ROAA		0.000		0.000		0.000		0.000
		[1.45]		[1.45]		[0.95]		[0.95]
NPL		0.000		0.000		0.000		0.000
		[0.47]		[0.47]		[1.10]		[1.10]
Fixed Effects								
Bank	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HomeCountry x Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ExpCountry x Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank
Adj-R-sq	0.25	0.25	0.26	0.26	0.25	0.24	0.26	0.25
N	22898	19397	22898	19397	22898	19397	22898	19397

Notes: The table summarizes the results of the equation (1) with dependent variables *SovereignPortion* (I-IV) and *SovereignPortionBias* (V-VIII) estimated over a time period fully spanning the Eurozone crisis on a biannual basis from early 2010 to mid-2015. *SovereignPortion* is the portion of the total bank-debt of a sovereign held by a specific bank. *SovereignPortionBias* is the portion of total bank-debt of a sovereign held by a specific bank, after adjusting for a standard CAPM model (see the Data section). *Domestic* is a dummy variable equal to 1 only if the country of exposure is the same as the home country of the bank. *Crisis* is a dummy variable which is equal to 1 only if a country's bond yields are above 6 percent calculated as the average of daily bond yields over the 3-month period preceeding the observation date. *Bank-level Controls* include *LogAssets* which is the logarithm of the bank's total assets (originally in million Euros); *Tier1/RWA* which is the Tier 1 capital of the bank as a percentage of its risk-weighted-assets; *Loans/Deposits* which is the net loans divided by bank's customer deposits; *ROAA* which is the return on average assets computed as the net income of the bank divided by its average total assets; and *NPL* which is the non-performing loan ratio calculated as the impaired loans of the bank divided by its gross loans. All Bank-level Controls come from Bankscope and are used with a year lag. Sovereign bond holding data comes from various exercises of the European Banking Authority (EBA) and country exposures are included for 30 members of the European Economic Area (EEA). Bond yields for Crisis dummy are obtained from Datastream. Robust standard errors are clustered at the bank-level and t-statistics are reported in brackets. * p<0.1, ** p<0.05, *** p<0.01.

Table 4. Sovereign debt reallocation across European banks during crisis: Stressed Banks

Dependent Variable:		SovereignPortion				SovereignPortionBias			
		I	II	III	IV	V	VI	VII	VIII
Domestic		0.121***	0.125***	0.114***	0.116***	0.123***	0.127***	0.116***	0.118***
		[10.40]	[10.01]	[9.38]	[8.79]	[10.47]	[10.08]	[9.46]	[8.86]
StressedBank*Crisis		0.015***	0.014***	0.004**	0.004*	0.015***	0.014***	0.004**	0.004*
		[3.39]	[3.15]	[2.18]	[1.82]	[3.37]	[3.12]	[2.17]	[1.80]
StressedBank*Crisis*Domestic				0.079***	0.078***			0.079***	0.077***
				[2.96]	[2.81]			[2.93]	[2.78]
Bank-level Controls			Yes		Yes		Yes		Yes
Fixed Effects									
Bank		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HomeCountry x Time		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ExpCountry x Time		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering		Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank
Adj-R-sq		0.25	0.25	0.26	0.26	0.25	0.25	0.26	0.25
N		22628	19154	22628	19154	22628	19154	22628	19154

Notes: The table summarizes the results of the equation (2) estimated over a time period fully spanning the Eurozone crisis on a biannual basis from early 2010 to mid-2015. Dependent variables are *SovereignPortion* (I-IV), which is is the portion of the total bank-debt of a sovereign held by a specific bank, and *SovereignPortionBias* (V-VIII), which is the portion of total bank-debt of a sovereign held by a specific bank after adjusting for a standard CAPM model (see the Data section). *StressedBank* is a dummy variable indicating those observations in which the home country of the bank is considered to be "in crisis". *Domestic* is a dummy variable equal to 1 only if the country of exposure is the same as the home country of the bank. *Crisis* is a dummy variable which is equal to 1 only if a country's bond yields are above 6 percent calculated as the average of daily bond yields over the the 3-month period preceeding the observation date. *Bank-level Controls* include *LogAssets* which is the logarithm of the bank's total assets (originally in million Euros); *Tier1/RWA* which is the Tier 1 capital of the bank as a percentage of its risk-weighted-assets; *Loans/Deposits* which is the net loans divided by bank's customer deposits; *ROAA* which is the return on average assets computed as the net income of the bank divided by its average total assets; and *NPL* which is the non-performing loan ratio calculated as the impaired loans of the bank divided by its gross loans. All Bank-level Controls come from Bankscope and are used with a year lag. Sovereign bond holding data comes from various exercises of the European Banking Authority (EBA) and country exposures are included for 30 members of the European Economic Area (EEA). Bond yields are obtained from Datastream. Robust standard errors are clustered at the bank-level and t-statistics are reported in brackets. * p<0.1, ** p<0.05, *** p<0.01.

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Table 5. Sovereign debt reallocation during crisis: Resident banks vs other residents

Dependent Variable: *DomesticPortion*	I	II	III	IV	V
Crisis	-0.042*	-0.027**	-0.117***	-0.101***	
	[-1.71]	[-2.11]	[-3.57]	[-3.54]	
*ResidentBanks*Crisis*			0.150***	0.150***	0.150**
			[3.06]	[3.04]	[2.27]
Country-level Controls		Yes	Yes	Yes	Yes
Fixed Effects					
Country	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes
Creditor Type	Yes	Yes	Yes	Yes	Yes
Country x Time					Yes
Clustering	Country	Country	Country	Country	Country
Adj-R-sq	0.03	0.06	0.14	0.17	0.22
N	414	414	414	414	414

Notes: The table summarizes the results of the equation (3) with dependent variable *DomesticPortion* (I-V), which is the portion of the overall debt of a country held by a domestic agent (either by resident banks or other non-public residents), estimated over a time period fully spanning the Eurozone crisis on a quarterly basis from early 2010 to the end-of-2014. *ResidentBanks* is a dummy variable equal to one only if the creditor is the resident banks of the country. *Crisis* is a dummy variable which is equal to 1 only if a country's bond yields are above 6 percent calculated as the average of daily bond yields over the 3-month period preceding the observation date. *Country-level Controls* are the average values for each country's banks computed over the sample period and include *LogAssets* which is the logarithm of the bank's total assets (originally in million Euros); *Tier1/RWA* which is the Tier 1 capital of the bank as a percentage of its risk-weighted-assets; *Loans/Deposits* which is the net loans divided by bank's customer deposits; *ROAA* which is the return on average assets computed as the net income of the bank divided by its average total assets; and *NPL* which is the non-performing loan ratio calculated as the impaired loans of the bank divided by its gross loans. All Country-level Controls come from Bankscope and are used with a year lag. Domestic sovereign holding data comes from the dataset compiled from various national sources by Merler and Pisani-Ferry (2012). Countries include Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain and United Kingdom. Bond yields are obtained from Datastream. Robust standard errors are clustered at the country-level and t-statistics are reported in brackets. * p<0.1, ** p<0.05, *** p<0.01.

Table 6a. Debt reallocation across European banks during crisis: Sovereign vs retail debt

Dependent Variable: *DebtPortion*	I	II	III	IV	V	VI	VII	VIII
Domestic	0.139*** [10.14]	0.144*** [9.64]						
*Domestic*Retail*			0.166*** [8.33]	0.173*** [7.95]	0.157*** [7.94]	0.163*** [7.43]	0.155*** [7.86]	0.160*** [7.36]
*Domestic*Sovereign*			0.123*** [10.55]	0.127*** [10.15]	0.113*** [9.25]	0.115*** [8.58]	0.115*** [9.44]	0.117*** [8.81]
*Domestic*Crisis*					0.097*** [3.35]	0.094*** [3.13]	0.128*** [2.70]	0.124*** [2.57]
*Domestic*Crisis*Sovereign*							-0.048 [-1.10]	-0.045 [-1.05]
Bank-level Controls		Yes		Yes		Yes		Yes
Fixed Effects								
Bank	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HomeCountry x Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ExpCountry x Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Debt Type	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank
Adj-R-sq	0.22	0.21	0.22	0.22	0.23	0.23	0.23	0.23
N	36473	30806	36473	30806	36473	30806	36473	30806

Notes: The table summarizes the results of the equation (4) with dependent variable *DebtPortion* (I-VIII), which measures the portion of a specific type of total bank-debt (sovereign or retail) held by a specific bank, estimated over a time period fully spanning the Eurozone crisis on a biannual basis from early 2010 to mid-2015. *Sovereign* and *Retail* are dummy variables indicating the respective debt types held by the banks. *Domestic* is a dummy variable equal to 1 only if the country of exposure is the same as the home country of the bank. *Crisis* is a dummy variable which is equal to 1 only if a country's bond yields are above 6 percent calculated as the average of daily bond yields over the 3-month period preceeding the observation date. *Bank-level Controls* include *LogAssets* which is the logarithm of the bank's total assets (originally in million Euros); *Tier1/RWA* which is the Tier 1 capital of the bank as a percentage of its risk-weighted-assets; *Loans/Deposits* which is the net loans divided by bank's customer deposits; *ROAA* which is the return on average assets computed as the net income of the bank divided by its average total assets; and *NPL* which is the non-performing loan ratio calculated as the impaired loans of the bank divided by its gross loans. All Bank-level Controls come from Bankscope and are used with a year lag. Sovereign and retail debt data come from various exercises of the European Banking Authority (EBA) and country exposures are included for 30 members of the European Economic Area (EEA). Bond yields are obtained from Datastream. Robust standard errors are clustered at the bank-level and t-statistics are reported in brackets. * p<0.1, ** p<0.05, *** p<0.01.

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Table 6b. Debt reallocation across European banks during crisis: Sovereign vs corporate debt

Dependent Variable: *DebtPortion*	I	II	III	IV	V	VI	VII	VIII
Domestic	0.138***	0.144***						
	[10.14]	[9.59]						
*Domestic*Corporate*			0.164***	0.172***	0.156***	0.164***	0.156***	0.164***
			[8.47]	[8.16]	[8.08]	[7.60]	[8.00]	[7.54]
*Domestic*Sovereign*			0.123***	0.127***	0.115***	0.117***	0.115***	0.117***
			[10.54]	[10.13]	[9.28]	[8.62]	[9.44]	[8.81]
*Domestic*Crisis*					0.082***	0.078***	0.086*	0.078
					[2.84]	[2.59]	[1.70]	[1.51]
*Domestic*Crisis*Sovereign*							-0.006	0.000
							[-0.12]	[0.00]
Bank-level Controls		Yes		Yes		Yes		Yes
Fixed Effects								
Bank	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HomeCountry x Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ExpCountry x Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Debt Type	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank
Adj-R-sq	0.22	0.22	0.23	0.23	0.23	0.23	0.23	0.24
N	36473	30806	36473	30806	36473	30806	36473	30806

Notes: The table summarizes the results of the equation (4) with dependent variable *DebtPortion* (I-VIII), which measures the portion of a specific type of total bank-debt (sovereign or corporate) held by a specific bank, estimated over a time period fully spanning the Eurozone crisis on a biannual basis from early 2010 to mid-2015. *Sovereign* and *Corporate* are dummy variables indicating the respective debt types held by the banks. *Domestic* is a dummy variable equal to 1 only if the country of exposure is the same as the home country of the bank. *Crisis* is a dummy variable which is equal to 1 only if a country's bond yields are above 6 percent calculated as the average of daily bond yields over the 3-month period preceeding the observation date. *Bank-level Controls* include *LogAssets* which is the logarithm of the bank's total assets (originally in million Euros); *Tier1/RWA* which is the Tier 1 capital of the bank as a percentage of its risk-weighted-assets; *Loans/Deposits* which is the net loans divided by bank's customer deposits; *ROAA* which is the return on average assets computed as the net income of the bank divided by its average total assets; and *NPL* which is the non-performing loan ratio calculated as the impaired loans of the bank divided by its gross loans. All Bank-level Controls come from Bankscope and are used with a year lag. Sovereign and corporate debt data come from various exercises of the European Banking Authority (EBA) and country exposures are included for 30 members of the European Economic Area (EEA). Bond yields are obtained from Datastream. Robust standard errors are clustered at the bank-level and t-statistics are reported in brackets. * p<0.1, ** p<0.05, *** p<0.01.

Table 7. Sovereign debt reallocation across European banks during crisis: Distance vs. Branch Network

Dependent Variable: *SovereignPortion*	Full Sample				Only Foreign Exposures			
	I	II	III	IV	V	VI	VII	VIII
*CrossCountryDistance*Crisis*	-0.004*** [-3.18]				-0.000 [-0.54]			
*BankCountryDistance*Crisis*		-0.003*** [-2.73]				-0.000 [-0.46]		
*CrossCountryBranches*Crisis*			0.004*** [4.81]				0.002** [1.97]	
*BankCountryBranches*Crisis*				0.034*** [4.44]				0.143*** [5.06]
Bank-level Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects								
Bank	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HomeCountry x Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ExpCountry x Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HomeCountry x ExpCountry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank
Adj-R-sq	0.53	0.53	0.53	0.55	0.28	0.28	0.28	0.32
N	19397	19397	19397	17501	18702	18702	18702	16875

Notes: The table summarizes the results of the equation (5) with dependent variables *SovereignPortion* (I-VIII) estimated over a time period fully spanning the Eurozone crisis on a biannual basis from early 2010 to mid-2015. *SovereignPortion* is the portion of the total bank-debt of a sovereign held by a specific bank. *Crisis* is a dummy variable which is equal to 1 only if a country's bond yields are above 6 percent calculated as the average of daily bond yields over the 3-month period preceeding the observation date. *CrossCountryDistance* is the geographical distance (in thousand kilometers) between the capital city of the bank's home country and the capital city of the bank's exposure country. *BankCountryDistance* is the geographical distance (in thousand kilometers) between the city in which the bank is located and the capital city of the bank's exposure country. *CrossCountryBranches* is the total number of bank branches (in thousands) in the exposure country of the bank which ultimately belong to a bank from its home country. *BankCountryBranches* is the total number of bank branches (in thousands) in the exposure country of the bank which ultimately belong to the bank itself. *Bank-level Controls* include *LogAssets* which is the logarithm of the bank's total assets (originally in million Euros); *Loans/Deposits* which is the net loans divided by bank's customer deposits; *ROAA* which is the return on average assets computed as the net income of the bank divided by its average total assets; and *NPL* which is the non-performing loan ratio calculated as the impaired loans of the bank divided by its gross loans. All Bank-level Controls come from Bankscope and are used with a year lag. Sovereign bond holding data comes from various exercises of the European Banking Authority (EBA) and country exposures are included for 30 members of the European Economic Area (EEA). Bond yields for Crisis dummy are obtained from Datastream. Robust standard errors are clustered at the bank-level and t-statistics are reported in brackets. * p<0.1, ** p<0.05, *** p<0.01.