Repatriation of Debt in the Euro Crisis: Evidence for the Secondary Market Theory

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Legal Issues

Repatriation of Debt in the Euro Crisis: Evidence for the Secondary Market Theory[*]

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December 20, 2013

Abstract

The Euro Crisis has stopped the process of the European financial integration and triggered a strong repatriation of debt from foreign to domestic investors. We investigate this empirical pattern in light of competing theories of cross-border portfolio allocation. Three empirical regularities stand out: i) repatriation of debt occurred mainly in crisis countries; ii) repatriation affected mainly public debt; iii) public debt of crisis countries was reallocated to politically influential countries within the Euro Area. Standard theories are in line with pattern (i) at best. We argue that the full picture constitutes evidence for the "secondary market theory" of sovereign debt.

Keywords: Debt Repatriation, Sovereign Risk, Secondary Markets, Euro Crisis, Portfolio Home-Bias
JEL Classification: F34, F36, G01, G11, G21

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1 Introduction

Prior to the sovereign debt crisis financial integration in the Euro Area soared. In particular, buoyant economic conditions and higher sovereign yields in southern Europe, coupled with the absence of exchange rate risk, lured northern European banks into peripheral countries. The share of sovereign debt held abroad increased and yield spreads with respect to German bonds narrowed. This picture changed dramatically in late 2009, as fears of sovereign insolvency began to escalate in the so-called GIIPS countries. Foreign banks pulled out their positions, leaving domestic banks to absorb the drop in demand for local government bonds. Figure 1 illustrates these dynamics: the onset of the Euro Crisis has marked a sharp reversal in financial integration within the Euro Area. In short, sovereign debt of GIIPS countries began to be repatriated.

Figure 1: **Share of Domestically Held Debt - Total Non-Bank Debt**
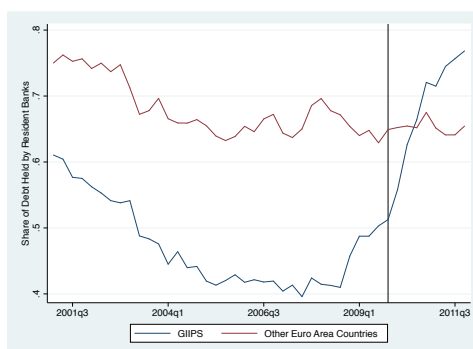
Holdings of public debt by local banks relative to total bank-held debt of the country. Simple averages by country group. The group of GIIPS countries includes Portugal, Ireland, Italy, Greece, Spain. The group of other Euro Area countries includes Austria, Belgium, Finland, France, Germany and the Netherlands. The vertical line denotes the outbreak of the Euro Crisis. See Section 2 for the description of the data and the counterparty countries considered. Source: Locational Banking Statistics (BIS) and IFS (IMF).

Why did domestic banks in the GIIPS countries increase exposures to local government debt amid rising fears of sovereign solvency? In doing so, they were

adding substantial default risk to their portfolios, which were loaded with local government debt already. Why didn't they diversify by investing abroad, e.g. in foreign government debt?

In this paper, we scrutinize this question empirically using balance-sheet data on bank positions and provide evidence that sheds light on the possible drivers of banks' investment behavior. Specifically, our analysis reveals three robust empirical regularities. First, the repatriation of debt affected primarily the countries in acute state of crisis, consistently with the patterns documented in Figure 1. Second, the repatriation of debt was much stronger for sovereign debt than for private debt. Third, and finally, the sovereign debt of crisis countries was reallocated across foreign countries according to the relative political influence within the Euro Area.

Some possible explanations for the observed repatriation of debt quickly spring to mind. For example, local banks may have taken advantage of arbitrage opportunities, investing in high-yield sovereign bonds using cheap funding provided by the ECB through LTROs. While that explanation may sound reasonable at first, it hardly explains why only banks of crisis countries engaged in the lucrative business and why did they increase exposure only to domestic debt. In fact, Spanish banks could be expected to take on Italian bonds and vice versa - predictions that are not at all consistent with a repatriation of debt.

"Moral suasion" could be another explanation: authorities in the GIIPS countries might have jawboned local banks to purchase domestic sovereign bonds. Yet, available data show that investments of local non-bank investors paralleled those of banks. Since non-bank investors are less susceptible to government pressures, this observation challenges the view that moral suasion was driving the debt repatriation.

Another possible explanation hinges on information asymmetries: as uncertainty and informational asymmetries between local and foreign investors deepened during the crisis, the better informed local investors might have increased their positions of local debt. Common wisdom, however, suggests that this argument applies first and foremost to corporate bonds or equities, on

which public information is relatively scarce. The fact that the repatriation has been much stronger for sovereign than for private debt thus defies the latter explanation as well.

Also standard hedging motives of non-tradable income and exchange rate risk might be consulted to explain our empirical findings. Yet, there is little empirical support for hedging of non-tradable income risk as an explanation of portfolio allocation in the first place. Moreover, casual observation suggests that sovereign and income risk tend to become more aliened in crisis periods. It thus hardly qualifies as a key driver of the repatriation of sovereign debt. Finally, exchange rate risk can be argued to be absent in the Euro Area, discarding related hedging motives. Standard hedging motives, too, seem to be unable to explain the patterns displayed in the data.

Overall, it appears that the fast and obvious explanations for Figure 1 do not match the full picture of the data.[1] We are thus left with the question: why did banks and investors in the GIIPS countries increase their exposure to local sovereign debt, while foreign banks sold off the same positions? We argue that the secondary market theory of sovereign debt, recently advanced by Broner, Martin and Ventura (2010), hereafter BMV, provides an intuitive, simple and plausible answer. Like most theories of sovereign debt, the secondary market theory starts from the premise that sovereigns care less about foreign creditors than about domestic creditors. Therefore, sovereigns have a stronger incentive to default on debt that is held abroad. This is not a problem under normal circumstances, as the fear of international sanctions leads the government to repay. In crisis periods, however, sovereign default becomes less costly and the government's temptation to renege its debt grow stronger. Facing a potential loss, foreign creditors try to reduce their exposure by selling government bonds in the secondary market. Domestic agents will buy these bonds, expecting that the government will have a stronger incentive to honor its domestic debt.[2]

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[1]For a more careful discussio of these explanations, see Section 3.2.

[2]One aspect of this theory is that the government has some ability to effectively discriminate across creditors. Besides an explicit, technical discrimination, this can also take place indirectly through compensation schemes. See also the discussion at the start of Section 4.

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The theory thus delivers sharp predictions for time series data. Following an exogenous shock to the sovereign risk of a country, its debt should reallocate to local investors. In the words of BMV, when "penalties are known to be insufficient foreign creditors try to sell their debts, perhaps at a discount, and 'leave' the country." This reallocation should be stronger for sovereign debt, as strategic default considerations are arguably more important for sovereign debt. Finally, a more general reading of the theory suggests that the debt of crisis countries should reallocate to larger countries within the Euro Area, which had a stronger say on the decision about sovereign default of peripheral countries. As our empirical findings are largely consistent with these predictions, we argue that they constitute evidence in favor of the secondary market theory.

Methodologically, we apply a difference-in-difference approach to test whether period of crisis are associated with an increase in banks' exposure to local sovereign debt. Our sample consists of a quarterly dataset of domestic and cross-border bank positions of both public and private debt, which includes 17 countries between 2006 and 2011. Focusing on the Euro Crisis, we define a country to be in crisis, if, first, it is a member of the Euro Area and, second, its bond yields exceed the threshold of 700 basis points, which was viewed as a critical level by financial market observers.[3] We then consider interactions between crisis episodes and other characteristics of bank positions to provide a more differentiate picture of the patterns displayed in Figure 1.

Our simplest empirical model is formally close to the traditional gravity equation, in which the log of bilateral trade flows are regressed on the log of the economic size of trade partners and distance. Santos Silva and Tenreyro (2006) have recently uncovered drawbacks of that traditional OLS estimation and suggest instead a Poisson pseudo-maximum-likelihood (PPML) estimator. We adopt this strategy, showing that our results are robust in a Poisson panel

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[3]We check the sensitivity of our results by considering a crisis threshold of 600 and 500 basis points. We also use bond yields to capture the effect of marginal increases in the risk of default, independently of any specific crisis threshold.

estimation.[4]

We observe that the common narrative of the Euro Crisis sustains that the increase in risk premia in our set of crisis countries was the result of bad fundamentals and unsound policies. According to this view, our estimates identify a causal effect of the Euro Crisis on the geographic allocation of sovereign bond positions. We do not want to stretch this argument unduly, however. While such a view is absolutely consistent with our findings, it has recently been pointed out that causality may go in the opposite direction as well. Broner et al. (2013) argue that the repatriation of sovereign bonds – i.e. the bond purchases by domestic residents – may crowd out investment in the domestic private sector, leading to lower growth and ultimately sending the economy into crisis (thus rationalizing the initial repatriation). We stress, however, that both interpretations of our results only apply under the premise that portfolios reallocate through secondary markets in times of (endogeneous or exogeneous) crises. They are thus derivatives of the original "secondary market theory".

Our paper relates to the extensive literature that analyzes enforcement problems in sovereign debt markets. Seminal contributions to this literature, e.g. Eaton and Gersovitz (1981) and Bulow and Rogoff (1989), have focused on the role of exclusion from financial markets and trade sanctions to sustain repayment.[5] Empirically, however, the debate about whether sovereign defaults are effectively associated with explicit foreign retaliation has yet to be settled.[6] The secondary market theory of Broner, Martin and Ventura (2010)

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[4]Santos Silva and Tenreyro (2006) state that the "estimator can be easily adapted to deal with [...] panel data". Hausman et al (1984) and Wooldridge (1990) have developed this strategy, which has been used, among others, by Acemoglu and Linn (2004).

[5]Influential contributions to the literature include Grossman and Van Huyck (1988), Cole and Kehoe (1998, 2000), Kletzer and Wright (2000), among others. See also the survey papers by Eaton and Fernandez (1995) and Panizza, Sturzenegger and Zettelmeyer (2009). A more recent strand of the literature includes Aguiar and Gopinath (2006), Yue (2006), Arellano (2008), Cuadra and Sapriza (2008), Sandleris (2008), Hatchondo, Martinez and Sapriza (2009), Mendoza and Yue (2011), D'Erasmo and Mendoza (2013).

[6]For the effect of sovereign default on subsequent borrowing costs, see Reinhart et al. (2004), Borenzstein and Panizza (2009), Gelos et al. (2011), Arteta and Hale (2008), and Cruces and Trebesch (2013). For the effect on international trade, see Rose (2008), Martinez and Sandleris (2011), Zymek (2012).

provides an alternative view of enforcement problems in sovereign debt markets. Rather than stressing the role of foreign penalties, this theory focuses on the role of secondary markets as a way to solve the commitment problem of the government. Secondary markets, indeed, limits the ability of governments to discriminate across creditors, as foreign bondholders are compensated indirectly through the bond purchases of domestic agents. Guembel and Sussman (2009), Broner and Ventura (2010, 2011), Brutti (2011), Gennaioli et al. (2009), Mengus (2013) then show that in the absence of discrimination, the repayment of sovereign debt depends on the cost inflicted by a default on the domestic private sector and is not directly related to foreign sanctions. We contribute to the literature on secondary markets providing empirical evidence consistent with the reallocation of sovereign debt predicted by the theory.

Our paper also relates to a growing literature that analyzes the behavior of cross-border investment during financial crises. Broner et al. (2013) and Milesi-Ferretti and Tille (2010) use balance-of-payment data to analyze the dynamics of gross capital flows during crisis periods.[7] The empirical evidence indicates that financial crises tend to be associated with a simultaneous decline in both capital inflows by foreigners and capital outflows by domestic investors, leading to increasing home bias of asset portfolios. Forbes and Warnock (2012) focus on episodes of extreme movements in gross capital flows and analyze their determinants. They find that global conditions (e.g., global risk) are more important than local conditions to explain such episodes. Our results, which show that the repatriation of debt was stronger in the crisis-stricken countries, suggest that local factors had a predominant role on cross-border asset allocations in the Euro crisis.[8] Similar to our paper, Goldberg and Cetorelli (2012) focus on bank positions and analyze the dynamics of banks' asset allocation during the Great Recession. Their focus, however, is on how funding shocks to

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[7]Specifically, Broner et al. (2013) focus on a comprehensive set of bank, currency and debt crises between 1970 and 2009, while Milesi-Ferretti and Tille (2010) focus on the period encompassing the Great Recession, i.e. 2007-2009.

[8]We note however that our analysis focuses on bank positions only and on a different sample of both countries and years.

banks in developed countries affected the supply of loans to emerging markets.[9]

The remainder of the paper is structured as follows. Section 2 describes the data and a number of additional stylized facts related to the repatriation of debt during the Euro Crisis. Section 3 discusses the empirical framework and the main estimation results. Section 4 provides an overview of the secondary market theory and reports additional estimation results related to this theory. Section 5 discusses potential caveats of our estimations and Section 6 concludes.

2   Data

Our analysis requires to combine two sources of data: the *Monetary and Financial Statistics* of IMF's International Financial Statistics (IFS), which report aggregate bank positions vis-a-vis domestic residents, and the *Locational Banking Statistics* (LBS) of the BIS, which report bank positions vis-a-vis non-resident on a bilateral basis. Data have a quarterly frequency and are expressed in millions of US dollars.[10]

The two sets of data share a number of common characteristics that make them comparable: i) they use the same definition of banks, which correspond to deposit-taking corporations except for the central bank; ii) they attribute bank positions based on the country of *residence* rather than the *nationality* of the institutions involved, consistently with Balance of Payments statistics; and iii) they apply the same valuation principles, reporting banks' positions at market prices.

To check the comparability of the two datasets, we aggregate the bilateral cross-border claims in the LBS to obtain a measure of total claims on

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[9]See also Giannetti and Laeven (2011).

[10]The IFS originally report banks' positions in national currency. We convert them into millions of US dollars using end-of-period exchange rates, consistently with the built-in currency conversion in the BIS data. The data on the exchange rate between US dollars and each national currency are taken from the IFS. Since we add time dummies in the estimations, the choice of currency is irrelevant as long as it is consistent for all positions.

non-residents for each country. We then compare this measure with the corresponding data available in the IFS. Table A1 shows that the within-country correlation between these two measures is high; on average, it is 0.971. We confidently conclude that the two datasets evaluate banks' positions consistently.[11]

Regrettably, the sectorial disaggregation available in the two sets of data is different. Specifically, the IFS data separate domestic claims between those on the central government and those on the non-bank private sector.[12] Domestic bank-to-bank lending is not reported since bank positions are consolidated within each country. The LBS, instead, only distinguishes between cross-border claims on banks and cross-border claims on non-bank borrowers. The latter category includes both claims on the government and claims on the non-bank private sector.

To separate among positions of public debt and private-non-bank debt in the LBS data, we compute a synthetic sector decomposition using the sector breakdown reported in the Consolidated Banking Statistics (CBS), also provided by the BIS.[13] Specifically, we multiply the LBS positions of aggregate non-bank debt with the respective bilateral sector shares reported in the CBS.[14] Some caveats, however, apply to this synthetic decomposition. Because the CBS data are consolidated on the level of banking groups, they comprise headquarters as well as foreign affiliates' positions. This means that

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[11]We do find some differences in the levels between the two datasets. However, as we control for country fixed effects in our estimations, the differences in the levels of bank positions will be controlled for. – The reason for not reporting more details of the data is that we are restricted by a confidentiality agreement with the BIS.

[12]More precisely, the IFS data report claims on other domestic sectors, which include claims on other financial (non-bank) corporations, claims on the private sector, claims on non-financial public corporations and claims on local and state government. These categories correspond almost exactly to the definition of non-bank private debt used by the BIS, with the only difference that the BIS considers the claims to local governments as general public debt. The difference in definitions, however, would tend to underestimate the relative increase of local public debt positions in crisis countries. Therefore, the bias in our coefficients of interest will go in the opposite direction of our testable hypothesis.

[13]We use the immediate borrower classification of the CBS data.

[14]The CBS indeed report banks' positions at the same level of sector disaggregation of the IFS.

the CBS attributes positions based on the nationality of the bank's ownership. In contrast, the positions reported in the LBS are based on the residency.

Our synthetic decomposition may then differ from the actual sector breakdown in the LBS due to two main discrepancies. The first discrepancy concerns the positions of foreign affiliates in the recipient country: e.g., positions of Greek debt held by the Greek offices of German banks. These positions are included in the CBS, whereas they do not enter the LBS data. The potential mistake, however, tends to be small for the following reasons. First, local lending by foreign affiliates constitutes a small share of foreign banks' positions in the CBS data (the median is less than 11 percent of bilateral claims on crisis countries).[15] Thus, changes in the claims of foreign affiliates cannot generate the large percentage changes in positions we observe in our empirical exercise. More importantly, however, the CBS records only local lending in non-local currency of foreign affiliates. Indeed, local positions by foreign affiliates in local currency do not enter the CBS statistics. As we focus only on crises countries in the Euro Area, and the debt issued by these countries is largely denominated in Euros, this restriction is likely to eliminate a large part of the discrepancy.

The second discrepancy concerns the positions of foreign affiliates in third countries. Specifically, the positions of Greek debt held by the Italian offices of German banks are reported as positions of Germany on Greece in the CBS, while they are treated as positions of Italy on Greece in the LBS. However, this classification error is unlikely to bias our estimates. The reason is that our coefficients of interest capture the change of local claims on a crisis economy relative to (average) foreign claims on the same crisis economy.[16] Foreign

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[15]To compute this value, we take the share of local positions of foreign affiliates over total foreign claims (cross-border positions plus local positions of foreign affiliates) for each country pair. We then restrict the sample to include only positions vis-a-vis the GIIPS countries, and we calculate the median value. The period is 2006:Q1 - 2011:Q4. The data used come from the ultimate risk classification of the CBS. These data are reported in slightly differently way with respect to the immediate borrower classification, which we use to perform our synthetic sectorial decomposition. It is reasonable, however, to expect that the share of local lending by foreign affiliates does not change much between the different classifications of the CBS data.

[16]We log all positions so that our coefficients of interest measure relative growth rates.

claims, in turn, cannot be systematically biased in one direction by misclassifying Italian claims on Greece as German claims on Greece or vice versa: a decrease of the first positions implies an increase in another country so that the average foreign position is unaffected.

Notice finally that claims of headquarters on foreign affiliates are recorded as bilateral claims in the LBS and could in principle introduce differences with respect to the CBS data. However, we exclude data on bank-to-bank lending from our exercise so that this problem does not arise. In sum, we can use our synthetic sectorial breakdown of the LBS positions with some confidence.

We combine the panel of bilateral bank positions with data on sovereign bond yields for each country. The data refer to daily yields on 10-year government bonds and come from Thomson Reuters. We use the average yield in each quarter to identify periods of crisis. In the empirical analysis, we restrict the sample to the period between the first quarter of 2006 and the last quarter of 2011. The choice of the period is dictated both by data coverage and by the focus on the Euro Crisis. We then exclude all country-pairs with missing or discontinuous observations over this period in order to obtain a balanced panel of bilateral exposures. Finally, we keep only those countries that appear in both the IFS and the BIS data. The final sample includes 17 countries.[17]

2.1   Additional Stylized Facts

In this section we provide a more detailed picture of the observed repatriation of debt. Specifically, we compare the shift in bank positions across different classes of assets and across individual countries.

Figure 2 shows that the process of repatriation mainly affected the public debt of countries in distress as opposed to private debt. The figure plots the share of domestically held debt in the GIIPS countries and in the other Euro Area countries, distinguishing between non-bank private debt (left panel) and sovereign debt (right panel). The graphs clearly show that the share of

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[17]Namely, Austria, Belgium, Brazil, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Mexico, Netherlands, Portugal, Spain, Sweden, United States.

domestic ownership increased only in the GIIPS countries and only for public debt positions. Conversely, no significant change of debt ownership is visible in other Euro Area countries nor for the private debt of GIIPS countries

Figure 2: **Share of Domestically Held Debt - Private and Public Debt**
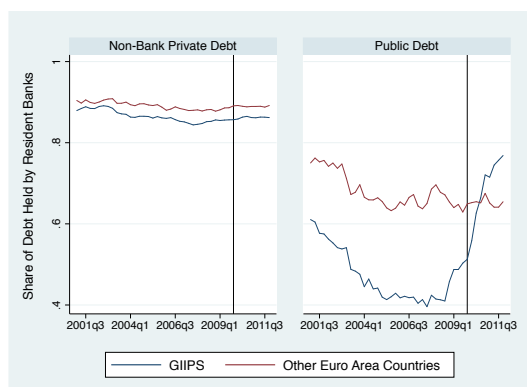
Debt holdings by local banks relative to total bank-held debt of the country. Simple averages by country group. See also notes to Figure 1 and Section 2 for a definition of the sector-breakdown. Source: Locational Banking Statistics (BIS), Consolidated Banking Statistics (BIS) and IFS (IMF).

Figure 3 reports the shares of public debt and private non-bank debt held by domestic banks at the country level, separating between GIIPS countries (left panel) and other Euro Area countries (right panel). These shares are plotted together with the corresponding yield on government bonds, which is taken as a measure of the intensity of the crisis. A first look at the graphs reveals that the tendency towards repatriation of public debt was common to all GIIPS countries, whereas we do not find any evidence of a clear trend in other Euro Area countries (with the exception of Finland). In addition, the shift in debt ownership was larger in the countries that experienced the fastest escalation of sovereign risk, like Greece, Ireland and Portugal. In Italy and Spain, instead, the crisis was less virulent and, accordingly, the fraction of public debt reallocated from foreign to domestic banks was lower.

Figure 3: **Share of Domestically Held Debt - Individual Countries**

(a) GIIPS   (b) Other EA Countries
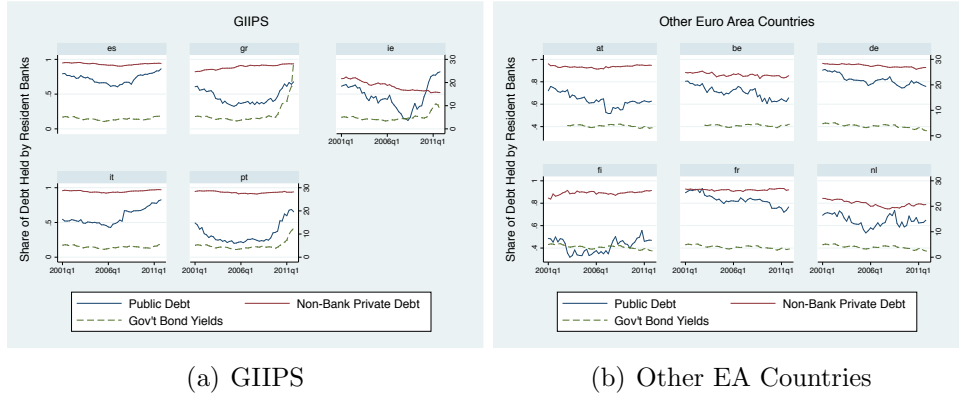
Debt holdings by local banks relative to total bank-held debt of the country. GIIPS countries are Spain (ES), Greece (GR), Ireland (IE), Italy (IT) and Portugal (PT). Other Euro Area countries are Austria (AT), Belgium (BE), Germany (DE), Finland (FI), France (FR) and the Netherlands (NL). See also notes to Figure 1 and 3. Source: Locational Banking Statistics (BIS), Consolidated Banking Statistics (BIS) and IFS (IMF).

Figure 4 reports the level, in logs, of the debt positions of domestic and foreign banks in the GIIPS countries. The left panel indicates the positions of public debt, while the right panel indicates the positions of private debt. In both cases, we find a tendency of domestic positions to increase and of foreign positions to decrease when sovereign risk sets in.[18] Nonetheless, the divergence between domestic and foreign positions appears more evidently in the case of public debt, consistently with the patterns observed in Figure 4 (left panel). Conversely, the positions of domestic and foreign banks in other EA countries moved substantially in parallel over the same period.[19]

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[18]In the case of public debt, the divergent trend starts around the first quarter of 2010 and continues until the second half of 2011. In late 2011, indeed, domestic positions start to decline as well, potentially reflecting stronger valuation effects at the peak of the crisis.

[19]The graphs reporting the levels of domestic and foreign banks' positions are not shown but available from the authors upon request.

Figure 4: **Foreign and Domestic Positions - Levels**

(a) Public Debt   (b) Private Non-Bank Debt
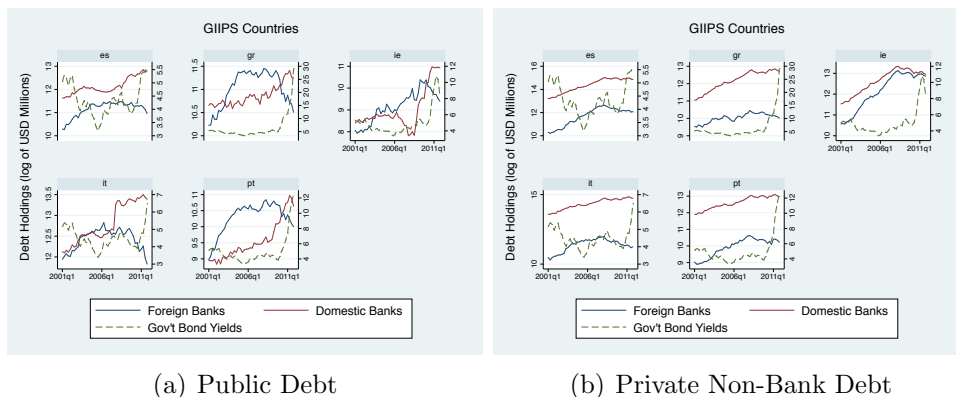
Nominal debt held by local and foreign banks. See also notes to Figure 1 and Figure 3. Source: Locational Banking Statistics (BIS), Consolidated Banking Statistics (BIS) and IFS (IMF).

3 Empirical Analysis

The stylized facts presented so far suggest a clear association between the increase in sovereign risk and the repatriation of public debt. In the empirical analysis, we show that this association is robust to the inclusion of a large number of controls. Furthermore, we provide a number of additional results that underscore our interpretation of the drivers of debt repatriation.

We consider the following empirical specification,

$$y_{c,b,t} = \beta \cdot Crisis_{b,t} * Own_{c,b} + \gamma \cdot Controls_{c,b,t} + \epsilon_{c,b,t} \tag{1}$$

In equation (1), the subscripts c and b denote the creditor and borrower country, and t indicates time, measured in quarters. The dependent variable $y_{c,b,t}$ indicates the (logged) position of sovereign debt issued by country b and held by the banks of country c at time t. The variable $Crisis_{b,t}$ is an indicator function, which equals one if the borrowing country is in a crisis and zero otherwise. A crisis is defined as a period of elevated sovereign risk; for the baseline definition we take the standard threshold level of 700 basis points on

bond yields.[20] The variable $Own_{c,b}$ is defined as one if the creditor country is equal to the borrower country and zero otherwise.

In our set of controls, we include country-pair fixed effects as well as a series of borrower-time and creditor-time dummies. The country-pair fixed effects control for long-run determinants of bilateral asset positions, such as distance (both in terms of geographic proximity and informational flows) or the aggregate market size of the two countries. These factors have been shown to be highly significant in explaining bilateral capital flows (Portes and Rey 2005), consistently with gravity models of global portfolio allocation (Martin and Rey 2004).[21] The borrower-time and creditor-time dummies control for country-specific shocks or trends in the level of outstanding debt and in the portfolio size of banks, respectively. Our specification, thus, allows us to control for several sources of variation in the allocation of bank positions.

The coefficient of interest β measures the percentage change of domestic banks' positions of local debt as countries enter the crisis. As we control for borrower-time fixed effects (which absorb the total outstanding debt of each country), this change is to be read relative to the change of foreign banks' positions in the crisis countries. Moreover, as we control for creditor-time fixed effects (which absorb the portfolio size of each country), the mentioned change is also relative to the change of domestic banks' positions in foreign countries.[22] Thus, the coefficient β can be equivalently interpreted as the repatriation of debt or as the change of portfolio home bias in crisis countries.

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[20]We check later on whether our results depend on the exact definition of crisis by considering different thresholds: e.g., 600 basis points and 500 basis points.

[21]Notice that these fixed effects control for the average *home bias* of international portfolio investment. Specifically, the coefficient on the dummy Own is large and significant in regressions without fixed effect.

[22]Notice that sum of the coefficients on $Crisis_{b,t}$, $Crisis_{c,t}$ and $Crisis_{b,t}*Own_c$ identifies the change in the local positions of banks located in crisis countries relative to the average positions in non-crisis countries of banks located outside the crisis countries.

3.1 Baseline results

Table 1 reports the estimation results for model (1), where we inspect the effect of the crises on the international allocation of sovereign debt. All reported estimations include fixed effects for each country pair and time dummies individually for each creditor and each borrower.

Column I shows that in our baseline specification, the estimate of the coefficient on $Crisis_{b,t} * Own_{c,b}$ is positive and significant. It shows that banks in crisis countries increased their claims on the local government by a factor of about 4 ($\exp(1.366) \approx 3.917$). More precisely, the estimate indicates that banks in crisis countries have increased their claims on the local government relative to the claims on foreign governments (indicating an increased home bias during a crisis) and relative to foreign banks' claims on the local government (indicating a repatriation of such claims).

How exactly should we read our estimates? At an initial share of domestically-held debt of 49 percent in crisis countries at the beginning of 2009 (compare Figure 1), the estimated coefficient implies that this share increased to 79 percent during the crisis.[23] These estimates are thus well in line with the increase in the domestically-held share of public debt, illustrated in Figure 1. Considering that the total volume of debt issued by the crisis countries was approximately equal to 1.4 trillion EUR, the 30 percentage points increase in the share of government debt held by domestic banks translates into a repatriation of 0.42 trillion EUR. While this back-of-the-envelope computation is based on average shares and disregards portfolio growth, purchases of debt by the ECB and issuance of fresh debt by crisis countries, it nevertheless accounts for a substantial part of the 1.5 trillion EUR decline in cross-border bank positions reported by the IMF (2013).

We observe that equation (1) is reminiscent of the so-called gravity model of international trade (see e.g. Anderson (1979)). The traditional gravity equation, in which the log of bilateral trade flows (or bilateral bond positions

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[23]The share of domestically-held debt increased with the crisis to to $\exp(1.366) * d/(1 + \exp(1.366) * d) = 0.790$, where $d = 0.49/(1 - 0.49)$ denotes the value of domestic positions relative to foreign positions before the crisis.

in our case) is regressed on the log of the economic size of trade partners plus country-pair constant characteristics (e.g., distance or common language), is in fact nested in our specification with country-time and country-pair fixed effects.[24] Recent work by Santos Silva and Tenreyro (2006) has uncovered severe drawbacks of estimating the gravity equation using a log-linearized transformation. Specifically, the authors show the presence of heteroskedasticity can generate severely biased estimates of the log-linear model and propose to estimate the class of constant-elasticity models (which includes the gravity equation) in their multiplicative form using a Poisson pseudo-maximum-likelihood (PPML) estimator.[25] While the authors recognize that "the presence of the individual effects may reduce the severity of this problem", they also add that "whether or not that happens is an empirical issue". We thus follow the strategy developed in Santos Silva and Tenreyro (2006) and run a Poisson panel estimation.[26]

The results from the PPML estimation of model (1) are reported in Column II of Table 1.[27] All reported coefficients have the same sign of the corresponding coefficients in the linear estimations. The coefficient of interest, the one on $Crisis_{b,t} * Own_{c,b}$, is positive and slightly larger in magnitude with respect to the linear model. Overall, the tendency toward debt repatriation is confirmed in both types of estimations.

3.2 Further Estimations and Related Theories

In this subsection, we present additional evidence that helps us to separate across alternative explanations for the observed repatriation of sovereign debt.

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[24]Previous literature has also used the gravity-approach to explain bilateral asset positions (see for instance Portes and Rey (2005) and Rose and Spiegel (2002)).

[25]In particular, the crucial independency assumption on the error term would be violated if the variance of the latter depends on some of the explanatory variables in the regression.

[26]Santos Silva and Tenreyro (2006) state that the "estimator can be easily adapted to deal with [...] panel data". Hausman et al (1984) and Wooldridge (1990) have developed this strategy, which has been used, among others, by Acemoglu and Linn (2004).

[27]In all estimations we use the ppml Stata command developed by Santos Silva and Tenreyro (2010) and we include a number of dummies to capture the same fixed effects considered in the linear regressions.

In discussing the results, we review and summarize each of the theories considered.

Investment Distortions induced by the ECB. A possible reading of the baseline results is that the increase in domestic exposures in the peripheral countries simply captures the effect of policy interventions enacted by the ECB in the height of the crisis. Some of these interventions, especially Long Term Refinancing Operations (LTROs) took place mostly via banks and, according to some observers, provided an incentive to banks of crisis countries to invest in government bonds. These banks, indeed, could exploit a profitable arbitrage by borrowing at low interest rates from the ECB and investing in local, high-yield government bonds. This type of behavior, also referred to as "Sarkozy's carry trade", has been substantiated by evidence provided by Acharya and Steffen (2013). In particular, the authors show that this strategy has been pervasive among under-capitalized banks, since these banks could enjoy the additional benefit of reducing their leverage ratios thanks to the low regulatory risk of government bonds.[28]

We argue, however, that it is not obvious at all that the ECB transfers should generate a repatriation of debt in crisis countries. In particular, as all banks had equal access to these programs, the banks from non-crisis countries had the same trading possibilities as banks from crisis countries. In fact, Acharya and Steffen (2013) write that "Dexia SA (Dexia), a Belgian financial group and one of the largest lenders to public sector entities, provides a quintessential example of such behavior as it invested heavily in these carry trades".

It is also not clear why the banks of crisis countries should have used the ECB liquidity to invest specifically in domestic assets. As government bonds of other crisis countries were paying similar yields, it is hard to explain why these banks should have exploited the carry trade by investing exclusively in

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[28]Relatedly, Auer (2014) examines how cross-border capital flows and current accounts correlate with the ECB's Target 2 imbalances, which measure the degree to which "national banking systems rely on liquidity provided by the ECB". The author concludes that the observed Target 2 imbalances were likely driven by a sudden stop in provision private liquidity to banks in crisis countries.

local government bonds. For example, Italian *btp* and Spanish *bonos* offered similar margins over the cost of ECB funds. Thus, banks in Italy and Spain should have been in principle indifferent about investing in the sovereign bonds of any of the two countries.

We check the latter hypothesis by considering a specification of equation (1) that includes the interaction term $Crisis_{c,t} * Crisis_{b,t}$, where $Crisis_{c,t}$ is an indicator for crisis episodes in creditor countries and is defined in parallel with $Crisis_{b,t}$. With this additional interaction term, we aim to control for the possibility that troubled banks in crisis countries invested over-proportionally not only in the domestic country but also in other crisis countries, seeking assets that yielded similarly high returns. The results corresponding to this specification are reported in column III and IV of Table 1. We find that the estimated coefficient of $Crisis_{c,t} * Crisis_{b,t}$ is negative and statistically significant at the five percent level, indicating that the banks of crisis countries were actually reducing exposures to the sovereign debt of other crisis countries during the crisis. In addition, the inclusion of this additional control does not affect the estimated coefficient on $Crisis_{b,t} * Own_{c,b}$, which remains positive and highly significant. This evidence thus suggests that explanations based on arbitrage trading or gambling for resurrection strategies do not provide a clear description of the observed repatriation of debt.

Moral Suasion. One may be worried that the increase in local positions reflect "moral suasion", that is the tendency of governments in crisis countries to coerce domestic banks into sovereign bond purchases. Reinhart and Sbrancia (2011), for example, document that similar practices have been especially common among developed countries to reduce the level of public debt in the post-World War II period. Governments resorted to various forms of financial repression to create captive buyers for local government debt, introducing in particular restrictions to capital flows, controlled interest rates and other regulatory measures. While we can rule out that explicit repressive measures have been adopted by peripheral countries in the midst of the crisis - these measures would indeed be in contrast with the principle of common and unrestricted markets across European countries -, it is still a possibility

that governments exerted an implicit and subtle form of pressure on domestic banks to secure their own financing needs.

To address this concern, we show that the repatriation of public debt in crisis countries occurred not only through the bond purchases of banks but also through those of non-bank financial institutions and non-financial domestic investors (e.g., households and private companies). Figure 5 reports the share of public debt held by four broad categories of investors in the GIIPS countries: domestic banks, non-bank financial institutions, non-financial domestic investors and foreign residents. These shares are computed using annual data from the Government Finance Statistics published by the ECB, which reports general government debt by type of bond holders.[29] The vertical line indicates the year 2009, which approximates the beginning of the Euro Crisis.[30]

The graphs clearly reveal a tendency of both bank and non-bank domestic agents to increase their holdings of public debt relative to foreign investors. In particular, domestic banks did not play a dominant role among domestic investors in the repatriation of debt. In Spain, for example, non-financial domestic investors increased their exposure to local sovereign debt faster than banks and other financial investors. The same is true for Italy in 2010, a period in which the concerns about debt sustainability intensified in the country. In Greece and Portugal, we find that the positions of domestic non-financial investors declined relatively to those of domestic banks, but they still increased relatively to non-domestic agents. Overall, Figure 5 suggests that the bond

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[29]The original data classify holdings of government debt by five types of holders: Central Bank, Other Monetary and Financial Institutions, Other Financial Institutions, Domestic Sectors excluding Financial Corporations and General Government, Rest of the World. The definition of Other Monetary and Financial Institutions includes all resident credit institutions (except for the central bank) and all other resident financial institutions "whose business is to receive deposits and/or close substitutes for deposits from entities other than MFIs". This definition corresponds to the definition of banks applied in the Locational Banking Statistics of the BIS and in the International Financial Statistics of the IMF, except for the inclusion of money market funds. We re-label this category as "banks". We then use data on total government debt, also from the Government Finance Statistics of the ECB, to compute the share of public debt held by each type of investor. Finally, we are forced to exclude Ireland due to lack of observations in the data.

[30]More precisely, the vertical line indicates the end of 2009, as the ECB data report end-of-year positions.

Figure 5: **Share of Public Debt by Holder**
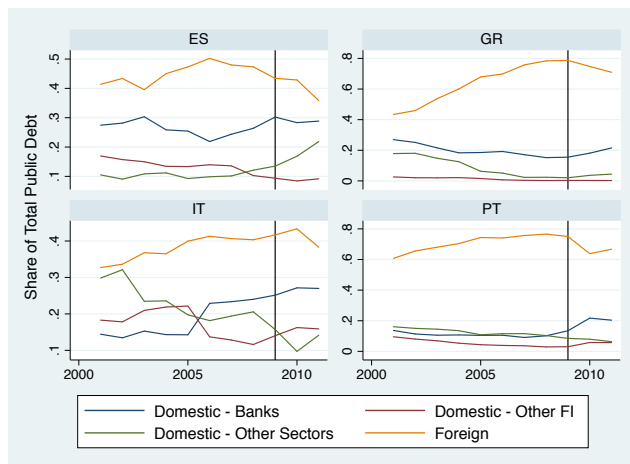
Debt holdings by each investor group relative to the total general government debt. The reported debt shares do not add up to one, as we exclude the share of debt held by central banks. Source: Government Finance Statistics (ECB).

purchases of bank and non-bank domestic investors moved in parallel. To the extent that non-bank investors depend less on governments goodwill, they are less susceptible to corresponding pressures. We argue that this evidence challenges the view that moral suasion is a key driver behind the patterns reported.

Standard CAPM. We now ask whether standard economic theory can help us to rationalize the investment behavior of banks located in crisis countries. As a natural benchmark, we consider a plain vanilla model of international portfolio diversification with complete markets.[31] One important prediction of this model is that the share of domestic portfolio holdings should be proportional to the wealth, or the portfolio size of a country. This prediction is in fact consistent with the patterns displayed in Figure 1, where the share of domestically-held debt in peripheral countries was small relative to countries at the Euro Area core before the beginning of the crisis. This model, how-

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[31]See for instance Ch. 5 of Obstfeld and Rogoff (1996).

ever, has a more important prediction for the interpretation of our empirical results. In particular, it shows that the observed repatriation of debt could come about simply as a consequence of an increase in the relative portfolio size of crisis countries' banks. We can discard this type of explanation as largely counterfactual when contemplating the evolution of the Euro Crisis. Furthermore, the inclusion of creditor-time dummies in all our specifications should control for such portfolio growth effects. We thus turn to conventional theories of portfolio home bias, which explain the increase in local positions as a consequence of an active portfolio rebalancing towards local assets.

Information Frictions. We consider two main sources of portfolio home bias, following a recent article by Coeurdacier and Rey (2011). The first source of home bias relates to the existence of informational asymmetries between domestic and foreign investors. Domestic investors will naturally bias their portfolios towards local assets if they have an informational advantage relative to foreign investors on these assets. According to this view, one should expect an increase in home bias during a crisis, since informational asymmetries are likely to worsen in times of uncertainty (Brennan and Cao 1997).

On the empirical side, the information-based theories of portfolio home bias have been tested using a gravity model. In particular, Portes and Rey (2005) find that cross-border equity flows depend negatively on measures of distance that proxy for information costs (e.g., volume of telephone call traffic, index of foreign bank penetration, time zone differences).[32] Interestingly, Portes et al. (2001) find that the effect of distance on cross-border flows differs across classes of assets. In particular, an increase in the distance between two countries is associated with a much larger decline in the trade flows of information-intensive assets, such as equities and corporate bonds, compared to more homogenous products such as treasury bonds.

To assess whether information asymmetries could explain the shift in bank

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[32]Using data from the Coordinated Portfolio Investment Survey (CPIS) of the IMF, Faruqee et al. (2004) find similar results when estimating a gravity model using cross-border positions instead of cross-border flows. See also Aviat and Coeurdacier (2007) and Lane and Milesi Ferretti (2008).

positions in crisis countries, we test whether the effect of crises differs across classes of assets. To do so, we exploit the sectoral disaggregation in bank positions, distinguishing between holdings of (non-bank) private debt and holdings of public debt. Accordingly, our empirical specification is now described by the following equation

$$y_{s,c,b,t} = \beta_0 \cdot Crisis_{b,t} * Own_{c,b} + \beta_1 \cdot Crisis_{b,t} * Own_{c,b} * Publ_s$$
$$+ \gamma \cdot Controls_{s,c,b,t} + \epsilon_{s,c,b,t} \qquad (2)$$

In equation (2), the additional subscript s denotes the "sector" of each debt position. The variable $Publ_s$ denotes a dummy variable that identifies the positions of public debt. In this specification, the coefficient β_0 measures the effect of a crisis on the domestic positions of local private debt, while the coefficient β_1 measures the additional effect on the domestic positions of local public debt. Thus, a positive value for β_1 indicates that the repatriation of debt is stronger for public debt than for private debt. The set of controls include creditor-borrower-sector fixed effects as well as creditor-time, borrower-time and sector-time dummies. In addition, we control for the interactions $Crisis_{b,t} * Publ_s$ and $Crisis_{c,t} * Publ_s$.[33]

Table 2 reports the estimation results for the different specifications of equation (2). The set of regressors is defined in parallel to those underlying Table 1, while now the interaction terms with $Publ_s$ are included.[34] Column I reports a negative coefficient on $Crisis_{b,t} * Publ_s$, indicating that all countries had the tendency to reduce positions of public debt from crisis countries. This observation supports the conjecture that the overall drop in the exposure to

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[33]The variable $Crisis_{c,t}$ denotes a crisis in the creditor country and is defined in parallel with $Crisis_{b,t}$. The first term controls for the increase of foreign banks' positions of public debt in the crisis countries, relative to the change in the corresponding private debt positions. With this term, we aim to capture a potential flight by foreign banks from private to public debt of crisis countries. The second term, conversely, controls for the increase in local banks' positions of public debt in foreign non-crisis countries, relative to the change in the corresponding private debt positions. This term thus captures a potential tendency of banks located in crisis countries to substitute between private and public foreign bonds.

[34]Fixed effects refer to creditor-borrower-sector now, so that $Publ_s$ itself drops out of the set of regressors.

debt from crisis countries (estimated in Columns I of Table 1) was partly driven by valuation effects of sovereign bonds and by purchases by the ECB. Further, the coefficient on $Crisis_{c,t} * Publ_s$ is positive, suggesting that the banks located in crisis countries increased their holdings of foreign public debt relative to foreign private debt.

The two coefficients of interest, however, are those on $Crisis_{b,t} * Own_{c,b}$ and $Crisis_{b,t} * Own_{c,b} * Publ_s$. The first is positive and significant, indicating that private debt was repatriated in the crisis countries. The second coefficient, too, is positive and significant (albeit at the 5 percent level only) showing that sovereign debt was over-proportionally affected by this repatriation. Together, these estimates suggest that banks in crisis countries increased their positions of domestic private debt by a factor of 2.24 ($\exp(0.805) \approx 2.24$) but increased, at the same time, their positions of domestic public debt by a factor of 4 ($\exp(0.805 + 0.607) \approx 4.104$), which is in line with the results from the baseline estimations. We argue that the repatriation of private debt constitutes evidence in favor of an increase of information asymmetries in times of crisis, as conjectured by Brennan and Cao (1997, 2005). However, the finding that repatriation has been stronger for public debt than private debt seems to be in contrast with theories that rely only on information asymmetries.

Column II of Table 2 reports the PPML estimates of the coefficients on $Crisis_{b,t} * Own_{c,b}$ and on $Crisis_{b,t} * Own_{c,b} * Publ_s$. We find that the picture that emerges is in line with the one painted by the linear estimations. The coefficients on both interaction terms are significant at the one percent level and the point estimates are in the same realm of the ones obtained from the linear regressions.

In Column III-IV of Table 2, we include the regressors $Crisis_{b,t} * Crisis_{c,t}$ and $Crisis_{b,t} * Crisis_{c,t} * Publ_s$. The negative and significant coefficient on the second term, combined with the insignificant coefficient on the first term, indicates that banks in crisis countries reduced their exposure to public debt of other crisis countries. Moreover, the coefficients on the variables of interest, $Crisis_{b,t} * Own_{c,b}$ and $Crisis_{b,t} * Own_{c,b} * Publ_s$, are even larger than in the previous specification. These results, which are in line with our baseline esti-

mates, provide additional support to the idea that the repatriation of public debt cannot be read as a manifestation of gambling strategies by banks in crisis countries.

Hedging Motives. The second class of explanations for portfolio home bias invokes standard hedging motives. This view maintains that local assets may provide better insurance against key risks faced by local investors. Particularly, the desire to hedge *real exchange rate risk* can induce home bias in portfolio shares if the returns on local assets are high in times when the relative price of local goods increases. This argument is traditionally applied to the equity portfolio: given that equity prices of producers of non-tradable goods correlate positively with local agents' expenditure on non-tradable goods, a home bias in equities can naturally arise (see Lucas 1982 and Serrat 2001). These effects, however, are quite sensitive to the elasticity of substitution between tradable and non-tradable goods, as well as to individuals' preferences for consumption smoothing. Also, the empirical validity of this explanation is questioned (see, e.g., Lewis 1999 and Pesenti and van Wincoop 2002).

Relating our empirical findings to this theory, we need to assess whether the repatriation of debt was possibly generated by underlying hedging motives. To scrutinize the role of (real) exchange rate risk, we restrict our sample to the countries within the Euro Area, where the nominal exchange rate is fixed and only minor differences in inflation occurred over the period considered.[35,36] Table 3 reports the estimation results for the restricted sample. The estimates largely confirm the earlier findings: the coefficients on $Crisis_{b,t} * Own_{c,b}$ and $Crisis_{b,t} * Own_{c,b} * Publ_s$ have similar statistical significance compared to the

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[35]Notice also that within the sample of Euro Area countries, regulatory incentives and differences in valuation are unlikely to play a major role in explaining the difference between domestic and foreign banks, as these countries share, to some extent, a unified supervisory framework.

[36]Alternatively, we could introduce additional interaction terms to estimate differential effects between Euro Area countries and the rest of the world. The reason for not doing so is computational power: the number of dummies and interaction terms is large already in the baseline. Adding an Euro Area-dummy with all interaction terms would further increase the number of independent variables and generate computational problems. We also argue that our choice of limiting the sample is not entirely inappropriate for the purpose of controlling for exchange rate effects.

full sample. As for the magnitude of the two coefficients, we find a slightly smaller estimate for the first coefficient, which is now equal to 0.504, and almost no change for the second coefficient, which remains at a value of 0.608. These estimates indicate that the debt of GIIPS countries was repatriated from countries within the Euro Area and slightly more from outside. More importantly, they show that the stronger repatriation of public debt cannot be explained by factors related to (real) exchange rate risk.

Another extensively-studied hedging motive concerns non-tradable income risk, typically read as labor income. Individuals bias their portfolios towards local assets whenever returns to these assets (relative to foreign assets) correlate negatively with local labor income. Empirically, there is some evidence for a negative (conditional) correlation between labor income and local equity (see Julliard 2002 and Coeurdacier and Rey 2011), yet severe doubts remain concerning the importance of this explanation (see Massa and Simonov 2006). Recently, Coeurdacier, Kollmann and Martin (2010) and Coeurdacier and Gourinchas (2011) have argued that portfolios allocation of different asset classes cannot be analyzed separately. Using a standard portfolio model with multiple asset classes, they show that contemporaneous trading in bonds and equities affect the hedging properties of each of the two assets. Bonds will be used to hedge fluctuations in the real exchange rate. Equities will be used to hedge non-tradable income risk, conditionally on bond returns. According to this logic, the repatriation of debt in crisis countries cannot be explained by the hedging of non-tradable income risk. A conclusive answer, however, can come at best from a fully calibrated model of portfolio investment.

Applying a less rigorous but simpler logic, we observe that the major risks of crisis countries - in particular, income risk and sovereign risk - have become more aliened in crisis-stricken countries. We then find it hard to sustain that the strong repatriation of public debt in crisis countries may have been driven by hedging motives, especially when related to local labor income. More generally, recent literature has shown that this specific channel has mixed or little empirical support (see Coeurdacier and Rey 2010).

After reviewing conventional explanations, our initial question is left unanswered: why did banks in crisis countries increase their exposures to local government debt? In the next section, we turn to a less conventional reading of the patterns displayed in the data.

4   Secondary Market Theory

The secondary market theory of BMV predicts that in times of crisis there is a tendency of sovereign debt to flow back to the originating countries. This repatriation arises as a market response to a looming sovereign default. A key element is that the government, when deciding upon default, may effectively discriminate between domestic and foreign agents.[37] Importantly, however, technical discrimination is not a requirement. Specifically, it does not matter whether the government technically defaults only on foreign creditors or whether it defaults on all investors but compensates domestic creditors through internal transfers (e.g., bank bailouts). In either case, domestic agents will expect to obtain higher returns on sovereign debt than foreign agents and they will be incentivized to buy bonds in the secondary market. Sovereign debt will be repatriated.

As the theory is more nuanced than this simple description, we lie down a stylized model that builds on BMV to clarify the assumptions and the implications of the theory.

4.1   Model

Consider the government of a small open economy that issues an amount of debt D in period 0; repayment is due in period 1. At time t foreigners hold the fraction x_t of that debt. Specifically, at $t = 0$ foreign agents buy a fraction x_0 of the debt and domestic agents buy the remaining fraction $1 - x_0$.

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[37]We discuss below that the assumption that the government can discriminate across creditors is not necessary to generate a repatriation of debt. We will show in particular that this assumption allows to eliminate a potential multiplicity of equilibria in the model, but has no implications for the existence of the specific equilibrium we are going to discuss.

Both types of agents are risk neutral, do not discount the future and behave competitively. We assume that in period 0 the future taxable aggregate income of the economy, y, is uncertain. Specifically, aggregate taxable income of period 1 can take three different values: $y \in \{y_G, y_R, y_D\}$ with $y_D < D < y_R < y_G$. We refer to the realization y_G as a good state of the world, to y_R as recovery, and to y_D as depression. The realization of y is revealed through two successive information shocks. The first information shock is observed between period 0 and 1 – that is, at period 1/2. In this intermediate period the economy slips into a crisis with probability π_0. Given a state of crisis in period 1/2, the economy experiences an additional shock in period 1. In particular, the economy further plunges into depression with probability π_1 or it recovers with probability $1 - \pi_1$. If the economy does not slip into a crisis at period 0, the realization of y is y_G with probability 1. Figure 6 describes the timing of events with the corresponding realizations of y.

Figure 6: Timing
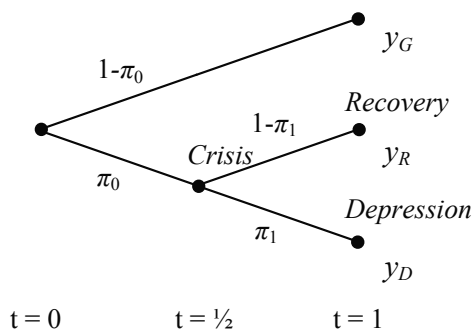
If depression strikes the economy, the government necessarily defaults on its debt (since $y_D < D$). This occurs with ex-ante probability of $\pi_0 \pi_1$.

In all other states of the world, the government may decide opportunistically to default on its debt. Whenever the government defaults, a penalty

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accrues that amounts to the share α of output.[38] In period 1, when contemplating default, the government maximizes the average consumption of domestic agents. By assumption, the government can discriminate across creditors so that its payoff structure is

$$
u_1 = \begin{cases} y - x_1 D & \text{if the gov. repays all investors} \\ y - x_1 D - \alpha y & \text{if the gov. repays only foreigners} \\ y - \alpha y & \text{else} \end{cases}
$$

Obviously, the government will never repay only foreign investors. Moreover, a default effectively concerns only the debt held by foreigners, since repayment of domestic debt just redistributes resources within the economy. Consequently, the government has no incentive to default on domestic creditors and we assume that the government always repays them.[39] The interesting part of the government decision concerns repayment of foreigners. These investors are repaid if and only if

$$x_1 D \leq \alpha y.$$

Assume now that the initial share of foreign-held debt is $x_0 > \bar{x} = \alpha y_R / D$ and at period $1/2$ the economy enters into crisis.[40] In the absence of secondary markets for government debt, portfolios cannot be adapted and investors have to wait until maturity ($x_0 = x_1$). Thus, the government defaults with certainty on foreign creditors and with probability π_1 on domestic creditors.

If a secondary market for government debt opens after the economy enters into crisis, however, the picture is different. Foreign agents will sell government bonds to domestic agents, who expect a lower probability of default on their

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[38]This share is independent of whether foreigners, locals, or both investor groups are defaulted on.

[39]Notice that we implicitly assume that whenever the government is indifferent between repayment and default, it will choose to repay its debt. Relaxing this assumption may generate multiplicity of equilibria. Indeed, whenever the allocation of debt satisfies this indifference condition, there exists a continuum of equilibria with different default expectations and equilibrium prices. For simplicity, we rule out this possibility in our model.

[40]The initial level of foreign-held debt, x_0, may easily be endogenized. However, we refrain from doing so for the sake of brevity.

holdings of sovereign bonds. In particular, domestic agents will buy government bonds at the price $1 - \pi_1$, which reflects the probability that the economy enters a state of depression and the government is forced to default on all its debt. The reallocation of debt continues until the share held by foreign agents is equal to the threshold $\bar{x}$. At this point, indeed, the government has no longer an incentive to strategically default on foreign agents and honors all of its debt. At the same time, the expected return on government bonds is equalized across investors.[41],[42]

Overall, the model provides the following picture. Initially, the government issues the debt D, a share x_0 of which is held by foreigners. The unit price of the bonds issued is $1 - \pi_0 \pi_1$, reflecting the a-priori default probability (in combination with the risk-neutrality of investors). If the economy does not enter into crisis, the value of the bonds appreciate, because investors know that they will be repaid with certainty.[43] Nothing happens to portfolio allocations.

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[41]In the absence of effective discrimination among creditors, there exists a multiplicity of equilibria with secondary markets. In this case, the default decision of the government depends on the distribution of aggregate debt across creditors. Since agents are atomistic, they do not internalize the effect of their bond purchases on the distribution of debt and therefore on the repayment choice of the government. In particular, starting from a situation in which the share of debt held by foreign creditors is larger than the cost of default, there are at least two possible equilibria. In one equilibrium, sovereign debt is reallocated to domestic agents at a price $1 - \pi_1$ and the government ends up repaying if the economy recovers and defaults if the economy enters a depression. There is also an alternative equilibrium, in which there is no reallocation of sovereign debt and the government defaults even if the economy recovers. This equilibrium arises because domestic agents do not internalize that, by buying sovereign bonds, they will affect the government's default choice and eventually the returns on government bonds. As domestic agents expect the government to default with probability one given the prevailing distribution of debt, they don't have any incentive to repatriate debt. In fact, it is possible to show that in between these two cases, there exists a continuum of additional equilibria. Indeed, any distribution of sovereign bonds across creditors and default probabilities that satisfy the government's incentives are potentially an equilibrium in the absence of effective discrimination.

[42]Notice that although the government can discriminate across creditors, the reallocation of debt ensures that there is no discrimination in equilibrium. In particular, all agents obtain the same payoff from their initial bond positions. The secondary market theory of BMV thus provides a theoretical justification to the assumption of non-discrimination on which a growing strand of the literature has built, e.g. Guembel and Sussman (2009), Broner and Ventura (2010, 2011), Brutti (2011), Gennaioli et al. (2009), Mengus (2013).

[43]For simplicity, consider the case $x_0 D < \alpha y_G$.

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If the economy enters into crisis, instead, the price of the bond falls to $1 - \pi_1$, along with the increase of default probability from $\pi_0\pi_1$ to π_1. At the same time, debt positions are reallocated from foreign investors to local investors of the total volume $(x_0 - \alpha y_R/D) \cdot D > 0$.

Implications of the secondary market theory. This stylized model delivers clear implications regarding the effect of crises on sovereign debt markets. First, and foremost, the model predicts that the sovereign debt of a country will be repatriated as the economy is hit by a shock and the risk of sovereign default on foreign creditors increases, as observed in the data.

Second, the model can account for the increase in the bond yields of crisis countries. In particular, the price of government bonds in period 0 and period 1 are $1 - \pi_0\pi_1$ and $1 - \pi_1$, respectively.

Third, to the extent that secondary markets for government bonds tend to be more liquid than corresponding markets for corporate bonds, we should expect a stronger repatriation of public debt than for private debt. Moreover, strategic default considerations may be limited in the case of private debt, as the prospects of enforcing repayment through court litigation are arguably higher than in the case of sovereign debt.

Overall, the rich set of implications arising from the secondary market is largely consistent with our empirical findings. Next, we argue that a more general reading of this theory delivers an additional testable implication which concerns the reallocation of the sovereign debt of crisis countries across the members of the Euro Area.

Reallocation of debt within the Euro Area. In the Euro Crisis, the relevant decisions regarding sovereign default of peripheral countries were to some degree taken collectively by all members of the Euro Area, through a process that certainly reflected the respective political weights of individual countries. Against this backdrop, the logic of the secondary market theory, read somewhat more generally, implies that the sovereign debt of a crisis country should be reallocated to countries whose governments have a more direct

control on potential default. For example, if the German government decides whether Greece defaults or not, Greek sovereign debt should reallocate to German banks. These banks, indeed, know that the decisive political agent (the German sovereign) is less inclined to let Greece default, the more of Greek debt is held in Germany. German banks may then profit from buying Greek debt from banks located in less influential countries, which face a larger risk of default.

In order to test this additional prediction of the theory, we consider a specification of equation (2) that includes the interaction terms $Crisis_{b,t} * EUR_c$ and $Crisis_{b,t} * EUR_c * Publ_s$, where EUR_c is defined as the share of the creditor's GDP in the Euro Area (i.e., the creditor's GDP over Euro Area GDP).[44] We set $EUR_c = 0$ for countries that are not member of the Euro area. This variable proxies the political weight of a creditor country c within the Euro Area. By including this proxy of political influence, we control for potential effects by which banks may alter their investment strategies, internalizing the own country's political influence.

The results are reported in Columns I-II of Table 4 for the full sample of countries and in Columns III-IV for the restricted sample of Euro Area countries. We find that the coefficient on $Crisis_{b,t} * EUR_c$ is not significantly different from zero, while the one on $Crisis_{b,t} * EUR_c * Publ_s$ is positive and significant in all specifications. These estimates indicate that the sovereign debt of crisis-stricken Euro Area countries was reallocated to those Euro Area countries of high political weight (i.e., the positive coefficient on $Crisis_{b,t} * EUR_c * Publ_s$), whereas the same is not true for private debt. Importantly, the estimated coefficient on $Crisis_{b,t} * Own_{c,b}$ and $Crisis_{b,t} * Own_{c,b} * Publ_s$ are largely unaffected by the inclusion of the variables including EUR_c, indicating that the reallocation of debt towards the originating country remains strong relative to the country size. Having read the results from these additional estimations, we argue that they constitute additional evidence in favor of the secondary market theory.

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[44]Notice that the direct effect of EUR_c is captured by country dummies.

4.2 Robustness Checks

In order to provide additional evidence for the patterns exhibited so far, we run two more set of robustness checks. In the first one, we replace the crisis dummy with the log of corresponding bond yields. Specifically, we replace our previous specification (2) with the following model,

$$y_{s,c,b,t} = \beta_0 \cdot Yield_{b,t} * Own_{c,b} + \beta_1 \cdot Yield_{b,t} * Own_{c,b} * Publ_s + \gamma \cdot Controls_{s,c,b,t} + \epsilon_{s,c,b,t}$$
(3)

where the set of controls include the individual terms $Yield_{b,t}$ and $Yield_{c,t}$.[45] This specification has the virtue that it captures marginal effects: it captures the effect of moderate increases in a country's risk of default beyond or below the critical threshold of 700 basis points on the allocation of government bonds. In addition, it allows us to avoid using a discrete definition of crisis, which is difficult to apply to countries as heterogenous as Greece and Mexico (both countries enter our sample). Thus, the notion of crisis is replaced by $Yield$. Since the set of countries includes non-Euro Area countries, the reallocation of debt from crisis countries towards Euro Area countries is meaningless. We therefore drop the interaction terms involving the variable EUR_c.

Table 5, Columns I and II reports the corresponding results. The coefficients on $Yield_{b,t} * Own_{c,b}$ and $Yield_{b,t} * Own_{c,b} * Publ_s$ are always positive, though not jointly significant. Together, these results indicate that the repatriation of public debt is always significant, but it is stronger than the repatriation of private debt only in the specification reported in Column II.

The clear downside of a specification including bond yields is that the estimated coefficients may suffer of a reverse causality bias. Specifically, we observe that an exogenous drop in the foreign demand for a country's bonds could potentially induce a relative increase of local positions and, simultaneously, a rise of the corresponding yields.[46] The magnitude of the rise of bond

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[45]Recall that the definitions of $Yield_{x,t}$ are based on quarter-averages.

[46]We argue that, while small changes in the yields (or spreads) are likely to be affected by changes in demand for bonds, the large changes that drive the $Crisis$ dummies are probably mostly driven by changes in fundamentals.

yields, in turn, depends on the ability or willingness of local investors to absorb the excess supply generated by foreign sales. In principle, the potential endogeneity of bond yields could affect the estimates in a direction that is difficult to predict.[47]

To overcome the endogeneity problem, we adopt an instrumental variable (IV) approach that allows us to predict the value of bond yields based on a small number of macroeconomic indicators, which are typically taken as orthogonal to reallocations of debt positions. Specifically, our set of instruments includes the level of GDP, the central government's balance and debt (both as ratio of GDP), the growth rate of GDP, the current account balance as ratio of GDP and the inflation rate.[48,49] These variables appear regularly among the main determinants of sovereign bond yields (see for example Borenzstein and Panizza (2006)) and their large predictive power for debt distress episodes have led some observers to derive simple "rule of thumbs" to identify future defaults based on these indicators (see Manasse and Roubini (2005)). Consistent with the findings in these studies, our first-stage panel estimation indicates that these variables explain more than 60 percent of the variation of bond yields.[50]

Table 5, Columns III and IV, report the IV estimates of model (3). In the specification reported in Column III, the coefficients on $Yield_{b,t} * Own_{c,b}$ and $Yield_{b,t} * Own_{c,b} * Publ_s$, which capture the repatriation of private and public debt, are significant at the 10 percent and at the one percent confidence level, respectively. In Column IV, the coefficient on $Yield_{b,t} * Own_{c,b}$ is insignificant, while the one on $Yield_{b,t} * Own_{c,b} * Publ_s$ is significant on the one percent level.

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[47]In theory, the shift towards local bond holdings might actually even lower the yield when local demand for bonds is perfectly elastic since, domestic bond holdings would reduce the default risk, making bonds more secure investment.

[48]The data source for each variable is reported in the notes to Table A2 in the Appendix.

[49]Clearly, one may argue that these variables are not independent of debt levels, wherefore we tend to read the results of the instrumented regression with caution.

[50]To perform the first-stage estimations, we use the same sample of countries used in all other estimations. However, we slightly extend the time sample to encompass the period between 2001:Q1 and 2011:Q4. The results are shown in Table A2 in the Appendix. All coefficients have the expected sign except for the coefficient on the current account balance. We don't have a clear explanation for the sign of the latter coefficient, although we think it is possible that the yield responds with a lag to external adjustments.

Overall, the main and most robust pattern emerging from the specification involving $Yields$ is that, as a country enters a crisis, public debt is repatriated.

As the second and final robustness check, we re-run our estimations with a definition of the variable $Crisis$ based on two different thresholds - 600 and 500 bp of bond yields. The according results, presented in Table 6 are similar to those presented in Table 2 and show that the results presented so far do not hinge on the specific definition of the crisis. In particular, the estimated coefficient on $Crisis * Own_{c,b} * Publ_s$ is positive and significant at least on the 5 percent level. The estimated coefficient on $Crisis_{b,t} * EUR_c * Publ_s$ is still positive but largely insignificant.

5   Discussion

Some concerns must be addressed when mapping our findings to the secondary market theory. First, one may wonder whether it is possible to test the predictions of this theory using data on banks' balance-sheet positions. Specifically, by observing end-of-quarter positions we cannot separate between transactions in the secondary market and in the primary market. The relative increase in domestic bond positions could then come about without an active transfer of positions among investors, but simply as a result of lower purchases by foreign investors in the primary market.

A militant interpretation of the secondary market theory, however, would hold that the reallocation of sovereign debt should take the form of actual secondary market transactions between foreign and domestic investors. We forcefully disagree with such a narrow interpretation of the theory. We argue, instead, that as long as domestic and foreign banks have equal access to both primary and secondary markets, the exact form in which debt is reallocated between investors is irrelevant.[51]

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[51]An additional requirement we impose is that the government either defaults on all its debt at the same time, or does not default at all. In theory, a the government could default on one bond tranches without affecting the probability to default on other tranches, the secondary market theory would apply to each bond trance separately. We deem the

To clarify this idea, we use the following example. Consider a government, which has issued a short-term bond maturing Today and a long-term bond maturing Tomorrow. Today the government must roll over the short-term bond until Tomorrow. Before doing that, however, the country is hit by a shock that will inevitably lead to a sovereign default under the prevailing allocation of debt. The predictions of the secondary market theory are that we should observe a market reallocation of the country's debt from foreign to domestic investors. However, as long as there is an increase in the relative positions of domestic investors, the reallocation of debt can equivalently involve secondary market transactions of the long-term bond or primary market purchases of the short-term bond. We thus conclude that we can test the predictions of the secondary market theory using data on investor (i.e., on bank) positions.

An additional concern is that our estimates of debt repatriation in crisis countries may be contaminated by potential valuation effects in banks' positions, which result from the differential change in prices within our broader asset classes. This problem arises in particular if the composition of banks' positions across classes of assets differs between domestic and foreign banks. Loan positions indeed are reported at book value in our data, while bond positions are reported at market value. As bond prices dropped in crisis countries, a different share of bonds in the portfolios of domestic and foreign banks may spuriously affect our estimates.

To assess the extent to which valuation can potentially bias our results, we take data on banks' balance sheet positions from Eurostat. These data report positions of monetary and financial institutions (MFIs) by country, distinguishing between domestic and external assets. The former are further decomposed between asset classes (loans and bonds) and counterpart sectors (MFIs, government and non-bank private sector). Clearly, the definition of monetary and financial institutions comprises more than banks. Yet, we can

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condition that governments default separately across bond tranches as highly counterfactual. For example, in March 2012 private investors in Greek government bonds had to accept a 53.5% nominal write-off on their positions. This agreement affected privately held debt of all maturities of which only about 7% (14.4 billion EUR) fell due the same month.

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take the ratio of bonds in the portfolios of MFIs as a proxy for the same ratio in the portfolios of banks. For the set of GIIPS countries, the share of bonds is 80.9% for claims on domestic government and 10.9% for claims on domestic non-bank private sector.[52]

Based on these ratios, we compute the rate of debt repatriation that would have arisen in the absence of valuation effects. To this aim, we take the average price change for 10-year government bonds of GIIPS countries between January 2, 2009 and December 30, 2011.[53] The drop in prices was approximately 33.7 percent, implying a 27.3 percent decline in the value of public debt positions held by domestic banks (0.337*0.809=0.2726). We then assume that foreign banks held the government debt of GIIPS countries exclusively in the form of government bonds. While this assumption is undoubtedly extreme, it allows us to compute an upper bound for the relative drop in foreign banks' positions caused by the change in government bond prices. Under this assumption, the valuation-induced drop in foreign banks' positions is the entire 33.7 percent, implying a relative increase of domestic banks' positions of roughly 6.4 percent (0.337-0.237=0.064). Compared to the estimated increase of 310 percent for the relative public debt positions of domestic banks in our baseline specification ($\exp(0.805 + 0.607) - 1 = 3.104$), this back-of-the-envelope calculation indicates a "real" repatriation over 300 percent in the crisis countries.

We next assess the extent to which the change in corporate bond prices may bias our estimates of the relative repatriation of public over private debt in crisis countries. In doing so, we run into data limitations since a composite price index for corporate bonds is not readily available for Euro Area countries. To address the problem, we hypothesize a 100 percent depreciation in corporate bonds in the crisis countries. Here again, we focus on this extreme hypothesis to compute an upper bound for the bias (downward bias on β_0 and thus upward bias of β_1 in equation (2)) arising from valuation effects. In this case, the drop in the private debt positions of domestic banks caused by the

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[52]These numbers are averages over the period 2001-2004, since data on more recent years were not available.

[53]These data comes from Datastream. We also consider the change in prices of government bonds with shorter maturity, obtaining comparable results.

price change would be equal to the share of bonds in banks' portfolios, and thus equal to the 10.9 percent reported above. The drop in the relative domestic positions would be at most equal to the entire 10.9 percent (in the case that foreign banks held no bonds in their positions of private debt). Combining the 6.4 percent domestic (relative) increase in public debt positions and the 10.9 percent domestic (relative) decline of private debt positions, we compute that the valuation-induced repatriation of public debt relative to private debt is of the order of 17 percent. This number is clearly below the estimated 83.5 percent increase of local public debt over local private debt positions in the portfolios of banks in crisis countries estimated in our baseline specification $(\exp(0.607) - 1 = 0.835)$. We thus conclude that valuation effects explain only a minor part of the strong patterns presented in our empirical estimations.

6   Conclusion

This paper has uncovered strong empirical patterns of the geographical allocation of debt during the Euro Crisis. First, those countries which enter an acute state of crisis have a tendency to repatriate their debt. Second, this tendency is especially strong for public debt. As a third, slightly weaker, pattern, public debt of crisis countries is reallocated to those Euro Area countries of higher political weight. These patterns survive when controlling for a wide range of country-specific effects and trends in a large number of specifications.

Conventional theories of portfolio allocation and home bias are consistent with the first of these findings at best. By contrast, the broader picture is consistent with the secondary market theory recently proposed by Broner, Martin and Ventura (2010). Starting from the premise that sovereigns care more about domestic than foreign creditors, the theory predicts that an adverse shock to the government's temptation to default will be associated with a repatriation of debt. Domestic investors, indeed, will rationally buy sovereign bonds from foreign investors, knowing that the government will be re-incentivized to pay back its debt as the repatriation proceeds.

The theory thus predicts that sovereign debt flows back to the originating

country when a default is looming. It also predicts a stronger repatriation of public debt compared to private debt. Enforcement problems and strategic default, indeed, are less severe in the case of private debt. Finally, extending the logic to a collective choice setting, the third prediction of the theory is that the debt of crisis countries should flow towards all those countries that participate in the default decision. These are exactly the patterns we observe in our empirical analysis.

The recent fragmentation of European financial markets has troubled policymakers. These trends may indeed seem worrying, given that integrated markets grant an efficient allocation of capital and a proper transmission of a common monetary policy (see ECB 2012). From the vantage point of the secondary market theory, however, the situation appears less alarming. In particular, the increasing market fragmentation is not a sign of panic but reflects the rational response of investors to adverse shocks to sovereign solvency. Read from this perspective, our paper offers a slightly more comforting outlook, suggesting that the financial disintegration may reverse as soon as risks of sovereign defaults abate.

Finally, we observe that the Euro Area, with its deep secondary bond markets and its high level of financial integration, provides an ideal setting for the secondary market theory to apply. At the same time, it seems uncertain whether the strong financial integration and the dramatic bond reallocations of the Euro Crisis can also be found in other sovereign debt crises. Looking forward, however, one may expect that as bond markets will develop further, the forces uncovered by the secondary market theory will be increasingly at play.

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Table 1 - Panel Regression Total Bilateral Debt Positions

	I	II	III	IV
	(OLS)	(PPML)	(OLS)	(PPML)
Dependent Variable: Total Bilateral Debt Position				
$Crisis_{b,t}*Own_{c,b}$	1.366***	1.625***	1.941***	2.697***
	[0.235]	[0.154]	[0.363]	[0.176]
$Crisis_{b,t}*Crisis_{c,t}$			-0.637**	-1.118***
			[0.307]	[0.198]
Observations	4464	4440	4464	4440
Creditor fixed effects	no	no	no	no
Country-pair fe	yes	yes	yes	yes
Creditor-time fe	yes	yes	yes	yes
Borrower-time fe	yes	yes	yes	yes
Adjusted R-squared	0.935	.	0.935	.

Note: The dependent variable is log(1+x) in OLS estimations and it is x in PPML estimations, where x denotes the holdings of total non-bank debt of country b (borrower) by banks of country c (creditor). End-of-quarter positions between 2006:Q1 and 2011:Q4. Crisis is a dummy variable that equals one if the bond yield exceeds 7 percent and the corresponding country belongs to the Euro Area. Countries are: Austria, Belgium, Brazil, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Mexico, Netherlands, Portugal, Spain, Sweden, United States. Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 2 - Panel Regression Bilateral Debt Positions by Sector

	I	II	III	IV
	(OLS)	(PPML)	(OLS)	(PPML)
Dependent Variable: Sectorial Bilateral Debt Position				
$Crisis_{b,t}*Publ_s$	-0.313***	-0.353***	-0.394***	-0.334***
	[0.089]	[0.071]	[0.125]	[0.069]
$Crisis_{c,t}*Publ_s$	0.649***	0.112	0.710***	0.144
	[0.089]	[0.139]	[0.091]	[0.139]
$Crisis_{b,t}*Own_{c,b}$	0.805***	0.506***	0.962***	1.210***
	[0.200]	[0.055]	[0.303]	[0.078]
$Crisis_{b,t}*Own_{c,b}*Publ_s$	0.607**	0.778***	1.426***	1.123***
	[0.280]	[0.173]	[0.416]	[0.152]
$Crisis_{b,t}*Crisis_{c,t}$			-0.112	-0.715***
			[0.260]	[0.085]
$Crisis_{b,t}*Crisis_{c,t}*Publ_s$			-0.822**	-0.395**
			[0.356]	[0.193]
Observations	8938	8904	8938	8904
Creditor-Security fe, Debtor fixed effects	no	no	no	no
Creditor-time fe	yes	yes	yes	yes
Borrower-time fe	yes	yes	yes	yes
Sector-time fe	yes	yes	yes	yes
Adjusted R-squared	0.952	.	0.952	.

Note: The dependent variable is log(1+x) in OLS estimations and it is x in PPML estimations, where x denotes the holdings of debt of type s (sector) issued by country b (borrower) and held by banks of country c (creditor). End-of-quarter positions between 2006:Q1 and 2011:Q4. Crisis is a dummy variable that equals one if the bond yield exceeds 7 percent and the corresponding country belongs to the Euro Area. Countries are: Austria, Belgium, Brazil, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Mexico, Netherlands, Portugal, Spain, Sweden, United States. Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 3 - Panel Regression Bilateral Debt Positions by Sector; Euro Area Counties

	I	II	III	IV
	(OLS)	(PPML)	(OLS)	(PPML)
Dependent Variable: Sectorial Bilateral Debt Position				
$Crisis_{b,t}*Publ_s$	-0.385***	-0.311***	-0.297***	-0.282***
	[0.088]	[0.070]	[0.092]	[0.068]
$Crisis_{c,t}*Publ_s$	0.706***	0.348***	0.802***	0.392***
	[0.090]	[0.131]	[0.094]	[0.131]
$Crisis_{b,t}*Own_{c,b}$	0.504***	0.537***	0.581**	1.155***
	[0.171]	[0.051]	[0.252]	[0.080]
$Crisis_{b,t}*Own_{c,b}*Publ_s$	0.608**	0.507***	1.423***	1.110***
	[0.238]	[0.167]	[0.341]	[0.154]
$Crisis_{b,t}*Crisis_{c,t}$			-0.071	-0.634***
			[0.219]	[0.083]
$Crisis_{b,t}*Crisis_{c,t}*Publ_s$			-0.981***	-0.675***
			[0.295]	[0.190]
Observations	4752	4752	4752	4752
Cred-borr-sect fe	yes	yes	yes	yes
Creditor-time fe	yes	yes	yes	yes
Borrower-time fe	yes	yes	yes	yes
Sector-time fe	yes	yes	yes	yes
Adjusted R-squared	0.960	.	0.961	.

Note: The dependent variable is log(1+x) in OLS estimations and it is x in PPML estimations, where x denotes the holdings of debt of type s (sector) issued by country b (borrower) and held by banks of country c (creditor). End-of-quarter positions between 2006:Q1 and 2011:Q4. Crisis is a dummy variable that equals one if the bond yield exceeds 7 percent and the corresponding country belongs to the Euro Area. Countries are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain. Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 4 - Panel Regression Bilateral Debt Positions by Sector; Reallocation across EA countries

	I	II	III	IV
	(OLS)	(PPML)	(OLS)	(PPML)
Dependent Variable: Sectorial Bilateral Debt Position				
$Crisis_{b,t}*Publ_s$	-0.481***	-1.081***	-0.819***	-1.130***
	[0.119]	[0.113]	[0.137]	[0.122]
$Crisis_{c,t}*Publ_s$	0.659***	0.141	0.745***	0.388***
	[0.089]	[0.138]	[0.090]	[0.129]
$Crisis_{b,t}*Own_{c,b}$	0.856***	0.447***	0.486***	0.451***
	[0.204]	[0.061]	[0.181]	[0.061]
$Crisis_{b,t}*Own_{c,b}*Publ_s$	0.728**	1.386***	0.935***	1.186***
	[0.286]	[0.174]	[0.250]	[0.172]
$Crisis_{b,t}*Euro_c$	0.739	-0.427	-0.255	-0.570*
	[0.670]	[0.304]	[0.679]	[0.318]
$Crisis_{b,t}*Euro_c*Publ_s$	1.927**	4.152***	3.722***	4.598***
	[0.905]	[0.541]	[0.899]	[0.571]
Observations	8928	8904	4752	4752
Cred-borr-sect fe	yes	yes	yes	yes
Creditor-time fe	yes	yes	yes	yes
Borrower-time fe	yes	yes	yes	yes
Sector-time fe	yes	yes	yes	yes
Adjusted R-squared	0.952	.	0.961	.

Note: Columns I-II report the estimates for the full sample of countries, while Columns III-IV report the estimates for the restricted sample of Euro Area countries. The dependent variable is log(1+x) in OLS estimations and it is x in PPML estimations, where x denotes the holdings of debt of type s (sector) issued by country b (borrower) and held by banks of country c (creditor). End-of-quarter positions between 2006:Q1 and 2011:Q4. Crisis is a dummy variable that equals one if the bond yield exceeds 7 percent and the corresponding country belongs to the Euro Area. Countries are: Austria, Belgium, Brazil, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Mexico, Netherlands, Portugal, Spain, Sweden, United States. Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 5 - Panel Regression Bilateral Debt Positions by Sector; Yields

Table 5 - Panel Regression Bilateral Debt Positions by Sector; Yields

	I	II	III	VI
Dependent Variable: Sectorial Bilateral Debt Position				
	Panel regression		*Instrumented Yields*	
$Yield_{b,t}*Publ_s$	-0.040***	-0.016	0.106*	0.709***
	[0.008]	[0.011]	[0.064]	[0.176]
$Yield_{c,t}*Publ_s$	0.082***	0.107***	0.078	0.661***
	[0.009]	[0.012]	[0.061]	[0.170]
$Yield_{b,t}*Own_{c,b}$	0.078***	0.035	0.223*	0.065
	[0.020]	[0.030]	[0.122]	[0.125]
$Yield_{b,t}*Own_{c,b}*Publ_s$	0.018	0.118***	0.676***	0.803***
	[0.028]	[0.042]	[0.171]	[0.174]
$Yield_{b,t}*Yield_{c,t}$		0.003*		0.163***
		[0.001]		[0.029]
$Yield_{b,t}*Yield_{c,t}*Publ_s$		-0.006***		-0.133***
		[0.002]		[0.036]
Observations	8038	8038	7604	7604
Creditor-borrower fixed effects	yes	yes	yes	yes
Creditor-time fe	yes	yes	yes	yes
Borrower-time fe	yes	yes	yes	yes
Sector-time fe	yes	yes	yes	yes
Adjusted R-squared	0.952	0.952	0.953	0.953

Note: The dependent variable is log(1+x), where x denotes the holdings of debt of type s (sector) issued by country b (borrower) and held by banks of country c (creditor). End-of-quarter positions between 2006:Q1 and 2011:Q4. Columns III-IV report IV estimates based on a first-stage panel regression of bond yields GDP per capita, real GDP growth, government debt to GDP, government balance to GDP, current account balance to GDP, inflation rate and country-fixed effects. Countries are: Austria, Belgium, Brazil, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Mexico, Netherlands, Portugal, Spain, Sweden, United States. Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 6 - Panel Regression Bilateral Debt Positions by Sector

	I	II	III	IV	V	VI
Dependent Variable: Sectorial Bilateral Debt Position						
	600 bp threshold			*500 bp threshold*		
$Crisis_{b,t}*Publ_s$	-0.296***	-0.245***	-0.415***	-0.183***	-0.185**	-0.248***
	[0.083]	[0.086]	[0.109]	[0.068]	[0.074]	[0.088]
$Crisis_{c,t}*Publ_s$	0.547***	0.601***	0.554***	0.282***	0.281***	0.285***
	[0.084]	[0.088]	[0.084]	[0.066]	[0.070]	[0.066]
$Crisis_{b,t}*Own_{c,b}$	0.712***	0.698***	0.747***	0.399***	0.249	0.403***
	[0.185]	[0.251]	[0.188]	[0.149]	[0.174]	[0.150]
$Crisis_{b,t}*Own_{c,b}*Publ_s$	0.604**	1.075***	0.675**	0.658***	0.652***	0.684***
	[0.260]	[0.345]	[0.264]	[0.209]	[0.241]	[0.210]
$Crisis_{b,t}*Crisis_{c,t}$		0.025			0.203	
		[0.201]			[0.124]	
$Crisis_{b,t}*Crisis_{c,t}*Publ_s$		-0.570**			0.009	
		[0.274]			[0.168]	
$Crisis_{b,t}*Euro_c$			0.619			0.128
			[0.618]			[0.501]
$Crisis_{b,t}*Euro_c*Publ_s$			1.390*			0.775
			[0.830]			[0.666]
Observations	8038	8038	8038	8038	8038	8038
Creditor-borrower fixed effects	yes	yes	yes	yes	yes	yes
Creditor-time fe	yes	yes	yes	yes	yes	yes
Borrower-time fe	yes	yes	yes	yes	yes	yes
Sector-time fe	yes	yes	yes	yes	yes	yes
Adjusted R-squared	0.952	0.952	0.952	0.951	0.951	0.951

Note: The dependent variable is log(1+x), where x denotes the holdings of debt of type s (sector) issued by country b (borrower) and held by banks of country c (creditor). End-of-quarter positions between 2006:Q1 and 2011:Q4. Countries are: Austria, Belgium, Brazil, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Mexico, Netherlands, Portugal, Spain, Sweden, United States. Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table A1. Foreign Assets of Local Banks – Summary Statistics

	Mean		St.Dev.		
ccode	IFS	BIS	IFS	BIS	Corr(IFS,BIS)
at	12.6984	12.4923	0.5094	0.6059	0.9911
be	13.3981	13.4182	0.4123	0.4020	0.9995
br	10.2419	10.5986	0.4991	0.5961	0.9759
de	14.6856	14.6178	0.4183	0.3955	0.9916
dk	11.9029	11.7715	0.4636	0.4557	0.9931
es	13.0246	12.7994	0.4682	0.4988	0.9985
fi	11.5263	11.3789	0.5982	0.7222	0.9380
fr	14.4540	14.3319	0.4911	0.5209	0.9942
gr	11.5164	11.4504	0.7180	0.6664	0.9947
ie	13.6422	13.1939	0.5649	0.5979	0.9926
it	12.9775	12.8399	0.4364	0.4688	0.9758
jp	14.1640	14.4255	0.3264	0.3374	0.9681
mx	10.0190	9.5474	0.5339	0.4093	0.7055
nl	13.5607	13.5317	0.4338	0.4425	0.9966
pt	11.7688	11.5404	0.4261	0.3692	0.9968
se	12.1783	12.1655	0.5847	0.6781	0.9979
us	14.2059	14.5717	0.3675	0.4301	0.9918

Banks' claims to non-residents (line 31 minus line 11) from IFS (IMF) and external positions of banks vis-a-vis all sectors (Table 2a) from Locational Banking Statistics (BIS). Period: 2001:Q1 – 2011:Q4. Data are logged.

Table A2. First-Stage IV Estimation

Dependent Variable: Bond Yield	
GDP	-0.000***
	[0.000]
GDP Growth	-0.045***
	[0.014]
GOVT Debt	1.331***
	[0.261]
GOVT Balance	-0.169
	[0.833]
Inflation	1.713
	[6.250]
CA	0.073***
	[0.019]
Observations	627
Adjusted R-squared	0.606
Country fe	yes

Note: Dependent variable is the yield on 10 years government bonds. Quarterly averages, 2001:Q1 – 2011:Q4. The regressors are: the level of GDP, the growth rate of GDP, government's debt and balance over GDP, the growth of the GDP deflator and the current account over GDP. All variables are from OECD statistics, except for government variables. Data on government debt are from the Public Sector Debt Database of the World Bank. The government's balance is defined as the change in the level of debt. All data have quarterly frequency. Countries are: Austria, Belgium, Brazil, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Mexico, Netherlands, Portugal, Spain, Sweden, United States. Standard errors in brackets. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.
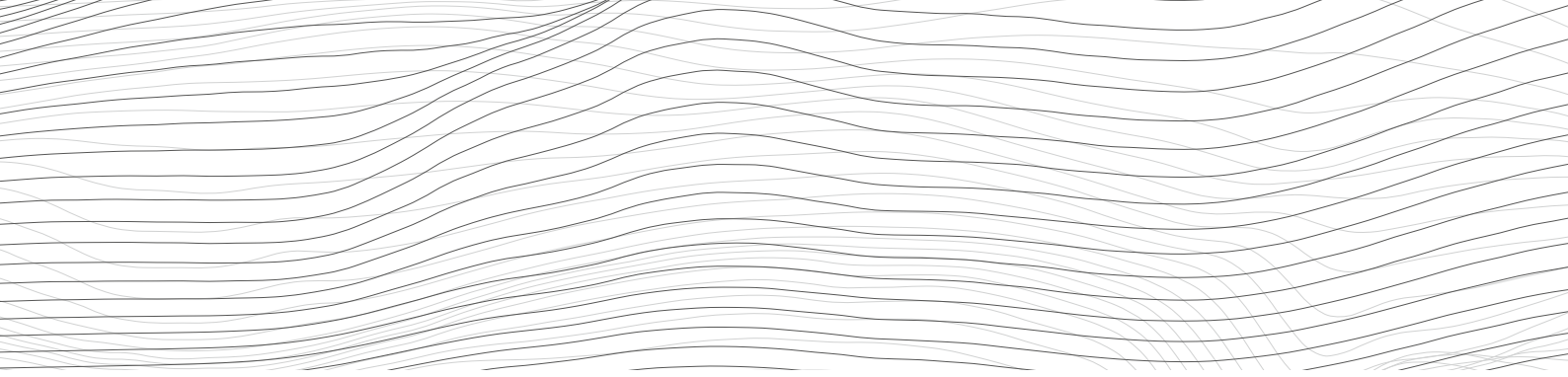
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