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Exporting Sovereign Stress: Evidence from Syndicated Bank Lending during the Euro Area Sovereign Debt Crisis*

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Abstract. We show that after the start of the euro area sovereign debt crisis, lending by non-GIIPS European banks with sizeable holdings of GIIPS sovereign bonds declined relative to nonexposed banks. This effect is not driven by changes in borrower demand or by other shocks to banks' balance sheets. We also find that affected banks withdrew from all foreign markets with the exception of the USA, suggesting an increase in home bias. The slowdown in lending continued after ECB's LTRO in December 2011, but it was lower for banks that increased their risky exposures in the early stages of the crisis.

JEL Classification: E44, F34, G21, H63

1. Introduction

The sovereign debt crisis which erupted in the euro area in the spring of 2010 sent ripples through the global economy and prompted interventions by governments and central banks on a scale comparable to the programs

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implemented during the global financial crisis of 2008–09. European authorities pledged funds in the neighborhood of €1 trillion for the recapitalization of troubled euro area governments. And the European Central Bank (ECB) injected unprecedented amounts of liquidity into the euro area banking system, in order to mitigate the consequences of the banking sector's balance sheet exposure to deteriorating sovereign debt. These policy measures have largely been motivated by concerns that sovereign pressures have impaired the flow of credit to the real economy.

In this article we go to the heart of the question, if and in what way sovereign stress affects the supply of credit. To this end, we analyze the effect of balance sheet exposure to impaired sovereign debt on syndicated lending to both domestic and foreign corporate borrowers. We do so for a sample of thirty-four banks domiciled in eleven non-GIIPS[1] European countries, for which we have exact exposures to GIIPS sovereign debt. Moreover, we study changes in the geographic composition of banks' loan portfolios, we look at the effect of sovereign exposure during different time periods, and we analyze the effect of changes in risky exposures during the crisis on bank lending.

Our empirical analysis uncovers a direct link between deteriorating creditworthiness of foreign sovereign debt and lending by banks holding such debt on their balance sheet. When using our preferred econometric specification, we find that after 2010:Q3, banks with substantial holdings of GIIPS sovereign debt reduced syndicated lending by 21.3% relative to banks with marginal holdings. This indicates that exposure to GIIPS sovereign debt mooted the observed recovery in syndicated lending in the wake of the global financial crisis. We also provide evidence that banks cut syndicated lending relatively more to foreign corporates, with the exception of US borrowers, implying that the decline in lending was accompanied by an increase in home bias. Finally, we show that the slowdown in lending is less pronounced for banks that increased their risky sovereign debt exposures during 2010. This suggests that at the early stages of the crisis, a number of euro area banks with access to cheap wholesale funding may have viewed the turmoil in government bond markets as a short-term profit opportunity, boosting their willingness to lend to the real sector. At the same time, we do not find evidence that the ECB's LTRO from December 2011 arrested the decline in lending we observe.

[1] Throughout the article, we use the abbreviation GIIPS to denote the five euro area countries whose access to international bond markets became impaired during the sovereign debt crisis: Greece, Ireland, Italy, Portugal, and Spain.

Theory offers alternative explanations for the propagation of shocks to the net worth of internationally active financial intermediaries, including agency costs (Ueda, 2012; Dedola, Karadi, and Lombardo, 2013), capital requirements (Kollmann, Enders, and Muller, 2011; Mendoza and Quadrini, 2012), and monopolistic competition generating countercyclical price-cost margins (Olivero, 2010). The observed decline in bank lending can come from any of these underlying factors. For example, large credit losses in one market can reduce bank capital and force banks to raise equity, affecting borrowing costs and therefore lending. Alternatively, information asymmetries between banks and investors can be exacerbated by an adverse shock to banks' net worth in one country, reducing lending to another country. While our results are silent on the relative importance of these factors, they strongly suggest that balance sheet weaknesses induced by exposure to sovereign stress are propagated globally.

We obtain our results using an empirical model where, in addition to taking into account changes in bank balance sheets, we control for unobservable bank-specific heterogeneity and for borrower quality by including a comprehensive set of bank and borrower-time fixed effects. In this way, we address the dual concerns that lending and sovereign debt exposures are simultaneously determined by a bank-specific time-invariant unobservable factor, such as the bank's business model or risk appetite, and that our results are driven by changes in the level and/or composition of demand. Furthermore, we show that our results are not driven by the concurrent operation of a number of alternative mechanisms, such as balance sheet exposure to the bank's own sovereign, pressure to deleverage in government-supported banks, systematic differences in business models across banks, currency valuation effects, and exposures to the real sector in the countries under stress.

Several other recent papers have examined the effect of the euro area sovereign debt crisis on bank lending (Correa, Sapriza, and Zlate, 2012; Ivashina, Scharfstein, and Stein, 2012; Bofondi, Carpinelli, and Sette, 2013; Adelino and Ferreira, 2014; De Marco, 2014). These papers show that banks reduce lending to the private sector in response to sovereign shocks that negatively affect their balance sheets. In an important precursor, Arteta and Hale (2008) show that sovereign debt crises in emerging markets have in the past lead to a decline in foreign credit to domestic private firms.

Our work differs from these papers along three dimensions. The first is methodological. We use loan-level data rather than bank aggregates to assess the link between exposure to sovereign stress and lending. This level of disaggregation greatly helps us in controlling for changes in the demand and quality of the pool of borrowers. Second, most of these papers

determine banks' exposures to sovereign stress by looking at the nationality of the parent bank (e.g., European versus US, or Italian versus foreign), or by comparing the rating of the bank to the rating of the sovereign. In contrast, we use balance sheet data on banks' holdings of debt securities issued by sovereigns currently experiencing fiscal stress. The third contribution is our analysis of the interaction between policy and banks' sovereign exposures in determining the supply of credit. Specifically, we study the impact of "carry trade"-type behavior (see Acharya and Steffen, 2014) and of the ECB's LTRO introduced in December 2011.

This article is also related to a large body of work studying the link between shocks to bank capital and bank lending, both domestically (Kashyap and Stein, 2000; Ivashina and Scharfstein, 2010, Santos, 2011; Jimenez *et al*., 2012; Bord and Santos, 2014) as well as across borders (Peek and Rosengren, 2000; Cetorelli and Goldberg, 2011; Claessens, Tong, and Wei, 2012; De Haas and Van Horen, 2012; Giannetti and Laeven, 2012a, 2012b; Popov and Udell, 2012; Schnabl, 2012; De Haas and Van Horen, 2013; Kalemli-Ozcan, Papaioannou, and Perri, 2013; Ongena, Peydro, and Van Horen, 2013). We add to this literature by studying the effect on bank lending of a specific type of shock to bank capital, namely, balance sheet exposure to impaired foreign sovereign debt.

The rest of the article is organized as follows. Section 2 discusses the link between sovereign debt and bank lending. Section 3 introduces the empirical strategy. Section 4 describes the data used in the article. Section 5 reports the main results as well as a battery of robustness tests. Section 6 provides additional results related to portfolio rebalancing, the timing of the effect of sovereign exposure on lending, and to carry trade-type behavior by banks. Section 7 concludes with a discussion of the main messages of the article.

2. Sovereign Debt and Bank Lending

2.1 SOVEREIGN DEBT ON BANK BALANCE SHEETS: THE ROLE OF REGULATION AND SUPERVISION

The sizeable exposure of banks to sovereign debt can be largely attributed to regulatory requirements. The Basel Accords created international standards for bank regulators to control the amount of capital banks set aside in order to insure them, and the economy at large, against various financial and operational risks. The resulting Basel II and Basel III rules on capital measurement and capital standards have been transposed in European Union (EU) law through the Capital Requirements Directive (CRD). While these capital standards are in principle aimed at promoting the stability of the global banking

system, critics have pointed to three features of the CRD that have a destabilizing potential because they provide regulatory incentives for banks to accumulate excessively large sovereign exposures. First, a zero risk weight is applied to banks' exposures, denominated in domestic currency, to sovereigns with ratings between AAA and AA-. Second, government bills and bonds form a substantial part of the liquid assets required in the recently established liquidity coverage ratio. Third, the large exposure regime excludes government debt issued in domestic currency by highly rated sovereigns from the 25% of equity limit on large exposures. This last feature of the CRD in particular is not part of a global standard of capital regulation, but a regional decision by the EU.

The CRD has important implications for sovereign bond holdings by euro area banks. Because the preferential treatment of sovereign debt issued in domestic currency applies to debt issued by any euro area member government, banks in the euro area hold sizeable amounts of debt issued not just by domestic, but also by foreign sovereigns, including debt issued by the GIIPS countries. And while the regulatory incentive to hold sovereign debt was already in place prior to the start of the 2008–09 global financial crisis, it only became stronger after the collapse of Lehman Brothers when increased market uncertainty induced a flight to quality in the banking sector.[2] For banks required to increase their capital ratios in an environment where raising capital was expensive, undertaking long positions in both domestic as well as foreign government debt securities, including those from GIIPS countries, offered a relative inexpensive way to comply with more stringent capital requirements. For example, at the start of 2011 French banks held €162.5 bln, and German banks held €106.4 bln worth of government bonds issued by Greece, Ireland, Italy, Portugal, and Spain. In comparison, UK banks held €31.7 bln and US banks held €25.4 bln worth of GIIPS government bonds (Hannoun, 2011). In relative terms, banks' exposure to the public sector of foreign countries ranges from 75% of Tier 1 capital for Italian and German banks to over 200% for Belgian banks (Bank of International Settlements, 2011).

In addition to regulatory incentives to hold government debt, including GIIPS-issued one, it is possible for national supervisors to actively encourage banks to increase, or to not reduce, the amount of sovereign debt securities they hold on their balance sheets. Some commentators have argued that in the wake of the Lehman Brothers bankruptcy, regulatory authorities started to actively encourage banks to take refuge in government

[2] For work on flight to quality and Knightian uncertainty in financial markets, see Caballero and Krishnamurthy (2008, 2013) and Easley and O'Hara (2009), among others.

debt, sowing the seeds of the sovereign debt crisis.[3] Others have argued in particular that Greek banks loaded up on Greek bonds at the government's urging,[4] although the increase in Greek debt holdings by Cypriot banks during the early stages of the crisis, for example, seems to be mostly due to regulatory and to profit motives rather than to "moral suasion" (Michaelides, 2014). In a recent paper, Becker and Ivashina (2014) provide evidence consistent with the idea that during the crisis, governments of ailing euro area countries have been using various means to induce banks to acquire large stocks of domestic sovereign debt.

2.2 SOVEREIGN STRESS AND BANK LENDING: EMPIRICAL MECHANISMS

The goal of this article is to identify the effect of tensions in sovereign debt markets on nonfinancial corporate lending by banks with balance sheet exposure to impaired foreign sovereign debt. Theory suggests two channels through which tensions in foreign sovereign debt markets can negatively affect credit supply.

The first channel works through the direct holdings of sovereign debt. When foreign sovereign debt is downgraded, balance sheets of banks exposed to this debt are weakened and their profitability is reduced (Gertler and Kiyotaki, 2010). The extent of the impact will depend on whether securities are carried on the balance sheet at market value or at amortized costs (when they are held on the banking book). In the first case, a fall in the value of sovereign bonds has a direct immediate effect on banks' profit and loss statements, and on their equity and leverage. In the second case, losses are recorded only when the securities are impaired (e.g., when sovereign restructuring or default occurs).[5] However, expected losses on sovereign debt, too, can increase bank funding costs as they raise concern about the solidity of the bank and force investors to require higher rates on deposits. Because both domestic as well as foreign sovereign bond holdings tend to take up a large part of the balance sheet of banks, (expected) losses on this asset class will likely be more serious for a bank compared to losses on other asset classes.

The second channel works through the use of sovereign bonds as collateral to secure wholesale funding. An increase in sovereign risk reduces the

[3] "The Basel II concept leads to a false sense of security" (M. Pomerleano, *Financial Times*, 3rd February 2010).

[4] "Greek plan may reward some bank executives" (L. Thomas Jr., *The New York Times*, 25th June 2013).

[5] Note that across EU countries, most of the exposure (on average 85%) is held on the banking book, which somewhat limits the impact of a rise in sovereign spreads (Bank of International Settlements, 2011).

eligibility of these securities as collateral, with negative consequences for banks' funding capacity. This happens through two mechanisms. First, the reduction in the price of a sovereign bond will immediately lead to a reduction in the value of the collateral pool. If the bond was already used in a transaction, mark-to-market valuation of collateral could trigger a margin call. Furthermore, a downgrade could result in government bonds being excluded from the pool of eligible collateral. Second, collateral valuation uncertainty, market liquidity, and credit risk are the major determinants of haircuts. Therefore, an increase in sovereign risk can increase the haircuts applied to sovereign bonds. While in normal times, sovereign bonds tend to have only marginal haircuts, in times of stress these can quickly increase. Moreover, because sovereign bond haircuts often serve as a benchmark for those applied to other securities, the impact on bank funding costs could be magnified through changes in haircuts on other securities. Given the widespread use of government securities as collateral, increased risk with respect to this asset class will likely have important effects on the funding position of banks.[6]

While we do not attempt to disentangle the two mechanisms, both imply that an increase in sovereign risk will negatively affect the funding position of exposed banks. To the extent that higher funding costs somehow have to be offset, we expect a negative impact on lending by these banks.

3. Empirical Methodology

We examine the lending behavior in the syndicated loan market of a sample of European banks. Due to the substantial number of instances when a bank does not lend to a particular borrower country in a particular quarter, we assume that the provision of syndicated lending is derived from a Poisson process. Specifically, we estimate the following model of lending by bank i to borrowers in country j during quarter t:

$$\text{Prob}(\text{Lending}_{ijt}) = \exp(-\lambda_{ijt})\lambda_{ijt}^{\text{Lending}_{ijt}}/\text{Lending}_{ijt}, \quad (1)$$

[6] In the Eurosystem's refinancing operations, 20% of the transactions are secured by government bonds. Furthermore, in the euro area, the amount of outstanding repos in June 2010 was equivalent to 75% of GDP, with four fifths of the transactions collateralized by government bonds. In addition, in 2008 and 2009 one-third of the gross issuance of covered bonds in the euro area was backed by sovereign debt. Finally, end-of-2010 government securities accounted for 17% of total delivered collateral in OTC derivatives transactions (Bank of International Settlements, 2011).

where

$$\lambda_{ijt} = \beta_1 \text{Post}_t \times \text{Affected}_i + \beta_2 X_{it} + \beta_3 \phi_i + \beta_4 \eta_{jt}. \quad (2)$$

Here Affected_i is a dummy variable equal to 1 if bank i is in the top half of the sample in terms of exposure to GIIPS debt in December 2010, and to 0 otherwise; Post_t is a dummy variable equal to 1 in 2010:Q4 and afterwards, and 0 otherwise; X_{it} is a vector of time-varying bank-level control variables; φ_i is a bank fixed effect; and η_{jt} is a matrix of borrower country fixed effects and quarter fixed effects. $Affected_i$ and $Post_t$ are not included in the specification on their own because the effect of the former is subsumed in the bank fixed effects, and the effect of the latter is subsumed in the quarter fixed effects.

Our coefficient of interest is β_1, and it captures the change in lending, from the precrisis to the postcrisis period, for the treatment group (affected banks) relative to the control group (nonaffected banks). A negative coefficient β_1 would imply that all else equal, lending declined for the group of affected banks, relative to the group of nonaffected banks, after the crisis started. The numerical estimate of β_1 captures the percentage difference in overall lending between the pre- and the post-period induced by switching from the group of nonaffected banks to the group of affected banks. The vector of bank-level controls X_{it} allows us to capture the independent impact of various bank-specific developments, such as sudden losses on the bank's loan portfolio or changes in bank size. In our preferred specification, we also include bank fixed effects and borrower country-quarter fixed effects. By including bank fixed effects, we address the possibility that both the amount of loans extended and the bank's holdings of impaired foreign sovereign debt are driven by a time-invariant bank-specific unobservable factor, such as risk appetite. By including the interaction of borrower country fixed effects and quarter fixed effects, we aim to alleviate concerns that our results might be driven by time-varying differences in the demand for syndicated loans or by differences in borrower quality (at the country level) in the various borrower countries.

Our main sample period is 2009:Q3–2011:Q4. We choose 2011:Q4 as the end point of the sample period in order not to have our main results contaminated by the ECB's long-term refinancing operation in December 2011. The start of the period is chosen in order to exclude the unprecedented collapse in syndicated lending during the global financial crisis from mid-2007 to mid-2009. Given that we let our postperiod start in 2010:Q4, our sample period is symmetric, with five precrisis and five postcrisis periods.[7] In

[7] One could argue that given that we measure exposures to GIIPS sovereign debt in December 2010 it would be more logical to start our postperiod in 2011:Q1. As this would make for unequal pre- and post-crisis periods, this is not our preferred option.

robustness tests, we show that our results are not affected by the choice of the prepost cut-off date. We also look at the effect of sovereign exposure on lending before and after our main sample period.

The Poisson model is ideally suited for a fixed effect-type analysis of count panel data models because the Poisson maximum likelihood estimator admits a large number of fixed effects and at the same time exhibits very strong robustness properties in small samples (Wooldridge, 2002). Standard errors are clustered at the bank level to account for the fact that banks' portfolio allocation exhibits geographical specialization and is therefore correlated over time. We show that our results also hold when we cluster the standard errors at the bank-borrower country level. Such multi-way clustering should make inference more conservative in case the errors are correlated simultaneously within lending banks and within borrowing countries.[8]

4. Data and Descriptive Statistics

Our identification strategy is built on exploiting differences between banks over time with respect to their exposure to impaired foreign GIIPS debt. Such analysis needs to be based on high-frequency bank-level data, and data on syndicated lending are particularly well-suited for this purpose for several reasons. In particular, syndicated loans (loans provided by a group of financial institutions—mostly banks—to a corporate borrower) are publicly registered, and so information on the universe of loans is readily available, limiting sample selection concerns. Furthermore, syndicated lending has been an important source of external finance to corporates since the 1980s, and information is publicly available for an extended period of time. In addition, the dataset provides us with information on both domestic and cross-border lending by a large number of banks to a large number of countries. This characteristic is crucial for two reasons. First, it allows us to exploit differences between banks with respect to their exposure to impaired GIIPS debt. Second, because our goal is to identify the credit supply channel, it is important to be able to control for changes in credit demand and borrower quality. Given that in the syndicated loan market multiple banks lend to the same country, we can use (time-varying) borrower country fixed effects to control for credit demand and borrower quality at the country level. Controlling for a common borrower as a way to isolate credit supply is a technique often applied in this type of literature

[8] For details, see Cameron, Gelbach, and Miller (2011).

(e.g., Khwaja and Mian, 2008; Cetorelli and Goldberg, 2011; De Haas and Van Horen, 2012; Schnabl, 2012; De Haas and Van Horen, 2013).

We begin by identifying a group of syndicated lenders for which information on exposure to GIIPS sovereign debt is available. To this end, we first identify all European banks active in the syndicated loan market over the period July 2009–December 2011. This list includes 119 banks. Next, we cross-check this list with the banks included in the stress test conducted by the European Banking Authority (EBA). Since 2010, EBA conducts biannual stress tests on large European banking groups and publishes this information, including their exposure to GIIPS sovereign debt. This leaves us with a group of fifty-nine European banks.

In the final sample selection step, we exclude all banks from Greece, Ireland, Italy, Portugal, and Spain. The reason is that for banks in impaired countries, it is difficult to identify the empirical channel we are interested in. For example, if one observes declining lending by a Greek bank holding a large amount of Greek sovereign bonds on its portfolio, this may be because investors are demanding higher rates on deposit in response to the bank's higher riskiness (the effect we are after), but it may also be because in a recessionary environment, depositors are reducing their savings to make up for a decline in labor income. This final step leaves us with a set of thirty-four banks in non-GIIPS European countries. In total, these banks are responsible for about 71% of the syndicated lending issued by the 119 banks in our initial sample.

Our data source for syndicated loans is the Dealogic Loan Analytics database, which contains comprehensive information on virtually all syndicated loans issued since the 1980s. We download all syndicated loans extended to nonfinancial corporates worldwide, focusing on the period from July 2009 to December 2011. Our unit of observation is the volume of syndicated loans issued by bank i to borrowers in country j during quarter t. To this end, we split each loan into the portions provided by the different syndicate members. Loan Analytics provides only the exact loan breakdown among the syndicate members for about 25% of all loans. Therefore, we use the procedure applied by De Haas and Van Horen (2012, 2013) and divide the loan equally among the syndicate members. In total, we split 5,862 syndicated loans in which at least one bank in our sample was active into 17,213 loan portions.[9]

[9] In Section 5.4, we provide robustness tests that indicate that our results remain unchanged when we use a different assignment of the loan amount or when we study the number of loans issued by each bank.

We then use these loan portions to construct our main dependent variable *Lending*. For each bank in our sample, we compute the total amount of loans that the bank issued during each quarter to a particular country. We divide this by the annual CPI of the country in which the bank is located to account for differences in inflation.[10] As is common in this literature, we attribute to each bank (including subsidiaries) the nationality of its parent bank (see, e.g., Mian, 2006; Giannetti and Laeven, 2012b).[11] We exclude bank–country pairs where no lending took place over the sample period.

In total, over the sample period our group of thirty-four banks issued loans to corporates in 146 different countries (both advanced economies and emerging markets). The variation across lending banks and borrowing countries is quite large. There are 4,323 nonzero bank-borrower country-quarter observations (39.1% of the total). Average quarterly bank-country lending is 88 mln euro with a standard deviation of 364 mln euro. All banks in our sample lend to domestic firms, and each bank lends on average to fifty-eight foreign countries during the sample period. The majority of lending is within Western Europe (53%), out of which 11% to the GIIPS countries.

Next, we create a variable capturing the degree to which bank i is exposed to GIIPS sovereign debt. The variable *GIIPS exposure* is calculated using data from EBA on each individual bank's holdings of GIIPS debt securities as of December 2010, normalized by the bank's total assets as of December 2010.[12] In particular,

$$\text{GIIPS exposure}_{it} = \sum_{k} \frac{\text{Debt\_Securities}_{ikt}}{\text{Total\_Assets}_{it}}, \tag{3}$$

where $t =$ December 2010 and $k \in \{\text{Greece, Ireland, Italy, Portugal, Spain}\}$

We then construct the dummy variable $Affected_i$ by splitting the sample of thirty-four banks in two equal groups and assigning a value of 1 to each bank in the top half of the distribution of GIIPS exposure.[13] We need to acknowledge that this assignment of banks to "treated" and "control" groups is not random. In particular, because we split the sample in two

[10] Inflation differences at the borrower country level are accounted for by the borrower country-quarter fixed effects that we include in most of our specifications.

[11] Note that only about 6% of all loan portions are provided by subsidiaries.

[12] EBA also provides exposure data as of March 2010. We prefer to use the December 2010 data because information is available for more banks in our dataset (34 versus 27). We, however, show in a robustness test that our results remain quantitatively unchanged when we use the March 2010 exposure instead.

[13] The composition of groups is remarkably stable over time; for example, only two banks switch groups if we use the March 2010 instead of the December 2010 exposure.

groups across the medium exposure, banks with relatively similar exposures to impaired debt end up in different groups. To address this issue, in robustness tests we compare banks with zero or close-to-zero GIIPS exposures to banks with very large GIIPS exposures.

We also include a number of time-varying bank characteristics to capture the effect of other types of shocks to bank balance sheets on lending and to further address the issue that our banks are not randomly assigned to the "treatment" and "control" group. To this end, we link our banks to Bureau van Dijk's BankScope database. We include as bank characteristics the total assets of the bank (Size) to capture changes in bank size. Furthermore, we include three variables that capture (changes in) overall bank health: the Tier 1 capital ratio (*Tier 1*), the share of impaired loans to total assets (*Impaired loans*), and net income of the bank normalized by total assets (*Net income*). Finally, we include three variables that capture the bank's funding and business model: equity funding as a share of total assets (*Leverage*), deposit funding as a share of total assets (*Deposits*), and costs (*Cost to income*). All bank-level variables are measured at year end prior to issuing the loan.[14] Table I shows definitions and summary statistics of all variables used throughout the article and indicates that the median bank in the sample has €593.1 billion in assets, is well-capitalized with a Tier 1 capital ratio of 10.8, has high reliance on deposit funding (32.2), positive net income and a relatively small share of impaired loans. However, a number of banks in the sample record negative net income, as well as a very high share of impaired loans to assets (a high of 9.3%). To the degree that such balance sheet weaknesses are correlated with sovereign debt exposure, it is important to formally control for them.

Table II illustrates the difference between affected and nonaffected banks with respect to a number of variables (all measured before the euro area sovereign debt crisis started, in 2009). Affected banks are on average smaller and have a marginally lower Tier 1 capital ratio. They also have negative net income while nonaffected banks' net income is on average close to zero. Affected banks on average also exhibit a lower reliance on deposit funding, higher cost-to-income ratios, lend more, and are relatively more focused on domestic lending. None of these differences is significant in a statistical sense, however. The only two statistically significant differences

[14] In unreported regressions, we confirm that our results are not affected when we use quarterly balance sheet data. We prefer to use annual data as quarterly data are not available for all banks and if they are available they are only available from 2008 onwards, which makes it impossible to use quarterly data for the placebo tests that we conduct in Section 6.2.

Table I. Descriptive statistics

This table presents definitions and summary statistics of all variables used in the paper. Syndicated loan variables are computed by the authors using data from Dealogic's Loan Analytics database. Exposure to GIIPS sovereign debt is computed using information provided by the European Banking Authority on sovereign debt holdings by European banking groups and CDS spreads come from Datastream. Real sector exposure is computed using information provided by the European Banking Authority. Information on government support measures is collected by the authors from a large number of publicly available sources. Bank-specific variables are from BankScope.

Variable name	Unit	Definition	*N*	Mean	Median	St. dev	Min	Max
Lending	Million EUR	Total volume of loans extended by bank *i* to borrowers in country *j* in quarter *t* divided by annual CPI of country in which the bank is located	11,070	88.48	0	363.57	0	8,006
Lending industry	Million EUR	Total volume of loans extended by bank *i* to borrowers in industry *k* of country *j* in quarter *t* divided by annual CPI of country in which the bank is located	27,768	16.62	0	57.03	0	1343
Continued	0/1	Dummy = 1 if bank *i* continued lending to firm *k* in the post period	1,734	0.73	1	0.44	0	1.00
Lending number	Number	Total number of loans extended by bank *i* to borrowers in country *j* in quarter *t*	11,070	1.68	0	6.35	0	168.00
GIIPS exposure	%	The sum of bank *i*'s holdings of GIIPS sovereign debt divided by the bank's assets (all measured in 2010:Q4)	11,070	1.30	0.79	1.24	0	7.44
Affected	0/1	Dummy = 1 if *GIIPS exposure* of bank *i* is above the median level	11,070	0.58	1	0.49	0	1
Affected (2010:Q1)	0/1	Same as *Affected*, except exposure is measured in 2010:Q1	9,430	0.56	1	0.50	0	1
Affected (equity)	0/1	Same as *Affected*, except exposure is divided by bank *i*'s equity	11,070	0.57	1	0.49	0	1
Affected (weighted)	0/1	Same as *Affected*, except exposure to each country is weighted by the CDS spread of that country's sovereign debt (measured in 2010:Q4)	11,070	0.53	1	0.50	0	1
Affected own sovereign	0/1	Same as *Affected*, except based on exposure to own sovereign	11,070	0.44	0	0.50	0	1

(continued)

Table I. (Continued)

Variable name	Unit	Definition	*N*	Mean	Median	St. dev	Min	Max
Affected real sector	0/1	Same as *Affected*, except based on exposure to GIIPS real sector	11,070	0.50	1	0.50	0	1
Size	Log	Log of total assets of the bank (1 year lagged)	11,070	20.19	20.32	1.05	17.09	21.65
Tier 1	%	The ratio of Tier 1 capital to risk-weighted assets (1 year lagged)	10,620	10.83	10.56	2.15	6.90	19.89
Impaired loans	%	Impaired loans divided by total assets (1 year lagged)	10,186	1.79	1.37	1.45	0.09	9.28
Net income	%	Net income divided by total assets (1 year lagged)	11,070	0.14	0.25	0.46	−2.33	0.86
Leverage	%	Equity divided by total assets (1 year lagged)	11,070	3.95	3.97	1.60	0.64	8.32
Deposits	%	Deposits divided by total assets (1 year lagged)	11,070	32.20	29.00	12.02	2.14	64.62
Cost to income	%	Cost to income ratio (1 year lagged)	10,884	65.52	62.82	15.29	35.21	110.00
Support	0/1	Dummy = 1 if bank *i* received government support during the global financial crisis	11,070	0.61	1	0.49	0	1
Carry trader	0/1	Dummy = 1 if bank *i* increased its exposure to GIIPS sovereign debt between March and December 2010	9,430	0.41	0	0.49	0	1

are related to the fact that affected banks have lower equity funding and that lending to GIIPS countries is a considerably higher share of overall lending for affected banks, even though they are not domiciled in GIIPS countries.

Appendix Table AI provides a list of all the banks in our sample. It shows each bank's country of incorporation and the total lending volume of the bank during the pre- and post-periods and the changes therein. In addition, it provides each bank's *GIIPS exposure* at 2010:Q4 and whether the bank is included in the group of affected or nonaffected banks. The table demonstrates that there is substantial cross-country, but also within-country, heterogeneity in the degree of balance sheet exposure to GIIPS debt. For example, there are both affected and nonaffected banks in Austria, Germany, Netherlands, and the UK, while all French banks are affected and none of the Swedish banks are. Appendix Table AII gives a finer breakdown of nominal exposures by GIIPS country. The ratio of GIIPS debt securities to total assets ranges from 0 for DNB Bank ASA (Norway), Svenska Handelsbanken (Sweden), and Swedbank First Securities (Sweden) to 7.44% for BCEE (Luxembourg).

Table II. Comparison affected and nonaffected banks

This table shows the means and medians of the respective variables for the group of affected and the group of nonaffected banks and a *t*-test and Pearson chi-square test that test whether the mean or median is the same for the two groups of banks. All variables are based on 2009 information.

	Mean			Median		
	Nonaffected	Affected	*T*-test of equal means (*p*-value)	Nonaffected	Affected	Pearson chi-square test of equal medians (*p*-value)
Balance sheet						
Size (assets; billion USD)	486.90	663.28	0.37	225.15	469.35	0.30
Tier 1 ratio	11.20	11.32	0.89	10.40	10.50	0.73
Impaired loans	2.34	1.86	0.39	1.53	1.66	0.87
Net income	−0.04	−0.12	0.72	0.29	0.09	0.73
Leverage	4.84	3.59	0.03	4.42	3.54	0.09
Deposits	34.15	29.98	0.32	30.26	25.69	0.30
Cost to income	58.98	65.91	0.25	59.75	62.03	0.73
Syndicated lending						
Total lending (billion EUR)	5.50	9.31	0.19	3.00	4.94	0.85
Share domestic lending	0.29	0.34	0.52	0.24	0.28	0.85
Share GIIPS lending	0.04	0.11	0.01	0.01	0.10	0.07
Share European lending (incl. domestic)	0.65	0.63	0.78	0.61	0.61	0.85

5. Empirical Evidence

5.1 SYNDICATED LENDING DURING THE SOVEREIGN DEBT CRISIS

Before estimating our empirical model, it is insightful to first have a look at the market for syndicated lending. Figure 1 shows the evolution of syndicated lending between 2007 and 2011. On a quarterly basis, global syndicated lending peaked in 2007:Q2 at €620.1 billion, then collapsed during the global financial crisis to a quarter of that in 2009:Q3, and then recovered to almost its precrisis levels in 2011:Q4. However, the recovery in lending by European banks was much less pronounced, with quarterly lending in 2011:Q4 25% lower than in 2007:Q2. Figure 2 suggests that balance sheet exposure to impaired sovereign debt by a number of European banks could be one of the reasons behind this slow recovery. It plots the evolution of total syndicated lending by our sample of thirty-four

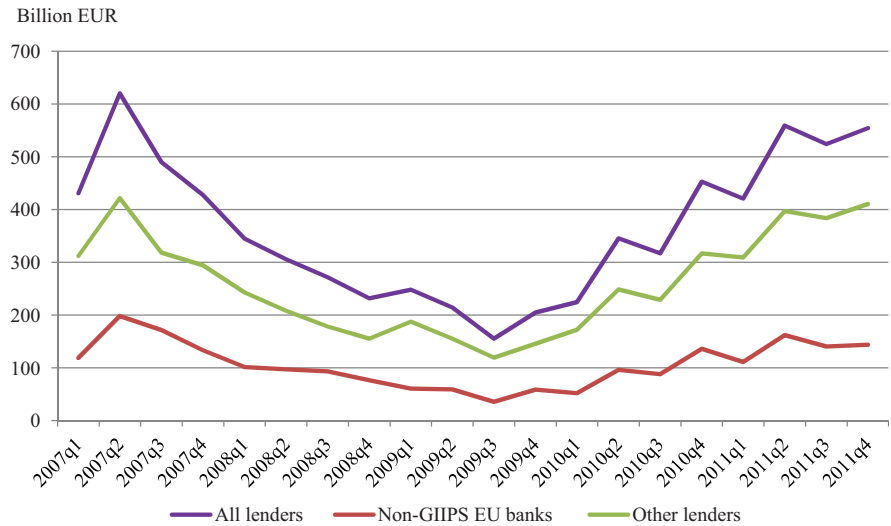

Figure 1. Syndicated lending, 2007–2011. This figure shows the evolution of the total amount of syndicated loans issued worldwide in billion euros by all lenders in the market and by our sample of thirty-four non-GIIPS European banks over the period 2007:Q1 to 2011:Q4. Only loans to nonfinancial corporates are included.

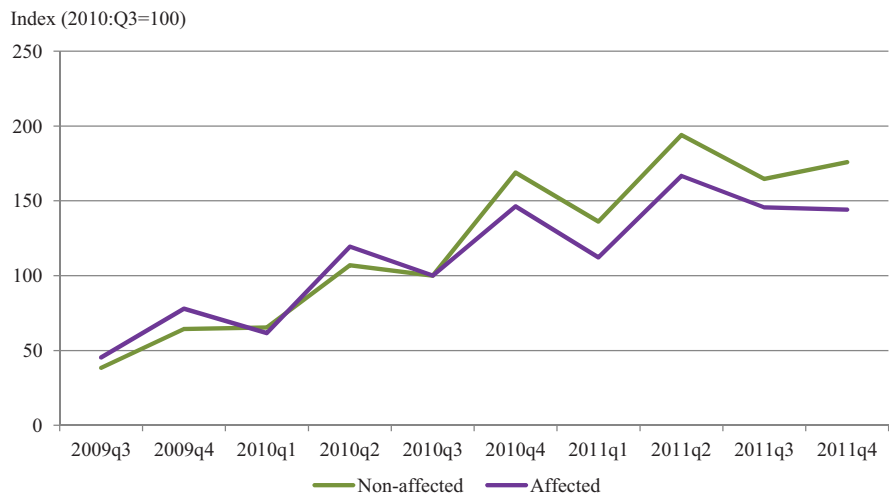

Figure 2. Impact of GIIPS sovereign debt exposure on bank lending.This figure shows the evolution of total syndicated lending by our sample thirty-four European banks over the period 2009:Q3 to 2011:Q4. It depicts total volume (in euros) of syndicated loans issued in each quarter for the two groups of banks indexed to be 100 at 2010:Q3. Only loans to nonfinancial corporates are included. Nonaffected contains the group of banks whose exposure to GIIPS debt was below the median level and Affected contains the group of banks whose exposure was above the median level.

European banks from non-GIIPS countries over our sample period 2009:Q3–2011:Q4. The figure shows that up until 2010:Q3, there were no significant differences in the rate of change of syndicated lending by the group of affected and the group of nonaffected banks. After the crisis intensified with the Greek government securing a €110 billion bailout loan from the EU and the IMF in mid-2010,[15] loan growth by non-GIIPS European banks exposed to GIIPS sovereign debt has been substantially lower than lending by non-GIIPS European banks not exposed to GIIPS sovereign debt.

5.2 MAIN RESULTS

The main results of the article are reported in Table III. We estimate a number of different versions of Model (1). In column (1), we include bank, quarter, and borrower country fixed effects, but do not control for time-varying bank characteristics. The estimate of coefficient β_1 is statistically significant (at the 1% level), and economically meaningful. Given that total syndicated lending increased between the pre- and the post-crisis period, the magnitude of the coefficient indicates that syndicated lending was on average 20.9% lower in the post-sovereign debt crisis period for the group of banks with a significant exposure to GIIPS debt compared to that of the group of banks with limited exposure.[16] Because the specification includes bank fixed effects, quarter fixed effects, and borrower country fixed effects, it is unlikely that our results are driven by unobservable time-invariant bank heterogeneity, by global changes in the syndicated loan market, or by time-invariant differences in country-level borrower demand and/or quality.

A possible concern regarding our estimates so far is that we have simply captured changes in the demand for loans between the pre- and post-period which may have declined relatively more in countries that borrow more from our group of affected banks. To address this concern, in column (2) we replace the quarter and borrower country fixed effects with borrower country–quarter fixed effect interactions. The idea is to compare an affected and a nonaffected bank lending to the same country at the same

[15] This was followed by a €85 billion rescue package for Ireland in November 2010 and by a €78 billion rescue package for Portugal in May 2011.

[16] The interpretation of the coefficient from a Poisson regression is the following. The regression coefficient is −0.234. The exponential of the coefficient is 0.791. Therefore, in the postcrisis period, banks with a significant exposure to GIIPS debt distributed 0.791 as many euros in syndicated loans as banks without significant exposures to GIIPS debt, corresponding to a decline of 20.9%.

Table III. Transmission of GIIPS sovereign debt exposure

This table shows the impact of GIIPS sovereign debt exposure on bank lending. The dependent variable is *Lending* which measures the lending of bank *i* to borrowers in country *j* during quarter *t*. The sample period is 2009:Q3–2011:Q4 and the *Post* period is 2010:Q4–2011:Q4. All regressions include bank fixed effects. In addition, column [1] and [2] include borrower country and quarter fixed effects, and column [3]–[5] borrower country × quarter fixed effects. All regressions are estimated using Poisson. All regressions include a constant and standard errors are clustered by bank in regressions [1]–[3] and [5] and by bank and borrower country in regression [4]. Robust standard errors appear in parentheses and ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively. See Table I for variable definitions and sources.

	[1]	[2]	[3]	[4]	[5]
Affected * Post	−0.234***	−0.210***	−0.239***	−0.239***	
	(0.082)	(0.078)	(0.069)	(0.076)	
Affected Greece* Post					−0.257***
					(0.051)
Affected Ireland * Post					−0.011
					(0.087)
Affected Italy * Post					−0.110
					(0.079)
Affected Portugal * Post					0.082
					(0.063)
Affected Spain * Post					−0.128**
					(0.054)
Size			−0.080	−0.080	−0.084
			(0.209)	(0.170)	(0.134)
Tier 1			−0.005	−0.005	0.002
			(0.024)	(0.025)	(0.022)
Impaired loans			0.018	0.018	−0.005
			(0.056)	(0.047)	(0.036)
Net income			−0.071	−0.071	−0.040
			(0.090)	(0.133)	(0.064)
Leverage			0.107	0.107	−0.020
			(0.119)	(0.100)	(0.083)
Deposits			−0.015	−0.015**	0.005
			(0.010)	(0.007)	(0.009)
Cost to income			0.003	0.003	0.002
			(0.003)	(0.002)	(0.002)
Clustering	Bank	Bank	Bank	Bank and borrower country	Bank
Bank fe	Yes	Yes	Yes	Yes	Yes
Quarter fe	Yes	No	No	No	No
Borrower country fe	Yes	No	No	No	No
Borrower country × quarter fe	No	Yes	Yes	Yes	Yes
No. of observations	11,070	11,070	10,744	10,744	10,744

point in time. This allows us to control for time-varying borrower demand and/or quality at the country level, and to alleviate concerns that our results so far have simply captured changes in the demand for loans. The estimate fully confirms our previous result, but the magnitude is somewhat lower than in the test with a less rich set of fixed effects.

In column (3), we report the estimates from our preferred specification. This time, we not only include bank fixed effects and borrower country-quarter fixed effects, but also a wide range of bank balance sheet data. This allows us to account for time-varying shocks to the bank's financial health unrelated to its exposure to impaired GIIPS debt. In order to account for the fact that the response to accounting variables may not be immediate, we use 1-year lags in the regression.

Our estimate of β_1 continues to be negative and economically meaningful. The magnitude of the coefficient implies that during the postcrisis period, syndicated lending decreased on average by 21.3% for the group of banks that were significantly exposed to GIIPS debt compared to those less exposed. Furthermore, the balance sheet variables largely have the expected sign. For example, banks with a lower income lend less as they may need to rebalance their portfolio away from risky lending (Berger and Udell, 1994; Peek and Rosengren, 1997). Also, well capitalized banks and banks that rely relatively more on deposit funding lend less, although in none of the cases is the effect significant in the statistical sense.[17]

In column (4), we report estimates from a regression which includes bank balance sheet variables and where the errors are clustered simultaneously at the bank level and at the borrower country level. As expected, the standard errors on the main explanatory variable (the interaction of the *Affected* and the *Post* dummies) are larger with this more conservative approach.

[17] To reduce potential concerns that our results are biased because of omitted time-varying bank characteristics, we also apply the method in Altonji, Elder, and Taber (2005) to gauge the relative importance of possible omitted variable bias. We measure coefficient stability by calculating the ratio between the value of the coefficient in the regression including controls (numerator) and the difference between this coefficient and the one derived from a regression on the same number of observation but without control variables (denominator). The ratio amounts to 14 for the specification in column 3 of Table III. This suggests that to explain the full effect of the bank's exposure to GIIPS sovereign debt, the covariance between unobserved factors and the bank's exposure to GIIPS sovereign debt needs to be more than fourteen times as high as the covariance of the included controls (by way of comparison, Altonji, Elder, and Taber (2005) estimate a ratio of 3.55 which they interpret as evidence that unobservables are unlikely to explain the entire effect they document). We therefore conclude that it is unlikely that unobserved heterogeneity can completely explain away the negative impact of exposure to impaired sovereign debt on syndicated lending that we document.

Importantly, the effect of balance sheet exposure to impaired sovereign debt on bank lending is still significant at the 1% statistical level. Reliance on deposit funding also affects bank lending negatively and significantly.

In column (5), we test for the relative effect of exposures to individual GIIPS countries. In practice, we replace the variable *GIIPS Exposure* with five separate dummy variables, each of which is equal to 1 if the bank is in the top half of the distribution of exposure to Greece, Ireland, Italy, Portugal, or Spain. This test allows us to gauge the relative importance of individual exposures and to test whether the overall effect on lending is not entirely driven by exposure to the most problematic country, Greece. We do find that a sizeable holding of Greek sovereign bonds did affected lending negatively and significantly. However, so did exposure to Spanish debt (significant at the 5% level) and to Italian debt (significant at the 15% level), suggesting that exposure to Greek sovereign debt does not fully drive the main effect.

5.3 ALTERNATIVE EXPLANATIONS

We now consider a number of alternative explanations that may fully or partially account for the results reported in our baseline regression. The first possibility we address is that our results are demand-driven. In particular, it is possible that within the same borrower country, low-net worth firms borrow from affected banks while high-net worth firms borrow from nonaffected banks. Alternatively, the decline in credit may have come from firms switching away from banks with high GIIPS exposures, not from affected banks cutting lending. Such demand effects will not be captured by our borrower country-quarter fixed effects.

We perform two tests to address these issues. First, we rerun our main specification, this time with borrower country–industry–quarter fixed effect interactions, in addition to bank balance sheet data. The idea of this test is to control more precisely for borrower demand, by comparing lending by an affected and by a nonaffected bank to the same industry (e.g., agriculture) in the same country (e.g., Turkey) at the same point in time. To that end we construct a new dependent variable, *Lending industry*, which equals total syndicated lending, in euros, by bank i to borrowers in industry k in country j at time t divided by annual CPI of the country in which the bank is located. We exclude bank-borrower country-industry triplets with zero lending throughout the sample period. We report the estimates from this test in column (1) of Table IV. The estimate of the effect of balance sheet exposure to impaired sovereign debt on bank lending is once again negative and significant at the 1% statistical level, suggesting that our preferred,

Table IV. Alternative explanations

This table shows a number of robustness tests on the impact of GIIPS sovereign debt exposure on bank lending. The dependent variable is *Lending*, unless otherwise specified. In column [1], the dependent variable is *Lending industry* which measures the lending of bank *i* to borrowers in industry *k* of country *j* during quarter *t*. In column [2] the dependent variable is *Continued*, which captures the probability that bank *i,* a creditor of firm *q* in the preperiod, continued lending to the same firm in the postperiod. In column [3] we control for the exposure of the bank to its own sovereign. In column [4] we control for government support received by the bank. In column [5] we only include bank–country pairs between which syndicated lending took place in at least five quarters during the sample period. In column [6] we exclude GIIPS borrowers. In column [7] we control for the exposure of the bank to the real sector of the GIIPS countries. In column [8] we only include loans denominated in Euros. The sample period equals 2009:Q3–2011:Q4 and *Post* equals 2010:Q4–2011:Q4. All regressions include bank level controls as in Table III, bank fixed effects and a constant. In addition, column [1] included borrower country × industry × quarter fixed effects, column [2] firm fixed effects and columns [3]–[8] borrower country × quarter fixed effects. All regressions are estimated using Poisson and standard errors are clustered by bank. Robust standard errors appear in parentheses and ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively. See Table I for variable definitions and sources.

	[1] Control for demand: lending industry	[2] Control for demand: continued	[3] Control for own sovereign exposure	[4] Control for govern-ment support	[5] Important markets only	[6] Excluding GIIPS countries	[7] Control for real sector exposure	[8] Euro loans only
Affected * Post	−0.294***		−0.252***	−0.191***	−0.169**	−0.230***	−0.230***	−0.322***
	(0.072)		(0.066)	(0.067)	(0.068)	(−0.071)	(0.067)	(0.100)
Affected		−0.222***						
		(0.080)						
Affected own sovereign * Post			0.052					
			(0.086)					
Support * Post				−0.179***				
				(0.054)				
Affected real sector * Post							−0.099	
							(0.073)	
Bank level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fe	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Borrower country × quarter fe	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Borrower industry × country × quarter fe	Yes	No	No	No	No	No	No	No
Firm fe	No	Yes	No	No	No	No	No	No
No. of observations	27,013	1,734	10,744	10,744	3,790	9,940	10,744	5,394

albeit less rich specification in Table III, column (3) is a reasonable approach to accounting for changes in demand.

Second, we isolate the subsample of nonfinancial corporates that borrowed from at least two banks in our sample during the preperiod and at least once during the postperiod. There are 403 such firms for a total of 1,734 bank–firm pairs. We then estimate a regression where the dependent variable, *Continued*, is a dummy variable which is equal to one if bank i was lending to a particular firm q in the pre-period and continued lending to that same firm in the postperiod. In this specification, our variable of interest is $Affected_i$. Because in this setup multiple banks—both affected and unaffected—are lending to the same firm, this specification should net our firm demand perfectly, and any difference in the estimate on $Affected_i$ should be supply-driven. We report the evidence in column (2), and it strongly suggests that our main results are not contaminated by unobservable firm-specific demand.

Next we take into account the fact that in addition to balance sheet exposure to foreign sovereigns, banks tend to hold on their balances sheet a substantial amount of sovereign debt issued by their own government. Therefore, deteriorating creditworthiness of the bank's own sovereign will negatively affect the asset side of the bank's balance sheet, its profitability, and its ability to use this debt as a source of collateral, thereby raising funding costs. Furthermore, owing to strong links between sovereigns and banks, sovereign downgrades often lead to downgrades of domestic banks regardless of their exact balance sheet exposure, thereby creating an additional channel through which funding costs can rise. Finally, a weakening of the bank's own sovereign can reduce the value of implicit or explicit government guarantees.[18]

As a first way of addressing this concern, we exclude from the start banks domiciled in GIIPS countries. However, the euro area sovereign debt crisis has been characterized by heterogeneity in the behavior of sovereign bond yields across non-GIIPS countries, as well. For example, while in 2011 yields

[18] A number of recent papers have documented these empirical regularities. For example, Angeloni and Wolff (2012) find that European banks' stock market performance was impacted by exposures to GIIPS sovereign debt. Arezki, Candelon, and Sy (2011) show that news on sovereign ratings affected bank stock prices in Europe during the period 2007–10. Brown and Dinc (2011) provide evidence that a country's ability to support its financial sector, as reflected in its public deficit, affects its treatment of distressed banks. Demirguc-Kunt and Huizinga (2013) find that in 2008 systemically large banks saw a reduction in their market valuation in countries running a large fiscal deficit as these banks became too big to save. Correa *et al.* (2014) find that sovereign rating changes impact bank stock returns, especially in the case of downgrades.

on German bunds went down, yields on French debt went up. If French banks are on average more exposed to GIIPS debt than German banks, we could mistakenly attribute a reduction in lending to balance sheet exposure to GIIPS debt while, in reality, it is due to concerns by French banks about the weakening of their domestic safety net.

To address this concern, we now explicitly control for deterioration of the creditworthiness of the bank's own sovereign. We do so by including in the model a variable capturing the bank's exposure to its own sovereign debt. The results of this procedure are reported in column (3) of Table IV. They strongly suggest that balance sheet exposure to the bank's own sovereign did not affect lending over that period, implying that exposure to impaired foreign sovereign debt was indeed the major reason for observed variations in lending behavior across the banks in our dataset.

Another alternative explanation for our main result is that affected banks happen to be banks which received government support during the financial crisis. This support may have come in many different forms, ranging from the acquisition of an equity share to recapitalization to an implicit guarantee on the bank's liabilities. Consequently, the government may have exerted pressure on these banks to deleverage, potentially leading to lower lending. To account for this possibility, we collect data from a number of publicly available sources on government support programs enacted during the financial crisis. We then create an indicator variable equal to 1 if the bank received any form of government support during the financial crisis, interact it with the dummy variable $Post_t$, and include this new interaction variable in our preferred specification. The results, reported in column (4), suggest that government support did play a significant role in bank decisions to rebalance their portfolio away from syndicated lending, indicating that such support may have indeed come with strings attached regarding lending. Importantly, in addition balance sheet exposure to impaired sovereign debt continues to play a significant role in explaining changes in syndicated lending.

The next concern we need to address is related to the fact that banks with balance sheet exposure to impaired sovereign debt may have been lending to relatively more remote and/or less important markets before the crisis. Then, if all banks reduced lending once the crisis started, affected banks may have reduced it more not because their weakening balance sheets forced them to rebalance their portfolios, but because the relationship to their customers was weaker (De Haas and Van Horen, 2013). To address this issue, we include in column (5) only observations from bank-country pairs between which syndicated lending took place in at least five quarters during the 2009:Q3–2011:Q4 period. Our results continue to hold, suggesting that our

main finding is not driven by the fact that affected banks systematically serve marginal foreign markets.[19]

A related concern is that affected banks were lending relatively more to borrowers in GIIPS countries before the crisis started. The summary statistics in Table II do suggest that alongside leverage, this is the main systematic difference between affected and nonaffected banks. Consequently, affected banks may have reduced lending not because of their own balance sheet problems, but because growth opportunities in GIIPS countries collapsed as the sovereign debt crisis progressed. This effect will not be fully netted out by the borrower country-quarter fixed effects if affected banks lend mostly to GIIPS countries and nonaffected banks lend mostly to non-GIIPS countries. We address this issue by excluding GIIPS borrowers from the regressions (column (6)). The estimates imply that the main result in the article is not driven by a widening of expected returns across the two groups of banks. Regarding leverage, differences across banks are due to very high leverage of two Landesbanken. However, when (in unreported regressions) we exclude those two banks from the sample, the results hardly change.

It is also possible that banks are exposed to GIIPS countries not only by holding debt securities issued by the five GIIPS governments, but also by holding debt securities issued by private corporations in the five countries under stress. If the two types of exposures are correlated, then we could be overstating the effect of balance sheet exposure to impaired foreign sovereign debt. For all the banks in our sample, EBA also reports exposures to the real sector in the GIIPS countries in December 2010. In column (7), we explicitly control for this exposure, and it turns out to matter economically, albeit not statistically. The effect of balance sheet exposure to GIIPS sovereign debt on lending survives this alternative test.

One final concern is related to potential systematic differences across the two groups of banks in the currency denomination of the loans. We have converted all loans into euros before running our tests. It is possible that affected banks also happen to lend in currencies which depreciated after the sovereign debt crisis started. If so, then the reduction in lending we register may be picking up a mechanical effect related to exchange rate movements. We account for this possibility by excluding from the tests all loans issued in a currency other than the euro. The estimates reported in column (8) suggest that our main result is not driven by currency valuation effects.

[19] The results are qualitatively unchanged in an alternative regression (unreported for brevity) where we only include observations from bank-country pairs between which syndicated lending took place in all ten quarters during the 2009:Q3–2011:Q4 period.

5.4 ROBUSTNESS TESTS

In Table V, we present a battery of robustness tests. We first test whether our results are affected by alternative measures of sovereign debt exposure. In column (1), we utilize March 2010 instead of December 2010 exposure data to calculate the $Affected_i$ dummy, and make the $Post_t$ dummy equal to 1 on and after 2010:Q2. An argument can be made that the crisis started already in May 2010, when the bail-out package for Greece was agreed upon[20] and the European Financial Stability Facility (EFSF) was established.[21] If so, the reduction in lending would have started earlier than our baseline cut-off point (2010:Q4). In addition, the December 2010 exposure data on which we base the separation of banks into affected and nonaffected groups may be misleading. Depending on how banks unwound their GIIPS exposures between the "true" start of the crisis and 2010:Q4, our results could be upward biased. Recalculating the $Affected_i$ dummy results in the loss of seven banks for which there are no EBA data on exposure as of March 2010. The results are qualitatively unchanged, however, indicating that they are robust to the exposure classification criterion.

In column (2), we report estimates from a regression where the variable $Affected_i$ is calculated based on the ratio of impaired GIIPS debt to equity rather than to assets, as in the main tests. This alternative method provides a measure of risk that is more in line with regulatory requirements as it measures the bank's holding of risky assets in relationship to its capital. This test confirms that our main result does not depend on how we scale the bank's risky sovereign exposure. In column (3) we replace our binary variable $Affected_i$ with a continuous variable equal to the natural logarithm of exposure to GIIPS debt as defined in Equation (3). Our main results are confirmed. In addition to that, using the continuous exposure variable

[20] On May 2, 2010, the Greek government, the IMF, and euro-zone leaders agree to a €110 billion ($143 billion) bail-out package that would take effect over the next 3 years.

[21] On May 9, 2010, the twenty-seven EU member states agreed to create the EFSF, a legal instrument aiming at preserving financial stability in Europe by providing financial assistance to euro area states in difficulty. The EFSF can issue bonds or other debt instruments on the market with the support of the German Debt Management Office to raise the funds needed to provide loans to euro area countries in financial troubles, to recapitalize banks, or to buy sovereign debt. Emissions of bonds are backed by guarantees given by the euro area member states in proportion to their share in the paid-up capital of the European Central Bank. The €440 billion lending capacity of the facility is jointly guaranteed by the euro area countries' governments and may be combined with loans up to €60 billion from the European Financial Stabilization Mechanism (reliant on funds raised by the European Commission using the EU budget as collateral) and up to €250 billion from the IMF to obtain a financial safety net up to €750 billion.

Table V. Robustness tests

This table shows a number of robustness tests on the impact of GIIPS sovereign debt exposure on bank lending. The dependent variable is *Lending*. In column [1] we recalculate our *Affected* dummy based on March 2010 exposures, and the postperiod is 2010:Q2–2011:Q4. In column [2] we divide exposure by equity instead of total assets. In column [3] we use the continuous exposure variable calculated as in (3) instead of the dummy *Affected*. In column [4] we classify banks as affected after first weighing their holdings of debt securities with the CDS spread of the countries' sovereign debt. In column [5] we only include banks that are in the top or bottom tertile of the distribution of our GIIPS exposure measure. In column [6] we assign the loan to the lead arranger(s) only, instead of assigning it to all syndicate members. In column [7] we use the number of loans extended by bank i to country j in quarter t instead of the total volume of loans. In column [8] we assign a value of 1 to the *Post* dummy in 2011:Q1 and onwards instead of 2010:Q4 and onwards. In column [9] we exclude UK banks from our sample. The sample period equals 2009:Q3–2011:Q4 and *Post* equals 2010:Q4–2011:Q4, unless otherwise specified. All regressions include bank level controls as in Table III, bank fixed effects, borrower country × quarter fixed effects and a constant. All regressions are estimated using Poisson and standard errors are clustered by bank. Robust standard errors appear in parentheses and ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively. See Table I for variable definitions and sources.

	[1] Affected based on March 2010 exposures	[2] Exposure as share of equity	[3] Continuous exposure variable	[4] Including CDS spread	[5] Top/bottom quartile	[6] Lead bank only	[7] Number loans	[8] Post starts 2011:Q1	[9] Excluding UK banks
Affected * Post	−0.378***	−0.289***	−0.180***	−0.298***	−0.381***	−0.238***	−0.189***	−0.187***	−0.330***
	(0.096)	(0.061)	(0.043)	(0.056)	(0.109)	(0.070)	(0.062)	(0.070)	(0.066)
Bank level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fe	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Borrower country × quarter fe	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	9,162	10,744	10,744	10,744	4,754	9,452	4,542	10,744	8,704

allows us to calculate the effect of a marginal increase in exposure on lending. The magnitude of the coefficient indicates that an increase in the riskiness of the bank's exposure to impaired debt by one standard deviation results in a 17.3% decline in lending.

In column (4), we account for the fact that the underlying sovereign risk affects a bank's holdings of sovereign debt securities through the prices investors are willing to pay for insuring this risk. To take this price dimension into account, we now classify banks as affected after first weighing the holdings by bank *i*'s debt securities of each individual foreign GIIPS country by the average Credit Default Swap (CDS) spread of that country's sovereign debt over 2010:Q4. The evidence suggests that our main results are not driven by whether we price individual exposures or not. Finally, in column (5), we report estimates from a test where we compare banks in the top and bottom quartile of the distribution of exposures. The magnitude of the estimate is larger relative to the main specification, suggesting that the divergence in lending is more pronounced once we compare groups of banks that differ substantially in their exposure to impaired GIIPS debt.

We next check the robustness of our results to alternative definitions of lending. To deal with the fact that Loan Analytics only provides information on the loan breakdown for about 25% of the loans, we have so far followed the procedure in De Haas and Van Horen (2012, 2013) and assumed for the other 75% of the loans that each lender provided the same amount. We now employ an alternative procedure where we assign the full loan to the lead bank (as in Ivashina and Sharfstein, 2010, and Giannetti and Laeven, 2012b).[22] Column (6) of Table V indicates that our main result is not affected by this different assignment of the loan amount.

It is also possible that while lending less in total, affected banks are extending loans to more borrowers. To that end, we test for a difference between the intensive and the extensive margin by looking at the number of loans extended by bank *i* to country *j* in quarter *t*, rather than at the total volume of the loans. By doing so, we capture the frequency aspect of syndicated lending.[23] The estimate of β_1 in column (7) is still negative, implying that part of the difference in lending between affected and nonaffected banks comes from a decline in the number of loans extended by affected banks.[24]

[22] If a given loan is extended by more than one lead bank, then we assume that each lead bank extends the loan pro rata (see Giannetti and Laeven, 2012b, for details).

[23] An added advantage of this dependent variable is that it contains no measurement error as all lenders in a syndicate are known.

[24] In this case, the number of observations is smaller as the model only converges when we drop bank-borrower country pairs with less than three observations.

Another potential problem is the choice of cutoff for the beginning of the euro area sovereign debt crisis. The sovereign debt crisis was not triggered by a Lehman Brothers-type event, but rather saw a gradual deterioration in the outlook of the five GIIPS countries. For example, Greece received a bailout from the EC and the IMF in May 2010; Ireland received one in November 2010; Portugal agreed on a bailout in May 2011; and Spain and Italy never became "program countries", but rather saw a protracted increase in government bond yields. While the cutoff we have chosen (2010:Q4) is not unreasonable given that chain of events, any cutoff is imprecise by default. To make sure that our results are not driven by the choice of cutoff, we reestimate our main model after assigning the $Post_t$ dummy a value of 1 from 2011:Q1 onwards. Column (8) indicates that our results are not sensitive to how we date the crisis.[25]

The final concern we address is the possibility that our findings may be driven by the behavior of UK banks that constitute a relatively large part of the sample and may have reduced lending due to reasons specific to this set of banks. In particular, during the financial crisis the UK government acquired large equity stakes in two of the nonaffected banks in the dataset, RBS and Lloyds. It is possible that the two banks were pressured by the government to increase, especially domestic, corporate lending. Given that UK banks account for a large share of overall syndicated lending over the sample period (about 1/3), our results may be driven by this or other peculiarities of the UK market. However, the estimates reported in column (9), where we have excluded UK banks from the regressions, imply that this is not the case. In fact, the magnitude of β_1 increases when UK banks are excluded.

6. Portfolio Rebalancing, Timing of the Effect, and the Impact of Carry Trade-Type Behavior

6.1 PORTFOLIO REBALANCING

Our results so far indicate that banks that were highly exposed to GIIPS sovereign debt significantly reduced their lending compared to otherwise similar nonexposed banks. This raises the question, if and how these banks rebalanced their portfolio. The existing literature provides several insights as to how rebalancing could have occurred.

[25] The estimates remain qualitatively unchanged if we change the cutoff to 2010:Q3. We do not report these results for brevity.

First, banks are more likely to abandon foreign customers with whom they have weaker lending relationships. This can happen due to biases arising from informational advantages for domestic investors (Brennan and Cao, 1997; Kang and Stulz, 1997; Ahearne, Griever, and Warnock, 2004; Portes and Rey, 2005; Van Nieuwerburgh and Veldkamp, 2009; Andrade and Chhaochharia, 2010), from familiarity considerations (Grinblatt and Keloharju, 2000; Huberman, 2001; Seasholes and Zhu, 2010), or from both. While there is strong evidence that banks transmit negative shocks to their capital domestically (Kashyap and Stein, 2000), the evidence also suggests that banks sharply reduce lending to their overseas customers as well (Peek and Rosengren, 1997; Cetorelli and Goldberg, 2011; De Haas and Van Horen, 2012; Popov and Udell, 2012), and the overall effect often involves a rebalancing of the bank portfolio in favor of domestic customers (Giannetti and Laeven, 2012b) and away from foreign borrowers that are geographically and in other ways more distant to the lender (De Haas and Van Horen, 2013).

In the first two columns of Table VI, we check if similar patterns can be detected in our sample. Our results suggest that there is no difference in lending to domestic borrowers (column (1)). However, when we test for the effect on lending to foreign borrowers (column (2)), we find that banks exposed to impaired sovereign debt decrease lending relative to nonexposed or marginally exposed banks. These results confirm the findings in Giannetti and Laeven (2012b) and show that there is a flight home taking place.

We next investigate portfolio rebalancing across foreign markets. We first look at the foreign markets that are institutionally closest to domestic markets, namely, European markets. We find that affected banks lend less to foreign Western European borrowers after the crisis started (column (3)), and we continue to obtain this result once we exclude lending to borrowers in GIIPS countries (column (4)). The result, however, disappears once we look at lending to GIIPS countries only (column (5)). The evidence thus implies that while all banks withdraw from foreign markets with deteriorating growth prospects (GIIPS), banks hit by negative balance sheet shocks withdraw from core foreign European markets, too.

In column (6), we present the estimates from a test where we have run our main specification on all non-Western European markets. The results strongly support the idea that banks with balance sheet problems related to holdings of impaired sovereign debt are more likely to reduce their lending to non-Western European customers. We next investigate whether this withdrawal from non-Western European markets is driven by a flight to quality. One possibility is that when facing weakening balance sheets, banks

Table VI. Portfolio rebalancing

This table shows the impact of exposure to GIIPS sovereign debt on domestic and foreign lending. The dependent variable is *Lending*. In column [1] only domestic (European) borrowers are included and in column [2]–[8] only foreign borrowers. Column [2] includes all foreign borrowers. In column [3] all foreign Western European borrowers are included; in column [4] includes all non-GIIPS Western European borrowers and column [5] includes only GIIPS borrowers. Column [6] includes all non-Western European borrowers. In column [7] all non-Western European borrowers except the USA are included. In column [8] only US borrowers are included. The sample period equals 2009:Q3–2011:Q4 and *Post* equals 2010:Q4–2011:Q4. All regressions include bank level controls as in Table III, bank fixed effects, borrower country × quarter fixed effects and a constant. All regressions are estimated using Poisson and standard errors are clustered by bank. Robust standard errors appear in parentheses and ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively. See Table I for variable definitions and sources.

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
	Domestic	Foreign						
		All	Western Europe	Western Europe ex GIIPS	GIIPS	ROW	ROW ex US	US
Affected * Post	0.106	−0.289***	−0.348***	−0.366***	−0.107	−0.183*	−0.405***	−0.050
	(0.079)	(0.081)	(0.088)	(0.092)	(0.168)	(0.102)	(0.099)	(0.129)
Bank level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fe	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Borrower country × quarter fe	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	316	10,428	3,388	2,584	804	7,040	6,760	280

rebalance their portfolios toward safer and more transparent assets. Prior evidence has suggested that local lending is highest in markets characterized by superior corporate governance and creditors' protection (Djankov, McLiesh, and Shleifer, 2007). The evidence indeed suggests that European banks hit by a negative balance sheet shock withdraw forcefully (relative to nonaffected European banks) from the non-US segment of foreign markets (column (7)), but not from the US market (column (8)). Ivashina, Scharfstein, and Stein (2012) show that in 2011, US money market funds sharply reduced the funding provided to European banks, leading to significant violations of the euro-dollar covered interest parity and to a drop in dollar lending by European banks that were more reliant on money market funds. Our evidence suggests that this decline in funding to US subsidiaries of European banks has not been complemented by a decline in lending to US corporates.

To summarize, our results indicate that several factors were driving the decline in lending by European banks highly exposed to impaired GIIPS sovereign debt. In the first place, we find evidence of a "flight home" effect, with affected banks withdrawing from foreign but not from domestic markets. Second, while lending by affected banks relative to nonaffected banks to corporates located in both core foreign Western European countries and in the rest-of-the-world declined, lending to US corporates did not, indicating that even when faced with balance sheet shocks, banks are reluctant to withdraw from markets with superior corporate governance.

6.2 TIMING OF THE EFFECT OF SOVEREIGN EXPOSURE ON BANK LENDING

Our sample period (2009:Q3–2011:Q4) was chosen to capture the period between the end of the global financial crisis and the ECB's LTRO in December 2011. While this choice ensures that our results are not contaminated by the financial crisis or by ECB's nonconventional monetary policy, it leaves a number of important questions unanswered. For example, if there were different trends between affected and nonaffected banks prior to the crisis or during the crisis (e.g., because of systematic differences in risk taking between the two groups of banks), we might incorrectly interpret our results as being driven by exposure to impaired foreign sovereign debt. Second, it is an important question on its own, whether the ECB's large-scale liquidity operation achieved its stated goal, namely, to restore the transmission of monetary policy through the bank lending channel.

We address these questions in Table VII. For comparison purposes, Column (1) replicates the main test from column (3) in Table III. To test for different trends between the two types of banks before our sample period, we first perform a test in which we move our baseline sample period by four and a half years back, to 2005:Q1–2007:Q2. This results in a time period which falls fully before the beginning of the global financial crisis,[26] while at the same time we still split the banks in affected and nonaffected based on their December 2010 GIIPS exposures. If there are systematic differences in risk taking between banks based on bank characteristics unobserved by the econometrician, the estimate of β_1 in this new test should still be negative and significant. However, the estimates in column (2) and the test statistic in column (5) imply that this not the case.

[26] Tensions in global financial markets first emerged on 9th August 2007 when BNP Paribas barred investors from redeeming cash from two of its funds.

Table VII. Behavior of affected and nonaffected banks in different time periods

This table compares our main result (column [1]) with similar estimations for three alternative sample periods. The results in column [2] are based on a regression in which the complete sample period lies before the start of the global financial crisis (2005:Q1–2007:Q2) where we let *Post* start in 2006:Q2. The results in column [3] are based on a regression over the sample period before and after the collapse of Lehman Brothers (2007:Q3–2009:Q4) where *Post* starts just after the collapse of Lehman Brothers (2008:Q4). The results in column [4] are based on a sample period before and after the introduction of the LTRO (2010:Q3–2012:Q4) where *Post* starts in 2011:Q4. All regressions include bank level controls as in Table III column [3], bank fixed effects, borrower country × quarter fixed effects and a constant. All regressions are estimated using Poisson and standard errors are clustered by bank. Robust standard errors appear in parentheses and ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively. Columns [5]–[7] show *p*-values of one-sided *t*-tests to test whether the estimated coefficients based on different sample periods are larger compared to the one obtained during the sovereign debt crisis. See Table I for variable definitions and sources.

					T-test (*p*-value)		
	Sovereign debt crisis [1]	Placebo [2]	Financial crisis [3]	LTRO [4]	Sovereign debt > Placebo [5]	Sovereign debt > Financial [6]	Sovereign debt > LTRO [7]
Affected * Post	−0.239*** (0.069)	−0.052 (0.042)	−0.078 (0.120)	−0.178* (0.102)	0.00	0.05	0.24
Bank level controls	Yes	Yes	Yes	Yes			
Bank fe	Yes	Yes	Yes	Yes			
Borrower country × quarter fe	Yes	Yes	Yes	Yes			
No. of observations	10,744	9,952	10,732	10,342			

We next examine whether the differential effect we find is specific to the sovereign debt crisis and we are not capturing the effects of the global financial crisis. To this end we move the sample period to 2007:Q3–2009:Q4, such that the prepost cutoff coincides with the bankruptcy of Lehman Brothers in 2008:Q3 and use again the same categorization of banks (column (3)). If there are systematic differences in the impact of the global financial crisis on banks with high or low exposure to impaired sovereign debt, the estimate of β_1 should be significant. Again we find that this is not the case.

Finally, we test for the effect of nonconventional monetary policy on lending by moving our sample period to 2010:Q3–2012:Q4, so that ECB's LTRO falls midway through the period. In this case, we find that banks with

significant balance sheet exposures at the beginning of the crisis extended significantly less credit to the real sector after the LTRO than before (column (4)). In addition, we fail to reject the hypothesis that the coefficient from this regression is the same as the coefficient from the main regression (column (7)). The evidence thus strongly suggests that the variation in lending behavior across European banks that we capture did not predate the sovereign debt crisis, and that the ECB's LTRO was not very effective in mitigating the effect of balance sheet exposure to impaired sovereign debt on bank lending. Our findings complement the evidence indicating that the LTRO led to an increase in holdings of sovereign debt, in particular by weakly capitalized banks (Drechsler *et al.*, 2013).

6.3 IMPACT OF CARRY TRADE-TYPE BEHAVIOR ON LENDING

It is reasonable to expect that the banks in our sample have adjusted not only lending, but also actively managed their exposure to GIIPS debt over the course of our sample period. This adjustment in their debt exposures may have impacted their lending behavior.

Recognizing that debt securities issued by countries under stress may be negatively weighting on the euro area banks' asset side, in May 2010 the ECB instituted the Securities Markets Program (SMP). The SMP represented a series of open market operations whereby the ECB bought government debt securities in secondary markets, while simultaneously absorbing the same amount of liquidity to prevent a rise in inflation. Initially only Greek debt was eligible, yet already in the summer of 2010 the ECB started buying Irish and Portuguese debt, and later that year Spanish and Italian debt, too. The overall size of the program reached €218 billion in December 2012.

Our data on bank-level GIIPS exposures suggest that banks on average reduced their exposures after March 2010, although we do not know if they took advantage of the SMP, sold the debt securities to private investors, or simply did not roll over maturing debt. However, a number of banks actually increased their GIIPS exposures, during the initial stages of the sovereign debt crisis. For example, one-third of the banks for which we have data on GIIPS exposures in March 2010 had higher overall exposure to the five GIIPS countries in December 2010, mainly due to increased exposure to Italian and Spanish debt. Given that the SMP gave those banks the opportunity to reduce their exposures if they wanted to, doing the opposite may be evidence of a "carry trade"-type behavior whereby banks with access to short-term unsecured funding in wholesale markets undertake longer GIIPS sovereign bond positions, hoping to pocket the

spread between long-term bonds and short-term funding costs (Acharya and Steffen, 2014). This behavior is perfectly rational if banks expect bond yields to keep rising without materialization of default risks.

To examine the impact of this type of behavior by looking at the impact that changes in sovereign debt exposure have on bank lending. We create a dummy called *Carry trader*$_i$ which is equal to 1 if banks increased their holdings of government debt between March 2010 and December 2010, and interact it with the variable *Post*$_t$. Notice that *Carry trader*$_i$ can apply to both affected and nonaffected banks in that banks that held no GIIPS sovereign bonds in early 2010 may have decided to load up on peripheral debt after the crisis started.

The estimates reported in Table VIII suggest that lending by banks which reduced their exposure to GIIPS debt over the course of 2010 declined relative to carry traders which loaded on peripheral debt in the expectation of future profits. This result points to the existence of lending benefits—at least in the short-run—from such carry trade. Importantly, the statistical difference between affected and nonaffected banks survives after controlling for the change in GIIPS debt exposure.

Column (2) confirms that these results are not driven by non-euro area banks, such as Barclays, which increased its debt holdings (in nominal terms) by a whopping 68% between March 2010 and December 2010. We conclude that in the initial stages of the crisis, the slowdown in overall lending may have been arrested by a carry trade-type behavior by a number of banks which increased their overall GIIPS exposures at a time when the yields on sovereign debt securities rose while the perceived default risk on sovereign (in particular Spanish or Italian) debt was still relatively low.

7. Conclusion

Regulatory requirements give euro-area banks an incentive to hold large amounts of sovereign debt on their balance sheet. Therefore, understanding the potential negative side-effects of this exposure is important. We use lending behavior of European banks during the euro area sovereign debt crisis to examine whether exposure to impaired foreign sovereign debt affects both domestic and cross-border bank lending. Specifically, we study syndicated lending behavior of thirty-four banks, domiciled in eleven European non-GIIPS countries, for which data on exact exposures to GIIPS sovereign debt are available from EBA, and analyze the effect of sovereign stress on bank lending, as well as on changes in the geographic composition of loan portfolios. Furthermore, we examine how strategic

Table VIII. Carry-trade type behavior and lending

This table shows the impact of a change in GIIPS sovereign debt exposure in the initial phase of the euro area sovereign debt crisis on subsequent bank lending. The dependent variable is *Lending*. The variable *Carry trader* is added and equals one if the bank increased its exposure to GIIPS debt between March 2010 and December 2010. The regression in column [1] includes all banks and in column [2] only euro area banks. The sample period equals 2009:Q3–2011:Q4 and the *Post* period equals 2010:Q4–2011:Q4. All regressions include bank level controls as in Table III, bank fixed effects, borrower country × quarter fixed effects and a constant. All regressions are estimated using Poisson and standard errors are clustered by bank. Robust standard errors appear in parentheses and ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively. See Table I for variable definitions and sources.

	[1] All banks	[2] Euro area banks
Affected * Post	−0.312***	−0.184***
	(0.066)	(0.068)
Carry trader * Post	0.223***	0.150**
	(0.072)	(0.065)
Bank level controls	Yes	Yes
Bank fe	Yes	Yes
Borrower country × quarter fe	Yes	Yes
No. of observations	8,852	5,314

behavior of banks with respect to their sovereign exposures affected their lending behavior during the crisis.

Our results suggest that sovereign stress can have a sizeable impact on bank lending through the channel of bank funding. We find that while syndicated lending recovered in the aftermath of the financial crisis (after 2009:Q3), lending by banks with significant exposures to sovereign debt issued by GIIPS countries was on average lower by 21.3% than lending by banks without a significant GIIPS exposure. This effect is entirely driven by a decline in lending to foreign corporates, while lending to domestic corporates is not affected (a "flight home" effect). Finally, we show that the slowdown in syndicated lending was lower for banks that increased their risky sovereign debt exposures in the early stages of the crisis, suggesting that banks which took the crisis as a profit opportunity were less likely to reduce the share of corporate lending in their portfolios. At the same time, it does not appear that the ECB's LTRO from December 2011 arrested the overall decline in lending.

In addition to implementing short-term fixes, European policy makers have proposed a long-term solution to the feedback loop between sovereign

fragility and weak bank balance sheets,[27] in the form of a banking union. Through centralization of bank supervision, the union is expected to simultaneously manage the flow of credit risk emanating from weak banks to sovereign balance sheets, and the flow of credit risk emanating from sovereigns to banks holding sovereign debt. Our results have straightforward implications for the debate on the harmonization of regulation and the centralization of supervision, and thus relate to the broader body of research that studies legal convergence.[28] Future work can investigate the effect of European banking harmonization policies on the sovereign bank nexus, but also on the broader question of bank risk taking. Because our results stem from the analysis of a small sample of banks and of a particular type of lending, future research can broaden our understanding of the effect of the sovereign crisis on the real economy by analyzing the behavior of non-European banks and by looking at other types of lending, such as mortgage or SME loans.

Appendix

Table AI. List of banks

This table shows all banks in our sample, their nationality, our measure of GIIPS sovereign debt exposure, whether the bank is included in the group of affected or nonaffected banks and the total volume of loans the bank issued in the pre- and post-periods (in million EUR).

Bank name	Nationality	Exposure GIIPS sovereign debt	Affected	Total lending pre (2009Q3–2010Q3)	Total lending post (2010Q4–2011Q4)	% change
Erste Group	AUT	0.60	0	1,417	2,289	0.62
Oesterreichische Volksbanken	AUT	0.80	1	260	561	1.16
Raiffeisen Bank	AUT	0.33	0	3,404	6,408	0.88
Dexia	BEL	4.00	1	4,258	4,112	−0.03
KBC	BEL	2.45	1	4,892	6,493	0.33

(continued)

[27] This phenomenon is often referred to as "deadly embrace" or "doom loop". For theoretical analyses, see Acharya, Drechsler, and Schnabl (2014), Broner *et al.* (2014), Cooper and Nikolov (2013), Farhi and Tirole (2014), Gennaioli, Martin, and Rossi (2014), and Uhlig (2013).

[28] See Coffee (2005), Enriques and Volpin (2007), and Kalemli-Ozcan, Papaioannou, and Peydro (2010), among others.

Table AI. (Continued)

Bank name	Nationality	Exposure GIIPS sovereign debt	Affected	Total lending pre (2009Q3–2010Q3)	Total lending post (2010Q4–2011Q4)	% change
BayernLB	DEU	0.42	0	6,220	11,043	0.78
Commerzbank Group	DEU	3.18	1	12,647	28,568	1.26
Deutsche Bank	DEU	0.67	0	33,708	69,309	1.06
DZ Bank	DEU	2.28	1	4,381	7,693	0.76
HSH Nordbank	DEU	0.66	0	1,579	2,396	0.52
Landesbank Berlin	DEU	0.88	1	757	778	0.03
LBBW	DEU	0.75	0	4,255	6,620	0.56
NordLB	DEU	1.23	1	1,561	3,037	0.95
WestLB	DEU	5.08	1	8,924	12,754	0.43
WGZ	DEU	3.79	1	506	723	0.43
Danske Bank	DNK	0.29	0	2,142	9,593	3.48
Nykredit Bank	DNK	0.39	0	302	726	1.40
OP-Pohjola Group	FIN	0.05	0	443	1,613	2.64
BNP Paribas	FRA	2.06	1	48,082	81,019	0.69
Credit Agricole	FRA	2.32	1	32,757	46,971	0.43
Societe Generale	FRA	1.62	1	27,074	43,613	0.61
Barclays	GBR	1.16	1	27,726	65,465	1.36
HSBC	GBR	0.79	1	32,595	77,881	1.39
Lloyds Banking Group	GBR	0.01	0	11,483	24,394	1.12
RBS	GBR	0.61	0	31,586	73,638	1.33
BCEE	LUX	7.44	1	149	0	−1.00
ABN AMRO Bank	NLD	0.77	1	3,291	7,733	1.35
ING	NLD	1.20	1	26,221	44,390	0.69
Rabobank	NLD	0.17	0	9,751	20,437	1.10
DNB Bank ASA	NOR	0.00	0	6,431	21,759	2.38
Nordea Markets	SWE	0.03	0	8,564	19,717	1.30
SEB	SWE	0.26	0	3,696	14,099	2.81
Svenska Handelsbanken	SWE	0.00	0	2,664	8,066	2.03
Swedbank First Securities	SWE	0.00	0	1,009	4,780	3.74

Table AII. Sovereign debt exposures

This table shows the GIIPS sovereign debt exposures of the banks in our sample as of December 2010 provided by the European Banking Authority. Exposures are divided by assets of the bank in 2010 (from Bankscope). Numbers are percentages.

Bank name	Nationality	Exposure Greece	Exposure Ireland	Exposure Italy	Exposure Portugal	Exposure Spain	Exposure GIIPS
ABN AMRO Bank	NLD	0.00	0.06	0.65	0.00	0.05	0.77
Barclays	GBR	0.01	0.03	0.54	0.08	0.50	1.16
BayernLB	DEU	0.05	0.01	0.16	0.00	0.21	0.42
BCEE	LUX	0.22	0.00	6.30	0.47	0.45	7.44
BNP Paribas	FRA	0.26	0.03	1.40	0.12	0.25	2.06
Commerzbank Group	DEU	0.49	0.01	1.87	0.16	0.65	3.18
Credit Agricole	FRA	0.09	0.02	1.50	0.17	0.54	2.32
Danske Bank	DNK	0.00	0.10	0.14	0.03	0.03	0.29
Deutsche Bank	DEU	0.09	0.03	0.40	0.01	0.14	0.67
Dexia	BEL	0.61	0.00	2.79	0.34	0.26	4.00
DNB Bank ASA	NOR	0.00	0.00	0.00	0.00	0.00	0.00
DZ Bank	DEU	0.19	0.01	0.72	0.26	1.09	2.28
Erste Group	AUT	0.17	0.02	0.29	0.05	0.07	0.60
HSBC	GBR	0.07	0.02	0.54	0.05	0.11	0.79
HSH Nordbank	DEU	0.07	0.00	0.44	0.04	0.12	0.66
ING	NLD	0.08	0.01	0.82	0.08	0.21	1.20
KBC	BEL	0.14	0.08	1.74	0.05	0.44	2.45
Landesbank Berlin	DEU	0.34	0.00	0.25	0.00	0.29	0.88
LBBW	DEU	0.21	0.00	0.38	0.03	0.14	0.75
Lloyds Banking Group	GBR	0.00	0.00	0.00	0.00	0.01	0.01
Nordea Markets	SWE	0.00	0.00	0.02	0.00	0.01	0.03
NordLB	DEU	0.07	0.02	0.82	0.11	0.22	1.23
Nykredit Bank	DNK	0.08	0.00	0.31	0.00	0.00	0.39
Oesterreichische Volksbanken	AUT	0.24	0.03	0.33	0.06	0.14	0.80
OP-Pohjola Group	FIN	0.00	0.05	0.00	0.00	0.00	0.05
Rabobank	NLD	0.06	0.01	0.07	0.01	0.03	0.17
Raiffeisen Bank	AUT	0.00	0.00	0.33	0.00	0.00	0.33
RBS	GBR	0.07	0.03	0.41	0.02	0.09	0.61
SEB	SWE	0.05	0.00	0.12	0.05	0.04	0.26
Societe Generale	FRA	0.25	0.09	0.78	0.08	0.42	1.62
Svenska Handelsbanken	SWE	0.00	0.00	0.00	0.00	0.00	0.00
Swedbank First Securities	SWE	0.00	0.00	0.00	0.00	0.00	0.00
WestLB	DEU	0.78	0.08	2.52	0.00	1.70	5.08
WGZ	DEU	0.34	0.24	1.49	0.49	1.24	3.79

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