REPATRIATION OF DEBT IN THE EURO CRISIS

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Abstract
With the beginning of the Euro Crisis, the long-standing trend of European financial integration reversed. Investors unwound cross-border positions of debt obligations and increased holdings of locally issued debt. In other words, debt obligations were repatriated. We use data on bank portfolios to document three new empirical regularities of the financial disintegration: (i) repatriation affected mainly debt of crisis countries; (ii) repatriation affected mainly public debt; (iii) the public debt of crisis countries that was not repatriated was reallocated to large and politically influential countries within the Euro Area. We read these results in light of standard theories of cross-border portfolio allocation and argue that the sum of these patterns constitutes evidence for the secondary market theory of public debt. (JEL: F34, F36, G01, G11, G21.)

Keywords: Debt Repatriation, Sovereign Risk, Secondary Markets, Euro Crisis, Portfolio Home-Bias.

1. Introduction

Prior to the sovereign debt crisis financial integration in the Euro Area soared. Northern European banks, in particular, scaled up exposure to peripheral countries and the share of foreign-held Southern debt increased. This picture changed in late 2009, as fears of sovereign insolvency escalated in Greece and later in Ireland, Italy, Portugal and Spain (together, the so-called GIIPS countries). Foreign banks pulled out of GIIPS’ sovereign bonds, and domestic banks absorbed the drop in demand. Figure 1 (bold line, left panel) illustrates these dynamics, which we will refer to as a repatriation of debt.

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This paper scrutinizes the patterns of geographical portfolio reallocation using bank balance-sheet data, aggregated at the level of country pairs (i.e., the creditor and borrower country). Our analysis reveals three robust empirical regularities. First, the repatriation of debt affected primarily countries in acute state of crisis (Figure 1, left panel). Second, the repatriation of debt was much stronger for public debt than for private debt (Figure 1, both panels). Third, the part of public debt from crisis countries, which was not repatriated was reallocated to large and politically influential countries within the Euro Area (in particular, to Germany). These shifts in the geographical distribution of European debt (and the resulting fragmentation of European financial markets) prove robust across a broad set of specifications.

The sum of these empirical regularities documents that creditors in different countries reacted very differently, as a debtor was struck by the crisis. While creditors located in some countries walked away from crisis countries quick and radically, others did less so. This information is interesting for understanding how the European Debt Crisis unfolded in the geographical dimension. It is also important when regarding the crisis as self-fulfilling, since it highlights the role played by foreign creditors in refusing to roll over the debt of crisis countries.\footnote{See e.g. Conesa and Kehoe (2012), Lane (2014) and Erce et al (2014).} We then argue that understanding the drivers of our three empirical patterns is crucial for any comprehensive reading of the European debt crisis.
In our view, when discussed in light of different theories, the patterns uncovered are best explained by the secondary market theory of sovereign debt, recently advanced by Broner, Martin and Ventura (2010) – BMV hereafter. This theory starts from the common premise that sovereigns care more about the welfare of domestic creditors than about that of foreign creditors. Therefore, sovereign defaults are more likely, the more public debt is held abroad. While the threat of international sanctions and financial autarky leads governments to honor their debt in normal times, a government’s temptation to renge its debt grows stronger in crisis period. In such situations, secondary debt markets become crucial: foreign investors, who face potential losses, try to reduce their exposure by selling government bonds in secondary markets. Domestic agents will buy these bonds, expecting that the government will have a stronger incentive to honor its domestic debt after the change of bond ownership.\footnote{One version of this theory relies on the government’s ability to effectively discriminate across creditors. Besides an explicit, technical discrimination, this can also take place indirectly through compensation schemes. See the discussion at the start of Section 4.1.}

The secondary market theory thus delivers a sharp prediction regarding the reallocation of bond ownership in periods of crisis: when an adverse shock reduces a country’s ability (or willingness) to repay its debt, sovereign bonds should flow from foreign to local investors through secondary markets. This prediction corresponds to the first pattern above. Moreover, given that strategic default considerations are more important for public debt, repatriation should be stronger for public debt than private debt (second pattern). Finally, in a broader reading of the theory, the debt of a distressed country should also flow towards foreign countries with an effective control on the government’s decision to default. This view calls for a reallocation of distressed peripheral Euro Area countries towards the countries at the core of the Euro Area, and especially Germany (third pattern). In sum, all of our empirical findings are largely consistent with the secondary market theory.\footnote{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, and therefore refrain from a clear causal interpretation of our results.}

Methodologically, we apply a difference-in-difference approach on banks’s debt positions to test whether periods of crisis are associated with repatriations of locally issued public 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 spreads over German bunds exceed the threshold of 400 basis points.\footnote{We check the sensitivity of our results by considering a other threshold for the definition of a crisis.} The three empirical patterns emerge under a broad set of different specifications and estimation techniques.
Our paper relates to the extensive literature that analyzes enforcement problems in sovereign debt markets. Early, 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. Empirically, however, the debate about whether sovereign defaults are effectively associated with explicit foreign retaliation is yet to be settled. BMV provide an alternative view of enforcement problems in sovereign debt markets. Rather than stressing the role of foreign penalties, they highlight the role of secondary markets to solve the commitment problem of the government. We contribute to the literature on secondary markets providing empirical evidence.

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. 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) find that global risk conditions are more important than local conditions to explain episodes of extreme movements in gross capital flows. Our results, instead, suggest that local factors had a predominant role on cross-border asset allocations in the Euro crisis. 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 banks in developed countries affected the supply of loans to emerging markets. Hale and Obstfeld (2015) investigate the geography of European financial integration prior to the Euro crisis, documenting that after the establishing of the Euro, banks in the core of the Euro increased lending to periphery countries and borrowing from outside.

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6. For the effect of sovereign default on subsequent borrowing costs, see Reinhart et al. (2004), Borenstein and Panizza (2009), Gelos et al. (2011), Arteta and Hale (2008), and Cruces and Trebesch (2013). For the effect on international trade, see Rose (2005), Martinez and Sandleris (2011), Zymek (2012).

7. Relatedly, Guembel and Sussman (2009), Broner and Ventura (2010, 2011), Brutti (2011), Gennaioli et al. (2009), Mengus (2013) show that in the absence of discrimination, the repayment of public debt depends on the cost inflicted by a default on the domestic private sector and is not directly related to foreign sanctions.

8. 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.

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

10. See also Giannetti and Laeven (2011).
the Euro area.\footnote{See also Acharya and Steffen (2013) on this point.} Very similar in scope and method to their study, our current work can be read as its complement and continuation.

Finally, recent papers have analyzed the dynamics of public debt holdings during the Euro crisis, e.g. Arslanalp and Tsuda (2012), Andritzky (2012) and Merler and Pisani-Ferry (2012). Looking at how public debt is distributed across classes of creditors, these papers document a shift of positions from foreign to domestic residents in the countries affected by the Euro crisis.\footnote{Similar evidence has been reported by Broner et al. (2013).} This evidence is consistent with the first of our empirical patterns. In contrast to these papers, our data allows us to break down debt positions on a bilateral basis and to distinguish public and private debt, which enables us to identify the additional empirical patterns presented in this paper.

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 related theories and Section 5 concludes.

2. A Closer Look at the Data

In this section we provide more details of the observed repatriation of debt, comparing the shift in bank positions across different asset classes and countries. We open this section with a brief description of the data our analysis relies on.

\textit{Data Description.} Our aim is to construct a panel of aggregate bilateral bank positions $y_{c,b,s,t}$: that is, aggregate claims of banks located in country $c$ on borrowers in country $b$ and sector $s$ (public or non-bank private) at time $t$.\footnote{The IFS as well as the BIS label the type of borrower (public or non-bank private) by sector. We adopt this convention throughout the paper.} To that aim, we combine two main data sources: first the \textit{Monetary and Financial Statistics} of the IMF’s \textit{International Financial Statistics} (IFS), and, second, the \textit{International Banking Statistics} (IBS) of the BIS.\footnote{See Section B.2 in the Online Appendix for confidentiality and replication issues of the BIS \textit{International Banking Statistics}.}

The IFS reports aggregate claims of a country’s banking sector on domestic residents, broken down between claims on central government and claims on non-bank private sector. As claims on non-residents are not available on a bilateral country basis, we need to combine the IFS with the IBS. The IBS consists of two main datasets: the Locational Banking Statistics (LBS) and the Consolidated Banking Statistics (CBS). The LBS reports bilateral bank positions based on banks residence (like the IFS), but does not separate between claims on government and claims on non-bank private...
sector. The CBS does include this breakdown, but it reports bank positions based on nationality (e.g., positions of Deutsche Bank UK are reported as German positions). To ensure comparability with IFS data, we take aggregate bilateral bank positions from LBS data - based on bank residence but not disaggregated between public and non-bank private - and we use the “sectoral” shares in the CBS data to separate between claims on government and claims on non-bank private sector. The potentially arising bias from the discrepancies in the LBS and the CBS are discussed in the Online Appendix.

All datasets have quarterly frequency and report bank positions in millions of US dollars. Banks are defined as deposit-taking institutions less the central bank. Valuation principles are generally based on market prices.

Finally, we take 10-year government bond yields from Thomson Reuters and we use the spread with respect to German bonds to identify periods of crisis in our econometric analysis, as further explained in Section 3.

**Debt by Issuing Country.** Figure 2 reports domestic and foreign shares of both public and private (bank-held) debt for individual countries, separating between Other Euro Area countries (top row) and GIIPS countries (bottom row). These shares are plotted together with the corresponding spread with respect to German bonds. The graphs confirm that the tendency towards repatriation of public debt was common to all GIIPS countries, whereas no clear evidence of a trend in other Euro Area countries can be detected (with the possible 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.

**Debt of GIIPS Countries - Levels.** Figure 3 reports the logged levels of public debt (top panel) and non-bank private debt (bottom panel) of GIIPS countries, disaggregated by issuing country and by foreign versus domestic claimants. For both, positions of public debt and positions of private debt, there is a tendency of domestic positions to

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15. In the CBS, data exist based on ultimate risk and immediate borrower basis. For data availability, we use the immediate borrower classification of the CBS data.

16. 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.

17. For more details on potential valuation effects, see Section 3.2.2. For a detailed presentation of valuation principles and other reporting practices in the IFS data and in the BIS data, see IMF’s Monetary and Financial Statistics Manual and BIS’ reporting practices available at https://www.bis.org/statistics/count_rep_practices.htm.
Figure 2. Share of domestically held debt - individual countries. Debt holdings by local banks relative to total bank-held debt of the issuing country. Source: Locational Banking Statistics (BIS), Consolidated Banking Statistics (BIS) and IFS (IMF).

Figure 3. Debt of GIIPS countries - levels. Nominal debt held by local and foreign banks. Source: Locational Banking Statistics (BIS), Consolidated Banking Statistics (BIS) and IFS (IMF).
increase and of foreign positions to decrease as sovereign risk sets in.\textsuperscript{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 1 (left panel).\textsuperscript{19}

**Non-Bank Investors.** Figure 4 shows 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). The figure plots 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.\textsuperscript{20} The graph reveals a clear 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 particularly dominant role among domestic investors in the repatriation of debt. In Spain, for example, non-financial domestic investors increased their exposure to local public debt faster (from 12.1\% in 2008 to 21.9\% in 2011) than domestic banks (from 26.4\% in 2007 to 28.8\% in 2011) and other financial investors (from 10.3\% in 2008 to 9.2\% in 2011). The same is true for Italy in 2010, a period in which the concerns about debt sustainability intensified in the country (the respective increase between 2010 and 2011 was 4.4\%, −0.2\% and −0.4\%). 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.\textsuperscript{21} Overall, Figure 4 suggests that the bond purchases of bank and non-bank domestic investors moved in parallel.

### 3. Empirical Analysis

The stylized facts presented in the preceding section suggest a clear association between the increase in sovereign risk and the geographical reallocation of (public) debt. In the following empirical analysis, we show that this association is robust to the inclusion of a large number of controls and across a wide set of specifications.

To analyze the crisis relative to the pre-crisis period, we restrict the sample to the period between the first quarter of 2006 and the last quarter of 2011.\textsuperscript{22} We further

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\textsuperscript{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.

\textsuperscript{19} The positions of domestic and foreign banks in other EA countries moved essentially in parallel over the same period. The according graphs are not shown but available from the authors upon request.

\textsuperscript{20} Shares are computed using end-of-year data from the Government Finance Statistics published by the ECB - see Section B.3 of the Online Appendix for a description of the data and further information.

\textsuperscript{21} Compare also Table B.3 in the Online Appendix.

\textsuperscript{22} For an analysis of the dynamics of the earlier period around the introduction of the Euro, see Hale and Obstfeld (2015).
exclude all country-pairs with missing or discontinuous observations over this period to obtain a balanced panel of bilateral exposures. This procedure leaves us with a final sample includes 17 creditors and 15 borrowers.\textsuperscript{23}

### 3.1. Empirical Framework

We begin by analyzing positions of public debt only, using the following empirical specification

\[
y_{c,b,t} = \beta \cdot \text{Crisis}_{b,t} \ast \text{Own}_{c,b} + \gamma \cdot \text{Controls}_{c,b,t} + \varepsilon_{c,b,t}
\]  

(1)

where \(y_{c,b,t}\) indicates the log of country \(c\)’s positions of public debt issued by country \(b\) at time \(t\).\textsuperscript{24} \(\text{Crisis}_{b,t}\) is a dummy variable indicating crisis periods in the borrowing country \(b\). A crisis is defined as a period of elevated sovereign risk, corresponding to government bond spreads relative to German bonds above 400 basis points.\textsuperscript{25} \(\text{Own}_{c,b}\) is an indicator of locally held debt positions.

We aim to control for country-pair fixed effects, borrower-time, creditor-time dummies as well as own-time effects. The country-pair effects control, among other

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\textsuperscript{23} These countries are Austria, Belgium, Brazil, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Mexico, Netherlands, Portugal, Spain, Sweden and the United States. Japan and Mexico are only included as creditors but not as borrowers.

\textsuperscript{24} With respect to the notation introduced in Section 2, the sector index has been omitted as we focus only on public debt.

\textsuperscript{25} In the robustness checks, we consider different thresholds of 500 and 600 basis points. We point out that according to this definition, Germany is never in crisis. This assumption seems reasonable at least \textit{ex post}. In a working paper version, we also consider thresholds on raw bond yields (instead of spreads) with little effect on the results.
things, for distance and market size, factors that have proven highly significant in explaining bilateral asset positions (see Martin and Rey 2004 and Portes and Rey 2005).  

By controlling for borrower-time effects, the coefficient of interest $\beta$ measures the change of debt holdings by domestic banks relative to average foreign banks’ holdings. In addition, controlling for creditor-time effects changes are relative to the change of domestic banks’ claims on foreign countries. Finally, own-time dummies capture any general trend towards repatriation.

Table 1 reports summary statistics for the bilateral debt positions used in the regressions. The statistics are reported for both levels and logs and for both raw and transformed data, where the latter are obtained after removing the fixed effects prior to estimation. The table also reports skewness and kurtosis of the original and the transformed variables.

26. The latter fixed effects control for the average home bias of international portfolio investment.

27. Given that our dependent variable is expressed in logs, the borrower-time fixed effects also control for valuation effects, if these are uniform across countries. We discuss valuation effects in more detail in section 3.2.2.

28. Okawa and van Wincoop (2012) lay the theoretical foundations for financial gravity equations, pointing out that existing empirical work often suffers from omitting destination and source dummies. Our specification is proof to that critique.

29. As further explained below, model (1) is estimated in both its log-linear and its multiplicative form. The dependent variable in the latter case is in levels.

30. Overall, the large set of dummies (17x15 country-pairs for each sector, 17x18 and 15x18 borrower-time and creditor-time effects, and more in specifications below distinguishing sectors) induces convergence problems in the GLS and Poisson estimations described below. Therefore, we remove the fixed effect prior to estimation by running an OLS regression of the log positions in a first step and then using the residuals to run the main regression in a second. All independent variables are also regressed on the control dummies and replaced by their respective residual. The standard errors in the main regression are adjusted by the number of all regressors (those included in the first and the second step). In the multiplicative specifications of the model described below, we re-scale the bilateral positions (which is required to be non-negative) by the value implied by the fixed effects, which we obtain by running a Pseudo Poisson Maximum Likelihood (PPML) estimation of the bilateral debt positions on the full set of dummies.
Table 1 - Summary Statistics Bilateral Debt Positions

<table>
<thead>
<tr>
<th></th>
<th>In(Level)</th>
<th>Level</th>
<th>In(Level), demeaned</th>
<th>Level, renormalized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>7.55</td>
<td>94.2</td>
<td>0.00</td>
<td>1.02</td>
</tr>
<tr>
<td>Min</td>
<td>-2.00</td>
<td>0.0</td>
<td>-4.78</td>
<td>0.00</td>
</tr>
<tr>
<td>Max</td>
<td>16.47</td>
<td>14245.8</td>
<td>3.08</td>
<td>20.39</td>
</tr>
<tr>
<td>Variance</td>
<td>7.15</td>
<td>530809.5</td>
<td>0.32</td>
<td>0.53</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.16</td>
<td>14.9</td>
<td>-0.64</td>
<td>7.19</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>3.51</td>
<td>254.8</td>
<td>9.08</td>
<td>127.55</td>
</tr>
<tr>
<td>Observations</td>
<td>9056</td>
<td>9288</td>
<td>9056</td>
<td>9288</td>
</tr>
</tbody>
</table>

Note: Quarterly bilateral debt positions of Austria, Belgium, Brazil, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Mexico, Netherlands, Portugal, Spain, Sweden, United States for 2006Q1 to 2011Q4 before and after demeaning and renormalizing. See Section 3 for further descriptions.
### 3.2. Estimation Results

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
<th>VII</th>
<th>VIII</th>
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<tr>
<td></td>
<td>Clusters Poisson GLS (AR1)</td>
<td>Poisson (AR1)</td>
<td>Clusters Poisson GLS (AR1)</td>
<td>Poisson (AR1)</td>
<td>Clusters Poisson GLS (AR1)</td>
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<td>Clusters Poisson GLS (AR1)</td>
<td>Poisson (AR1)</td>
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<tr>
<td>Dependent Variable: Public Bilateral Debt Position</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crisis_b,t * Own_c,b</td>
<td>1.47***</td>
<td>1.05**</td>
<td>0.76***</td>
<td>0.81**</td>
<td>1.26**</td>
<td>0.97**</td>
<td>0.75***</td>
<td>0.76*</td>
</tr>
<tr>
<td></td>
<td>[0.49]</td>
<td>[0.47]</td>
<td>[0.12]</td>
<td>[0.36]</td>
<td>[0.50]</td>
<td>[0.44]</td>
<td>[0.14]</td>
<td>[0.40]</td>
</tr>
<tr>
<td>Crisis_b,t * Crisis_c,t</td>
<td>0.28</td>
<td>0.10</td>
<td>0.00</td>
<td>0.07</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>[0.39]</td>
<td>[0.31]</td>
<td>[0.10]</td>
<td>[0.27]</td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

| No. Obs | 4403 | 4632 | 4403 | 4632 | 4403 | 4632 | 4403 | 4632 |

Note: Dependent variable is log(x) in odd columns and x in even columns (PPML estimations), where x denotes the bilateral positions of public debt of country b (borrower) by banks of country c (creditor). Control variables include country-pair, creditor-time, borrower-time and own-time fixed effects insofar as described in footnote 30. End-of-quarter positions between 2006:Q1 and 2011:Q4. Crisis is a dummy variable that equals one if the bond yield spreads of country c over German bunds exceeds 4 percent and c 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.
(i) Repatriation of Public Debt. Table 2 reports the estimation results for model (1), which inspects the effect of the crisis on the international allocation of public debt. Column I reports the OLS estimates, where the standard errors are clustered at the borrower level. The coefficient of interest is positive and significant. The point estimate indicates that banks of crisis countries increased their holdings of local government debt by a factor of 4.36, relative to foreign banks ($\exp(1.47) = 4.35$).

With an initial share of domestically-held debt of 49% in crisis countries at the beginning of 2009 (compare Figure 1), the estimated coefficient implies that this share increased to 81% during the crisis, which roughly corresponds to the increase reported in Figure 1.31 In terms of volumes, a rough approximation indicates that the amount of government debt repatriated by banks of crisis countries was of the order of 0.35 trillion USD.32 This back-of-the-envelope computation (which disregards portfolio growth, purchases of debt by the ECB and issuance of fresh debt by crisis countries) 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 the model (1) constitutes a log-linearized version of the gravity model à la Anderson (1979) or Portes and Rey (2004). Recent work by Santos Silva and Tenreyro (2006) has uncovered two potentially severe drawbacks of estimating the gravity equation using a log-linearized transformation, as considered in our baseline specification. First, the authors show that heteroskedasticity can generate severely biased point estimates of log-linear models and propose to estimate this class of models in their multiplicative form using a Poisson pseudo-maximum-likelihood (PPML) estimator.33 Obviously, this problem cannot be addressed by simply clustering the standard errors as done in the baseline specification, since clustering leaves point estimates unchanged. The second drawback of the log-linearized model is that is that bilateral positions with a value of zero translate into missing values. This affect 229 or 4.9% of observations. The PPML, on the other hand, correctly includes the information these observations provide. For both of these reasons, we run a Poisson panel estimation of model (1).34 The results are reported in Column II of Table 2, with

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31. The share of domestically-held debt increased with the crisis to $\exp(1.472) \cdot \frac{d}{1 + \exp(1.472) \cdot d} = 0.807$, where $d = 0.49/(1 - 0.49)$ denotes the value of domestic positions relative to foreign positions before the crisis.

32. In December 2009, total claims on the public sector of GIIPS by BIS reporting banks in our sample were at 1.51 trillion USD, in December 2011 this amount was 1.47 trillion USD. Based on these numbers, and adjusting for the end-2011 EUR/USD exchange rate of 0.7721, the amount repatriated was $(1.47\cdot0.81 - 1.51\cdot0.49)\cdot0.7721 = .348$

33. In particular, the crucial independency assumption on the error term is violated if the variance of the latter depends on some of the explanatory variables in the regression.

34. 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).
standard errors clustered at the borrower level as in Column I. The coefficient of interest, the one on \( \text{Crisis}_{b,t} \times \text{Own}_{c,b} \), is somewhat smaller in magnitude with respect to the linear model, but positive and significant at the 5% level.

Potential concerns may arise due to the presence of autocorrelation in the error term. Indeed, the test for autocorrelation in panel data (see Wooldridge 2010, 282-283) strongly rejects the hypothesis of no first-order autocorrelation in both of the above specifications. We then report GLS estimations of the log-linear model that allow for panel-specific autocorrelation of order 1 (AR1) in the error term (Column III) as well as PPML estimations with robust standard errors that allow for AR1 errors (Column IV). The estimated coefficients of both specifications are positive and in the same order of magnitude of the ordinary PPML estimation. Again, they are significant at the 1% (Column III) and at the 5 confidence level (Column IV).

Next, we test if banks located in crisis countries generally increased exposure to debt of crisis countries (both domestic and foreign), potentially in an attempt to gamble for resurrection. To that aim, we include the interaction term \( \text{Crisis}_{c,t} \times \text{Crisis}_{b,t} \), where \( \text{Crisis}_{c,t} \) is an indicator for crisis episodes in creditor countries and is defined in parallel with \( \text{Crisis}_{b,t} \). The results corresponding to this specification are reported in Columns V and VIII of Table 2. The coefficient on the additional interaction term is statistically insignificant. The trend of repatriation, on the other hand, is largely unchanged: the estimates of the coefficient on \( \text{Crisis}_{b,t} \times \text{Own}_{c,b} \) are significant at the 5% or 1% level (Columns V - VIII).

(ii) Public versus Private Debt. Next, we test whether the effect of a crisis differs across type (or sector) of issuer. 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

35. In all PPML specifications of the empirical model, we control for the fixed effects as follows. We renormalize the independent variable (which is required to be non-negative) by running a PPML regression (using the ppml Stata command developed by Santos Silva and Tenreyro 2010) on the full set of dummies and divide the actual investment position by the predicted one. The thus renormalized independent variable is then used in the main regression. See also Table 1 for the corresponding summary statistics. For the main regressions, we use the xtpoisson Stata command, which allows to address heteroskedasticity and autocorrelation in the errors. In the PPML, too, we adjust standard errors of the second stage regression by accounting for the number of dummy variables in the first stage regression.

36. The according F-statistic is 183.35 in the log-linear model and 356.54 in the PPML model.

37. We notice that clustering at the borrower level allows for heteroskedasticity along the time dimension and may be argued to partly address these concerns. Also, unobserved fixed effects are absorbed by the country-pair dummies. Nevertheless, we address these concerns with estimation techniques specifically designed to tackle autocorrelation. In the GLS and Poisson estimation, we also adjust standard errors of the second stage regression by accounting for the number of dummy variables in the first stage regression.

38. Indeed, the difference between the estimated coefficients in Columns V - VIII closely match the estimated coefficients in Columns I - IV.
equation

\[ y_{s,c,b,t} = \beta_0 \cdot \text{Crisis}_{b,t} \cdot \text{Own}_{c,b} + \beta_1 \cdot \text{Crisis}_{b,t} \cdot \text{Publ}_s \]

\[ + \gamma \cdot \text{Controls}_{s,c,b,t} + \varepsilon_{s,c,b,t} \quad (2) \]

In equation (2), the additional subscript \( s \) denotes the sector of each debt position. The variable \( \text{Publ}_s \) denotes a dummy variable that identifies the positions of public debt.\(^{39}\)

In this specification, the coefficient \( \beta_0 \) measures the effect of a crisis on domestic positions of local private debt, while the coefficient \( \beta_1 \) measures the additional effect on domestic positions of local public debt. Thus, a positive value for \( \beta_1 \) indicates that the repatriation of debt is stronger for public debt than for private debt. As before, we control for creditor-borrower-sector effects, creditor-time and borrower-time effects and, in addition, for sector-time effects. Also, we control for the interactions \( \text{Crisis}_{b,t} \cdot \text{Publ}_s \) and \( \text{Crisis}_{c,t} \cdot \text{Publ}_s \).\(^{40}\)

Table 3 reports the estimation results for the different specifications of equation (2). The two coefficients of interest are those on \( \text{Crisis}_{b,t} \cdot \text{Own}_{c,b} \) and \( \text{Crisis}_{b,t} \cdot \text{Own}_{c,b} \cdot \text{Publ}_s \). The first one is always positive and significant but in Columns IV and VIII. This finding suggests that there was a tendency to repatriate private debt of crisis countries. The second coefficient is always positive and significant but in Columns II, IV and VIII. However, statistics reported in the last row of Table 3, show that the joint F-test of the sum of coefficients on \( \text{Crisis}_{b,t} \cdot \text{Own}_{c,b} \) and \( \text{Crisis}_{b,t} \cdot \text{Own}_{c,b} \cdot \text{Publ}_s \) is always rejected at the 1% confidence level. These findings document that the tendency to repatriate public debt was significant and, overall, stronger than the one of private debt.

---

39. As the specification includes creditor-borrower-sector fixed effect, the variable \( \text{Publ}_s \) enters only in the interaction terms.

40. The first of these terms 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. This term captures a potential flight by foreign banks from private to public debt of crisis countries. The second term 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.
<table>
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<tr>
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<td>Clustered Poisson (AR1)</td>
<td>Poisson (AR1)</td>
<td>Clustered Poisson (AR1)</td>
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<tr>
<td>Crisis_{b,t} * Own_{c,b}</td>
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<td>0.56**</td>
<td>0.32***</td>
<td>0.49**</td>
<td>0.46</td>
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<td>0.31***</td>
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<td>0.33</td>
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<td>Crisis_{b,t} * Crisis_{c,t} * Publ_{c}</td>
<td>-0.30</td>
<td>-0.32</td>
<td>-0.04</td>
<td>-0.25</td>
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<td><strong>Joint F-test</strong></td>
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<td>2.498</td>
<td>6.879</td>
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<td>3.186</td>
<td>2.976</td>
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<td>2.441</td>
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Note: Dependent variable is log(x) in odd columns and x in even columns (PPML estimations), where x denotes the bilateral positions of public or non-bank private debt. The joint F-test (last two) indicates the t-statistic of the test that the sum of the coefficients in the first and second row are zero. See also notes for Table 2. Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.
The table also reports negative coefficients on $\text{Crisis}_{b,t} \times \text{Pubs}$, indicating that bank positions of public debt were generally reduced in crisis countries. This result may be driven by both valuation effects - as bank positions are reported at market value - and purchases of the ECB - as such purchases reduce the amount of sovereign debt from crisis countries held by banks.

(iii) Debt Reallocation to Large, Politically Influential Countries. A third pattern emerging from the data concerns the debt of crisis countries that is not repatriated but remains on the balance sheets of foreign banks. Specifically, this debt moved towards large and politically influential countries within the Euro area.

Our definition of political influence aims to capture the ability of a creditor country to exert some form of control on crisis countries regarding the terms of debt restructuring in the event of default. We consider two different proxies of such ability. The first measure considers a country’s share of ECB capital. This variable, labeled $\text{Euro}_c$, is set to zero for non-member of the Euro area. It attributes a political weight of 29.7% to Germany, which probably underestimates the effective weight of Germany in the negotiations around EFSF and ESM and, in particular, the Greek bailout. In relative terms, Germany’s weight was particularly large as two of the four largest Euro area countries (Italy and Spain) were close to entering an acute state crisis themselves, which affected their bargaining position in those negotiations. Therefore, we also look at reallocation of crisis countries’ debt exclusively to Germany, which is done by using the dummy $\text{DEU}_c$ (unity if $c$ is Germany and zero otherwise).

Table 4 reports the estimation results for specifications of equation (2) that include the interaction terms $\text{Crisis}_{b,t} \times \text{Euro}_c$ and $\text{Crisis}_{b,t} \times \text{Pubs}$ or $\text{Crisis}_{b,t} \times \text{DEU}_c$ and $\text{Crisis}_{b,t} \times \text{DEU}_c \times \text{Pubs}$. Results are reported in Column I-IV for the full sample and in Column V-VIII for a restricted sample of Euro Area countries. To save space, we report only results corresponding to the GLS specification as well as PPML estimates (those corresponding to Columns III and VI in Table 3).

42. See, e.g., Lane (2012). Also, Ardagna and Caselli (2014) highlight the role of Germany during the negotiation process around the Greek bailouts.
43. In addition, we experiment with three alternative measures. The first reflects shares based on economic size. The second, uses economic size of Germany and France only, the two most important partners in the negotiations around the Greek bailout (see Ardagna and Caselli (2014)). For the third measure, we collect the number of hits by google.com in a search for the joint keywords “Greek bailout” “ft.com” and “X”, where X stands for the head of government in the respective Euro area member state. This latter measure proxies the involvement of in restructuring negotiations and consequently gives a higher weight to Germany. All three measures render similar estimation results. See Tables B.4a and B.4b in the Online Appendix for estimation results and Table B.5 for further documentation.
44. Notice that the direct effect of $\text{EUR}_c$ is captured by country dummies.
### Table 4 - Panel Regression with Political Influence

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<tr>
<td>IV</td>
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</table>

**Dependent Variable: Sectorial Bilateral Debt Position**

- **Crisis\(b_t\) * Own\(c,b\)**
  - 0.29***
  - 0.36
  - 0.30***
  - 0.36
  - 0.25**
  - 0.33*
  - 0.25**
  - 0.33*
  - [0.11] [0.24] [0.11] [0.24] [0.11] [0.19] [0.11] [0.19]

- **Crisis\(b_t\) * Own\(c,b\) * Publ\(s\)**
  - 0.54***
  - 0.49
  - 0.53***
  - 0.50
  - 0.52***
  - 0.48
  - 0.52***
  - 0.49
  - [0.18] [0.41] [0.18] [0.40] [0.18] [0.41] [0.18] [0.40]

- **Crisis\(b_t\) * Euro\(c\)**
  - 0.14
  - 0.23
  - [0.24] [0.57]

- **Crisis\(b_t\) * Euro\(c\) * Publ\(s\)**
  - 1.10***
  - 0.71
  - [0.36] [0.84]

- **Crisis\(b_t\) * DEU\(c\)**
  - -0.03
  - -0.04
  - -0.07
  - -0.08
  - [0.06] [0.12] [0.06] [0.11]

- **Crisis\(b_t\) * DEU\(c\) * Publ\(s\)**
  - 0.34***
  - 0.39**
  - 0.32***
  - 0.41**
  - [0.09] [0.16] [0.09] [0.18]

**Note:** Dependent variable is log(x) in GLS estimations and it is x in PPML estimations, where x denotes the bilateral positions of debt by sector. See also notes to Tables 2 and 3. Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

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</table>
The coefficient on $\text{Crisis}_{b,t} * \text{Euro}_c$ has mixed sign and is insignificant in all four specifications (Columns I, II, V and VII); at the same time, the coefficient on $\text{Crisis}_{b,t} * \text{Euro}_c * \text{Publ}_s$ is always positive and significant.\textsuperscript{45} The estimations with $\text{DEU}_c$ produce a very similar picture: the coefficient on $\text{Crisis}_{b,t} * \text{DEU}_c$ is virtually zero throughout, while the coefficient on $\text{Crisis}_{b,t} * \text{DEU}_c * \text{Publ}_s$ is positive and significant at the 5% level at least. Notice also that the estimated coefficient on $\text{Crisis}_{b,t} * \text{Own}_{c,b}$ and $\text{Crisis}_{b,t} * \text{Own}_{c,b} * \text{Publ}_s$ are largely unaffected by the inclusion of the variables including $\text{Euro}_c$.

Interpretations of these results must, of course, be conducted with care, because measures of political influence necessarily correlate with country size and there may be other reasons why the latter could matter.\textsuperscript{46} Nevertheless, the results presented in Table 4, is consistent with the view that there is an association between the political influence of countries and the appetite of local banks for troubled countries debt.

### 3.2.1. Additional Specifications.

In order to show that our results do not hinge on the exact definition of crisis, we present a set of robustness checks where the definition of the variable $\text{Crisis}$ is based on two different thresholds: 500 and 600 bp for the yield spread against German bonds. Table 5 reports the according results for the same set of specifications considered in Column V-VIII of Table 4. These results confirm, by and large, the picture that emerged from our previous specifications. In particular, the estimated coefficient on $\text{Crisis} * \text{Own}_{c,b} * \text{Publ}_s$ is positive and significant at the 5% level at least. The estimated coefficient on $\text{Crisis}_{b,t} * \text{Euro}_c * \text{Publ}_s$ and $\text{Crisis}_{b,t} * \text{DEU}_c * \text{Publ}_s$ are also positive and significant.

\textsuperscript{45} Notice that the baseline estimation suggests an overall effect of $\text{Euro}_c * (0.14 + 1.1)$. For Germany with a political weight of 0.3 the effect is $0.3 * (0.14 + 1.1) = 0.37$. The repatriation effect for Germany is thus smaller than the repatriation effect for the crisis country itself ($0.29 + 0.54 = 0.83$).

\textsuperscript{46} Notice that our dependent variable is logged so that changes are measured in percentage terms. Consequently, effects related to absolute changes, e.g. that large economies hold more positions of any asset in proportion to their size, are controlled for by our set of dummy variables. To address potential size effects in excess of proportionality, we also estimate the specifications presented in Columns I and II of Table 4 as well as those of Table B.4a from the Online Appendix, while controlling for interaction dummies with the GDP share of the Euro area countries, i.e., $\text{Crisis}_{b,t} * g \text{dp}_c$ and $\text{Crisis}_{b,t} * g \text{dp}_c * \text{Publ}_s$. The results, reported in Table B.4c of the Online Appendix show that, despite the strong correlation between economic size and political influence, the coefficients on the interaction terms with our original proxies have the expected sign and do not lose significance in most of the specifications. By contrast, the coefficients on the added controls have mixed signs and are insignificant.
Table 5 - Panel Regressions, Alternative Crisis Definitions

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<td>Dependent Variable: Sectorial Bilateral Debt Position</td>
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<tr>
<td>Crisis_{b,t} *Own_{c,b}</td>
<td>0.33**</td>
<td>0.37</td>
<td>0.32*</td>
<td>0.36</td>
<td>0.20</td>
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</table>

Note: Dependent variable is log(x) in GLS estimations and it is x in PPML estimations, where x denotes the bilateral positions of debt by sector. See also notes to Tables 2 and 3. Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.
3.2.2. **Valuation Effects.** The critical reader may be concerned that our estimates of debt repatriation in crisis countries are contaminated by valuation effects. Specifically, as reporting rules generally differ from bond and loan positions - the former being typically reported at market value and the latter at nominal value - a different mix of bond and loans in foreign and domestic bank positions might spuriously drive our results.

To address this concern, we use the breakdown between bond and loan in banks’ positions available from Eurostat. Specifically, Eurostat reports positions of monetary and financial institutions (MFI), aggregated at country level, for different asset classes - bonds and loans - and different counterparty sectors - MFIs, government and non-bank private sector. We proxy the ratio of bonds in the portfolios of banks by the ratio of bonds in the portfolios of MFIs.

Unfortunately, Eurostat reports the distinction between bonds and loans only for domestic positions. This leaves us with the option of computing just an upper bound for valuation-induced biases in our results. Specifically, after computing the exact share of bond and loan positions in domestic positions, we assume that foreign banks held government debt only in the forms of bonds. Under this assumption, the artificial increase in domestic to foreign positions would be highest for public debt and lowest (and even negative) for private debt, overstating our results.

Government bond prices in the GIIPS countries declined on average by 33.7% between 2009 and 2011.\(^{47}\) With an average share of bonds equal to 80.9%, this drop in bond prices implies a decline in domestic banks’ positions of public debt of 27.3 due to valuation effects.\(^ {48}\) As the valuation-induced drop in foreign banks’ positions is the entire 33.7% - under the assumption that foreign banks’ holdings of the public debt of crisis countries contain only bonds - the relative increase of domestic banks’ positions of roughly 6.4% \((0.337 - 0.237 = 0.064)\). Compared to the estimated increase of 359% for the relative public debt positions of domestic banks in our baseline specification \((\exp(0.71 + 0.82) - 1 = 3.59, \text{see Table 3, Column I})\), this number indicates a strong “real” repatriation of public debt in crisis countries.\(^ {49}\)

4. **Related Theories**

We regard the conditional correlations presented in the previous section as interesting per se and, in particular, as important for a detailed assessment of the European debt
crisis. They might actually be compatible with various existing theories of sovereign debt crises and encourage novel interpretations of events. In this section, we make a first attempt of interpretation with a brief discussion of the empirical findings in light of relevant related theories. Doing so, we put special emphasis on the secondary market theory, which we deem to be the most successful in explaining the empirical patterns.

### 4.1. The Secondary Market Theory

The secondary market theory of BMV predicts the repatriation of debt when a country enters a sovereign debt crisis: locally issued debt is sold by foreign and bought by domestic investors. Simplifying slightly, its logic runs as follows.

In a sovereign debt crisis, a government becomes more inclined to default on outstanding debt. For fear of default, foreign investors try to sell their bonds on secondary markets. Local investors anticipate that the government will be less likely to default when bonds are held domestically (since the government cares about locals but not for foreigners). Therefore, local investors purchase the bonds offered by foreigners. This change in bond ownership reduces the government's temptation to default (eliminating default risk in the extreme case).\(^{50}\) In sum, in response to an (exogenous) increase in sovereign risk of a country, public debt is repatriated. This prediction corresponds to our first empirical pattern.\(^{51}\)

The secondary market theory can be formalized and read in terms of contract enforcement (instead of outright default decision), in which case it also applies to private debt. In this sense, it rationalizes the repatriation of private debt (the positive coefficient of \(\text{Crisis}_{b,t} \times \text{Own}_{c,b}\) in Tables 3 to 5). However, there are good reasons why the theory plays out more strongly in the data for sovereign than for private debt. First and foremost, the existence of well-established, liquid secondary markets are at the center stage of the secondary market theory.\(^{52}\) As secondary markets for sovereign debt are less fractionalized and arguably deeper than those for the various forms of private debt, the theory is certainly more applicable to sovereign debt. Moreover, the decision to default on outstanding debt is more directly related to the central governing authority of a crisis country than the exercise of influence on the decentralized process of private contract enforcement by an a priori independent jurisdiction through legislation or the potentially illicit exercise of control. Thus, default decisions are less prone to institutional delays, uncertainties and frictions and secondary market mechanisms are more likely to play out in sovereign than in private debt.

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\(^{50}\) The theory is more nuanced than in this simple version. In the Online Appendix we discuss the theory in more detail, including the government's ability to discriminate across creditors and the possibility of a repatriation with a simultaneous increase of equilibrium default probabilities and bond yields.

\(^{51}\) A specific concern may arise when mapping the secondary market theory to data on investment positions. Specifically, one may worry whether debt is reallocated through secondary markets or via maturing debt in combination primary markets. We offer a discussion of this issue in the Online Appendix.

\(^{52}\) BMV write "[a]ll the crucial assumptions directly relate to the workings of secondary markets. Whatever assets exist, it should be possible to retrade them in secondary markets that are competitive and free from government intervention and other trading frictions."
debt positions.\textsuperscript{53} Such considerations suggest that the stronger repatriation of public debt observed during the Euro Crisis is consistent with the predictions of the secondary market theory.

Finally, we take a mildly generalized read of the secondary market theory. In its basic interpretation, local governments have full control on sovereign default and decide by weighing the benefits of local investors only (who have then an incentive to repatriate debt). While this is a good description of many sovereign debt crises, it might not fit the context of the Euro crisis. As shown by the restructuring of Greek sovereign debt, defaults in the Euro Area are the outcome of a process of complex cooperative decision-making.\textsuperscript{54} Within this process, the large and politically influential countries – Germany, in particular – had arguably a higher impact on the outcome. In such a context, the secondary market theory suggests that bond ownership changes through secondary market transactions so that all governments that participate in the default decisions are re-incentivized in favor of honoring debt. In sum, debt of crisis countries should reallocate to those countries, whose governments effectively decide upon repayment. In sum, the part of crisis-countries’ debt, which is not repatriated, is reallocated to politically influential countries within the Euro area. This prediction is confirmed with the third of our empirical pattern.

4.2. Other Theories

In this section, we briefly touch on a number of other theories that relate to our three empirical patterns. We argue that each of them faces problems in explaining the full set of the empirical patterns presented above.

\textit{ECB Interventions.} One may argue that the first two patterns simply capture the effect of policy interventions enacted by the ECB at the height of the crisis. The LTROs, for example, by providing cheap funds to banks against sovereign collateral, raised their incentives to invest in high yield government bonds to exploit a profitable “carry trade.”\textsuperscript{55}

However, all European banks had access to these investment opportunities, yet the repatriation did not occur in Northern Europe. Certainly, banks in crisis countries were relatively poorly capitalized and thus prone to exploit the mentioned carry trade. Yet there was a priori no need to invest in domestic debt – as opposed to risky debt in general, e.g., debt issued by other GIIPS countries. For example, Italian \textit{btp} and

\textsuperscript{53} Also for practical reasons of the estimation procedure, our identification of a crisis through the bond spreads clearly relates more to sovereign defaults (including the observed restructuring) than to the exercise of a government’s influence on contract enforcement.

\textsuperscript{54} See Ardagna and Caselli (2014).

\textsuperscript{55} Acharya and Steffen (2013) 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. 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”.

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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. The estimation results show, however, that such strategies are not evident in the data. The insignificant and sometimes negative coefficient on the interaction term Crisis_{c,t} * Crisis_{b,t} (Tables 2 and 3) suggests that banks in crisis countries did not invest debt of crisis countries in general.

**Moral Suasion.** It is sometimes argued that the increase in local positions reflects “moral suasion”, i.e. the tendency of governments of crisis countries to coerce domestic banks into sovereign bond purchases (Reinhart and Sbrancia (2011) document such practices for the post-World War II period). While explicit financial repression would violate the principle of common markets across European countries, it is still possible that governments exerted an implicit form of pressure on domestic banks to secure their own financing needs. This explanation, however, seems inconsistent with the dynamics illustrated in Figure 4 in Section 2, which show that bond purchases of bank and non-bank domestic investors moved in parallel. To the extent that non-bank investors depend less on governments’ goodwill and regulation, they are less susceptible to corresponding pressures. We argue that these patterns challenge the view that moral suasion is a key driver behind the patterns reported.

**Carry Trades.** Does repatriation simply reflect a reversal of those factors that had led to the financial integration of the Euro area between 2000 and 2007 (see Figure 1)? Hale and Obstfeld (2015) document that the increase in financial integration was fueled by large banks at the core of the Euro area intermediating lending from non-Euro area financial centers into peripheral countries. The authors argue that unique factors such as declining transaction costs, the harmonization of ECB’s collateral rules and a more efficient payment system through the TARGET settlement system generated a comparative advantage for core European banks in lending to the periphery. The latter banks then exploited this advantage, inflating both sides of their balance sheets in a version of carry trade.56

So, can debt repatriation be understood simply as a reversal of the early integration process? On the one hand, we observe that the key factors of comparative advantage remained in place after the outbreak of the Euro crisis, challenging the reading of the observed repatriation of debt as a reversal of the previous factors and incentives. On the other hand, debt repatriation may still have resulted from an unwinding of foreign positions and the tendency towards deleveraging by banks during the Euro crisis. This latter explanation, however, appears to be inconsistent with our third empirical patterns, which shows that the banks in core countries of the Euro area (e.g., Germany) reduced exposure to crisis countries by much less than banks of other countries in the Euro

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56. We notice that a perceived absence of currency risk between the Euro area core and the periphery would hardly induce such a comparative advantage, since the currency risk would re-enter the balance sheet through the funding currency. Also, country risk would not affect the comparative advantage in lending; see Hale and Obstfeld (2015).
area and non-Euro area countries. Overall, severe doubts thus remain regarding the explanation based on the unwinding carry trade.

**Home Bias - Asymmetric Information.** We next examine explanations based on portfolio home bias due to informational asymmetries. 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, if informational asymmetries are likely to worsen in times of uncertainty (Brennan and Cao 1997).

One reading of that theory suggests that, once information asymmetries grow more important, repatriation should be stronger for private than for public debt.\(^{57}\) This prediction is clearly refuted by the data, as our second pattern shows the exact opposite effect. Still, one may suggest that the role of asymmetric information for public debt has become more important relative to that for private debt. As the increase in information asymmetries in crisis countries was pervasive, however, we find it hard to sustain that only a specific class of assets was affected. Therefore, we interpret second pattern as evidence against the view based exclusively on information frictions. In addition, this approach is clearly unable to explain the third pattern.

**Hedging Exchange Rate Risk.** An important class of explanations for portfolio home bias invokes hedging motives. One of the key risks is real exchange risk, which may indeed be hedged with local assets: in order to keep asset returns aligned with (local currency denominated) expenditure, investor might be more willing to invest at home than abroad.\(^{58}\) So, could changes in perceived exchange rate risk have reinforced the home bias and thus explain the repatriation of debt? In a first attempt to address this question,\(^{59}\) we compare our estimation results based on the full set of countries (Table 4 Columns I – IV) and the restricted sample of Euro area countries (Table 4 Columns V – VIII). One might argue that nominal exchange rates are fixed within the Euro area and

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57. This interpretation is conjectured by Brennan and Cao (1997, 2005). 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.

58. Stockman and Dellas (1989) make this argument in a model with tradable and non-tradable goods, showing that a home bias in equities naturally arise since equity returns on local non-tradable goods producers correlate positively with local agents’ expenditure on non-tradable goods. These effects, however, are quite sensitive to preference structures (e.g., Tesar 1993 and Baxter et al. 1998).

59. At first glance, it may seem that the logic based on private equity of (non-tradeable) producers cannot explain our patterns, as repatriation of private debt was less strong than that of sovereign debt. However, Coeurdacier, Kollmann and Martin (2010) and Coeurdacier and Gourinchas (2011) show that portfolio allocation of different asset classes cannot be analyzed separately. Indeed, the hedging properties of bonds and equities depend on the returns from each asset class conditional on the other class’s returns. 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 are used to hedge fluctuations in the real exchange rate, while equities are mostly used to hedge non-tradable income risk, conditionally on bond returns.
(differences in) inflation throughout period of analysis were very small, thus implying negligible exchange rate risks. Based on this view, the very similar estimation results between the full sample and the Euro area sample suggest that exchange rate risk was not a major determinant of debt repatriation.

One problem of this line of argument, however, is that the stability of the Euro area was not regarded as certain in 2010 and 2011 and exit scenarios of some countries would imply potentially large revaluation risks. In that case, revaluation risks (as a specific form of exchange rate risk) may have induced the observed repatriation of debt. We assess this potential channel in two ways. First, we observe that individual banks seemed to discount the likelihood of a breakup of the Euro area as close to zero, in which case the comparison above should be valid. But such anecdotal evidence may appear weak. Indeed, a number of exit scenarios were extensively discussed at the time, including various exits combinations of crisis countries or some Northern European countries. Since accounting for all of these scenarios is clearly beyond the scope of this paper, our second way to address the issue is by considering the scenario that was arguably the most likely one: a Greek exit. Specifically, if we exclude Greece as a borrower country from the regressions, the according coefficients indicating debt repatriation must be much lower if hedging of revaluation risk was a key driver of the debt repatriation. This is not the case, as shown in Table B.7 of the Online Appendix, which excludes Greece as a borrower in estimations otherwise identical to Table 3. In most specifications (except Column VII and VIII), the coefficients indicate repatriation of sovereign debt to a very similar extent as Table 3.

Finally, we point out that hedging exchange rate risks has been shown to have rather limited explanatory power in explaining the home bias (e.g., Lewis 1999 and Pesenti and van Wincoop 2002) and thus does not seem able to provide an entirely convincing explanation for our first two empirical patterns.

Overall, it seems that, while hedging exchange rate risks cannot be clearly dismissed as an explanation for the first and second of our empirical patterns, there are good reasons why the effect of these hedging motives are not dominant drivers of the repatriation of debt documented above.

Hedging Nontradable Income Risk. Another prominent hedging motive relates to 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.

At first sight, this argument has little bite in the context of the Euro crisis, since the downside risks of labor income increased severely in crisis countries, as documented by the Greek unemployment rates (7.7% in 2008 to 24.2% in 2012) and male youth
unemployment (17% in 2008 to 48.4% in 2012 according to the World Bank) and substantial declines in real wages (-13.3% in constant 2013 Euro according to the OECD). In view of these data, it seems that labor income must be expected to fall precisely when domestic sovereign bonds are defaulted on, making the latter a terrible hedge.

However, the related hedging motives cannot be dismissed that easily, as incomes net of taxes need to be considered. Indeed, repayment of sovereign debt implies a transfer from the domestic taxpayer to the creditor, while an implicit transfer in the other direction occurs under default. Abstracting from default costs (and other risks), the taxpayer is thus indifferent between repayment and default whenever she owns all domestically issued debt obligations. In other words, she is perfectly insured by holding the locally issued bonds. To convincingly assess and quantify the related effects is demanding, if at all possible. One would need to compare, for instance, the change in net labor income between crisis countries that defaulted and crisis countries that honored their debt, while controlling for all relevant country characteristics and external factors. Such an exercise is clearly beyond the scope of the present paper. Instead of going down that route, we point out that existing empirical evidence in favor of hedging income risk as a motive of the home bias is mixed at best. While some studies present evidence for a negative (conditional) correlation between labor income and local equity (see Julliard 2002 and Coeurdacier and Rey 2011), severe doubts remain concerning the importance this explanation and the size of its impact (see Massa and Simonov 2006 and Coeurdacier and Rey 2010). Since this hedging explanation has limited force to generate a home bias, it will hardly serve as a key determinant of the mayor shifts in home bias, which the documented repatriation indicates.

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62. More generally, Mendoza and Yue (2012) show that default events are associated with a drop in employment of about fifteen percent relative to pre-crisis levels. These authors compare the level of unemployment in the year of default with the level of unemployment three years before the default. Sandleris and Wright (2011) show that periods of crisis are associated with a substantial drop in total factor productivity and aggregate wages, which reflect in particular a misallocation of labor across industries.

63. Berriel and Bhattarai (2013) apply this logic to show that a natural home bias in emerges in nominal sovereign bonds, as agents try to hedge against otherwise uninsurable inflation risks. In such a setup, nominal domestic sovereign bonds give high real returns precisely when the tax burden is heavy and vice versa.

64. Under full insurance, the agent is indifferent between the states of the world. Indifference can be understood as a version of the Ricardian equivalence: the representative agent’s income is the same under a tax-saving default and repayment to herself through taxation.

65. Coeurdacier, Kollmann and Martin (2010) and Coeurdacier and Gourinchas (2011) argue that portfolio 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 especially strong repatriation of sovereign debt in crisis countries cannot be explained by hedging of non-tradable income risk.

66. Finally, sovereign debt may be repatriated because of the following argument. Suppose that local banks inevitably go bankrupt in the turbulence of a sovereign default. In that case, domestic banks are prone to invest in government bonds under looming sovereign default, since gains are high when default
5. Conclusion

The fragmentation of European financial markets during the Euro Crisis has troubled policymakers. Disintegrating markets, an argument runs, threaten the efficient allocation of capital and a proper transmission of a common monetary policy (see ECB 2012). Using bank balance sheet data, this paper has uncovered three empirical patterns that drove this financial fragmentation. First, debt obligations of countries that entered an acute state of crisis were unwound by foreign investors and purchased by domestic investors – a phenomenon, which we refer to as repatriation of debt. Second, while there was a tendency to repatriate private and sovereign debt, the phenomenon was especially strong for public debt. Third, the share of crisis countries’ public debt that was not repatriated was reallocated to large Euro Area countries with higher political weight. These patterns survive when controlling for a wide range of country-specific effects and trends in a large number of specifications.

We have discussed these empirical findings in light of various theories. In our view, the most successful theory in explaining the full picture of empirical patterns is the secondary market theory, recently proposed by Broner, Martin and Ventura (2010). Starting from the common premise that sovereigns care more about domestic than foreign creditors, the theory predicts that an adverse shock to the government’s temptation to default is associated with a repatriation of debt. Domestic investors rationally buy sovereign bonds from foreign investors, knowing that the government will be re-incentivized to pay back its debt as the repatriation proceeds. This theory thus predicts that public debt flows back to the originating country when a default is looming. Provided that enforcement problems and strategic default are less severe in the case of private debt, it also predicts a stronger repatriation of public debt compared to private debt. Finally, extending the logic to a collective choice setting, the theory predicts that debt of crisis countries should flow to all countries that participate in the default decision. These predictions match the patterns of our empirical analysis.

Read through the lens of the secondary market theory, the financial fragmentation reflects the rational response of investors to adverse shocks to sovereign solvency. This interpretation offers a comforting outlook, suggesting that the financial disintegration may reverse as soon as risks of sovereign defaults abate.

is avoided and losses occur when bankruptcy is anyway unavoidable. (This distortion is at the basis of Livshits and Schoors 2009, who analyse the deficiencies of prudential regulation.) We believe that the trends of repatriation by non-bank investors, which illustrated in Figure 4, speak against this view.
## Appendix

### Table A1. Foreign Assets of Local Banks – Summary Statistics

<table>
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<tr>
<th>Country</th>
<th>Mean IFS</th>
<th>Mean BIS</th>
<th>St.Dev. IFS</th>
<th>St.Dev. BIS</th>
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Banks' claims to non-residents (Monetary and Financial Statistics, 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. Logged data.
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