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Orkun Saka

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Poschingerstr. 5, 81679 Munich, Germany
Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email office@cesifo.de
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Domestic Banks as Lightning Rods? Home Bias and Information during the Eurozone Crisis

Abstract

European banks have been criticized for holding excessive domestic government debt during the recent Eurozone crisis, which may have intensified the diabolic loop between sovereign and bank credit risks. By using a novel bank-level dataset covering the entire timeline of the Eurozone crisis, I first re-confirm that the crisis led to the reallocation of sovereign debt from foreign to domestic banks. In contrast to the recent literature focusing only on sovereign debt, I show that the banks' private sector exposures were (at least) equally affected by the rise in home bias. Consistent with this pattern, I propose a new debt reallocation channel based on informational frictions and show that the informationally closer foreign banks increase their relative exposures when the sovereign risk rises. The effect of informational closeness is economically meaningful and robust to the use of different information measures and controls for alternative channels of sovereign debt reallocation.

JEL-Codes: F210, F340, F360, G010, G110, G210.

Keywords: home bias, information asymmetries, Eurozone crisis, sovereign debt.

Orkun Saka
University of Sussex
United Kingdom - Brighton, BN1 9RH
o.saka@sussex.ac.uk

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1. Introduction

Can domestic banks act as lightning rods for government bonds in the midst of a financial storm? On the contrary, by now, the diabolic loop between sovereign and bank credit risks has been very well documented. Increasing risk pressures in the banking sector may put an 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 a deterioration in the banking sector through losses on banks' government bond holdings and the loss of credibility for future government support (Acharya, Drechsler, and Schnabl, 2014).

Despite this adverse feedback mechanism, the link between governments and their domestic banks may in fact have a silver lining: local banks generally stand at a favorable position to have access to soft information regarding their sovereign clients thanks to their "daily exposure to local news stories, firsthand knowledge of the local economy, and personal relationships with key people at the issuing body" (Butler, 2008). During market downturns, such informational advantage might lead them to act as buyers of last resort absorbing the local assets while (potentially uninformed) foreign banks may shed their exposures in panic. Indeed a theoretical role for the lack of soft information and the resulting panic by less informed foreign banks are consistent with the evidence that government bond spreads moved in a self-fulfillingly pessimistic way during the Eurozone crisis and fell out of touch with the publicly observable hard information regarding the solvency of individual countries (De Grauwe and Ji, 2013; Saka, Fuertes, and Kalotychou, 2015).

In this paper, I present evidence for this latter view. I show that when European banks retreated from the sovereign debt markets of the crisis countries in the Eurozone, they did less so for the countries to which they were informationally closer. To put it in another way, *ceteris paribus*, a bank whose home country has more information regarding a target country increases its relative exposure when the sovereign risk rises in the target country. This result holds even among the foreign banks and does not depend on the alternative mechanisms such as the banks' risk-shifting tendency, the political strength of their home countries or the exchange rate/redenomination risk. Unlike the alternative hypotheses that are specific to the crisis episodes, I show that information channel is highly active even during the post-crisis period. Furthermore, both direct financial information (measured in bank branches or mergers) and aggregate information channels (such as common language across countries) seem to play a role. Hence, I interpret these findings as supportive of the view that informational asymmetries among banks played a key role in the recent fragmentation across the Eurozone sovereign debt markets.

Figure 1 clearly illustrates the puzzling phenomenon that this paper aims to address. Since early 2010, Eurozone banks have lifted up their portion of the domestic sovereign debt, but only in the crisis-countries. That is, at the peak of the government debt problems, these banks started accumulating domestic government bonds. The initial rise and the gradual reversal of this trend -along with the respective bond spreads- is visible only in periphery part of the Eurozone. In contrast, the corresponding pattern in the core-Euro countries seems to have been more or less stable throughout the Eurozone crisis. Intriguingly, the same observation 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).

With the dismal interaction between sovereign and banking crisis in the background, most of the recent literature attributed this observation to the argument of financial repression/moral suasion (Becker and Ivashina, 2018; De Marco and Macchiavelli, 2015; Ongena, Popov, and Van Horen, forthcoming). In other words, in order to gain relief from the crisis and to be able to rollover their debt, governments may have (implicitly) forced the banks in their jurisdiction to increase their domestic sovereign exposures. Another argument on the repatriation of public debt from the non-crisis to the 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 the foreign ones due to the costs such a default would inflict on the domestic economy (Broner, Martin, and Ventura, 2010; Gennaioli, Martin, and Rossi, 2014b). Hence, in the existence of well-functioning secondary markets, sovereign debt should naturally be reallocated back to the issuing country as the domestic agents there will attach a higher value to these securities than their foreign counterparts.

With respect to the latter argument, Figure 3 illustrates the evolution of home bias for different types of creditors in the Eurozone periphery and core countries.[1] Though it is clear from Panel A that the resident banks in the periphery accumulated a big portion of the domestic sovereign debt, this is hardly true for other non-bank private residents situated in these very same countries, which goes against the intuition of Broner et al. (2010) and asks for a further link between the resident banks and the domestic government debt.

This paper proposes an additional channel on top of the existing ones and argues that the European banks' increasing sovereign home bias may be related to one of the most conventional theories of home bias in the grand literature of international finance: namely, informational frictions (Brennan and Cao, 1997; Van Nieuwerburgh and Veldkamp, 2009; Dziuda and Mondria, 2012). According to this theory, home bias prevails in risky asset

[1] *Bank residents* are commercial banks and *Other residents* are private investors (individual or institutional; excluding commercial banks), both located in these countries. *Non-residents* are all private or public investors (excluding the European Central Bank) located outside these countries.

classes (e.g. equity) when there is an informational advantage in favor of the domestic agents. In tranquil periods and well-integrated markets such as the ones in Europe before the Eurozone crisis, one would not expect to observe a high level of home bias in risk-free debt. Nonetheless, in crisis episodes during which the government debt gets risky in many countries, it becomes crucial to have access to soft information regarding the true repayment intentions of the governments and thus the observed market behavior might deviate from the traditional predictors such as debt/GDP ratios or growth rates of individual countries. In that case, the less informed foreign banks may naturally rush to exit these markets in panic, selling most of their exposures to domestic banks at fire-sale prices. Such a market trajectory is indeed compatible with the evidence in De Grauwe and Ji (2013) and Saka et al. (2015) who detect an apparent disconnection between bond spreads and the publicly available information (i.e., country fundamentals) during the recent Eurozone crisis.

On one hand, the literature suggests that the banks' lending behavior is largely influenced by the proximity to the borrower since more proximate lenders could gain an edge in gathering soft information about their clients (Petersen and Rajan, 2002; Degryse and Ongena, 2005; Agarwal and Hauswald, 2010). If so, this would lead borrowers, especially the relatively small and opaque ones, to borrow more from informationally closer lenders. On the other hand, it is tempting to think that soft information should not matter in government debt markets. In tranquil times, when sovereign debt is considered risk-free, all banks are likely to follow the publicly observable signals (such as tax revenue or fiscal balance) as indicators for the strength of government's ability to pay back its debt. This would lead to a uniform pricing of sovereign bonds across banks and thus to a low level of home bias.[2]

Nevertheless, an interesting feature of the government debt markets is that, while corporate bankruptcy is always about the (in)ability of a company to repay, a sovereign default is -in most cases- a political decision and directly related to the degree of the governing party's willingness to cut back government spending and/or increase tax rates. This crucial difference between corporate and sovereign debt arises due to the lack of a legal mechanism to enforce repayment on sovereigns (Panizza, Sturzenegger, and Zettelmeyer, 2009) and makes it especially important in times of stress to have insider information on the government's willingness to honor its promises or country's political capacity to endure further budget cuts. In such times, the increasing noise in perceived country fundamentals may lead to a more heterogeneous pricing of sovereign bonds; and thus informationally distant banks may choose to sell their exposures to local banks who would be receiving a more precise signal

[2]Figure 3 is consistent with this prediction as the average portion of sovereign bonds that resident banks hold in both core and periphery countries is similarly low and around 10-15 percent prior to the Eurozone crisis.

regarding the true default risk of the sovereign and thus be better situated to carry such exposures in their balance sheets.

Before teasing out the information channel with a novel bank-level dataset compiled from various stress-tests, transparency and capital exercises of the European Banking Authority (EBA), I first re-confirm that European banks' home bias increased and sovereign debt was indeed reallocated from foreign to domestic banks at the peak of the crisis. Additionally, I illustrate that, in response to the crisis, private forms of debt (retail or corporate) in the same bank balance-sheets have experienced an equally large (if not larger) jump in home bias, which tilts the evidence towards a more general explanation of the home bias rather than the specific ones applied only to the sovereign debt in the recent literature.

Having gained leverage from this preliminary evidence on the potential role of information during the Eurozone debt crisis, I go on to clearly identify the information channel in the banks' sovereign debt holdings. To do this, I focus on the banks' foreign country exposures, which helps me minimize the potentially confounding effects of the alternative theories that are specific to the home country (domestic) exposures, such as moral suasion or secondary market channels.

Empirically, I take a difference-in-differences approach by comparing the sovereign exposures of foreign banks at different levels of informational closeness with varying levels of sovereign risk for the exposure country. In other words, I estimate the interaction between various information proxies (both financial and general) and sovereign bond spreads, by saturating the panel model with a rich set of fixed effects that take into account all the time-varying unobserved factors at bank and exposure country levels as well as constant bilateral linkages between home and exposure countries. These two layers of my identification strategy (informational distance and sovereign risk) assure that I capture the effect of information rather than some omitted variable as it could be the case in a direct estimation.

As a result, I find strong evidence for the argument that the foreign banks headquartered in informationally closer territories increase their relative exposures as the sovereign risk rises. This effect is robust to controlling for various alternative channels and changing sample compositions. Interestingly, information seems to matter both in the forms of financial (i.e., bank branch linkages) and general (i.e., common language) knowledge regarding the country of exposure. What is even more interesting is that the effects are statistically and economically meaningful even after the end of the Eurozone crisis (mid-2012) and even when very small subsets of the observations are taken into account to avoid the possible interference of alternative explanations.

Sovereign debt crises in a well-integrated monetary union constitutes an ideal setting to isolate the effect of information asymmetry on bank behavior. Avoiding the cross-country dif-

ferences in exchange rates, liquidity provision or collateral requirements, this paper presents evidence that information (or the lack thereof) played a significant role in the recent fragmentation across Eurozone debt markets. Thus, revisiting the question in the title of this paper, it is possible that the banks in crisis-countries have partly acted as lightning rods collecting the domestic sovereign debt while the less informed foreign banks left the market in panic, triggering a financial storm. Despite the so-called doom loop between the two, the relationship of the European banks with their local governments may have an underexplored silver lining.

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

2. The Related Literature

2.1. Recent home bias in the Eurozone

The main motivation of the paper comes from the recently-aroused interest in academic and policy circles on the causes of the rising fragmentation -home bias- across Eurozone sovereign debt markets. One of the earlier contributions by Becker and Ivashina (2018) 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 that the crisis-country banks with a higher number of government-affiliated board members hold more government bonds in their balance sheets. Using a proprietary bank-level dataset from the European Central Bank (ECB), Ongena et al. (forthcoming) demonstrate that, compared to the foreign ones, domestic banks located in the crisis-countries were more inclined to increase their exposures when the local governments had to rollover large chunks of outstanding public debt. Many other recent papers confirm these observations and conclude that a moral suasion channel was in operation during the Eurozone crisis (De Marco and Macchiavelli, 2015; Horváth, Huizinga, and Ioannidou, 2015; Altavilla, Pagano, and Simonelli, 2017).

Nonetheless, these studies are not always able to rule out the possible information channel that might be active between governments and the related (domestic or public) banks.[3] By constructing an identification strategy based on the informational heterogeneity across foreign banks and thus minimizing the moral suasion concerns, I contribute to this literature

[3] "... banks could voluntarily acquire local sovereign debt in a fire sale context due to a local information advantage." and "... strictly speaking, we do not rule out the fire sale explanation in this paper" (Becker and Ivashina, 2018, p. 4-5)

and illustrate that the information channel can be a key determinant in explaining the recent sovereign debt reallocation across the European banks.

Another strand in the home bias literature specific to sovereign debt underlines the assumption that it is harder for governments to default when their debt is held domestically. In such a scenario, government would rather choose not to default since the benefits could be offset by its harm on the domestic economy. Hence, in expectation of this conjecture by the local agents, government debt will flow back to the issuing country during times of rising sovereign stress (Broner et al., 2010). In a recent paper, Brutti and Sauré (2016) present confirming evidence in the context of the Eurozone crisis by demonstrating that the debt of the crisis-governments flew towards those banks whose home countries were politically more powerful in the Euro area, implying that the debt reallocation was mainly driven to discourage the troubled governments from declaring bankruptcy. Therefore, while identifying the information channel in this paper, I control for the political strength of the banks' home countries and show that the inclusion of such controls does not challenge my results.

A related literature focuses on the risk-shifting tendency of the undercapitalized banks. According to this argument, the banks with low capital ratios prefer high-risk instruments such as the government bonds of the crisis-countries so that the shareholders would asymmetrically 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). As shown by Crosignani (2015), such weak banks are more likely to exist in the crisis-countries. As a result, in the estimations of information channel, I control for the risk-shifting incentives of the banks headquartered in the distressed countries and again show that the inclusion of such controls does not qualitatively change any of the main results.

2.2. Home bias in other markets

There are many studies exploring the home bias in portfolio holdings of different asset classes. The literature mainly focuses on equity holdings (French and Poterba, 1991) whereas a few others investigate the regional biases in international bond portfolios (Lane, 2005). Most of this previous work revolves around three broad categorical explanations for home bias: exchange rate risk, transaction costs and informational frictions (Coeurdacier and Rey, 2013). In the specific context of Europe, with the increasing financial integration and exchange rate stability over the years, it is reasonable to argue that a more realistic culprit for the recently sky-rocketing home bias across various asset classes could be the informational asymmetries.

In a seminal paper, Brennan and Cao (1997) 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. On a similar path, Van Nieuwerburgh and Veldkamp (2009) show that, in the existence of (initially small) informational differences, costly information acquisition process may boost the agents' home bias. Lastly, Dziuda and Mondria (2012) demonstrate that, even with sophisticated investors such as investment funds, 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 in foreign ones. Therefore, one might observe home bias even in the portfolios of highly sophisticated institutions such as banks or mutual funds.[4]

Following the intuition that the informational frictions might lie behind the widely-observed home bias in various asset classes, 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 such firms that are close to them not only in terms of physical location; but also in terms of 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. In a cross-country study more closely related to the paper at hand, Portes and Rey (2005) conclude that the geographical distance matters for cross-border capital flows; however it mostly proxies the effects of other informational variables such as bank branches across countries or telephone call traffic. I borrow the empirical measures of informational distance (such as bank branches, common language or press coverage) from this literature and complement it by extending the evidence to the context of commercial banks' government bond holdings.

3. Data Description

The main body of the data used 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). Table 1 lists these exercises and the disclosure dates for each one 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

[4]For evidence on the informational advantage that domestic investors may hold vis-à-vis foreign investors, see, among many others, Kang and Stulz (1997); Kim and Wei (2002) and Kaufmann, Mehrez, and Schmukler (2005).

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 six of these. In each disclosure, the full country-breakdown of each bank's debt portfolio for up to 200 countries can be found. However, to focus on the debt reallocation across Europe, only the 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 dropped from one exercise to another. All exposures are consolidated at the parent bank level and each exercise involves at least 65% of the total banking assets in Europe and 50% of the banking sector in each EEA member. Compared to other studies using proprietary datasets from the European Central Bank (Altavilla et al., 2017; Ongena et al., forthcoming), the EBA data cover banks from a wider range of countries (including non-Eurozone) and documents a finer granularity in terms of full country-breakdowns of sovereign exposures at the bank-level.

I am mainly interested in what portion of a sovereign's total 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;

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

It is important to note that this measure is independent of the valuation technique used for the bank-level sovereign exposures as long as all the banks apply the same methodology at a given point in time, which is the case in my sample as all disclosures are centrally directed and homogenized by the EBA. This helps me better quantify the relative distribution of sovereign debt across banks. Furthermore, by construction, $SovereignPortion_{b,c,t}$ does not depend on the price changes as these are automatically reflected in all banks' nominal exposures and thus does not change the particular portion that a specific bank holds out of the total debt. Therefore, it also constitutes an ideal measure to understand the reallocation of sovereign debt over time.

In line with the mainstream literature on home bias (Ahearne, Griever, and Warnock, 2004; Coeurdacier and Rey, 2013), I also create an alternative variable that takes into account the 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 ($SovereignPortionCAPM_{b,t}$).[5] As conventional in the literature, this difference is standardized by the share of other banks' portfolios in the global portfolio ($1 - SovereignPortionCAPM_{b,t}$). That is;

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

where

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

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 bias. If it is zero, that means the bank holds exactly the portion of the debt suggested by the CAPM model, thus no bias. Additionally, I create the corresponding variable for retail exposures ($RetailPortion_{b,c,t}$) exactly in the same way as described above, but this time with the banks' nominal exposures to the retail sector.[6]

For the first part of my analysis on how home bias changes during the Eurozone crisis, I construct a dummy variable ($Crisis_{c,t}$) by using the daily yields of 10-year maturity bonds of 30 European countries that are obtained from Datastream.[7] I follow a similar approach to Brutti and Sauré (2016) and categorize a country as "in crisis" ($Crisis_{c,t} = 1$) if a country is a Euro member and the average of its daily bond spreads (with respect to Germany) for the previous three months was above 400 basis points.[8]

As a last step, in order to quantify the informational linkages across countries, I construct 8 proxies in line with the previous literature (Portes, Rey, and Oh, 2001; Portes and Rey, 2005; Guiso, Sapienza, and Zingales, 2009). These variables are likely to absorb the varying as well as the overlapping aspects of the bilateral information sets available to each bank in

[5]Notice that, in an ideal CAPM world, the optimal portion that a bank would hold in equilibrium for any country of exposure should depend only on the size of the bank's sovereign portfolio and the size of the global sovereign portfolio, meaning that it does not depend on the specific country of exposure (c).

[6]According to the definition in the EBA's Interactive Single Rulebook, retail exposures are generally composed of loans to individuals (such as consumer credit or mortgages) and small business loans not exceeding 1 million Euros.

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

[8]Robustness checks with the thresholds of 300bps or 500bps, reported in an earlier version of this paper (see Saka, 2018), do not lead to any meaningful change in my estimations.

my sample.

First one, $Branches_{l,c}$, represents the total number of bank branches in the exposure country of the bank which ultimately belong to a parent-bank located in its home country.[9] This proxy aims to capture the intensity of the financial information exchange between the two countries, which probably makes it the most relevant information proxy for the banks in my sample. Unfortunately, however, branch information cannot be derived historically and SNL Financial only provides the most recent data available (as of February, 2016). Despite the possibility that the Eurozone crisis itself may have changed the ownership network of bank branches across European countries, it is difficult to say towards which direction this kind of a bias would drive my estimates.

Nevertheless, to overcome the potential endogeneity concerns, I propose another proxy for the flow of financial information across countries, which -to the best of my knowledge- has not been used in this context before. This alternative variable, $Mergers_{l,c}$, is derived from the SDC Platinum and measures the total number of bank mergers that occurred between the home country and the exposure country in the years starting from 1985 all the way up to the pre-crisis year of 2008 in Europe. The downside of focusing on bank mergers is obviously the risk of underestimating other potential channels via which financial institutions may set up branches in foreign countries, such as greenfield investments. The identifying assumption here is that the method of foreign bank entry does not meaningfully differ across European countries, or is at least orthogonal to the sovereign risk.

For a more general information variable that is not specific to the financial expertise but can point out the overall familiarity between the citizens of different countries in my sample, I follow Guiso et al. (2009) and search the headlines of all news articles covered inside each country's highest circulated newspaper in Factiva for the years between 2003 and 2007.[10] Specifically, in order to construct the $Press_{l,c}$ variable, I record the frequency of each country or its citizens being mentioned in another country's newspaper headline and divide it by the total number of times in which the country or its citizens are mentioned in any newspaper in my sample. This simple index summarizes the relative familiarity of a country and its citizens to other countries. Still, it should be taken with a grain of salt; because newspapers are not

[9]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 (though results do not depend on this sample choice). 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).

[10]For Cyprus and Malta, there is no pre-crisis press coverage in Factiva. Thus, I use the most recently available coverage for the period furthest away in time from the Eurozone crisis, between the years 2016 and 2018.

neutral information transmitters and possibly biased towards covering negative/dramatic events that are likely to exaggerate the previously-held stereotypes (Hamilton, 2004).

In addition to the proxies above, the literature suggests a few structural variables that may capture linguistic, historical and geographical roots of information transmission. One of the most important of these is to share a common language which has been consistently shown to have a substantial positive impact on investors' asset holdings (Grinblatt and Keloharju, 2001; Hau, 2001). Accordingly, I employ a variable, $Language_{l,c}$, which takes the value of 1 if at least 9% of the population in both countries speaks the same language and 0 otherwise.

Another indicator that may absorb the common cultural and historical heritage across different nations which may make them more familiar with each other is their colonial ties, $Colony_{l,c}$, which is again a dummy variable picking up the pairs of countries that have ever had a colonial relationship in the past.

In terms of geographical proximity, which may ease the flow of information between two countries, I resort to the following two variables: $Distance_{l,c}$, the log distance in kilometers between the capital city of the bank's home country (l) and the capital city of the exposure country (c);[11] and $Border_{l,c}$, which is a dummy for pairs of countries sharing a common border. Note that these two geographical variables are usually treated as biased proxies as they may inversely pick up investors' diversification incentives to hold less correlated and thus more distant assets in which case the same proxies may correlate in the opposite direction with the banks' government bond holdings. All of these structural variables come from Mayer and Zignago (2011), except the measure of geographical distance which is derived via MapQuest.

On top of the more standard information measures described so far, I also include a dummy for the shared legal origins across countries ($Legal_{l,c}$) derived from La Porta, Lopez-de Silanes, and Shleifer (2008). Given the large literature on the exogenous introduction of legal traditions and how they may later lead to heterogeneous outcomes in economic rules and regulations, one could argue that the commonality of legal systems may serve as an informational tool for investors. Accordingly, it might be easier for the banks in my sample to invest in a foreign country with a similar legal system to that of their own country simply because they would face less uncertainty regarding financial rules and regulations. Keep in mind that the common legal origins are also likely to be highly correlated with the cultural traditions that may not have much to do with the exchange of actual information between

[11] Specifically, this variable is defined as $log(x_{l,c} + 1)$ and naturally takes the value of zero for domestic observations ($l = c$). I have also experimented with various distance measures from Mayer and Zignago (2011) that take into account countries' intra-national distances consistent with the international ones. None of them lead to any significant change in my results.

countries (Guiso et al., 2009).

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 also be said for retail debt (*RetailPortion*). 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 (16.44%) than it holds its country's sovereign debt (12.56%). This observation is consistent with the information asymmetry view of home bias, predicting that -in general- informationally more opaque assets (i.e., private debt) should suffer more from home bias than other more standardized assets (i.e., public debt) would do.

4. Methodology & Results

4.1. Home bias during the Eurozone crisis

Before I lay out my main analysis and show how the information channel -in interaction with sovereign risk- may affect government bond markets, I investigate the effect of the Eurozone crisis separately on European banks sovereign and retail debt home biases. For this purpose, I employ a simple *difference-in-differences (DD)* methodology, which assumes that the banks' home bias in crisis and non-crisis countries should share a parallel trend in the time period preceding the Eurozone crisis. A simple visual check on Panel A of Figure 3 confirms the fact that the sovereign portion held by the resident banks in core and periphery countries moved in tandem with each other prior to the Eurozone crisis, which provides assurance regarding the validity of this assumption. Therefore, I go on to estimate the following model:

$$Portion_{l,b,c,t} = \beta_1(Crisis_{c,t} \times Domestic_{l,c}) + \beta_0 Domestic_{l,c} + \theta_{b,t} + \gamma_{c,t} + \varepsilon_{l,b,c,t} \quad (1)$$

where (l) denotes the home country of the bank, (b) identifies the specific bank, (c) is for the country of exposure and (t) specifies the time dimension. All variables are constructed as previously explained in the Data Description section. Controls include a broad set of fixed-effects at the levels of *Bank*Time* ($\theta_{b,t}$) and *ExposureCountry*Time* ($\gamma_{c,t}$). Thus, the model controls for the overall effects of the crisis or any other time-varying factor both at the home country (since banks never change their home country) and exposure country levels and

Crisis dummy can only enter the regression in an interaction term. Additionally, $Domestic_{l,c}$ is a dummy variable which is equal to 1 if the bank's headquarters are located in the country of exposure (i.e., l=c). In this model, β_0 should give us an idea about the general level and significance of the home bias in the European banks' balance-sheets and β_1 measures the additional effect of the Eurozone crisis on this home bias. Same model is also estimated for the alternative dependent variable with CAPM adjustment ($PortionBias_{l,b,c,t}$).

Results with $SovereignPortion_{b,c,t}$ and $SovereignPortionBias_{b,c,t}$ as the dependent variables are presented in Table 3. Columns I-II and V-VI 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 12.6%. Given that average sovereign holding in our sample is around 1.2%, this finding clearly illustrates that a bank holds a much bigger portion of a country's debt when it comes to its own country. Columns III-IV and VII-VIII of the same table ratifies another observation that is consistent with the previous literature: the sovereign home bias increases during times of crisis (Gennaioli, Martin, and Rossi, 2014a; Brutti and Sauré, 2016). The effect is economically huge: the portion of a country's debt held by a representative domestic bank almost doubles in response to crisis. Hence, this finding establishes the link between a sovereign debt crisis and the absorption of government bonds by the domestic banks.

One could further investigate to find out where the treatment effect in Table 3 comes from. Since this is technically a *diff-in-diff* setting, the estimated effect could be due to the possibility that domestic banks are increasing their *SovereignPortion* during the crisis or foreign banks are decreasing theirs or these two patterns could be occurring simultaneously. Indeed, in Figure 3, one could visually compare the behavior of resident -i.e., domestic- banks (Panel A) and non-resident investors -including the foreign banks- (Panel B) and conclude that these two patterns might be occurring at the same time. To formalize this observation, I estimate the effect of the crisis separately on domestic and foreign bank samples; but this time using a simpler specification as the *Crisis* variable only changes across exposure countries and time. Results reported in Table A1 of the Online Appendix confirm the previous intuition that these two patterns occur at the same time.

Recent literature has mainly focused on the rise in European banks' home bias in government bonds although this behavior might also be a sub-observation of a more general phenomenon, such as informational frictions that may simultaneously affect multiple asset classes. Thus, I would like to compare the effect of the crisis on home bias in other -and potentially less transparent- asset classes held by the same banks, focusing first on the retail debt generally owed by individuals and small businesses. For this purpose, I employ the same specification as in Equation 1 but this time with the dependent variable as $RetailPortion_{b,c,t}$.

Columns I-II and V-VI in Table 4 confirm that there is a significant home bias in retail debt, indeed larger than the one in sovereign debt. The magnitude of general home bias for retail debt (16.84%) is more than 30 percent higher than the one for sovereign debt (12.57%; see Columns I-II in Table 3), which is in line with the notion that the informationally more sensitive assets such as retail debt should be held in general more intensively by the domestic agents who have an advantage in reaching out the relevant information for such assets (Portes et al., 2001; Portes and Rey, 2005).

The comparison of the remaining columns in Tables 3 and 4 provide even more interesting results. Columns III-IV and VII-VIII show that the Eurozone crisis has a positively significant effect on the home bias in retail debt. However, the size of this effect is larger than the one estimated for sovereign debt in Table 3, meaning that it is the retail debt that may have suffered more intensely from the rise in home bias during the Eurozone crisis. It is important to remind here that the *Crisis* variable is constructed using a sovereign risk metric (i.e., government bond spreads), which makes it a noisier proxy to represent the true credit risk of the retail debt unless sovereign and private sector credit risks are perfectly correlated within the same country. Such measurement error could possibly lead to attenuation bias, underestimating the true effect of the crisis on domestic retail debt holdings.[12]

4.1.1. Robustness checks

All the results related to this subsection can be found in the Online Appendix. As a first robustness check, Equation 1 is estimated with another form of private debt (namely, corporate debt from the same EBA disclosures) in Table A2. Not surprisingly, results are very much in line: in general, European banks have a higher home bias in their corporate exposures and, compared to sovereign debt, this bias rises at least equally in response to a crisis in a country.[13]

One concern regarding the construction of the dependent variable could be the possibility that *SovereignPortion* (or *RetailPortion*) for a specific bank can change independently of a change in its absolute (nominal) exposures since the relative holdings of other banks in the sample have an influence on the portion of debt that a specific bank holds, which may lead to

[12]The difference between unobserved retail sector credit risk and observed sovereign credit risk is likely to be larger during the Eurozone crisis, which would lead to a correlation between the measurement error and my observed proxy for credit risk ($Crisis_{c,t}$). This can cause a classical errors-in-variables problem that may underestimate the effect of the crisis on domestic retail debt (see Roberts and Whited, 2013). In simple terms, the assumption that the private sector shoud be in crisis every time the government is in trouble would lead us to underestimate the effect of the crisis on private debt. This is clearly because the private sector may not be in trouble in some of those periods when the government is.

[13]In another unreported robustness check, I repeat the analysis by only including the EBA disclosure dates in which both types of debt exposures were disclosed (6 dates; see Table 1) and find that results are unchanged.

an overestimation of the differences in a *diff-in-diff* setting. On the other hand, the advantage of using the *Portion* as the main dependent variable is to capture the relative shares of each bank holding a specific country's total debt portfolio, which not only standardizes the nominal exposures and eases the interpretation but also makes sure that the dependent variable does not change with the price changes in the underlying debt. Thus, I re-estimate Equation 1 by log-linearizing the nominal exposures of each bank (in million Euros). The results reported in Tables A3 and A4 are in line with the previous findings and alleviate the concerns that the *Portion* variable might lead to an overestimation of the home bias phenomenon.

Lastly, I re-estimate Equation 1 for sovereign and retail debt by clustering the standard errors at different levels. Although the previous literature has the convention of clustering at the bank-level (see Altavilla et al., 2017; Ongena et al., forthcoming), it is possible that the error structure is correlated across banks in the same country or in the same disclosure exercise. Thus, I experiment with 3 different clustering schemes at the home country (22 clusters), time (10 clusters) and home country x time (207 clusters) levels. As expected, standard errors (t-values) get larger (smaller) when they are clustered at a more aggregate level such as home-country in which the banks are fully nested (see Tables A5 and A6). On the other hand, when clustered only by time, std. errors decrease as the potential correlation of observations within the same bank across different disclosure dates is ignored (see Tables A7 and A8). Finally, std. errors are the smallest when clustered at the country x time level, in which the observations across a large number of clusters are assumed to be uncorrelated (see Tables A9 and A10). In each of these settings, all the estimated coefficients stay at the conventional levels of statistical significance.

To sum up, the robust findings documented in this section are consistent with the expectation that, during the crisis episodes that are usually associated with the rising informational frictions, most asset types are likely to experience a reallocation from foreign to domestic agents. Overall, the preliminary evidence implies that the recent sovereign debt reallocation in Europe was not a special case and could have been partly caused by a more general phenomenon that may have influenced various asset classes simultaneously.

4.2. Effect of informational closeness on banks' sovereign exposures

4.2.1. Identification strategy

My identification strategy to tease out the information channel builds on two layers. First, I argue that the informational closeness matters for the banks' asset holdings in general. It is already well established in the literature that the proximity to the borrower matters for the

banks' lending behavior and it determines the amount of soft information that the bank could gather to serve its customers.[14] In the context of government debt, such soft information could be obtained via domestic banks' local/political connections or simply by operating within the country and being more familiar with its daily news and economic as well as political climate. To this end, I employ 8 carefully-constructed measures of informational closeness, some of which are commonly used in cross-country studies (see Data Description).

Directly checking the effects of these proxies on government bond holdings may not be suitable as there exists the risk of picking up unobserved country/bank specific characteristics or, more importantly, other types of bilateral cross-country linkages that may not have anything to do with information. This weakness calls for the second layer of my identification strategy where I benefit from the theoretical prediction that the information channel should be stronger for riskier assets (Portes et al., 2001).

Why would information become more relevant with increasing tensions in sovereign debt markets? Though they are usually transparent and standardized, these markets also have an interesting aspect: while corporate bankruptcy is always about the (in)ability of a company to repay, a sovereign default is -in most cases- a political decision and directly related to the willingness of the political actors to cut back government spending or increase tax rates. This crucial difference between corporate and sovereign debt arises due to the lack of a legal mechanism to enforce repayment on sovereigns (Panizza et al., 2009) and makes it especially important in times of heightened sovereign risk to have in-advance information on government's willingness to honor its promises or country's political capacity to endure further budget cuts. For example, Butler (2008) illustrates a case in which local investment banks underwriting municipal bonds have comparative advantage in accessing and assessing soft information, *especially when the bond is risky*. Hence, I expect the effect of information channel to intensify at higher levels of default risk for the government.

Thanks to these two layers, I can employ a difference-in-differences model in which I estimate the interaction of information proxies with a measure of sovereign risk as in the following:

$$SovereignPortion_{l,b,c,t} = \beta_1(SovereignRisk_{c,t} \times Information_{l,c}) + \theta_{b,t} + \gamma_{c,t} + \mu_{l,c} + \varepsilon_{l,b,c,t} \quad (2)$$

where $Information_{l,c}$ stands for one of the 8 proxies of informational closeness of the banks towards other countries as well as towards their own and $SovereignRisk_{c,t}$ is the average of

[14] See, among many others, Petersen and Rajan (2002), Degryse and Ongena (2005), Mian (2006), Alessandrini, Presbitero, and Zazzaro (2009) and Agarwal and Hauswald (2010).

the past 3 months' daily bond spreads with respect to Germany.

Equation 2 has the spirit of the gravity regressions in the trade literature (e.g., Anderson and Van Wincoop, 2003) and I am able to saturate the model with a full set of fixed-effects, especially including dummies at the level of interaction between home country and exposure country ($\mu_{l,c}$) so that all time-invariant bilateral cross-country linkages could be directly controlled. This aspect is very crucial for my identification strategy and restricts the model to only use the time variation available in sovereign risk to be able to identify the information channel. That is, the interaction of cross-sectional variation in sovereign risk and informational proxies is automatically captured by $\mu_{l,c}$ and if there is not enough time variation in bond spreads, the inclusion of these dummies would bias my β_1 estimates downwards. For example, if British banks typically hold high levels of Cypriot government debt due to their informational advantage in Cyprus, I can capture this only if there is enough variation over time in the Cypriot government bond spreads; otherwise such pair-specific relationships will all be subsumed by $\mu_{l,c}$.[15]

Specifications in the previous section concentrated on the rising home bias phenomenon that was related specifically to the domestic observations in my sample, such as Greek banks' exposures to Greek government debt. In order to avoid the complications raised by the home bias phenomenon and its confounding channels (such as *moral suasion* or *secondary markets*), I take a rather extreme approach and drop all the domestic observations from the full sample and report a second set of results only with the banks' remaining exposures to foreign countries. Notice that this is a conservative way of identifying the role of information on banks' government bond holdings since such a channel, if it exists, would probably be strongest between governments and domestic banks. By dropping these domestic observations and comparing the informational closeness only across foreign banks, I would potentially be underestimating the true magnitude of the information channel in exchange for providing a cleaner identification.[16]

Finally, I estimate the effect of each information proxy first in separate regressions and then altogether in the same regression in order to see which ones are more relevant in this specific context. Even though such analysis must be taken with a grain of salt since most of these variables are highly correlated with each other (see Table B1), this could help identify the relative strengths and biases of each of these proxies.

[15] In line with this argument, *Crisis* variable (instead of *SovereignRisk*) was used in a previous version of this paper (see Saka, 2018), producing similar but less statistically significant estimates and supporting the argument that the information channel is broader than being specific to crisis episodes.

[16] I thank a referee for pointing out that some foreign banks may also act as market-makers in sovereign debt markets and thus might have aggregate information on investors' demand. Since the aim of this paper is to focus on the role of country-specific information that the foreign banks hold, the investigation of this complementary market-making channel lies beyond our scope.

4.2.2. Results

Table 5 presents the effects of informational distance on banks' government bond exposures conditional on the level of sovereign spreads. For easy comparison, estimations with two different samples (all vs. foreign) and specifications (single vs. full) are reported side by side. A point worth mentioning initially is that, compared to the previous estimations, the explanatory power (adjusted-r-square) of the model with full sample massively increases due to the fixed effects at HomeCountry x ExposureCountry level, implying that cross-country linkages matter substantially for the European banks' sovereign portfolios. In 'single variable' estimations with the full sample (Column I), interaction coefficients for all proxies are statistically significant at 1% level in the expected directions, being negative for geographical distance and positive for the rest. In the sample of foreign exposures (after the domestic ones are dropped; see Column III), corresponding proxies retain a high level of significance except the legal origins proxy, which is not surprising given the noisy nature of that variable as it is likely to capture other cultural and historical trends than pure informational distance (Guiso et al., 2009, p. 1106).

Most relevant proxies in this context are the ones measuring financial information transmission via current bank branches or historical bank mergers. The estimate in Column I implies that, for the country with median sovereign bond spreads in my sample (144bps), a change in branches from 0 to 220 (mean level) corresponds to an additional sovereign bond holdings of around 5% (508bps) at the individual bank level. This effect is economically meaningful and more than four times larger than the average sovereign portion holding in my sample (120bps, see Table 2). In comparison, the size of that effect is close to 50% of the additional contribution of the crisis to average home bias that was found previously (˜1100bps, see Columns III/IV in Table 3). A similar back-of-the-envelope calculation with the estimated coefficient of the mergers proxy in Column I generates an additional impact of 488bps for the median country and is comparable to the previous calculation with the coefficient for bank branches. The resulting implication is that financial information transmission matters and has sizeable effects both on banks' domestic and foreign government exposures.

One could argue that branches or mergers may also pick up the general effect of the governments' moral suasion on banks since more branches/mergers may mean more space for governments in corresponding countries to intervene and hence more regulatory leverage to use against the banks. Even though such possibility cannot be excluded in theoretical terms, one should expect that such pressures would naturally be stronger on domestic banks as the vast literature on moral suasion suggests (Altavilla et al., 2017; Becker and Ivashina, 2018; Ongena et al., forthcoming). If so, one should observe a higher coefficient on the full sample estimations (vis-a-vis foreign sample) for these two variables, which does not

seem to be the case. In fact, contrary to this prediction, coefficients found in the foreign sample (Column III) are 2-4 times larger than their full-sample counterparts which negates the possibility that these coefficients are influenced by moral suasion.

A more general information proxy is the *Press* variable, which essentially captures the newspaper coverage between banks' home and exposure countries prior to the Eurozone crisis. The separately estimated coefficients of the interactions for this proxy are significant in both samples (Columns I & III), despite its size being smaller in the foreign one. Hence, one could think of them as representing the lower and upper bounds of the true effect of general information on sovereign exposures. Additionally, other more structural variables such as common language and geographical distance also turn out to be highly significant in expected directions. To the extent that one could think of these proxies as historically determined and thus exogenous, the evidence here also points to the existence of a causal impact of information on sovereign bond exposures.

When all of these interactions are estimated within the same specification (Columns II & IV), the variables that have a dominant impact on sovereign exposures seem to be *Branches* and *Language*. Interestingly, *Press* variable takes the opposite sign possibly due to the biased nature of this variable as the media tends to transmit the negative news more heavily and is likely to feed the previously-held stereotypes. In a similar fashion, *Border* variable switches signs in the foreign sample (Column IV) which might be because, once the information channel is controlled, this variable might capture investor incentives to diversify their portfolios towards distant countries with less correlated business cycles.

To make sure that the estimations are not picking up some mechanical change due to the composition of the banks in my sample from one EBA announcement to another, I repeat the same analysis with several alternative dependent variables that try to adjust for such potential bias. Firstly, Table B2 contains the results with the CAPM-adjusted *SovereignPortionBias* variable which corrects the previous dependent variable by taking into account the size of each bank's relative government bond portfolio. Economic size and significance of these estimates are almost identical to the previous ones in Table 5.

Secondly, instead of normalizing the dependent variable, I directly use the banks' nominal exposures in a logarithmic form, à la Brutti and Sauré (2016). Results are available in Table B3 and show that, if anything, statistical significance rises for most coefficient estimates.

Finally, instead of dividing the banks' nominal bond exposures with the total bank-held debt of each country internally calculated within my sample at each point in time, I create a new dependent variable (*SovereignPortionECB*) by dividing the same nominal exposures by the total debt stock of each country as measured by the ECB at the corresponding time

points. This expectedly constitutes a noisier measure as it is more difficult to pin down the correct value of the country's aggregate debt stock especially if some of it is issued in the form that cannot be traded in secondary markets. Such a scale would be especially insensitive, and thus problematic, in periods when the value of government debt fluctuates intensely, which is obviously the case during my sample period. Nevertheless, despite its potential shortcomings, the results in Table B4 with this new dependent variable do not seem to deviate too much from the previous ones. Standard errors are expectedly higher and the point estimates seem to be smaller possibly due to the fact that nominal exposures are now scaled by total debt stock rather than only by bank-held debt. What is more interesting is the fact that the estimated coefficients for financial information (see *Branches* in Columns I and III) are very similar to the ones reported in Table 5. Overall, the findings in this subsection confirm the main prediction of the paper: government debt is reallocated to the informationally closer banks as the default risk of the underlying debt goes up.

4.2.3. Robustness checks

In this subsection, I will be using an incremental strategy where I incorporate the previous robustness checks as I move to the next one, reassuring the reader on the strength of my findings even when various restrictions are imposed simultaneously rather than one at a time. All the related tables containing the results of this subsection can be found in the Online Appendix.

One potentially confounding factor might be the possibility that the countries struck by the Eurozone crisis may also be better connected to each other. In such a case, information variables may capture the risk-shifting tendency of the foreign banks located in other crisis-countries (Crosignani, 2015). To control for this possibility, I include *StressedBank x Crisis* interaction as an additional control in Equation 2. Here, *StressedBank* constitutes a dummy that takes the value of one if the home country of the bank is experiencing a crisis (bond spreads $>$ 400bps). A further criticism might be due to Brutti and Sauré (2016) who argue that the political strength of the bank's home country might be important for sovereign debt reallocation. Since the banks from politically-powerful countries may feel more confident about enforcing repayments, they may tend to buy foreign government bonds while others are selling. If large and politically strong Eurozone countries also have banking systems closely-connected to the troubled economies, then I might simply be capturing this 'political strength' effect rather than the information channel. To incorporate this into my framework, I construct two additional control variables that Brutti and Sauré (2016) propose as a measure of political strength. One is the share of total Eurozone GDP that the home country of the bank produces, namely $EuroShare_l$; and the second is simply a dummy for

the German banks $GermanBank_l$. Table B5 updates the results with these extra controls and confirms that none of the previous findings regarding the information channel change in any meaningful way.[17]

One further extension could be to check whether previous results might be driven by the heterogeneous exposure to exchange rate risk. Since my sample includes some banks located in non-Eurozone countries such as HSBC in United Kingdom or Danske Bank in Denmark, differences in these banks' currency exposures may affect their hedging strategies via government bonds. To account for this scenario, I construct a subsample only composed of banks headquartered in the Eurozone countries. Hence, all the banks in this subsample use Euro as the main currency. Given that full currency compositions of the bank balance-sheets are unknown, I assume that these banks should on average face similar exchange rate risks towards other countries. Table B6 reports the corresponding estimates. As can be clearly seen, there is no material change in any of my previous findings. If anything, most coefficient estimates seem to be larger in this subsample.

Despite accounting for the differences in exchange rates, one can still argue that there was substantial redenomination (break-up) risk within the Eurozone during the recent crisis. As some countries may have started planning to get out of the monetary union, banks may have optimally started selling government bonds to hedge against such countries in order to avoid potential currency mismatches after a Eurozone break-up. However, it is not straightforward to list which countries actually planned to exit or which countries were perceived by the market as potentially preparing to exit. Thus, to test whether such motives are important in explaining my results, I follow a strategy similar to Brutti and Sauré (2016) and drop from my sample all the bank exposures towards Greece. It can be easily argued that, if any break-up expectations were evident during the sample period, this would be especially valid for Greece as it has been the country that suffered the most from the Eurozone crisis both economically and politically (Lane, 2012). Therefore, Table B7 presents the results with Eurozone banks, but this time without any Greek exposures. Again, there does not seem to be any significant change in the reported estimates, supporting the notion that they are not substantially driven by the redenomination risk.

On top of the previous setting with the Eurozone banks and the exclusion of all exposures to Greece, one can also think that possible moral suasion applied to the Greek banks may have distorted their exposures not only to Greece but to other countries as well. One possible way to check if this may have an impact on my results could be to drop all the Greek banks in my sample with all of their exposures. Table B8 illustrates the results with such further

[17] In an unreported robustness check, I also interact these home country variables with *SovereignRisk* (i.e., bond spreads) instead of *Crisis* and confirm that the results are very similar.

restriction on my sample. Coefficients on some of the structural proxies such as language and colonial links are now less precisely estimated (probably due to the loss of such relationships between Greek banks and Cyprus in the new subsample) although their economic magnitudes are still similar to the previous table. Most importantly, no significant change can be observed for financial information proxies, which remain highly significant.

In spite of the overwhelming evidence from the previous subsample checks, one could still suspect that the moral suasion or any other debt reallocation channel specifically applicable to the Eurozone crisis may be driving my results. To minimize such concerns and show that the information channel is more generalizable than being specific to a crisis episode, I focus only on the observations from the post-crisis period. As clear from the literature on the Eurozone crisis, Mario Draghi's "whatever it takes" speech in July, 2012, and the ECB's subsequent OMT programme have pulled the government debt markets from the brink of a collapse and marked the end of the intense phase of the Eurozone crisis (Saka et al., 2015; Delatte, Fouquau, and Portes, 2017). Therefore, in a new subsample test, I focus only on the observations after July, 2012. This gives me 5 data time points starting from the last quarter of 2012 (see Table 1), meaning that my sample size is automatically reduced by almost half. Even with such a small subsample, Table B9 shows that most proxies are still significant at conventional levels and, compared to the Columns I and III in Table 5, almost all of them are larger except the proxy for legal origins that turns out negative in the foreign sample but not significant. The fact that my estimates are larger in the second half of the sample period provides further reassurance that they are not driven substantially by other crisis-specific channels, such as moral suasion, whose intensity would expectedly be lower during the post-crisis period.

As an additional (as well a quite restrictive) check, I merge the conditions that led to Table B8 and Table B9; that is, I focus on the Eurozone banks in the post-crisis period by also dropping any exposure to Greece or any exposure by a Greek bank while still controlling for *risk-shifting* and the *strength of the home country* channels. Results with this smallest and most restrictive subsample are provided in Table B10. Vis-a-vis Table B8, coefficients are much less precisely estimated, which is not surprising given that the sample size shrinks considerably in Table B10. On the other hand, point estimates in general are not vastly different in terms of size. More importantly, there is still some statistical evidence that financial information proxies or structural factors such as geographical distance or common borders have an impact on banks' government bond exposures.

As a final test, I experiment with different clustering schemes as I did in the previous section for Tables 3 and 4. I find that the re-estimations of Table 5 with standard errors clustered by home country (Table B11), time (Table B12), and home country x time (Table B13)

still provide conventional levels of statistical significance.

4.3. Discussion and policy implications

The findings in this section clearly challenge the existing literature on the rising home bias in the Eurozone sovereign debt markets and provide evidence for a unique channel that has not been studied in this context before. One might argue that, in the age of technology and well-integrated markets such as the ones 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 the 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). This could be especially true in times of crisis.

Such an argument aligns well with the recent work studying the Eurozone sovereign spreads and providing 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 the government bonds while foreign banks leave the markets in a rush. In fact, the recent research shows that the banks that had loaded up periphery-country bonds during the crisis period benefited from this strategy by making huge profits as the bond prices went up later on (Acharya, Eisert, Eufinger, and Hirsch, 2016).

What is then so special about domestic banks over other types of domestic agents? First of all, domestic banks are the main players in the government debt markets. Figure 3 clearly illustrates that even before the crisis in the Euro periphery, domestic banks held almost as much sovereign debt as that of all other domestic agents combined. This could give the banks a comparative edge in pricing of government securities. Secondly, banks are natural information-gatherers for their economies. They transact with almost every sector of the domestic businesses and gain in-advance information on how well the overall economy may perform over the coming months/quarters, which would have a tremendous effect over government's ability to raise tax revenues and pay back its debt. Thirdly, banks are the agents with the greatest access to liquidity (via central banks) in times of financial crises. Hence, in a liquidity crunch, governments may find it easier to signal their intentions/plans to local banks than any other local agent. Last but not least, public ownership in the banking sector is still more common relative to other sectors, which does not only give the

government a tool to pressure banks, but also opens the possible communication channels that can transmit crucial soft information during times of sovereign stress (Ilzetzki, 2014).

Eurozone crisis has been characterized by sudden changes in the periphery countries' bond prices and various policy responses in the face of rising market speculation. Especially the actions taken by the European Central Bank (ECB) may have been instrumental. For instance, some may argue that the cheap financing provided by the ECB to commercial banks in the form of long term refinancing operations (LTROs) may have led some of these banks to increase their exposures to risky government bonds in other countries. However, since these operations were available for all the banks in the Eurozone, it still does not explain the incentives of the banks that loaded up government bonds by using these funds. Additionally, the ECB itself has started buying sovereign bonds via its Quantitative Easing (QE) programme since early 2015, which may have distorted the incentives of the commercial banks holding government bonds. However, as the sample period in my analysis (2010q1-2015q2) does not overlap with QE, the previous argument cannot dilute the main message of this paper either.

As a key policy conclusion: if information channel gets activated between governments and 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. Therefore, the close link between governments and their domestic banks may create positive externalities in terms of mitigating the effects of sudden stops and preventing the inefficient sovereign defaults. Nevertheless, policy discussions have so far emphasized shifting the regulatory power from national to supranational institutions to avoid moral suasion or coming up with various innovations of debt issuance in order to cut off the diabolic loop between sovereigns and their banks (see Brunnermeier, Garicano, Lane, Pagano, Reis, Santos, Thesmar, Van Nieuwerburgh, and Vayanos, 2016). Taken at face value, my results imply that these precautions would not be sufficient to prevent the rising home bias problem (to the extent that it constitutes a problem) during crises. Instead further policy discussions may also focus on increasing transparency in the sovereign debt markets especially in times of crisis or encouraging more cross-border banking activities to improve the informational ties across countries.

5. Conclusion

This paper proposes a new channel of sovereign debt reallocation across banks based on informational frictions and provides evidence in the context of the recent Eurozone debt crisis. Using a novel bank-level dataset, the paper first confirms that the European banks'

home bias increased and sovereign debt was indeed reallocated from foreign to domestic banks at the peak of the crisis. Later, it illustrates that the private forms of debt (retail and corporate) in the same bank balance-sheets have experienced an equally large (if not larger) jump in home bias in response to the same crisis, pointing towards a more general explanation of the home bias rather than the specific ones applied to sovereign debt in the recent literature.

To identify the information channel, I primarily focus on the banks' foreign country exposures, which helps me minimize the potentially confounding effects of the alternative stories that are specific to the domestic exposures, such as moral suasion or secondary market channels. Empirically, I take a difference-in-differences approach by comparing the sovereign exposures of foreign banks at different levels of informational closeness with varying levels of sovereign risk for the exposure country. In other words, I estimate the interaction between various information proxies and sovereign bond spreads. As a result, I find strong evidence for the argument that the foreign banks headquartered in informationally closer territories increase their relative exposures as the sovereign risk rises. This effect is also found to be robust to controlling for various alternative channels and changing sample compositions. Hence, this paper contributes to the extant empirical literature on the role that informational asymmetries play in asset markets and extends it to the context of government bond exposures of commercial banks.

The findings in the paper have direct implications for policymakers. In the absence of a national central bank acting as a lender of last resort, domestic banks in the Eurozone may have mitigated the disrupting effects of a sudden stop triggered by the less informed (and more panicky) foreign banks. Future policy discussions may benefit from focusing on increasing the transparency in the sovereign debt market and encouraging cross-border banking activities to mitigate the rising home bias in advance of the next Eurozone crisis.

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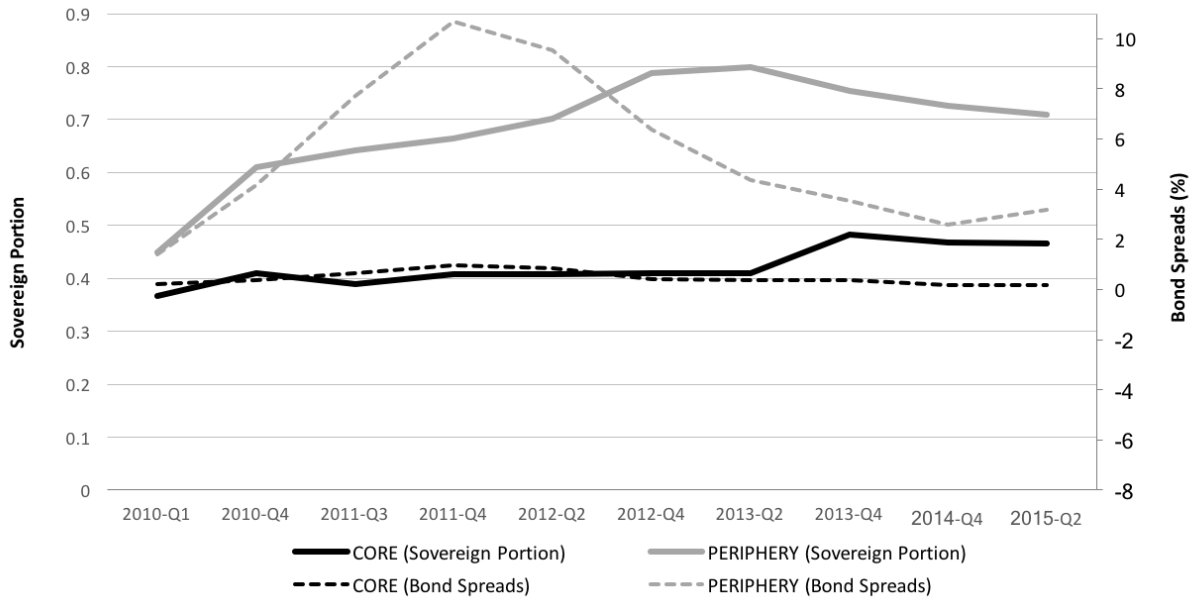


Fig. 1. **Sovereign portion of the domestic banks in core and periphery Euro countries (2010q1-2015q2).** The graph shows simple country averages of sovereign portion and bond spreads for each country group (core vs. periphery). Sovereign Portion is defined as the portion of the total sovereign debt of a country held by its domestic banks. Bond Spreads are computed as the average daily bond spreads for a country (with respect to Germany) over the 3-month period before each observation date. Sovereign bond exposure data come from various stress-tests, transparency and recapitalization exercises undertaken by the 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.

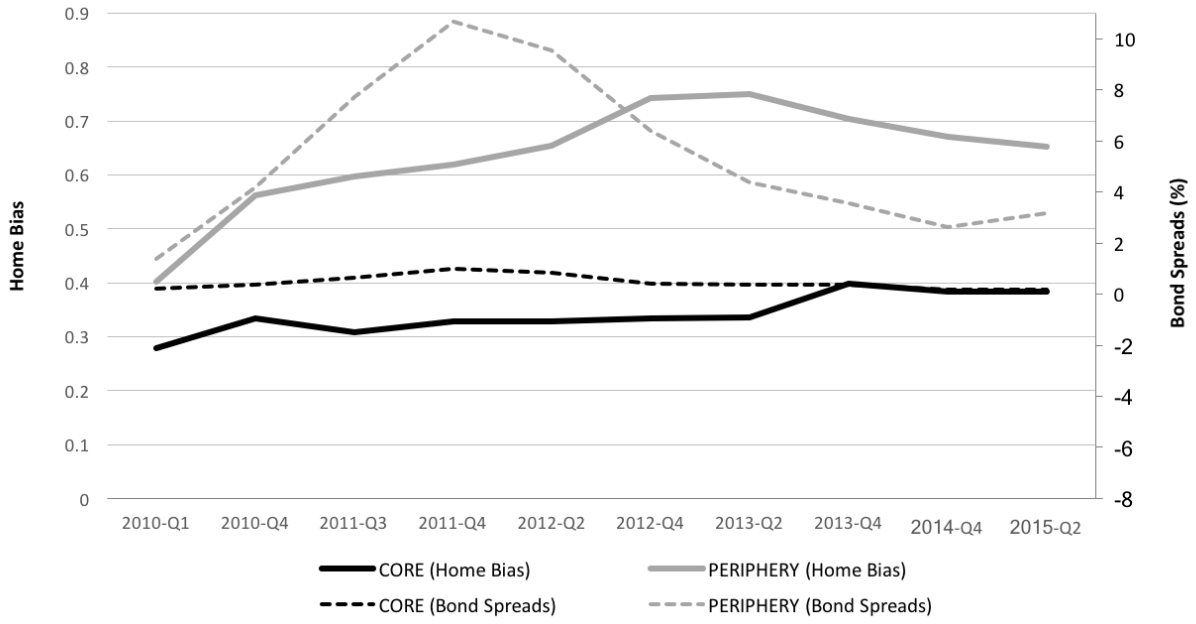
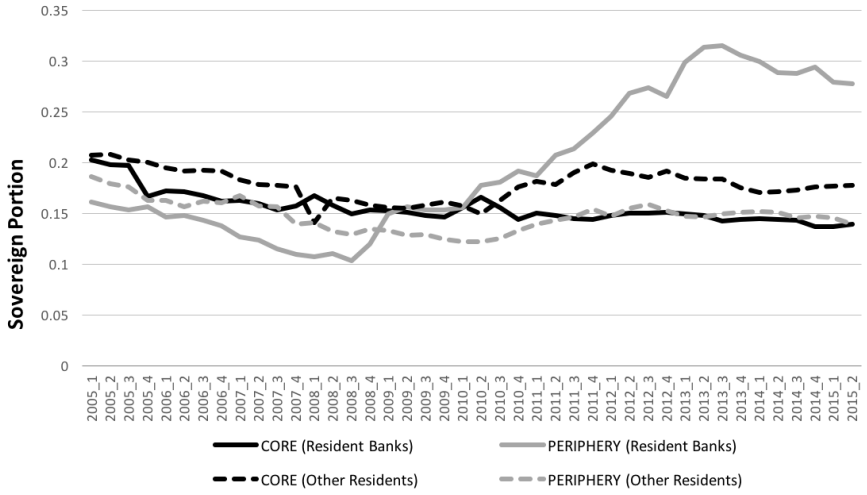
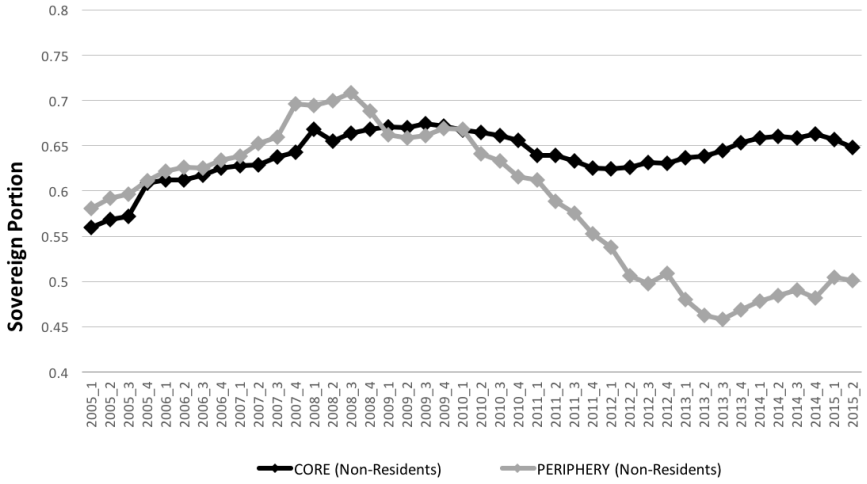


Fig. 2. **Home bias of the domestic banks in core and periphery Euro countries (2010q1-2015q2).** The graph shows simple country averages of home bias and bond spreads for each country group (core vs. periphery). Home Bias is defined as the portion of the total sovereign debt of a country held by its domestic banks, after taking into account the portfolio size of these domestic banks according to a standard portfolio (CAPM) model (see the Data Description). Bond Spreads are computed as the average daily bond spreads for a country (with respect to Germany) over the 3-month period before each observation date. Sovereign bond exposure data come from various stress-tests, transparency and recapitalization exercises undertaken by the 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.



(a) Bank residents and Non-bank residents



(b) Non-residents

Fig. 3. **Sovereign portion of bank residents, non-bank residents and non-residents in core and periphery Euro countries (2005q1-2015q2).** The graph shows simple country averages of sovereign portion held separately by resident banks, other (non-bank) residents and non-residents. Sovereign Portion is defined as the portion of the total sovereign debt of a country held by a particular creditor group. Sovereign debt exposures come from the dataset compiled from various national sources by Merler and Pisani-Ferry (2012) and include quarterly observations from 2005-Quarter1 to 2015-Quarter2. Core (non-crisis) countries: Belgium, Finland, France, Germany and Netherlands. Periphery (crisis) countries: Greece, Ireland, Italy, Portugal, Spain. Data for Belgium and Finland can only be found annually; so these data are linearly interpolated in order to obtain quarterly values.

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

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

Variables	*Mean*	*Median*	*Std. Deviation*	*Min*	*Max*	*Observations*	*Source*
SovereignPortion (in bps)	120	0	466	0	9725	23,268	EBA
SovereignPortionBias (in bps)	-1	-37	468	-755	9720	23,268	EBA
RetailPortion (in bps)	121	0	688	0	10000	13,509	EBA
SovereignPortion (Domestic - in bps)	1256	919	1281	0	8407	831	EBA
SovereignPortionBias (Domestic - in bps)	1150	720	1279	-137	8405	831	EBA
RetailPortion (Domestic - in bps)	1644	753	2078	0	10000	497	EBA
Bond Spreads (in bps)	254	144	335	-96	2883	280	Datastream
Crisis dummy (Spread > 400bps)	0.12	0	0.33	0	1	280	Datastream
Branches	220	0	1864	0	28718	616	SNL Financial
Mergers	5	0	34	0	610	616	SDC Platinum
Press	0.07	0.03	0.12	0.00	0.95	616	Factiva
Language	0.07	0.00	0.26	0.00	1.00	616	Mayer & Zignago (2011)
Colony	0.07	0.00	0.25	0.00	1.00	616	Mayer & Zignago (2011)
Distance	6.90	7.22	1.47	0.00	8.49	616	MapQuest
Border	0.13	0.00	0.33	0.00	1.00	616	Mayer & Zignago (2011)
Legal	0.30	0.00	0.46	0.00	1.00	616	La Porta et al. (2008)

Table 2: **Summary statistics for the main variables.** The table lists the variables used in the main regressions. "Bps" denotes basis points. *SovereignPortion* is the portion of the total sovereign debt of a country held by a specific bank. *SovereignPortionBias* is the portion of total sovereign debt of a country held by a specific bank, after adjusting for a standard CAPM model (see the Data Description section). *RetailPortion* is the portion of the total retail debt in a country held by a specific bank. Domestic in parentheses denotes the observations where the country of exposure is the same as the home country of the bank. *Bond Spreads* are the spreads (in basis points) on 10-year maturity bond for each country in the sample (with respect to 10-year German bond) averaged over three-months daily values before each observation date. *Crisis* is a dummy variable which is equal to 1 if a Euro country's three-month average bond spread (with respect to Germany) is above 400 basis points at an observation date. For the specific definitions of information proxies (*Branches-Legal*), see the Data Description section. The last column shows the data sources.

Dependent Variable:	*SovereignPortion*				*SovereignPortionBias*			
	I	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*
Domestic	1,257***	1,257***	1,127***	1,126***	1,273***	1,273***	1,143***	1,143**
	[10.430]	[10.276]	[9.363]	[9.210]	[10.511]	[10.356]	[9.437]	[9.284]
Domestic x Crisis			1,093***	1,102***			1,095***	1,101**
			[3.755]	[3.680]			[3.753]	[3.670]
Fixed Effects								
Bank	*Yes*		*Yes*		*Yes*		*Yes*	
ExpCountry x Time	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Bank x Time		*Yes*		*Yes*		*Yes*		*Yes*
Clustering	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank
Adj-R-sq	0.244	0.236	0.264	0.256	0.243	0.229	0.262	0.249
N	23268	23268	23268	23268	23268	23268	23268	23268

Table 3: **Sovereign debt reallocation across European banks during the crisis.** 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 total sovereign debt of a country held by a specific bank. *SovereignPortionBias* is the portion of total sovereign debt of a country held by a specific bank, after adjusting for a standard CAPM model (see the Data Description 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 Euro country's bond spread (with respect to Germany) is above 400 basis points calculated as the average of daily bond spreads over the 3-month period preceding the observation date. Sovereign bond holding 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 for *Crisis* dummy are obtained from Datastream. Robust standard errors are clustered at the bank-level and t-statistics are reported in brackets. $*p \leq 0.1, **p \leq 0.05, ***p \leq 0.01$.

Dependent Variable:	*RetailPortion*				*RetailPortionBias*			
	I	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*
Domestic	1,684***	1,684***	1,544***	1,542***	1,713***	1,713***	1,573***	1,569**
	[8.267]	[8.158]	[7.546]	[7.436]	[8.326]	[8.216]	[7.617]	[7.499]
Domestic x Crisis			1,299**	1,316**			1,297**	1,333**
			[2.582]	[2.557]			[2.554]	[2.545]
Fixed Effects								
Bank	*Yes*		*Yes*		*Yes*		*Yes*	
ExpCountry x Time	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Bank x Time		*Yes*		*Yes*		*Yes*		*Yes*
Clustering	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank
Adj-R-sq	0.198	0.185	0.210	0.197	0.196	0.189	0.207	0.201
N	13509	13509	13509	13509	13509	13509	13509	13509

Table 4: **Retail debt reallocation across European banks during the crisis.** The table summarizes the results of the equation (1) with dependent variables *RetailPortion* (I-IV) and *RetailPortionBias* (V-VIII) estimated over a time period fully spanning the Eurozone crisis on a biannual basis from early 2010 to mid-2015. *RetailPortion* is the portion of total retail debt of a country held by a specific bank. *RetailPortionBias* is the portion of total retail debt of a country held by a specific bank, after adjusting for a standard CAPM model (see the Data Description 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 Euro country's bond spread (with respect to Germany) is above 400 basis points calculated as the average of daily bond spreads over the 3-month period preceding the observation date. Data on retail exposures 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 for *Crisis* dummy are obtained from Datastream. Robust standard errors are clustered at the bank-level and t-statistics are reported in brackets. $*p \leq 0.1, **p \leq 0.05, ***p \leq 0.01$.

Dependent Variable:	*SovereignPortion*			
Sample:	*All observations*		*Foreign*	
	[I]	*[II]*	*[III]*	*[IV]*
Specification:	*Single variables*	*Full specification*	*Single variables*	*Full specification*
SovRisk x Branches	0.016***	0.015***	0.067***	0.082***
	[5.302]	[2.916]	[2.957]	[2.852]
SovRisk x Mergers	0.677***	-0.336	1.649***	0.449
	[3.786]	[-1.549]	[2.716]	[0.497]
SovRisk x Press	146.980***	-26.622	45.248**	-57.320**
	[4.176]	[-0.996]	[2.240]	[-2.443]
SovRisk x Language	77.261***	31.201**	34.284***	40.052**
	[6.340]	[1.982]	[3.519]	[2.499]
SovRisk x Colony	68.186***	1.671	28.298***	7.885
	[5.471]	[0.165]	[2.877]	[0.709]
SovRisk x Distance	-18.206***	-8.452*	-11.388**	-4.140
	[-4.756]	[-1.751]	[-2.566]	[-1.027]
SovRisk x Border	71.815***	3.348	17.012*	-26.230**
	[4.553]	[0.338]	[1.876]	[-2.430]
SovRisk x Legal	10.629***	4.105	4.065	5.922*
	[3.398]	[1.260]	[1.423]	[1.898]
Fixed Effects				
Bank x Time	*Yes*	*Yes*	*Yes*	*Yes*
ExpCountry x Time	*Yes*	*Yes*	*Yes*	*Yes*
HomeCountry x ExpCountry	*Yes*	*Yes*	*Yes*	*Yes*
Clustering	Bank	Bank	Bank	Bank
Adj-R-sq	-	0.519	-	0.226
N	23,268	23,268	22,437	22,437

Table 5: **Effect of informational distance on sovereign debt reallocation.** The table summarizes the results of the equation (2) separately in full sample (Columns I-II) and in foreign sample (Columns III-IV) estimated over a time period fully spanning the Eurozone crisis on a biannual basis from early 2010 to mid-2015. Each coefficient in Columns I and III is obtained from a separate estimation whereas the ones in Columns II and IV are obtained from the same estimation. Dependent variable is *SovereignPortion*, which measures the portion of total sovereign debt of a country held by a specific bank. *SovRisk* is a measure of sovereign risk and calculated as the average of daily bond spreads over the 3-month period preceding the observation date. For the specific definitions and sources of information proxies (*Branches-Legal*), see the Data Description section. Sovereign bond holding 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. $*p \leq 0.1, **p \leq 0.05, ***p \leq 0.01$.