Is small beautiful? The resilience of small banks during the European debt crisis

Is Small Beautiful? The Resilience of Small Banks during the European Debt Crisis

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Abstract

We examine the lending behaviour of small and large banks in the Eurozone during the sovereign debt crisis. Relative to large banks, small banks are less pro-cyclical in that they exhibit more stable lending growth across credit expansion and contraction periods. In peripheral countries, the portfolio rebalancing of small banks towards higher public debt (substitution effect) does not appear to cause a reduction of their lending to the private sector. Instead, the level of public debt seems to provide a liquidity buffer that influences bank-specific loan growth positively (complementarity effect), particularly during market-wide lending contractions. Our findings show that for small peripheral banks the substitution effect found in the literature can coexist with a complementarity effect when public debt grows faster than private loans. Our analysis contributes to the ongoing debate on the regulatory treatment of public debt in banks and supports incentives embedded in new banking regulation that penalise bank size.

JEL Classification: G01, G10, G21, G28

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1. Introduction

The European debt crisis[1], erupted in the wake of the Great Recession in late 2009, was characterised by an environment of accelerating levels of government debt and increasing government bond yields. One of the main causes of the debt crisis was that several European governments were forced to rescue troubled banks (Acharya et al. 2014). This led to a substantial increase in national debt burdens (IMF 2009). As banks absorbed higher levels of government debt, the balance between bank lending to the private and public sectors and its consequences for economic growth became the subject of much debate.

Several hypotheses have been developed to explain the relationship between banks' sovereign debt holdings and loan growth. The moral suasion hypothesis, documented by De Marco and Macchiavelli (2016), Ongena et al. (2016) and Becker and Ivashina (2018), suggests that when sovereign risk increases and government financing becomes costlier, governments may persuade the local financial sector - especially large domestic banks - to absorb more government debt. If the financial sector cannot raise additional funds to purchase government debt, these purchases may be made at the expense of other investments, such as retail and corporate loans. Furthermore, the regulatory arbitrage hypothesis suggests that given the regulatory capital treatment of sovereign debt, banks may realise higher yields and benefit from lower capital requirements by shifting from bank loans to risky government debt (Acharya and Steffen 2015). Banks willing to take on higher levels of risk may adopt this risk-shifting strategy to improve their chances of survival (Diamond and Raja 2011; Broner et al. 2014; Acharya and Steffen 2015; Crosignani 2015; Drechsler et al. 2016). A further link between sovereign debt exposure and bank loans may arise as a result of the marking to market of government debt, as discussed by Altavilla et al. (2017) and De Marco (2019). Specifically,

[1] For a comprehensive survey of previous studies on the European Sovereign Debt Crisis see Moro (2014) and Gruppe et al. (2017).

when sovereign bonds depreciate as credit spreads rise, banks suffer book losses that may further affect their ability to lend.

In this work we analyse a sample of 25,518 bank-year observations from 10 Eurozone countries over the period 2007 – 2015. We quantify the impact of banks' exposure to sovereign debt on loan growth. To explore the potential heterogeneity of this relationship we segment our sample by bank size , stages of the credit cycle and geographical regions with different risk profile, that is, Europe's core countries (Germany, France, Netherlands, Austria and Belgium) and Europe's periphery (Greece, Italy, Ireland, Portugal and Spain or GIIPS).[2] We find strong evidence that the level of bank's government bond holdings can contribute positively to loan growth in small peripheral banks both during credit expansion and contraction periods.

This study contributes to the literature in two ways. First, we add to previous research that mainly focuses on large banks and does not capture the interaction between public and private debt holdings that is specific to small banks. Understanding the asset allocation strategy of small banks is important. While it is true that the overall market share of small banks may not be prominent,[3] they are believed to play a critical role in the economy as they represent an important source of credit for small businesses (Sapienza 2002; Berger et al. 2005; Mian 2006). For this reason, we provide an extensive comparison of the determinants of bank lending for different bank sizes. This is particularly relevant in the light of new bank regulations that penalise large banks (i.e. through capital add-ons applied to systemically important institutions as well as by the ring-fencing of trading from retail operations[4]) and may lead to a banking system with fewer large players and more small-to-medium ones. Interestingly, Vallascas and

[2] In the paper we have adopted a distinction between peripheral and core European countries that is common in the European sovereign debt crisis literature (see, for example, Acharya and Steffen 2015, BenSaïda 2018 and De Marco 2019).
[3] In our sample, the aggregated loan provided by small banks is around 10% of the total.
[4] Provisions to ring-fence risky activities were included in the 2010 Dodd-Frank Wall Street Reform and Consumer Protection Act in the US, the UK's 2011 "Vickers Report" and the EU's "Liikanen Report" on Bank Structural Reform.

Keasey (2012) show that restricting the size of banks can reduce both the default risk of individual banks and their contribution to systemic risk.

Previous literature shows the presence of *substitution* of private debt with public debt in European banks (Gennaioli et al. 2014; Popov and Van Horen 2015; Abbassi et al. 2016; Altavilla et al. 2017; Becker and Ivashina 2018; De Marco 2019). We confirm the substitution effect for peripheral banks. Their average loans to assets ratio falls from before the government debt crisis to the sovereign crisis period and, at the same time, the average government debt to assets ratio increases (Table 1). However, while for large peripheral banks the increased exposure to government debt is accompanied by negative loan growth over the sovereign debt crisis, for small peripheral banks loan growth remains positive. This suggests that (a) a higher level of government debt does not necessarily lead to loan contraction and (b) a substitution effect in which the relative weights of loans and government debt move in opposite directions can coexist with a *complementarity effect* whereby the level of government debt and loan growth are positively related. Such *coexistence* materialises when both government debt and loans have positive growth but the former grows faster than the latter. Complementarity may arise as public debt holdings can increase the asset liquidity of banks and hence give them more confidence to lend, or limit lending contractions, in recession periods. Stronger propensity to lend may result from the higher protection such liquidity offers against funding liquidity shocks and runs. Indeed, the positive relationship between sovereign holdings and loan growth seems to be more often significant in contractions periods than in expansions. The liquidity effect of government debt may be stronger for small banks as they typically have more restricted access to other sources of liquidity, such as the interbank market, relative to large banks (Cocco et al 2009). Incidentally, the improved resilience to liquidity shocks is the intended outcome of new

liquidity requirements introduced by Basel III regulation.[5] Regulators have also recently decided not to discourage bank holdings of sovereign debt by refraining to increase sovereign debt risk weights for regulatory capital purposes (Basel Committee, 2017).

To our knowledge, the work of Albertazzi et al. (2014) on Italian banks is the only paper to date that has compared large and small banks in terms of the interaction between sovereign risk and bank lending. They find that large banks are more affected by changes in sovereign risk. Our study differs from their approach in several respects. While Albertazzi et al. (2014) focus solely on sovereign risk, we also consider bank-specific exposure to sovereign debt. We use a rich database from the European Banking Authority (EBA) for large banks and the Bureau van Dijk (BvD) Bankscope for large and small banks. This enables us to capture cross-sectional variations in sovereign exposure, which we find to be highly significant in explaining bank lending patterns. In addition, we extend our analysis beyond the Italian market to include a broad sample of Eurozone banks. We also look at the rise and peak of the sovereign debt crisis, and the following recovery phase, which are characterised by a remarkable growth in small banks' exposure to sovereign debt in peripheral countries (see Figure 1).

In a number of previous studies on the substitution effect generated by public debt holdings (Popov and Van Horen 2015, Altavilla et al. 2017, Acharya et al. 2018, Becker and Ivashina 2018 and De Marco 2019) bank lending is measured using data on syndicated loans to large firms or loans to non-financial corporations. In contrast, we measure bank lending in terms of total loans to the non-financial private sector. We do so by combining loan data from BvD Bankscope at the bank-level and from the ECB (European Central Bank) Statistical Data Warehouse at the country-level. The non-financial private sector includes both non-financial

[5] See Liquidity Coverage Ratio and Net Stable Funding Ratio in Basel Committee (2011) and Kinateder (2016) for a comparative assessment of the minimum capital requirement in Basel II and Basel III.

corporations and households. We are thus able to explore comprehensively the relationship between banks' sovereign bond exposure and their total lending.

Our second contribution relates to our analysis of bank lending behaviour over the sovereign debt crisis. We show that small banks generally exhibit more stable lending over expansion and contraction periods which makes them less pro-cyclical than large banks (see Figure 2). This implies that small banks appear to be less prone to contribute to a credit crunch in recessions. This confirms previous findings. Deyoung et al. (2015) suggest that pro-cyclical lending behaviour can be moderate in small US community banks if they are strategically committed to relationship-based lending to small businesses. Further, Berger et al. (2017) show that small US banks have a comparative advantage in alleviating the financial constraints of small businesses and that this advantage tends to be greater during crisis periods. In a recent paper, Levine et al. (2020) show that the negative impact of COVID-19 on local small firms is limited in areas with a larger proportion of small banks. Differently from previous work, our study focuses on the sovereign debt crisis and the interaction between bank lending and sovereign default risk. Indeed, we document important dissimilarities in bank behaviour not only in relation to bank size but also between core and peripheral countries which are characterised by different levels of sovereign distress.

Our work relates broadly to the literature on the sovereign–bank 'doom loop'. This term refers to the destabilising link generated by potential default risk spillovers between banks and sovereigns through banks' government bond holdings (Cooper and Nikolov 2013; Farhi and Tirole 2014; Acharya et al. 2014, and Brunnermeier et al. 2016). We observe a dramatic increase in sovereign debt holdings in the banking sector, especially among small banks in peripheral countries, which may exacerbate doom-loop effects. This scenario could have serious implications for financial stability in case of future shocks to sovereign debt yields.

In Section 2 of the paper, we present the data and some stylised facts. In Section 3, we introduce the empirical model. In Section 4, we present our results. Section 5 concludes the paper.

2. Data and Stylised Facts

Sovereign debt exposure data are collected from two data sources, the EBA for large banks and BvD Bankscope for large, medium and small banks. For large European banks, which participated in European stress tests and risk assessments between 2010 and 2015, we collect end-of-year bank specific sovereign exposures, detailed at the country level, that are made available by the EBA.[6] To be included in our "large bank" sample, a bank should be headquartered in any of the 10 countries considered in our analysis, participated at least twice in any EBA tests or assessments in different years, and had an average asset size of 20 billion euro over the sample period.[7] Seven out of 94 banks were excluded because they were too small or only participated once in the tests. Thus, our sample includes 87 large banks.

With the exception of the country-specific sovereign debt exposures for each large bank, all other bank-level variables for large, medium and small banks were sourced from BvD Bankscope. We also collected aggregated sovereign-exposure data for all banks from BvD Bankscope, which are used in most of our analysis. We employ EBA detailed sovereign data in robustness tests to distinguish between domestic and foreign government debt exposures.

[6] The 2009 country-specific end-of-year sovereign debt exposures are extrapolated from the March 2010 and December 2010 stress tests, the first two to be done by the EBA. The sovereign exposures in March 2010 are not as granular as in later stress tests as they combine both sovereign securities and sovereign loans. Since, in our regression analysis to measure substitution and complementarity effects we focus on banks' sovereign securities holdings, we approximate each bank's country-specific sovereign securities for the March 2010 stress tests by using the aggregate share of sovereign securities over sovereign loans at the country level as provided by the European Central Bank **(https://sdw.ecb.europa.eu/browse.do?node=9691315 XYZ please provide website details).** This is done under the assumption that each bank's share of sovereign securities over sovereign loans is equal to that of its home country's banking sector.

[7] We adopt the threshold between "mid-size" and "mega" banks in Rosen (2007) which uses $20bn of total assets. We employ the same amount but expressed in Euros.

In our analysis, we split the sample into three sub-groups of different bank sizes: large banks (as defined above); medium banks, with average assets over the sample period between 2 billion and 20 billion euros; and small banks, with average assets below 2 billion euros.[8] Alternative size thresholds have been used in robustness tests.

Summary statistics of our data are reported in Table 1. We compare large banks versus small banks in core countries and peripheral countries separately. The sample period is divided into periods 2007–2009 and 2010–2015, denoting the subprime crisis and the European sovereign debt crisis respectively. We observe that relative to large banks, small banks exhibit more stable and less pro-cyclical lending behaviour (Panel A). This behaviour is characterised by weaker loan growth for small banks relative to large banks during the expansion period that preceded the peak of the subprime crisis, with a statistically significant median difference of 4.5% for core countries and 2% for peripheral countries. During the sovereign crisis, the trend is reversed with small banks exhibiting stronger loan growth than large banks and a statistically significant median difference of 3.3% between the two size groups in both core and peripheral countries. However, while in core countries both large and small banks have positive growth, in peripheral countries only small banks remain in positive territory with a median loan expansion of 1%. By contrast, large peripheral banks show a significant credit contraction with a negative median growth of –2.3%. Figure 3 illustrates these findings in more detail with a breakdown by year. The first two years of the subprime crisis are characterised by strong expansion of lending by large European banks, with a sharp contraction only in 2009 following Lehman's default. For large banks, negative loan growth can be seen during the years of the sovereign debt crisis, especially in peripheral countries. In contrast, the median small bank in core countries exhibits steady loan growth throughout the observation period. The median small

[8] Deyoung et al. (2015) define small banks as those with total assets below $2 billion. Similarly, we set the threshold between small banks and medium banks at 2 billion euros.

bank in peripheral countries shows greater loan growth variability over time, and has a modest loan contraction in 2013 and 2014.

A possible explanation for the ability of small banks to lend during the sovereign debt crisis is that they expected lower losses than did large banks from their loans. This inference is supported by the lower credit risk, measured by loan-loss provisions, in small banks during the crisis (Table 1, Panel H). The median large core bank has 2.1% higher provisions than the median small core bank, whereas for peripheral banks there is a more pronounced deviation of 5.6%. Both differences are highly statistically significant. The lower credit risk of small banks might be related to their relationship lending model (Albertazzi et al. 2014), the related soft information they can gather about their borrowers (Cotugno et al. 2013; Deyoung et al. 2015; Sette and Gobbi 2015) and their stronger risk aversion (Deyoung et al. 2015).

The notion that sovereign debt holdings crowded out lending to the private sector during the sovereign debt crisis finds strong support in the literature (Altavilla et al. 2017; Becker and Ivashina 2018; De Marco 2019). Our results in Table 1 Panel B, confirm previous findings, but only for peripheral banks where we detect (relative) substitution effects. Large peripheral institutions saw a median contraction of the proportion of loans to total assets from 67.3% during the Great Recession to 62.9% in the sovereign debt crisis period. In small peripheral banks the fall was even more pronounced from 64.5% to 56.6%. Instead in core countries, both small and large banks show an increase in the proportion of loans to total assets when comparing the two sub-periods. Substitution is further confirmed for large peripheral banks when we look at Panels A and C in Table 1. From the subprime to the sovereign crisis, median loan growth declines from 7.3% to -2.3% while the stock of government debt goes in the opposite direction from 3.9% to 11.2%. However, small peripheral banks exhibit a completely different pattern. While loan growth declines from 5.3% during the subprime crisis to 1% over the sovereign debt crisis, it still remains positive. Sovereign debt holdings increase from 9.1%

to 15.9% which is the highest level across all region-bank size groups. In other words, a median increase in government debt was accompanied by a median increase, though weaker, in loan growth, which denote complementarity, in addition to relative substitution, between the two asset classes. Bank funding may explain this result (see Table 1, Panels E and F). For example, around 2011, small peripheral banks experienced a drop in retail deposits (Figure 4), probably due to sovereign risk and government-bond yields reaching their highest level in the observation period. However, they were able to attract considerable wholesale funds that more than compensated for the contraction in deposits (Figure 5) and caused a large increase in overall short-term funding (+21.4%)[9]. Such patterns likely reflect the fact that the ECB conducted the two largest long-term refinancing operations in December 2011 and March 2012 (Figure 6). The size of these operations was 489 billion and 529 billion euros, respectively, and they were extended to 523 banks in 2011 and to 800 banks in 2012; the interest rate was relatively low (1%) and maturity was up to 3 years.[10,11] To prevent reputational damage, the ECB does not disclose the identities of the banks that borrowed. However, according to Van Rixtel and Gasperini (2013), around 60% of the long-term refinancing operation (LTRO) funds were borrowed by banks in peripheral countries, especially Italy and Spain.

Finally, one of the main objectives of new banking regulations introduced with Basel 3 following the subprime crisis was to require banks to be better capitalised (BCBS 2011). This was achieved through higher risk-adjusted capital ratios and a leverage cap. It is interesting to note that on both counts, smaller banks in crisis-hit peripheral countries did better than large

[9] Wholesale funding in BvD Bankscope includes wholesale deposits and any other short-term funding with a maturity up to 1 year.

[10] "For some banks, the ECB funding comes with interest rates more than three percentage points lower than they could obtain on the open market". – The Guardian (https://www.theguardian.com/business/2011/dec/21/eurozone-banks-loans-ecb). The maturity of LTROs ranged from 3 months to 3 years. For more details: see https://www.ecb.europa.eu/press/pr/date/2011/html/pr111208_1.en.html

[11] Quantitative easing (QE) may impact bank lending through not only the funding channel but also the sovereign debt holding channel. For example, Kinateder and Wagner (2017) show that QE helped to decrease yield spreads for sovereign bonds of European monetary union countries.

banks. Specifically, small banks' leverage was lower, with a 7.1% and 5.5% median difference in the subprime and sovereign debt crisis periods, respectively; their median tier-1 capital ratio was 4.9% higher in the sovereign debt crisis (Table 1, Panels G and I).

To test the stationarity of our variables in our analysis, we conduct Fisher-type panel unit-root tests over the whole sample period. None of the variables contains unit roots. Results are reported at the end of each panel in Table 1.

3. Panel Regression model

For the main analysis, we employ the following baseline regression:

$$\Delta \ln(loan)_{i,t} = \alpha_0 + \gamma_1 \cdot SOV\_ALL_{i.t-1} \cdot Expansion_t$$

$$+\gamma_2 \cdot SOV\_ALL_{i.t-1} \cdot Contraction_t + \beta' X_{i,t-1} + \theta_i + \delta_{c,t} + \varepsilon_{i,t} \qquad (1)$$

The dependent variable is the annual growth rate of loans to the private non-financial sector for bank *i* at time *t*. The variable is obtained from "Gross Loan" in the BvD Bankscope database, which covers all loans provided to the non-financial sector but includes government loans (and excludes government bonds). Therefore, we need to adjust this variable in order to obtain a measure of lending to the private sector. To do so, we use country-level data from the ECB to calculate the ratio of loans to the non-financial private sector over the sum of loans to the non-financial private sector and to governments, for each country-year in the sample. The "non-financial private sector" includes loans to households and corporates. Then, we multiply the original variable ("Gross Loan") by this ratio. This adjustment has a marginal effect on our regression results because government loans are a small proportion of the loans to the non-financial private sector (about 10%) and their aggregate amount does not fluctuate much over the sample period.

The term SOV_ALL denotes a bank's sovereign debt securities exposure divided by total assets. To account for the differential impact of sovereign exposures on loan growth during

lending expansion and contraction periods we follow an approach similar to Pettengill, Sundaram and Mathur (1995) and introduce two dummy variables: *expansion* and *contraction.* These equal 1 if the total loans provided by all the banks from the same country (without the contribution of bank *i*) in year *t* is higher (expansion) or lower (contraction) than the total loans of year *t*-1. Then, we interact these two dummy variables with the lagged value of SOV_ALL. In the regression we also employ three bank-level explanatory variables, denoted by the vector X: the log of total assets (SIZE); the loan loss provision divided by total equity (LLP/TE); and the growth rate of funding sources, including retail deposits, total short-term and wholesale funding (Δln(DEP&ST)).

We estimate equation (1) using a panel regression with fixed-effects at the bank level (θ_i), which control for unobserved bank characteristics. We also include *Country*Year* ($\delta_{c,t}$) fixed effects to control for unobserved country-specific and time varying factors, such as bank-loan demand and local market conditions. Standard errors are heteroscedasticity-robust and clustered at the bank level using the White (1980, 1982) approach. To mitigate potential endogeneity concerns, all explanatory variables are lagged by a year, except the contemporaneous expansion and contraction dummies. Bank-specific variables are winsorised at the 1st and 99th percentiles in each of the six bank groups we consider.

4. Results

In this section, we discuss the results of our analysis of substitution and complementarity between private sector loans and government exposures. In the literature, the impact of sovereign debt holdings on loan growth is analysed through two distinct approaches. On one hand, researchers have focused on the 'balance sheet effects' of sovereign debt holdings where the *level* of sovereign exposure is deemed to affect lending (Popov and Van Horen 2015; Becker and Ivashina 2018). The other strand of research focuses on the return generated by

sovereign exposures, rather than their level, and its influence on lending, which we call 'profit and loss effects' (Altavilla et al. 2017; De Marco 2019). Below, we explore both types of effects.

4.1 Balance sheet effects of sovereign debt on lending

Table 2 presents the results for the baseline regression. To help the comparison of the coefficient of the variable of interest SOV_ALL across regressions for different bank sizes and country groups we adopt two approaches. First, we follow Ben-David et al. (2018) and standardize both the dependent variable and the key explanatory variable, SOV_ALL, by subtracting their mean and dividing by their standard deviation. Results are reported in Panels A and B in Table 2. Next, we use a fully nested model in which we combine all banks across all countries. In the nested model, we measure bank size and country group effects through the use of size (large, medium, small) and country group (core, peripheral) dummies (Table 2 Panel C). Both methods lead to similar findings.

With the first approach we can see that the coefficients for SOV_ALL*Expansion and SOV_ALL*Contraction are positive and highly statistically significant only for small peripheral banks. This confirms the presence of strong complementarity between sovereign exposures and loan growth during both expansion and contraction periods. In other words, small banks appear to expand or contract their balance sheets by making same-direction adjustments across asset classes over the lending cycle. The most noticeable difference in the results obtained from the nested model in panel C is that the low statistical significance of SOV_ALL for medium peripheral banks in a contraction period detected with the non-nested model (model 2 Panel B) now becomes highly significant. This suggests that complementarity may also occur in mid-sized banks when credit in the economy declines and confirms that there is a clear divide between large banks and smaller banks. As a robustness test, we have tried different bank size thresholds and our results are confirmed (Appendix A).

The control variables in our baseline regression are not always statistically significant. However, when they are significant, their behaviour agrees with our expectations. Specifically, other things being equal, (1) larger banks in each size group tend to display lower loan growth, which is in line with Altunbas et al. (2009) and Ehrmann et al. (2001); (2) higher credit risk, as measured by loan-loss provisions, is associated with lower loan growth; and (3) higher short-term funding growth is positively related to loan expansion.

We further explore the strong complementarity effects noted among small banks in peripheral countries, by comparing the characteristics of small institutions with high sovereign debt exposure against those with low exposure. The purpose is to identify factors that may determine sustained levels of loan growth in a crisis, beyond those inferred from Table 1 where we compared this group of banks with larger banks. We split the sample of small peripheral banks into top and bottom sovereign exposure quartiles. Results are reported in Table 3. The top quartile shows a high proportion of average (median) sovereign debt over total assets during the sovereign debt crisis, at 32.5% (32.0%). This figure is 32.1% (32.0%) higher than that related to the bottom quartile. Furthermore, we observe large and statistically significant differences in loan growth between the two quartiles. The top quartile exhibits an average (median) loan growth rate of 25.0% (17.1%), which is 25.8% (19.9%) higher than that of the bottom quartile. This suggests substantial differences within the small peripheral bank sample, with the complementarity effect being far stronger for institutions having higher sovereign debt exposure. This finding points to a pronounced expansion of the balance sheet among those banks during the sovereign crisis.

As shown in Table 3, rapidly expanding banks are characterised by lower leverage, better funding growth, and higher tier 1 ratio.[12] All these findings lend support for the provisions in

[12] A higher tier 1 ratio having a positive influence on the lending growth of small banks in a crisis is also documented by Košak et al (2015) during the Great Recession.

new banking regulations that were designed to make banks more resilient and less prone to lending contractions during a crisis. Accordingly, the Basel 3 agreement introduced higher capital charges across all banks, an additional capital charge for systemic banks to penalise size, and restrictions on leverage (BCBS 2011). However, the reliance of small peripheral banks on short-term funding and their large sovereign debt exposure may raise concerns. Indeed, Basel 3 also introduced tighter liquidity requirements that aim to constrain banks' dependence on short-term funding, unless it is compensated for by a commensurate level of short-term assets to absorb potential funding shocks (BCBS 2011).

4.1.2. Loan overhang effects

Deyoung et al. (2015) report that a bank's existing loan level can negatively affect future loan growth. This is because regulatory capital requirements mean that larger loan books absorb more equity capital. We aim to take this loan overhang effect into account and determine whether the loan-sovereign debt relationships reported in Table 2 still hold. However, the level of loans in the balance sheet is bound to be strongly negatively correlated with the contemporaneous level of sovereign debt, when both variables are measured as proportions of total assets (see Table 4). As the proportion of total assets captured by one asset class increases (e.g. from 30% to 40%), the proportion represented by the other asset classes will fall (in this example, from 70% to 60%). To avoid the interference of this mechanical relationship, we first orthogonalised loans over total assets with respect to sovereign debt over total assets. We extend the orthogonalisation to all other explanatory variables, to prevent indirect feedback effects on the sovereign exposure coefficients. The results are reported in Table 5. Because the loans over total assets variable is orthogonalised, the coefficients of all other variables do not change relative to those reported in Table 2. However, their significance could change. We note that changes in significance are minimal, which confirms our previous conclusions. Loan

overhang effects are present and strongly significant in all specifications of the non-nested (Panels A to C) and nested models (Panel D), which is in line with the findings of Deyoung et al. (2015).

4.1.3. The effect of funding on peripheral banks' balance sheets

In the previous sections, we showed that balance sheet-based complementarity was strongly significant among small banks in peripheral countries. The implication is that higher sovereign debt exposure leads to higher loan growth in those banks. In this section, we investigate how the expansion and contraction of these asset classes can be explained through short-term funding adjustments. For comparison, we extend the analysis to all sizes of peripheral banks. Our findings are reported in Table 6. The results show that there may be a funding channel that explains the complementarity between sovereign exposure and loan growth in small peripheral banks. Indeed, sovereign exposure growth and loan growth are positively related to deposit growth and the relationships are statistically significant (models 2 and 4). In other words, small peripheral banks react to changes in deposits by making same-direction adjustments to both lending and sovereign debt holdings. This simultaneous effect on government debt and loan growth is not detected in banks of large and medium size. However, in medium sized banks there is a statistically significant positive relationship between deposits growth and loan growth (model 2). The importance of deposits in stimulating loan growth in small banks is probably driven by risk aversion, as deposits tend to be a more stable source of funding than other short-term liabilities. As a result, they may be deemed to be more suitable to support lending expansions. This is also consistent with new liquidity regulation in which (retail) deposits rank just below equity capital as a stable source of financing.[13] Similarly, the stability of deposits as

[13] See BCBS (2014), Table 1, p. 6.

a source of financing, may have encouraged small banks to shift their lending away from the short-term interbank market (e.g. towards higher yield longer term loans and government debt) as suggested by the negative a highly statistically significant coefficient of deposit growth in model 3.

4.1.4. Domestic versus foreign sovereign debt holdings among large banks

We further test the robustness of the complementarity effects detected in Table 2 by separately looking at the influence of home and foreign sovereign exposures on loan growth. As shown in Figures 8 and 9, the evolution of home versus foreign debt, and safe versus risky debt, in banks' balance sheets exhibit different patterns for each group of countries. For instance, large banks in both core and peripheral countries developed a strong home bias in their sovereign bond portfolios (Figure 7). Core banks showed fluctuating exposure to risky GIIPS countries, whereas safer investments in German and French bonds steadily increased over time (Figure 8). Here, our analysis is limited to large banks and the 2010–2015 period. The reason is that granular data on sovereign debt is available only for large banks that participated in EBA stress tests, which began only after the subprime crisis.[14] Results are shown in Table 7. It turns out that the findings in Table 2 (for total sovereign exposures) conceal a more complex pattern. A weak complementarity effect of home debt exposures emerges for large peripheral banks during contraction periods. The effect has stronger statistical significance both in lending contractions and expansions for foreign debt exposures. However, given the substantial home bias and the marginal role played by foreign debt exposures in large

[14] As bond yields needed in later analysis are not consistently available for all EEA30 countries covered in the EBA sample, we only consider sovereign exposures to the 10 countries in our sample. Such restriction should not alter our conclusions, as the aggregated sovereign exposure held by our sample banks towards the included countries represents at least 85% of their total exposure to EEA30 countries.

peripheral bank portfolios, as shown in Figure 7.B, this result does not appear to be economically significant.

4.2. Profit and loss effects of sovereign debt on lending

In this section, we consider the profit and loss effects of sovereign debt holdings on loan growth. We measure the profit and loss impact of a bank's sovereign debt portfolio by employing a marked-to-market loss definition, as in De Marco (2019) and detailed in Appendix B. An increase in the yield of sovereign debt holdings causes a loss to the bank. Although the bonds may be held to maturity, the unrealised marked-to-market losses can still affect bank lending (De Marco 2019). We employ panel regressions to investigate the impact of banks' sovereign debt portfolio losses on loan growth for large, medium and small banks. In line with Altavilla et al. (2017), we assume two alternative debt maturities, namely 5 years and 10 years, and report the results for each. As we lack a breakdown of sovereign exposure by country of issue for medium and small banks, their portfolio losses are estimated under the assumption that sovereign holdings are primarily domestic bonds. This appears to be an acceptable approximation, considering the substantial home bias observed in large banks, particularly in peripheral countries (Figure 7). We consider four different domestic vs foreign sovereign debt combinations, namely, 100% domestic, 90% domestic and 10% foreign, 80% domestic and 20% foreign, and 70% domestic and 30% foreign.

Results are reported in Table 8. We can see that, whenever the coefficients of portfolio losses (LOSS_ALL) interacted with credit cycle and bank size dummies are statistically significant, they are negative, as expected. This indicates that (unrealised marked-to-market) sovereign debt portfolio losses have a negative impact on banks' loan growth. Furthermore, the fact that statistically significant coefficients are only found in credit contraction periods suggests that sovereign debt portfolio losses may negatively influence not only bank specific

but also aggregate lending patterns. It should be noted that a negative relationship between sovereign debt losses and loan growth may be consistent with both substitution and complementarity. Indeed, a negative coefficient implies that higher losses may lead to lower lending (substitution), while sovereign debt value appreciations – or negative losses – would lead to lending growth (complementarity).

In Appendix C we exploit the country breakdown of sovereign debt exposures that is available for large banks to describe the distribution of sovereign debt portfolio losses across large banks in each year of the period 2010 to 2015 (Panel A). Losses and gains are denoted by positive and negative values respectively. Total portfolio losses (LOSS_ALL) are decomposed into losses in domestic sovereign debt (LOSS_HOME) and foreign sovereign debt (LOSS_FOREIGN). We rank large banks according to their government bond portfolio losses by year, and find that all banks from the 10% to the 90% quantile of the sample, experience government bond portfolio losses in the early stages of the sovereign debt crisis in 2010. The largest losses are seen in peripheral banks which, in the 90% quantile of the distribution, suffer a substantial 7.44% fall in total government debt portfolio value relative to 0.43% in core countries. The losses stem primarily from domestic debt in peripheral banks and foreign debt in core banks. In 2011 the pattern is similar, while in following years both core and peripheral large banks experience overall gains from their sovereign debt portfolio, or very modest losses. In Panel B of Appendix C we show the results of stress tests on banks sovereign debt portfolios assuming a scenario in which all bond yields increase by one standard deviation computed in over the 2010-2015 period. Again, the largest losses are detected in 2010.

5. Conclusion

Previous research has shown that the credit crunch observed in Europe during the sovereign debt crisis can be explained by, among other factors, banks reallocating assets to government

debt and away from the private sector. This substitution effect is thought to have had pro-cyclical consequences that exacerbated the crisis. These findings have mostly been based on evidence from large banks' lending practices. By contrast, in this study we focused on small banks. Surprisingly, although we find evidence of substitution during the crisis, in small banks of peripheral European countries we also observe *complementarity* effects, whereby the level of government bond holdings can contribute positively to loan growth. Further, we show that substitution and complementarity can coexist. This occurs when public debt grows faster than loans.

A higher proportion of assets invested in government debt can give banks a better ability to withstand funding liquidity shocks. This, in turn, may enable banks to have greater confidence to sustain lending growth, or reduce lending contraction, during periods of crisis. However, a substantial expansion in sovereign debt holdings may reinforce the sovereign–bank nexus, in which government distress can easily cause instability in the banking system, and vice versa. A marked expansion in that asset class was indeed observed in small peripheral banks during the sovereign debt crisis. Therefore, we propose that a 'smaller is better' recipe for the banking system should be coupled with a framework to address the potentially critical interdependence between banks and sovereigns. Doing so may prove politically challenging. Finally, we also find that small banks generally exhibit a more stable lending behaviour than large banks, which suggests that they may have an important role in alleviating credit contractions during recessions, precisely when sustained lending is most needed.

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Figure 1: Proportion of total government security exposure to total assets for the median bank.

This figure shows government debt holdings relative to total assets for four region-bank size groups. Large banks are those that participated in the EBA serial tests at least twice and have average total assets higher than 20 billion Euro. Small banks have average total assets smaller than 2 billion Euro. Peripheral countries are Greece, Ireland, Italy, Portugal and Spain. Core countries are Austria, Belgium, Germany, France and Netherlands. Data source: BvD Bankscope.

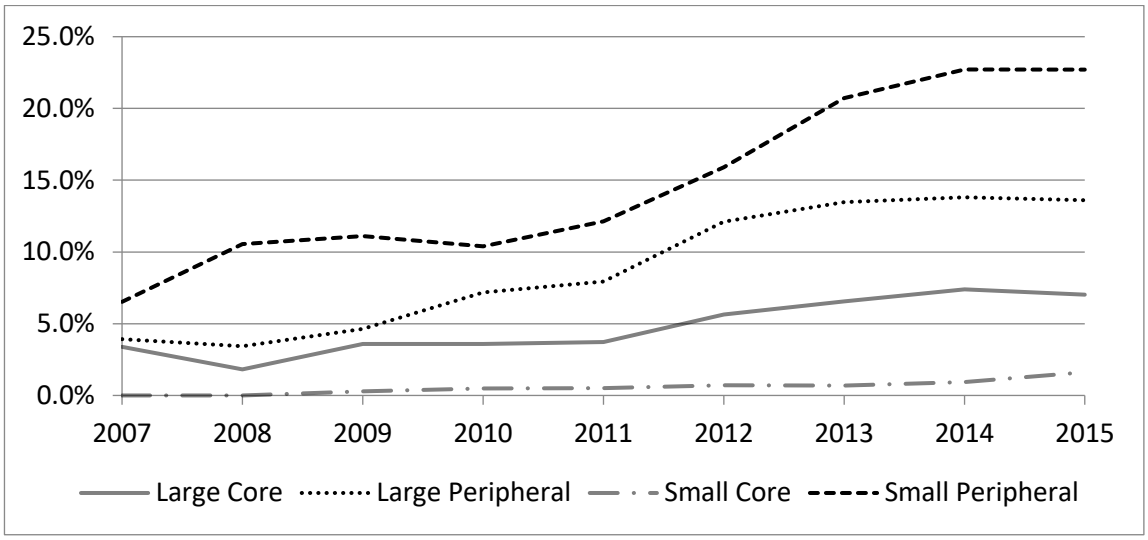
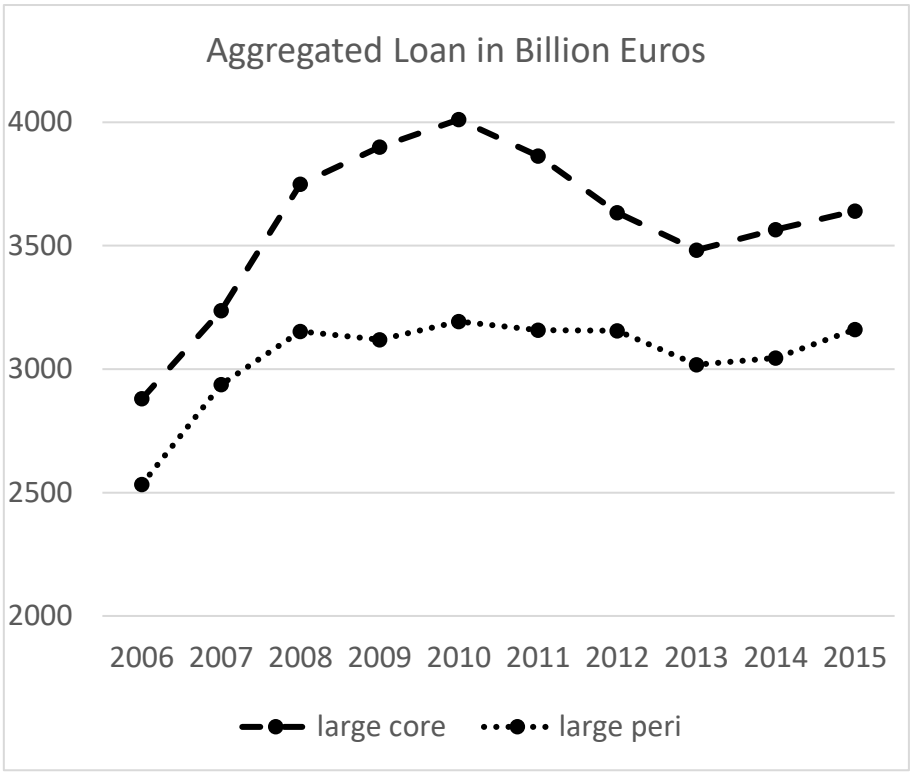


Figure 2: Aggregate loans to the non-financial private sector.

This Figures shows the loan aggregate value for four region-bank size groups based on a static pool which includes banks with observation in each year of the sample period. Large banks are those that participated in the EBA serial tests at least twice and have average total assets higher than 20 billion Euro. Small banks have average total assets smaller than 2 billion Euro. Peripheral countries are Greece, Ireland, Italy, Portugal and Spain. Core countries are Austria, Belgium, Germany, France and Netherlands. Data source: BvD Bankscope.



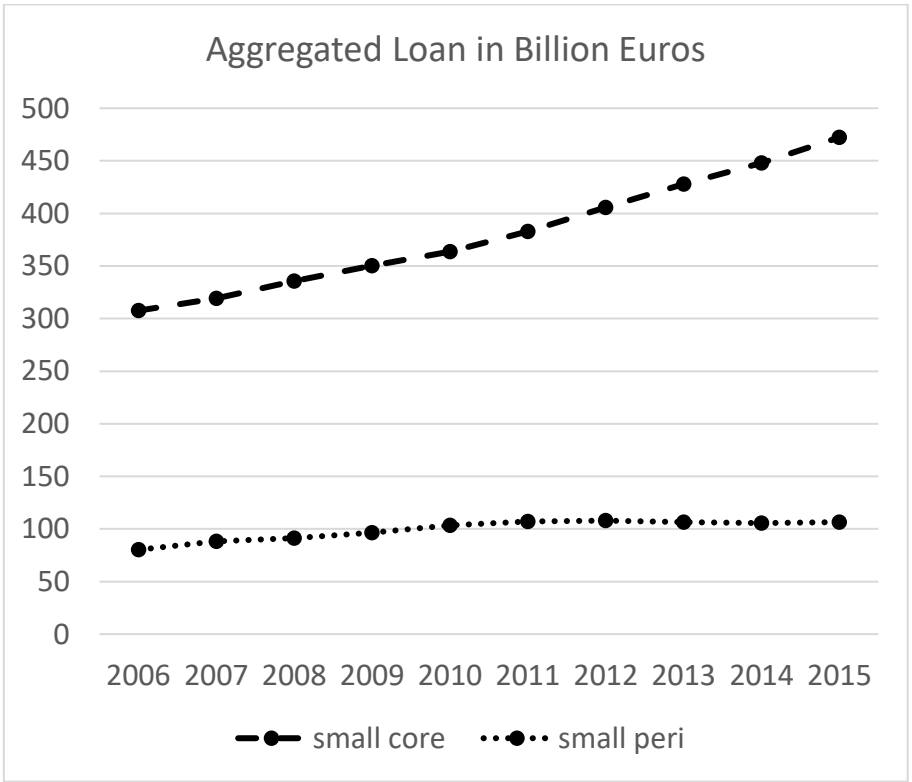


Figure 3: Growth rate of loans to the non-financial private sector.

This Figure shows the median loan growth rate for four region-bank size groups. Large banks are those that participated in the EBA serial tests at least twice and have average total assets higher than 20 billion Euro. Small banks have average total assets smaller than 2 billion Euro. Peripheral countries are Greece, Ireland, Italy, Portugal and Spain. Core countries are Austria, Belgium, Germany, France and Netherlands. Data source: BvD Bankscope.

Panel A. loan growth rate, median value.

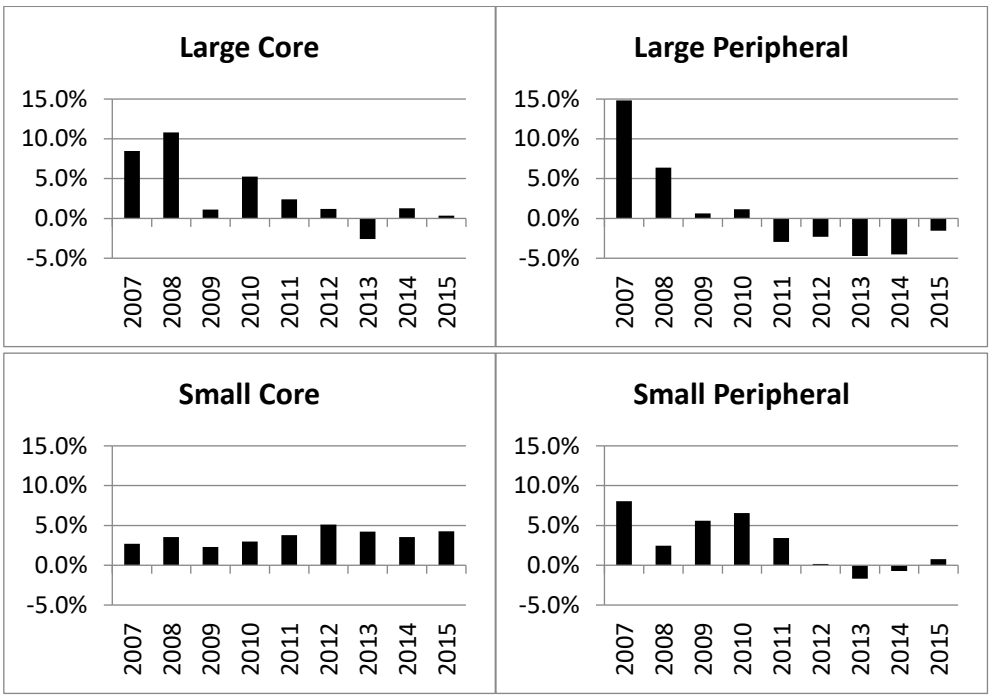


Figure 4: Growth rate of retail deposits, median value.

A bank is qualified as a large bank if it has participated in the EBA serial tests at least twice and has average total assets higher than 20 billion Euro. A bank is qualified as a small bank if its average total assets are smaller than 2 billion Euro. Peripheral countries are Greece, Ireland, Italy, Portugal and Spain. Core countries are Austria, Belgium, Germany, France and Netherlands. Data source: BvD Bankscope.

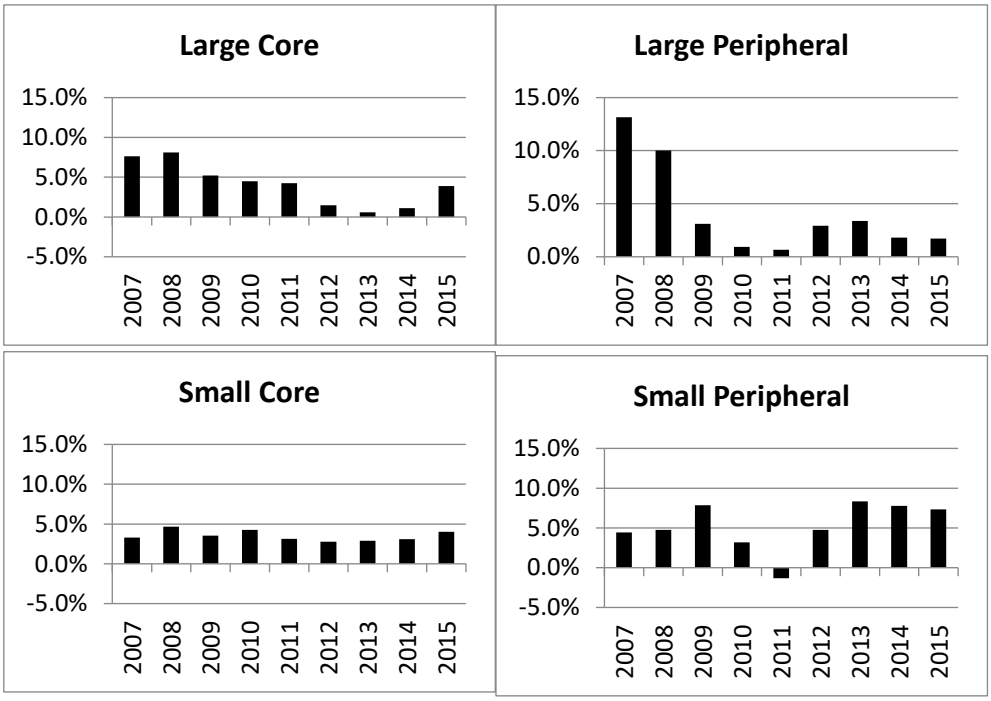


Figure 5: Growth rate of retail deposits and short-term funds, median value.

A bank is qualified as a large bank if it has participated in the EBA serial tests at least twice and has average total assets higher than 20 billion Euro. A bank is qualified as a small bank if its average total assets are smaller than 2 billion Euro. Peripheral countries are Greece, Ireland, Italy, Portugal and Spain. Core countries are Austria, Belgium, Germany, France and Netherlands. Data source: BvD Bankscope.

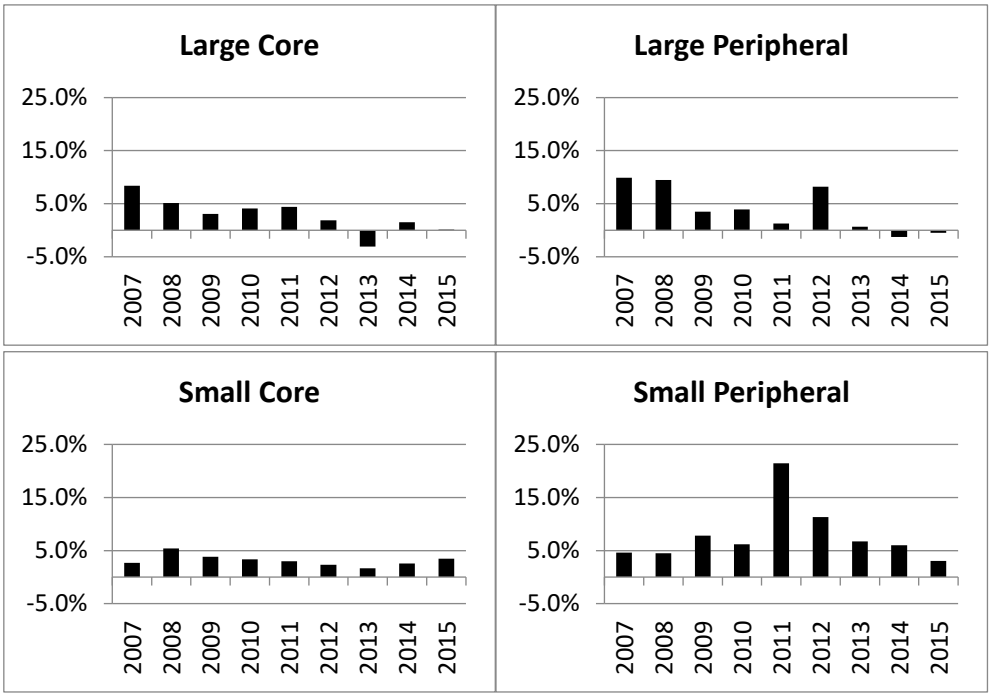


Figure 6: Characteristics of ECB's Long-Term Refinancing Operations (LTROs)

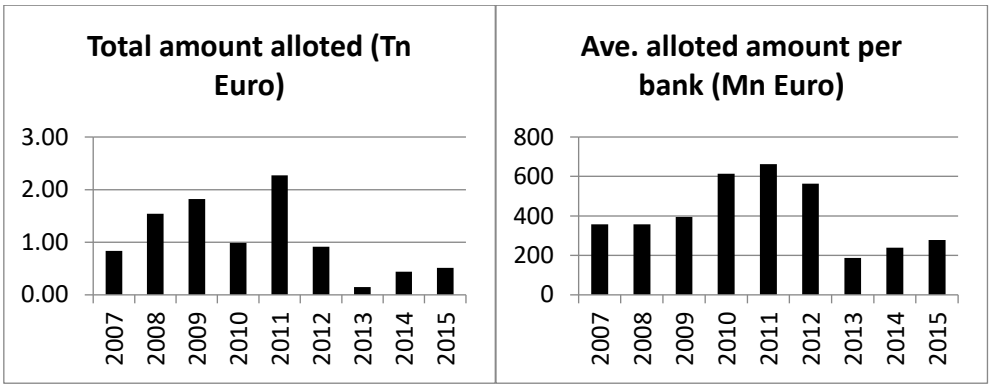
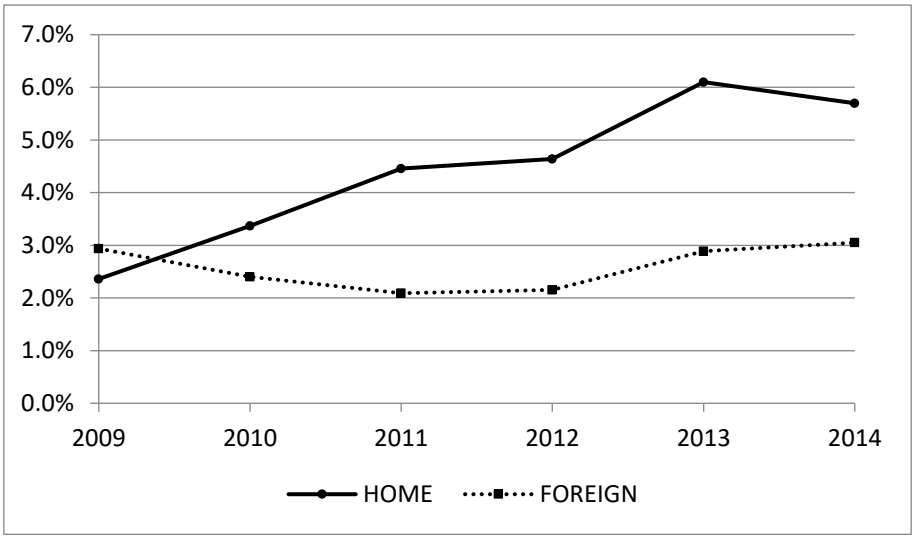


Figure 7: Average proportion of government security exposure to total assets – Home vs. Foreign.

Large banks are those that participated in the EBA stress tests and risk assessments. Core countries include Austria, Belgium, Germany, France and Netherlands. Peripheral countries include Greece, Ireland, Italy, Portugal and Spain. HOME is a bank's domestic sovereign bond exposure divided by total assets. FOREIGN is a bank's total sovereign exposure across all the above core and peripheral countries, divided by total assets. Data source: EBA.

A. Large banks in core countries.



B. Large banks in peripheral countries.

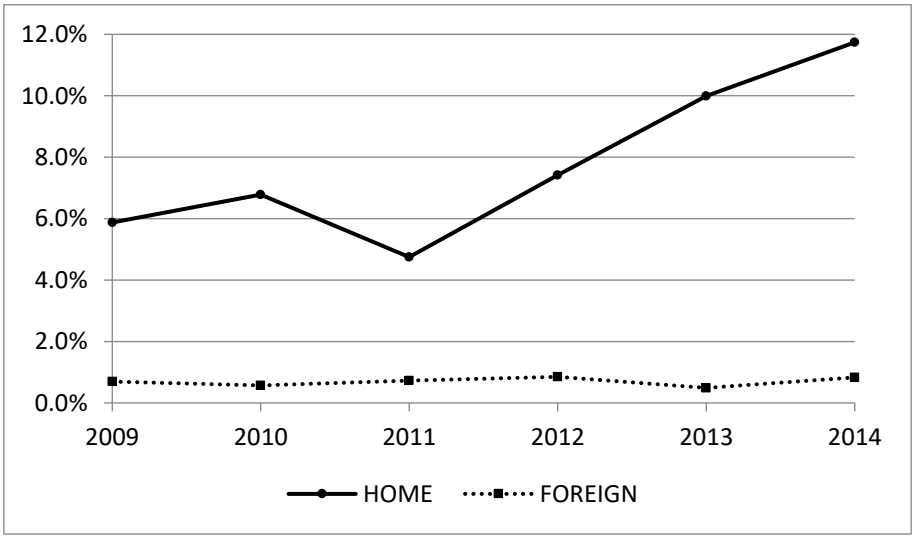
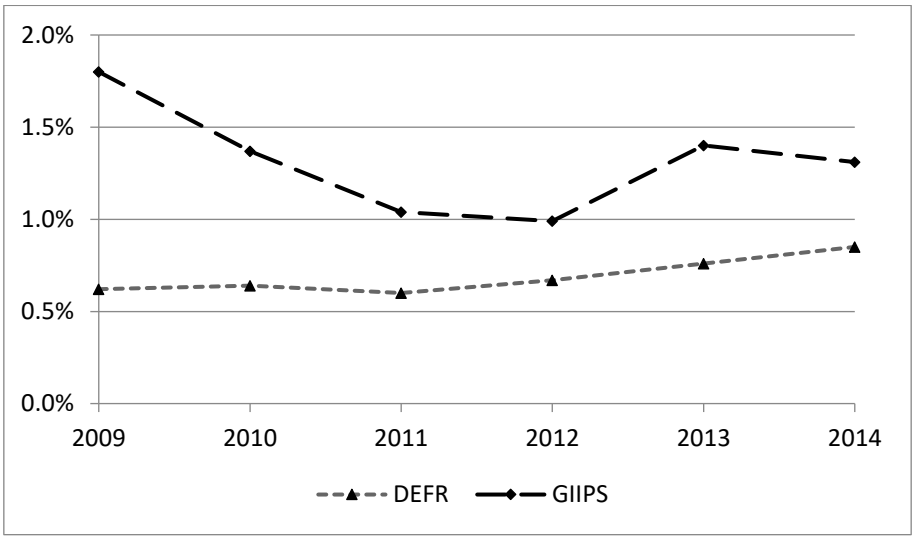


Figure 8: Average proportion of government security exposure to total assets – Foreign Safe vs. Foreign Risky.

Large banks are those that participated in the EBA stress tests and risk assessments. Core countries include Austria, Belgium, Germany, France and Netherlands. Peripheral countries include Greece, Ireland, Italy, Portugal and Spain. DEFR is a bank's exposure to German and French sovereign bonds when, for that bank, they are not a domestic exposure (e.g. for a German bank DEFR only includes exposures to French sovereign bonds) divided by the bank's total assets. GIIPS is a bank's total exposure to peripheral countries when they are not domestic exposures (e.g. for an Italian bank GIIPS only includes exposures to Greece, Ireland, Portugal and Spain) divided by the bank's total assets. Data source: EBA.

A. Large banks in core countries



B. Large banks in peripheral countries

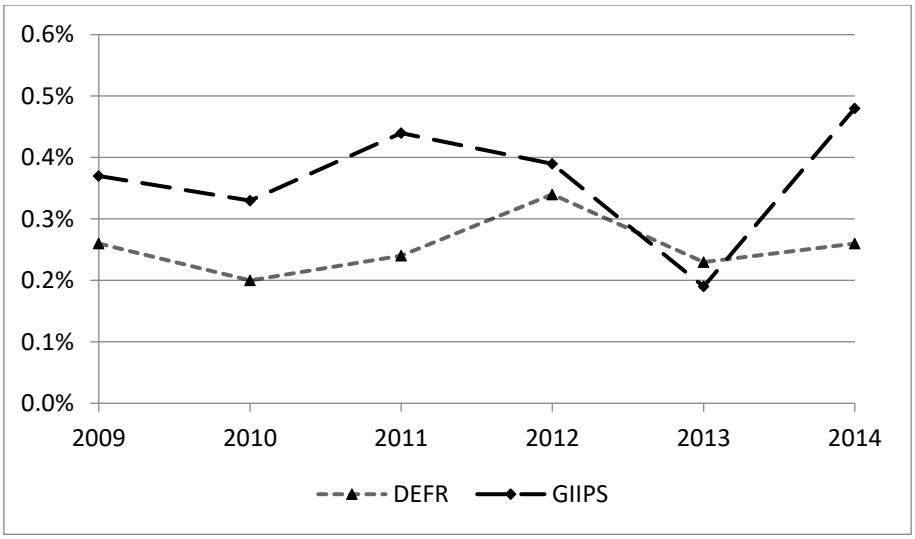


Table 1: Summary Statistics

A bank is qualified as a large bank if it has participated in the EBA serial tests at least twice and has average total assets higher than 20 billion Euro. A bank is qualified as a small bank if its average total assets are smaller than 2 billion Euro. Peripheral countries are Greece, Ireland, Italy, Portugal and Spain. Core countries are Austria, Belgium, Germany, France and Netherlands. Variables are winsorized at 1st and 99th percentile within each of the four bank groups. The significance level of t-test on mean and Wilcoxon test on median are indicated by ***, **, and * for 1%, 5% and 10%, respectively. Fisher-type unit-root tests are reported for each variable over the whole sample period (2007-2015). Unreported tests for medium sized banks in core and peripheral countries also reveal no unit roots for the variables of interest in those sub-samples. Data source: BvD Bankscope.

Panel A:	Loan Growth: Δln(loan)					
	Large Core	Small Core	Diff	Large Peripheral	Small Peripheral	Diff
Period: 2007 – 2009						
Mean	8.1%	3.8%	4.3%***	8.4%	6.9%	1.5%
Median	7.3%	2.8%	4.5%***	7.3%	5.3%	2.0%**
N	118	5,077		111	1,762	
Period: 2010 – 2015						
Mean	-0.1%	4.7%	-4.8%***	-1.0%	2.6%	-3.7%***
Median	0.7%	4.0%	-3.3%***	-2.3%	1.0%	-3.3%***
N	242	10,242		238	3,539	
Unit Roots (2007-2015)	No	No		No	No	

Panel B:	Loans / Total Assets					
	Large Core	Small Core	Diff	Large Peripheral	Small Peripheral	Diff
Period: 2007 - 2009						
Mean	42.4%	49.6%	-7.2%***	66.3%	62.3%	4.0%***
Median	44.4%	50.8%	-6.4%***	67.3%	64.5%	2.8%**
N	118	5,077		111	1,762	
Period: 2010 - 2015						
Mean	45.1%	51.0%	-5.9%***	62.0%	55.5%	6.4%***
Median	47.0%	52.3%	-5.3%***	62.9%	56.5%	6.3%***
N	242	10,242		238	3,539	
Unit Roots (2007-2015)	No	No		No	No	

Panel C:	Sovereign Debt Securities / Total Assets					
	Large Core	Small Core	Diff	Large Peripheral	Small Peripheral	Diff
Period: 2007 – 2009						
Mean	4.8%	1.2%	3.6%***	4.9%	11.4%	-6.5%***
Median	3.5%	0.0%	3.5%***	3.9%	9.1%	-5.2%***
N	118	5,077		111	1,762	
Period: 2010 – 2015						
Mean	6.3%	1.9%	4.4%***	11.8%	16.8%	-5.0%***
Median	5.5%	0.8%	4.7%***	11.2%	15.9%	-4.7%***
N	242	10,242		238	3,539	
Unit Roots (2007-2015)	No	No		No	No	

Table 1 Continued

Panel D:	SIZE: Million Euro					
	Large Core	Small Core	Diff	Large Peripheral	Small Peripheral	Diff
Period: 2007 - 2009						
Mean	359,767	549	359,218***	150,163	469	149,694***
Median	164,150	387	163,763***	60,132	293	59,839***
N	118	5,077		111	1,762	
Period: 2010 - 2015						
Mean	351,228	613	350,615***	163,532	516	163,016***
Median	149,800	420	149,380***	69,578	331	69,247***
N	242	10,242		238	3,539	
Unit Roots (2007-2015)	No	No		No	No	

Panel E:	Deposit Growth: Δln(DEP)					
	Large Core	Small Core	Diff	Large Peripheral	Small Peripheral	Diff
Period: 2007 – 2009						
Mean	6.7%	4.8%	2.0%	9.5%	7.4%	2.0%*
Median	6.6%	3.7%	2.9%***	7.6%	5.8%	1.7%**
N	118	50,04		111	1,750	
Period: 2010 – 2015						
Mean	1.0%	4.1%	-3.1%***	2.8%	5.7%	-2.9%***
Median	2.6%	3.3%	-0.7%***	1.7%	4.5%	-2.8%***
N	239	10,138		238	3,514	
Unit Roots (2007-2015)	No	No		No	No	

Panel F:	Deposit and Short Term Fund Growth: Δln(DEP&ST)					
	Large Core	Small Core	Diff	Large Peripheral	Small Peripheral	Diff
Period: 2007 – 2009						
Mean	6.5%	5.0%	1.5%	9.3%	7.1%	2.2%**
Median	5.7%	4.0%	1.8%**	6.9%	6.1%	0.9%**
N	118	5,077		111	1,762	
Period: 2010 – 2015						
Mean	-1.1%	3.3%	-4.4%***	3.5%	10.0%	-6.6%***
Median	0.0%	2.7%	-2.7%***	1.1%	6.8%	-5.7%***
N	242	10,242		238	3,539	
Unit Roots (2007-2015)	No	No		No	No	

Table 1 Continued

Panel G: Leverage: Total Assets / Total Equity

	Large Core	Small Core	Diff	Large Peripheral	Small Peripheral	Diff
Period: 2007 – 2009						
Mean	39.5	15.3	24.1***	18.0	9.6	8.4***
Median	32.1	15.3	16.8***	16.1	9.1	7.1***
N	118	5,077		111	1,762	
Period: 2010 – 2015						
Mean	29.6	12.5	17.1***	17.7	10.5	7.3***
Median	24.7	12.0	12.6***	15.5	10.0	5.5***
N	242	10,242		238	3,539	
Unit Roots (2007-2015)	No	No		No	No	

Panel H: Credit Risk: Loan Loss Provisions / Total Equity

	Large Core	Small Core	Diff	Large Peripheral	Small Peripheral	Diff
Period: 2007 – 2009						
Mean	7.3%	6.2%	1.1%	11.0%	4.5%	6.5%***
Median	4.9%	5.5%	-0.6%***	6.9%	3.2%	3.7%***
N	118	5,077		111	1,762	
Period: 2010 – 2015						
Mean	4.3%	1.5%	2.9%***	24.0%	9.4%	14.6%***
Median	3.4%	1.3%	2.1%***	11.8%	6.1%	5.6%***
N	242	10,242		238	3,539	
Unit Roots (2007-2015)	No	No		No	No	

Panel I: Tier 1 ratio: tier1 capital / RWA

	Large Core	Small Core	Diff	Large Peripheral	Small Peripheral	Diff
Period: 2007 - 2009						
Mean	n/a	n/a	n/a	n/a	n/a	n/a
Median	n/a	n/a	n/a	n/a	n/a	n/a
N	n/a	n/a	n/a	n/a	n/a	n/a
Period: 2010 - 2015						
Mean	15.4%	14.0%	1.4%*	10.8%	18.1%	-7.2%***
Median	12.9%	13.1%	-0.2%	11.0%	15.9%	-4.9%***
N	227	5,635		218	3,058	
Unit Roots (2007-2015)	No	No		No	No	

Table 2: Determinants of loan growth: large banks vs. medium banks vs. small banks.

This table contains the results of panel regressions of annual loan growth of banks on sovereign debt exposures and other control variables. Panel A (B) shows results for core (peripheral) countries' banks of different size. In Panel C, all bank groups are nested together. Core countries include Austria, Belgium, Germany, France and Netherlands. Peripheral countries are Greece, Ireland, Italy, Portugal and Spain. The explanatory variables include: SOV_ALL: sovereign securities exposure / total assets; SIZE: log of total assets (in thousand Euros); LLP/TE: loan loss provisions / total equity; Δln(DEP&ST): growth rate of total retail deposit and short-term funding; dummy variables *Expansion* and *Contraction* equal 1 if the aggregate loans provided by all the banks from the same country (without the contribution of bank *i*) in year t are higher and lower, respectively, than in year t-1. All explanatory variables are lagged by 1 year, with the exception of the dummies which are contemporaneous. Bank level variables are winsorized at the 1st and 99th percentile within each of the six bank groups – large core, large peripheral, medium core, medium peripheral, small core and small peripheral. Large, medium and small banks have average asset value over the sample period above Euro 20bn, between 20bn and 2bn and below 2bn respectively. In Panel A and B, both the dependent variable and the key explanatory variable, SOV_ALL, are standardized by subtracting their mean and dividing by the standard deviation in the relevant sample. Standard errors are White heteroscedasticity-robust and clustered at the bank level. ***, **, and * indicate significance at the 1, 5 and 10 percent levels, respectively. N represents the number of observations (bank-year) available. Data source: BvD Bankscope.

Panel A: Credit Expansion Vs. Credit Contraction, Banks from Core Countries

	[1]	[2]	[3]
Countries	Core	Core	Core
Bank Size	Large	Medium	Small
Sample Period	2007 - 2015	2007 - 2015	2007 - 2015
SOV_ALL_{t-1}*Expansion	-0.0529	-0.0535	0.0022
SOV_ALL_{t-1}*Contraction	0.1660	-0.0315	0.0085
$SIZE_{t-1}$	0.2151	-0.8924***	-1.2750***
LLP_{t-1}/TE_{t-1}	-2.0739**	-0.4301*	-0.5231***
$\Delta ln(DEP\&ST)_{t-1}$	0.7196*	0.5510***	0.5386***
Bank Fixed Effects	YES	YES	YES
Country*Year Fixed Effects	YES	YES	YES
N	346	3903	14613
Adj. R-Squared	0.23	0.09	0.06

Panel B: Credit Expansion Vs. Credit Contraction, Banks from Peripheral Countries

	[1]	[2]	[3]
Countries	Peripheral	Peripheral	Peripheral
Bank Size	Large	Medium	Small
Sample Period	2007 - 2015	2007 - 2015	2007 - 2015
SOV_ALL_{t-1}*Expansion	0.1039	0.1145	0.1614***
SOV_ALL_{t-1}*Contraction	0.0791	0.1378*	0.2998***
$SIZE_{t-1}$	-1.2855***	-0.7410***	-0.9609***
LLP_{t-1}/TE_{t-1}	-0.0302	-1.1062***	-1.5731***
$\Delta ln(DEP\&ST)_{t-1}$	0.1806	0.2916**	0.1985**
Bank Fixed Effects	YES	YES	YES
Country*Year Fixed Effects	YES	YES	YES
N	337	1319	5000
Adj. R-Squared	0.34	0.18	0.25

Panel C: Credit Expansion Vs. Credit Contraction, Nested Model

Countries	All
Bank Size	All
Sample Period	2007 - 2015
SOV_ALL_{t-1}*Expansion*Large Core	0.0661
SOV_ALL_{t-1}*Contraction*Large Core	-0.0537
SOV_ALL_{t-1}*Expansion*Medium Core	-0.2286*
SOV_ALL_{t-1}*Contraction*Medium Core	-0.2114
SOV_ALL_{t-1}*Expansion*Small Core	0.0112
SOV_ALL_{t-1}*Contraction*Small Core	0.0892
SOV_ALL_{t-1}*Expansion*Large Peripheral	0.0827
SOV_ALL_{t-1}*Contraction*Large Peripheral	0.0249
SOV_ALL_{t-1}*Expansion*Medium Peripheral	0.1561
SOV_ALL_{t-1}*Contraction*Medium Peripheral	0.3127***
SOV_ALL_{t-1}*Expansion*Small Peripheral	0.1528***
SOV_ALL_{t-1}*Contraction*Small Peripheral	0.2516***
Bank-Level Controls	YES
Bank Fixed Effects	YES
Country*Year Fixed Effects	YES
N	25518
Adj. R-Squared	0.11

Table 3: Complementarity effect in small peripheral banks

In this Table we look at the top and bottom quartiles of small peripheral banks ranked by their sovereign debt exposure during the period 2010 – 2015, these two groups are marked as HIGH and LOW respectively. Δln(loan1015) is the total loan growth in the period 2010 -2015; Δln(loan) is the annual loan growth; SIZE is the log of total assets (in thousand Euros); LLP/TE denotes loan loss provision / total equity; TA/TE equals total assets / total equity; SOV_ALL/TA is the ratio of sovereign securities exposure / total assets. Δln(DEP&ST) is the growth rate of total retail deposit and short-term funding; Δln(DEP) is the growth rate of retail deposit; Tier1 ratio is tier 1 capital / risk weighted asset. The significance level of t-tests on means and Wilcoxon test on medians are indicated by ***, **, and * for 1%, 5% and 10%, respectively.

	Mean			Median		
Item	HIGH	LOW	Diff	HIGH	LOW	Diff
SOV_ALL/TA	32.5%	0.5%	32.1%***	32.0%	0.0%	32.0%***
Δln(loan1015)	25.0%	-0.8%	25.8%***	17.1%	-2.9%	19.9%***
Δln(loan)	4.9%	0.0%	4.8%***	2.6%	-0.8%	3.3%***
SIZE	404	471	-67***	257	206	50
LLP/TE	8.6%	7.9%	0.7%	6.0%	3.6%	2.4%***
TA/TE	10.1	10.5	-0.4***	9.6	9.7	-0.2***
Δln(DEP&ST)	12.6%	3.8%	8.8%***	8.5%	2.6%	5.8%***
Δln(DEP)	6.6%	2.5%	4.1%***	4.9%	1.7%	3.2%***
Tier1 ratio	21.5%	20.6%	0.9%	19.2	17.7	1.5%***

Table 4: Correlation between loans and sovereign exposures.

This table shows the pairwise correlation between loans to total assets and sovereign exposure to total assets. Large banks are those that participated in the EBA serial tests at least twice between 2010 and 2015 and have average assets higher than 20 billion Euro. Medium and small banks have average total assets between 2 billion and 20 billion Euro and below 2 billion Euro respectively. Peripheral countries are Greece, Ireland, Italy, Portugal and Spain. Core countries are Austria, Belgium, Germany, France and Netherlands. ***, **, and * indicate significance at the 1, 5 and 10 percent levels, respectively.

Period	Large Core	Large Peripheral	Medium Core	Medium Peripheral	Small Core	Small Peripheral
2007 – 2009	-0.16*	-0.35***	-0.31***	-0.38***	-0.27***	-0.55***
2010 – 2015	0.03	-0.40***	-0.36***	-0.43***	-0.27***	-0.44***

Table 5: Loan overhang effect

In this table we employ panel regressions of loan growth on LOAN/TA which denotes lagged loan levels to total assets (loan overhang effect), and other bank specific controls. LOAN/TA is orthogonalized with respect to all the other explanatory variables. Panel A, B and C show the results for large, medium and small banks. Large banks are those that participated in the EBA serial tests at least twice between 2010-2015 and have average assets higher than 20 billion Euro. Medium and small banks have average total assets between 2 billion and 20 billion Euro and less than 2 billion Euro respectively. In Panel D, all the six bank groups are nested together. Peripheral countries are Greece, Ireland, Italy, Portugal and Spain. Core countries are Austria, Belgium, Germany, France and Netherlands. Explanatory variables include SIZE: log of total assets (in thousand Euros); LLP/TE: loan loss provision / total equity; SOV_ALL: sovereign securities exposure / total assets; Δln(DEP&ST): growth rate of total retail deposit and short-term funding. Dummy variables *Expansion* and *Contraction* equal 1 if the aggregate loans provided by the banks in the relevant sub-samples (without the contribution of bank *i*) in year t are higher and lower, respectively, than in year t-1. In Panel A, B and C, both the dependent variable and the key explanatory variable, SOV_ALL, are standardized by subtracting their mean and dividing by their standard deviation in the relevant sample. All explanatory variables are lagged by 1 year, with the eception of the dummies which are contemporaneous. Bank level variables are winsorized at the 1st and 99th percentile within each of the six bank groups – large core, large peripheral, medium core, medium peripheral, small core and small peripheral. Large, medium and small banks have average asset value over the sample period above Euro 20bn, between 20bn and 2bn and below 2bn respectively. Standard errors are White heteroscedasticity-robust and clustered at the bank level. ***, **, and * indicate significance at the 1, 5 and 10 percent levels, respectively. N represents the number of observations (bank-year) available. Data source: BvD Bankscope.

Panel A: Large Banks (EBA banks with total assets larger than 20 billion Euro)

	[1]	[3]
Countries	Core	Peripheral
Sample Period	2007 - 2015	2007 - 2015
$LOAN/TA_{t-1}$	-0.4848***	-0.5122***
SOV_ALL_{t-1}*Expansion	-0.0529	0.1039
SOV_ALL_{t-1}*Contraction	0.1660	0.0791
$SIZE_{t-1}$	0.2151	-1.2855**
LLP_{t-1}/TE_{t-1}	-2.0739**	-0.0302
$\Delta ln(DEP\&ST)_{t-1}$	0.7196	0.1806
Bank Fixed Effects	YES	YES
Country*Year Fixed Effects	YES	YES
N	346	337
Adj. R-Squared	0.27	0.43

Table 5 - continued

Panel B: Medium Banks (total assets between 2 to 20 billion Euro)

	[1]	[3]
Countries	Core	Peripheral
Sample Period	2007 - 2015	2007 - 2015
$LOAN/TA_{t-1}$	-0.7380***	-0.6406***
SOV_ALL_{t-1}*Expansion	-0.0535	0.1145
SOV_ALL_{t-1}*Contraction	-0.0315	0.1378*
$SIZE_{t-1}$	-0.8924***	-0.7410***
LLP_{t-1}/TE_{t-1}	-0.4301	-1.1062***
$\Delta ln(DEP\&ST)_{t-1}$	0.5510***	0.2916*
Bank Fixed Effects	YES	YES
Country*Year Fixed Effects	YES	YES
N	3903	1319
Adj. R-Squared	0.27	0.34

Panel C: Small Banks (total assets smaller than 2 billion Euro)

	[1]	[3]
Countries	Core	Peripheral
Sample Period	2007 - 2015	2007 - 2015
$LOAN/TA_{t-1}$	-0.4473***	-0.5779***
SOV_ALL_{t-1}*Expansion	0.0022	0.1614***
SOV_ALL_{t-1}*Contraction	0.0085	0.2998***
$SIZE_{t-1}$	-1.2750***	-0.9609***
LLP_{t-1}/TE_{t-1}	-0.5231***	-1.5731***
$\Delta ln(DEP\&ST)_{t-1}$	0.5386***	0.1985*
Bank Fixed Effects	YES	YES
Country*Year Fixed Effects	YES	YES
N	14613	5000
Adj. R-Squared	0.24	0.43

Table 5 - continued

Panel D: Nested Model

Countries	All
Bank Size	All
Sample Period	2007 - 2015
$LOAN/TA_{t-1}$	-0.3746***
SOV_ALL_{t-1}*Expansion*Large Core	0.0661
SOV_ALL_{t-1}*Contraction*Large Core	-0.0537
SOV_ALL_{t-1}*Expansion*Medium Core	-0.2286*
SOV_ALL_{t-1}*Contraction*Medium Core	-0.2114
SOV_ALL_{t-1}*Expansion*Small Core	0.0112
SOV_ALL_{t-1}*Contraction*Small Core	0.0892
SOV_ALL_{t-1}*Expansion*Large Peripheral	0.0827
SOV_ALL_{t-1}*Contraction*Large Peripheral	0.0249
SOV_ALL_{t-1}*Expansion*Medium Peripheral	0.1561
SOV_ALL_{t-1}*Contraction*Medium Peripheral	0.3127***
SOV_ALL_{t-1}*Expansion*Small Peripheral	0.1528***
SOV_ALL_{t-1}*Contraction*Small Peripheral	0.2516***
Bank-Level Controls	YES
Bank Fixed Effects	YES
Country*Year Fixed Effects	YES
N	25518
Adj. R-Squared	0.29

Table 6: Funding Effects on Peripheral Banks

In this Table we employ panel regressions to study the effects of funding on average loan growth Δln(loan), growth in interbank loans Δln(loan_bank), growth of sovereign exposures Δln(sov) and non-sovereign securities Δln(sec) for peripheral banks. Large banks are those that participated in the EBA serial tests at least twice between 2010-2015 and have average assets higher than 20 billion Euro. Medium and small banks have average total assets between 2 billion and 20 billion Euro and less than 2 billion Euro respectively. Bank-level controls are the same bank level variables as in the baseline model in Table 2. Bank fixed effects and country*year fixed effects are also included. All explanatory variables are lagged by 1 year, with the exception of the dummies which are contemporaneous. Bank level variables are winsorized at the 1st and 99th percentile within each of the three bank groups –large, medium and small peripheral. Large, medium and small banks have average asset value over the sample period above Euro 20bn, between 20bn and 2bn and below 2bn respectively. Standard errors are White heteroscedasticity-robust and clustered at the bank level. ***, **, and * indicate significance at the 1, 5 and 10 percent levels, respectively. N represents the number of observations (bank-year) available. Data source: BvD Bankscope.

	[1]	[2]	[3]	[4]	[5]
Dependent Variable	Δln(loan)	Δln(loan)	Δln(loan_bank)	Δln(sov)	Δln(sec)
Sample Period	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015
$\Delta\ln(DEP\&ST)_{t-1}$* Large Peripheral	0.0134				
$\Delta\ln(DEP\&ST)_{t-1}$* Medium Peripheral	0.0556**				
$\Delta\ln(DEP\&ST)_{t-1}$* Small Peripheral	0.0193*				
$\Delta\ln(DEP)_{t-1}$* Large Peripheral		-0.0518	-0.1971	-0.0034	-0.1069
$\Delta\ln(DEP)_{t-1}$* Medium Peripheral		0.0293**	-0.0442	0.1665	0.1287
$\Delta\ln(DEP)_{t-1}$* Small Peripheral		0.0409***	-0.3241***	0.1713**	-0.0163
$\Delta\ln(ST)_{t-1}$* Large Peripheral		0.0114	0.0029	-0.0012	-0.0294
$\Delta\ln(ST)_{t-1}$* Medium Peripheral		0.0067*	-0.0188	-0.0181	0.0007
$\Delta\ln(ST)_{t-1}$* Small Peripheral		0.0001	0.0068	-0.0041	0.0033
Bank-level controls	YES	YES	YES	YES	YES
Bank Fixed Effects	YES	YES	YES	YES	YES
Country*Year Fixed Effects	YES	YES	YES	YES	YES
N	6656	6607	6577	5279	6428
Adj. R-squared	0.22	0.22	0.06	0.21	0.11

Table 7: Impact of sovereign debt on loan growth, domestic vs foreign.

This table shows the impact of a specific sub-portfolio of sovereign exposures (domestic or foreign) on loan growth for large banks. A bank is qualified as a large bank if it has participated in the EBA serial tests at least twice between 2010 and 2015 and has average total assets larger than 20 billion Euro. Peripheral countries are Greece, Ireland, Italy, Portugal and Spain. Core countries are Austria, Belgium, Germany, France and Netherlands. SOV_HOME (SOV_FOREIGN) is the domestic (foreign) sovereign exposure (to the other nine countries) divided by total assets. Dummy variables *Expansion* and *Contraction* equal 1 if the aggregate loans provided by the banks in the relevant sub-samples (without the contribution of bank *i*) in year t are higher and lower, respectively, than in year t-1. Bank-level controls are the same bank level variables as in the baseline model in Table 2. Bank fixed effect and country-year fixed effect are also included. All the other regression settings regarding winsorization, error-clustering and coefficient significance levels are the same as in Table 2. Data source: EBA.

Large Banks (EBA banks with total assets larger than 20 billion Euro)

Countries	All
Sample Period	2010-2015
SOV_HOME_{t-1}*Expansion*Core	-0.01
SOV_HOME_{t-1}*Contraction*Core	-0.2728
SOV_HOME_{t-1}*Expansion*Peripheral	-0.3583
SOV_HOME_{t-1}*Contraction*Peripheral	0.9717*
$SOV\_Foreign_{t-1}$*Expansion*Core	-1.5735
$SOV\_Foreign_{t-1}$*Contraction*Core	-0.1767
$SOV\_Foreign_{t-1}$*Expansion*Peripheral	6.0934**
$SOV\_Foreign_{t-1}$*Contraction*Peripheral	5.4331**
Bank-level controls	YES
Bank Fixed Effects	YES
Country*Year Fixed Effects	YES
N	326
Adj. R-squared	0.40

Table 8: Effect of marked-to-market bond portfolio losses on loan growth

In this table we present panel regressions of loan growth on marked-to-market bond portfolio losses and bank specific controls. Large banks are those that participated in the EBA serial tests at least twice between 2010 and 2015 and have average assets higher than 20 billion Euro. Medium and small banks have average total assets between 2 and 20 billion Euro and less than 2 billion Euro, respectively. Peripheral countries are Greece, Ireland, Italy, Portugal and Spain. Core countries are Austria, Belgium, Germany, France and Netherlands. LOSS_ALL is the marked to market loss on the total government bond portfolio of a bank, thus, a positive (negative) number indicates a loss (gain) in the sovereign portfolio. Dummy variables *Expansion* and *Contraction* equal 1 if the aggregate loans provided by all the banks from the same country (without the contribution of bank *i*) in year t are higher and lower, respectively, than in year t-1. Panel A (B) shows the result under the assumption that all sovereign bonds have a 5-year (10-year) maturity. Bank-level controls are the same bank level variables as in the baseline model in Table 2, except for the interaction terms with SOV_ALL. Bank fixed effect and country*year fixed effect are also included. All explanatory variables are lagged by 1 year, with the exception of the dummies which are contemporaneous. Bank level variables are winsorized at the 1st and 99th percentile within each of the six bank groups – large core, large peripheral, medium core, medium peripheral, small core and small peripheral. Large, medium and small banks have average asset value over the sample period above Euro 20bn, between 20bn and 2bn and below 2bn respectively. Standard errors are White heteroscedasticity-robust and clustered at the bank level. ***, **, and * indicate significance at the 1, 5 and 10 percent levels, respectively. N represents the number of observations (bank-year) available. Data source: BvD Bankscope.

Panel A: Bond Maturity 5-year

Countries	All			
Bank Size	All			
Sample Period	2010-2015			
Proportion of Domestic Exposure vs. Foreign Exposure	100% - 0% [1]	90% - 10% [2]	80% - 20% [3]	70% - 30% [4]
$LOSS\_ALL_{t-1}$*Expansion*Large Core	0.4445	1.658	2.8673	2.6797
$LOSS\_ALL_{t-1}$*Contraction*Large Core	-4.8404*	-3.8970*	-2.6441*	-1.9236
$LOSS\_ALL_{t-1}$*Expansion*Medium Core	1.5146	3.0308	4.1227	3.3106
$LOSS\_ALL_{t-1}$*Contraction*Medium Core	-2.3652	-2.4068	-1.7204	-1.0038
$LOSS\_ALL_{t-1}$*Expansion*Small Core	1.5158	1.7726	1.7032	1.2497
$LOSS\_ALL_{t-1}$*Contraction*Small Core	3.586	1.0391	-1.032	-1.0587
$LOSS\_ALL_{t-1}$*Expansion*Large Peripheral	-0.0937	-0.1018	-0.1164	-0.1173
$LOSS\_ALL_{t-1}$*Contraction*Large Peripheral	-0.7531*	-0.7827	-0.8174	-0.7638
$LOSS\_ALL_{t-1}$*Expansion*Medium Peripheral	-0.1953	-0.2594	-0.4099	-0.6128
$LOSS\_ALL_{t-1}$*Contraction*Medium Peripheral	-1.3754**	-1.4734***	-1.7122***	-1.8600***
$LOSS\_ALL_{t-1}$*Expansion*Small Peripheral	-0.6303	-0.5873	-0.5296	-0.5309
$LOSS\_ALL_{t-1}$*Contraction*Small Peripheral	-0.2546*	-0.2429	-0.2307	-0.2217
Bank Level Controls	YES	YES	YES	YES
Bank Fixed Effects	YES	YES	YES	YES
Country*Year Fixed Effects	YES	YES	YES	YES
N	16823	16823	16823	16823
Adj. R-Squared	0.08	0.08	0.08	0.08

Table 8 - continued

Panel B: Bond Maturity 10-year

Countries	All			
Bank Size	All			
Sample Period	2010-2015			
Proportion of Domestic Exposure vs. Foreign Exposure	100% - 0% [1]	90% - 10% [2]	80% - 20% [3]	70% - 30% [4]
$LOSS\_ALL_{t-1}$*Expansion*Large Core	0.2092	0.3968	0.8007	1.0606
$LOSS\_ALL_{t-1}$*Contraction*Large Core	-2.8536*	-2.7000*	-2.1705*	-1.6604
$LOSS\_ALL_{t-1}$*Expansion*Medium Core	0.8963	1.1557	1.5912	1.7675
$LOSS\_ALL_{t-1}$*Contraction*Medium Core	-1.1283	-1.0814	-0.9095	-0.6487
$LOSS\_ALL_{t-1}$*Expansion*Small Core	0.3635	0.3695	0.6612	0.6996
$LOSS\_ALL_{t-1}$*Contraction*Small Core	1.4071	0.6598	-0.1909	-0.533
$LOSS\_ALL_{t-1}$*Expansion*Large Peripheral	-0.1764	-0.1724	-0.1454	-0.0636
$LOSS\_ALL_{t-1}$*Contraction*Large Peripheral	-0.5461	-0.542	-0.495	-0.3741
$LOSS\_ALL_{t-1}$*Expansion*Medium Peripheral	-0.6496	-0.7085	-0.8486	-0.9901
$LOSS\_ALL_{t-1}$*Contraction*Medium Peripheral	-0.9144**	-0.9664**	-1.0601**	-1.1568**
$LOSS\_ALL_{t-1}$*Expansion*Small Peripheral	-0.5777	-0.5393	-0.4435	-0.3672
$LOSS\_ALL_{t-1}$*Contraction*Small Peripheral	-0.2807*	-0.2837*	-0.2765*	-0.2625*
Bank Level Controls	YES	YES	YES	YES
Bank Fixed Effects	YES	YES	YES	YES
Country*Year Fixed Effects	YES	YES	YES	YES
N	16823	16823	16823	16823
Adj. R-Squared	0.08	0.08	0.08	0.08

Appendix A. Bank size thresholds: Robustness tests.

This table aims to test the robustness of the thresholds used to divide the sample into large, medium and small banks. All the regression settings regarding variable definition, winsorization, error-clustering and coefficient significance levels are the same as in Table 2.

	[1]	[2]	[3]	[4]
Countries	All	All	All	All
Bank Size	All	All	All	All
Threshold (Large vs Medium; Medium vs Small)	€20bn; €1bn	€20bn; €3bn	€30bn; €3bn	€30bn; €4bn
Sample Period	2007 - 2015	2007 - 2015	2007 - 2015	2007 - 2015
SOV_ALL_{t-1}*Expansion*Large Core	0.0591	0.0651	0.1251	0.1257
SOV_ALL_{t-1}*Contraction*Large Core	-0.0644	-0.0562	-0.2149	-0.2128
SOV_ALL_{t-1}*Expansion*Medium Core	-0.1689*	-0.2714**	-0.2532*	-0.2723*
SOV_ALL_{t-1}*Contraction*Medium Core	-0.1483	-0.3012**	-0.2257	-0.2083
SOV_ALL_{t-1}*Expansion*Small Core	0.051	-0.0102	-0.0057	-0.0068
SOV_ALL_{t-1}*Contraction*Small Core	0.1275	0.0725	0.0584	0.0421
SOV_ALL_{t-1}*Expansion*Large Peripheral	0.0824	0.0908	-0.0965	-0.1058
SOV_ALL_{t-1}*Contraction*Large Peripheral	0.028	0.0439	-0.014	-0.0271
SOV_ALL_{t-1}*Expansion*Medium Peripheral	0.1177	0.2204*	0.1867	0.1746
SOV_ALL_{t-1}*Contraction*Medium Peripheral	0.2538***	0.3716***	0.3317***	0.2567**
SOV_ALL_{t-1}*Expansion*Small Peripheral	0.1611***	0.1425***	0.1591***	0.1631***
SOV_ALL_{t-1}*Contraction*Small Peripheral	0.2635***	0.2407***	0.2135***	0.2200***
Bank-Level Controls	YES	YES	YES	YES
Bank Fixed Effects	YES	YES	YES	YES
Country*Year Fixed Effects	YES	YES	YES	YES
N	25518	25518	25518	25518
Adj. R-Squared	0.11	0.11	0.11	0.11

Appendix B: Definition of sovereign portfolio losses.

Similar to De Marco (2019), we construct a bank-specific (unrealised) loss variable for bank *i*'s sovereign bond portfolio at time *t*:

$$LOSS_{i,t} = \sum_{s=1}^{S} Duration_{s,m,t} \times \Delta yield_{s,m,t} \times \frac{Exposure_{i,s,m,t-1}}{Total\ Assets_{i,t-1}} \quad (2)$$

where *s* is the specific sovereign country that bank i is exposed to, *t* refers to end-of-year observations 2010 to 2015, and *m* is the original time to maturity of each exposure in years. We focus on exposures to the 10 countries in our sample. As in Altavilla et al (2017) we assume two alternative debt maturities: 5 years or 10 years.

One of the components of the loss measure is each exposure's modified duration ($Duration_{s,m,t}$). For its calculation we need the exposure's coupon value. As this is not available, we assume that all sovereign bonds are par value bonds (i.e. the coupon equals the yield) and pay coupons semi-annually. Then, $Duration_{s,m,t}$ is calculated as follows :

$$Duration_{s,m,t} = \frac{1}{yield_{s,m,t}} * \left(1 - \frac{1}{(1+yield_{s,m,t})^{2m}}\right) \quad (3)$$

Given the semi-annual coupon assumption, $yield_{s,m,t}$ is a semi-annual yield. Accordingly, maturity is multiplied by 2.

Appendix C: Distribution of marked-to-market sovereign portfolio losses for large banks. This table shows how sovereign portfolio losses are distributed across all large banks' sovereign holdings in core and peripheral countries due to government bond yield changes in a given year. We assume that bond holdings have a 5-year maturity. LOSS_ALL is the marked to market loss on the total government bond portfolio of a bank. LOSS_HOME and LOSS_FOREIGN denote losses on domestic and foreign sovereign exposures respectively. A positive (negative) number indicates a loss (gain) in the sovereign portfolio. The losses are measured as percentage of the bank's total assets. In the second column, *percentile* indicates losses across all large bank's sovereign holdings held in the 10 countries (core and peripheral) in our sample. In Panel A, we present losses calculated with historical data on sovereign bond yields. In Panel B, we present losses under the stress scenario in which all sovereign bond yields increase by 1 standard deviation over the 2010-2015 period.

Panel A: losses based on actual changes in sovereign bond yield.

		LOSS_ALL		LOSS_HOME		LOSS_FOREIGN	
year	percentile	Core	Peripheral	Core	Peripheral	Core	Peripheral
2010	10%	0.01%	0.06%	-0.09%	0.06%	0.03%	-0.01%
	25%	0.02%	0.19%	-0.07%	0.16%	0.07%	0.00%
	50%	0.13%	0.32%	-0.02%	0.30%	0.15%	0.01%
	75%	0.16%	1.09%	-0.01%	0.90%	0.24%	0.06%
	90%	0.43%	7.44%	0.03%	7.44%	0.35%	0.26%
2011	10%	-0.24%	0.01%	-0.39%	0.01%	0.03%	-0.03%
	25%	-0.03%	0.07%	-0.20%	0.05%	0.10%	0.00%
	50%	0.09%	0.17%	-0.05%	0.09%	0.16%	0.01%
	75%	0.27%	2.51%	0.00%	1.96%	0.33%	0.09%
	90%	0.50%	9.28%	0.01%	9.28%	0.57%	0.49%
2012	10%	-1.27%	-3.29%	-0.40%	-2.06%	-0.89%	-1.23%
	25%	-0.62%	-1.59%	-0.28%	-1.54%	-0.45%	-0.18%
	50%	-0.41%	-0.78%	-0.12%	-0.61%	-0.27%	-0.08%
	75%	-0.24%	-0.24%	-0.06%	-0.10%	-0.11%	-0.02%
	90%	-0.15%	-0.06%	-0.04%	-0.05%	-0.07%	-0.01%
2013	10%	-0.02%	-1.67%	0.01%	-1.67%	-0.12%	-0.11%
	25%	0.02%	-0.94%	0.03%	-0.93%	-0.06%	-0.01%
	50%	0.07%	-0.35%	0.07%	-0.36%	0.00%	0.00%
	75%	0.12%	-0.22%	0.16%	-0.22%	0.01%	0.01%
	90%	0.19%	-0.08%	0.24%	-0.13%	0.04%	0.05%
2014	10%	-1.32%	-2.28%	-0.69%	-2.28%	-0.60%	-0.16%
	25%	-0.70%	-1.33%	-0.37%	-1.33%	-0.24%	-0.06%
	50%	-0.31%	-0.83%	-0.16%	-0.80%	-0.13%	-0.01%
	75%	-0.21%	-0.32%	-0.07%	-0.32%	-0.06%	0.00%
	90%	-0.12%	0.05%	-0.03%	0.07%	-0.03%	0.00%
2015	10%	-0.25%	-0.46%	-0.14%	-0.46%	-0.11%	-0.05%
	25%	-0.11%	-0.29%	-0.06%	-0.28%	-0.06%	-0.02%
	50%	-0.07%	-0.20%	-0.03%	-0.17%	-0.03%	0.00%
	75%	-0.04%	-0.10%	-0.01%	-0.08%	-0.02%	0.00%
	90%	-0.03%	-0.05%	-0.01%	-0.03%	0.00%	0.00%

Appendix C - continued

Panel B: Losses based on 1 standard deviation increase in all sovereign bond yields.

		LOSS_ALL		LOSS_HOME		LOSS_FOREIGN	
year	percentile	Core	Peripheral	Core	Peripheral	Core	Peripheral
2010	10%	0.39%	0.43%	0.04%	0.32%	0.27%	0.00%
	25%	0.52%	0.62%	0.08%	0.43%	0.31%	0.01%
	50%	0.74%	0.81%	0.13%	0.64%	0.60%	0.08%
	75%	0.93%	1.51%	0.33%	1.27%	0.82%	0.24%
	90%	1.89%	11.22%	0.45%	11.18%	1.37%	0.39%
2011	10%	0.34%	0.59%	0.09%	0.58%	0.12%	0.00%
	25%	0.43%	0.79%	0.11%	0.74%	0.21%	0.01%
	50%	0.64%	1.03%	0.18%	0.92%	0.34%	0.05%
	75%	0.90%	1.66%	0.53%	1.61%	0.56%	0.14%
	90%	1.43%	5.78%	0.73%	5.72%	0.80%	0.30%
2012	10%	0.25%	0.50%	0.09%	0.44%	0.12%	0.01%
	25%	0.47%	0.82%	0.12%	0.65%	0.14%	0.04%
	50%	0.71%	1.05%	0.24%	0.97%	0.37%	0.09%
	75%	1.06%	1.74%	0.44%	1.68%	0.50%	0.19%
	90%	1.47%	2.52%	1.11%	1.98%	0.71%	0.54%
2013	10%	0.34%	0.91%	0.10%	0.74%	0.05%	0.00%
	25%	0.46%	1.16%	0.15%	1.12%	0.19%	0.02%
	50%	0.59%	1.97%	0.32%	1.81%	0.22%	0.06%
	75%	1.07%	5.66%	0.58%	5.02%	0.40%	0.16%
	90%	1.10%	8.26%	1.04%	8.17%	0.53%	0.31%
2014	10%	0.42%	0.57%	0.10%	0.56%	0.11%	0.00%
	25%	0.56%	1.32%	0.16%	1.26%	0.18%	0.00%
	50%	0.75%	2.08%	0.39%	2.03%	0.30%	0.03%
	75%	1.48%	2.88%	0.68%	2.87%	0.50%	0.06%
	90%	2.09%	5.17%	1.35%	5.17%	0.82%	0.19%
2015	10%	0.37%	1.23%	0.14%	0.84%	0.07%	0.00%
	25%	0.59%	1.70%	0.19%	1.56%	0.21%	0.00%
	50%	0.80%	2.14%	0.39%	2.14%	0.34%	0.05%
	75%	1.16%	3.21%	0.69%	3.21%	0.56%	0.19%
	90%	1.97%	3.99%	1.54%	3.87%	0.99%	0.42%