

**The invisible hand of the government:  
"Moral suasion" during the European sovereign debt crisis**

Steven Ongena  
*University of Zurich, Swiss Finance Institute and CEPR*

Plattenstrasse 32, CH-8032 Zürich, Switzerland  
Telephone: +41 44 634 3954, Fax: + 41 44 634 5909  
E-mail: [steven.ongena@bf.uzh.ch](mailto:steven.ongena@bf.uzh.ch)

Alexander Popov\*  
*European Central Bank*

Sonnemannstrasse 20, D 60314 Frankfurt am Main, Germany  
Telephone: +49 69 13448428, Fax: +49 69 13448552  
E-mail: [alexander.popov@ecb.int](mailto:alexander.popov@ecb.int)

Neeltje Van Horen  
*De Nederlandsche Bank and CEPR*

Westeinde 1, 1017 ZN Amsterdam, the Netherlands  
Telephone: +31 20 5245704, Fax: +31 20 5242500  
E-mail: [n.van.horen@dnb.nl](mailto:n.van.horen@dnb.nl)

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### **Abstract**

Using a proprietary data set of banks' monthly securities holdings, we find that during the European sovereign debt crisis, domestic banks in fiscally stressed countries were considerably more likely than foreign banks to increase their holdings of domestic sovereign bonds in months with high domestic sovereign debt issuance. This effect is stronger for state-owned banks and for banks with low initial holdings of domestic sovereign bonds, and it does not appear to be fuelled by central bank liquidity provision. Our results remain when we control for concurrently operational mechanisms such as risk-shifting, carry-trading, regulatory compliance, or shocks to investment opportunities.

*JEL classification:* F34, G21, H63.

*Keywords:* Sovereign debt; sovereign-bank loop; moral suasion

## 1. Introduction

The special relationship between sovereigns and banks “goes way back”. For example, between 433 and 427 BC, the Temple of Athena lent money to the state of Athens at a 6 percent interest rate—a rather generous arrangement, given that loans to merchants and shipmasters commonly carried a rate of around 30 percent (Budin, 2004).<sup>1</sup> And after the Glorious Revolution of 1688, the English government granted a monopoly charter to the country’s first banking corporation, the Bank of England, in exchange for a series of loans to the government. In their recent book, Calomiris and Haber (2014) consider this another early example of modern banking which in their words “is best thought of as a partnership between the government and a group of bankers, a partnership that is shaped by the institutions that govern the distribution of power in the political system” (*op. cit.*, p. 13).

Yet, all governments face inherent conflicts of interest when it comes to this partnership with the banking system, the first (and perhaps foremost) conflict of interest being that governments regulate banks while at the same time look to them as a source of finance. The primacy of this conflict of interest suggests that governments also in modern times, and even in developed economies, can prompt banks to provide them with financing in times of need.

The question whether this “prompting” actually occurs became particularly acute in the aftermath of the global financial crisis when over the span of less than five years, the holdings of domestic sovereign bonds, as a share of total assets, for euro area banks more than doubled (Figure 1). This development was largely driven by banks in countries under fiscal stress, namely Greece, Ireland, Italy, Portugal, and Spain (hereafter “stressed countries” or “GIIPS”), for which the holdings of domestic sovereign bonds, as a share of total assets, almost tripled (Figure 2). Furthermore, Figure 3 shows that while initially both domestic and foreign banks in these countries were increasing their holdings of domestic sovereign debt, after the start of the sovereign debt crisis in May 2010, domestic banks as a group continued to increase their holdings at an ever higher pace—with their holdings of domestic sovereign bonds, as a share of total assets, quadrupling between September 2008 and December 2012—while foreign banks’ holdings of domestic sovereign debt (i.e., holdings of Italian sovereign bonds by subsidiaries of

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<sup>1</sup> In the pre-Christian era, temples often served as wealth depositories and loan providers (see Gilbart, 1911).

French banks in Italy) at the end of 2012 were roughly at the same level as at the beginning of the global financial crisis.

This development has led both academics and policy makers to speculate that the rapidly increasing exposures of domestic banks in stressed countries to their sovereign was not only due to increased incentives to hold domestic sovereign debt, for regulatory or risk-shifting reasons, but also at least partially the result of “moral suasion” by the sovereign.<sup>2</sup> The term “moral suasion” refers to an appeal to “morality” or “patriotic duty” to induce behaviour by the persuaded entity that is not necessary profit-maximizing for it. This appeal can be combined with a threat of a more repressive regime, such as in the case of banking intensified supervision, a revoking of a bank’s license or limited access to the Central Bank funding (Horvitz and Ward, 1987).<sup>3</sup> However, it can also entail a natural collusion or collaboration between two parties that have an equal interest. For example, banks may choose to respond to pressure from their government if they are locked in a long-term relationship with the government where it is implicitly understood that current favours are always reciprocated in the future. Furthermore, supporting the government in times of fiscal stress reduces spreads on sovereign bonds directly affecting banks’ funding costs as well.

While a number of recent papers find evidence consistent with the occurrence of “moral suasion” (e.g., Battistini, Pagano and Simonelli, 2014; Becker and Ivashina, 2014; Acharya and Steffen, 2015; De Marco and Macchiavelli, 2015), direct empirical evidence unequivocally showing that banks act in the government’s best interests when the government needs it most is still missing. This lack of direct empirical evidence, or “the smoking gun”, should not come as

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<sup>2</sup> „Time bomb? Banks pressured to buy government debt“ (Jeff Cox, *CNBC*, 31 May 2012, <http://www.cnbc.com/id/47633576>). „[...] sovereign credit risk may alter swiftly as it did in 2008-09 due to [...] moral suasion of the financial sector (‘financial repression’) to hold sovereign debt“ (Viral Acharya, „Banking Union in Europe and other reforms,“ *VOXEU*, 16 October 2012, <http://www.voxeu.org/article/banking-union-europe-and-other-reforms>). „The reasons for the increased exposure of banks to their domestic sovereigns may [include] moral suasion [...]“ (Jens Weidmann, „Weidmann in sovereign debt warning,“ *Financial Times*, 30 September 2013, <http://www.ft.com/intl/cms/s/0/557fe8be-29f2-11e3-9bc6-00144feab7de.html>). „[...] there could be „moral suasion by regulators or politicians“ in Greece to support the efforts of the authorities to effectively stay in the Eurozone.“ (Michaelides, 2014).

<sup>3</sup> Horvitz and Ward (1987) describe how in order to limit the outflow of dollars from the U.S., during the 1960s the Fed demanded that domestic banks reduced their foreign lending, warning that banks could not expect the increase in their loan portfolio to be considered an adequate reason for the extension of Federal Reserve credit through the discount window.

a surprise. Moral suasion in developed economies likely operates (often so by legal and political necessity) in the shadows, in the phone calls made by those responsible for placing government debt, in “the winks and nods” of a long-standing mutual and implicit understanding between the sovereign and “its” banks.

In this paper we take a decisive step towards identifying whether governments “morally sway” banks to purchase sovereign bonds in times of fiscal stress. We employ a novel identification strategy that exploits salient characteristics of sovereign bond markets. First, the main determinant of newly issued sovereign debt is the amount of maturing sovereign debt. For example, €360 billion of Italian government debt matured during 2012,<sup>4</sup> and the Italian government issued €365.2 billion of new debt over the course of 2012.<sup>5</sup> Second, the amount of retiring government debt is strappingly pre-determined, because it is the outcome of choices typically made years ago by previous governments. For example, the government of Mario Monti faced the need to roll over €45 billion of maturing Italian government debt in April 2012—2/3 of which was issued by the government of Silvio Berlusconi in 2010 and 2011, and 1/3 of which was issued by the government of Romano Prodi in 2007. Third, because of these past decisions the government’s need to refinance maturing debt fluctuates substantially month-to-month. As a result, total newly issued debt (the sum of roll-over debt and additional funding needs) also varies greatly on a month-to-month basis, both in normal as well as in crisis times, and the government has only limited ability to influence these monthly fluctuations when markets are stressed. For example, during the height of the crisis, Italy issued €32.9 billion in September 2011 and €30.7 billion in October 2011, but only €11.6 billion in November 2011.<sup>6</sup>

Our novel identification strategy rests on exploiting these month-to-month fluctuations in governments’ financing needs. If governments of fiscally stressed countries need to “morally sway” their banks, this should happen in those months where new issuance is high. Moreover, some banks are more likely to be “morally swayed” than others. This difference is most obvious

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<sup>4</sup> “Italy borrowing costs hit record 7 percent”, BBC News, 9 November 2011, <http://www.bbc.com/news/business-15652708>.

<sup>5</sup> Source: Bloomberg.

<sup>6</sup> Source: Bloomberg.

when comparing domestic and foreign owned banks. Domestic banks are more likely to be “swayed” than foreign banks as they are more vulnerable to explicit and implicit threats if they decide not to cooperate (Romans, 1966; Reinhart and Sbrancia, 2015). In addition, as domestic banks have more to lose if an auction should fail in terms of funding cost, they are more likely to comply with their government’s request to buy additional bonds.<sup>7</sup>

Our identification strategy therefor relies on assessing the differences in net purchases of domestic sovereign debt between high-need and low-need months during a period of fiscal stress, for domestic banks (the treatment group) relative to foreign banks (the control group). We define a “high-need” month to be a month in which the total amount of new debt auctioned by the domestic government is above the country-specific median for the applicable sample period. We focus on Greece, Ireland, and Portugal during the period May 2010 – August 2012 and on Italy and Spain during the period August 2011 – August 2012 (the acute phase of the crisis). Our hypothesis is that if the “moral suasion” channel is operational, domestic banks will be more likely than foreign banks to purchase domestic sovereign bonds during high-need months, while there should be no difference in behaviour between the two classes of banks during low-need months.

Employing a unique proprietary dataset which contains detailed end-of-month information on net flows and holdings of domestic sovereign debt securities for a large sample of domestic and foreign banks active in the peripheral euro zone countries, we find strong and consistent evidence that “moral suasion” took place in stressed countries during the sovereign debt crisis. Our analysis shows that during the height of the sovereign debt crisis, domestic banks are substantially more likely to purchase domestically-issued sovereign debt than foreign banks in high-need months. This effect is not only statistically significant but also economically relevant, i.e., it amounts to about half of the within-sample standard deviation of monthly purchases.

Our result is robust across different proxies for sovereign debt holdings and across many different specifications. Crucially, it also holds when we use *maturing* sovereign debt instead of newly issued sovereign debt, where maturing debt is fully exogenously determined by

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<sup>7</sup> For example, as funding costs of domestic banks are much more closely linked to the spread on sovereign bonds, compared to the funding costs of foreign banks present in the same country.

governments' past choices. In addition, domestic banks in Greece, Italy, Ireland, Portugal and Spain did not behave differently from foreign banks in high-need months during the global financial crisis, a period characterized with ample stress in financial markets, but not yet by that time sovereign bond markets. Similarly, during the height of the sovereign debt crisis domestic and foreign banks in Germany did not behave differently in high-need months. All of this evidence points to banks acting as "buyers of last resort" when demand for their sovereigns' debt is weak.

We find that the effect is strongest for state-owned and supported banks and in particular for those with low initial holdings of domestic sovereign banks. This indicates that the government strategically picks the banks it chooses to sway (i.e., those whose balance sheets are not yet saturated with domestic sovereign debt). At the same time, we find no evidence of crowding out of private investment by banks in high-need months. In other words, the occurrence of moral suasion does not necessarily have negative real short-run effects in an environment of abundant central bank liquidity.

A crucial characteristic of our month-on-month identification strategy is that it enables us to control for both unobservable time-invariant and observable time-varying bank characteristics that can impact the decision of a bank to buy sovereign bonds in a particular month, such as the need for regulatory compliance or a desire for risk shifting or carry trading. At the same time it allows us to control for unobservable time-varying country-specific factors that can impact all banks active in a particular country in a particular month. As such we are able to isolate the "moral suasion" channel by directly controlling for other factors, singled out in the literature to explain (domestic) banks' interest in increasing their holdings of domestic sovereign debt when their sovereign is stressed.

First of all, domestic banks may risk-shift, betting on their own survival by acquiring a riskier asset portfolio when their sovereign is close to default (Broner, Erce, Martin, and Ventura, 2014; Drechsler, Drechsel, Marquez-Ibanez, and Schnabl, 2015). The inclusion of bank fixed effects already controls for the fact that (some) domestic banks have a stronger incentive

to risk-shift compared to foreign banks.<sup>8</sup> This inclusion also alleviates concerns related to the potential presence of a collective moral hazard motive (Farhi and Tirole, 2012) whereby banks with little exposure to their sovereigns may wish to increase their exposures and link their fate to that of the domestic sovereign. Furthermore, we argue that to the extent that banks' incentive to shift risk also varies monthly, this would be especially strong in months when bond yields are high. We find that domestic sovereign bonds are not more risky in those months during our sample period when the government is in need to issue more new debt. Furthermore, when controlling for changes in bond yields, our result does not change.

Second, domestic banks may face regulatory pressure to boost their capital and therefore acquire more zero-risk sovereign debt.<sup>9</sup> Our specifications control for bank capitalization (both time-invariant through bank fixed effects and time-variant by including the level of capital at a monthly frequency) and hence for the motive to purchase government debt securities for regulatory purposes. Furthermore, there is no need to expect that such behaviour will be more pronounced in particular months of the year when the domestic government needs to place a lot of new debt in bond markets. Moreover, banks could be increasing their regulatory capital by buying sovereign debt issued by other euro area governments which is also zero-risk-weighted. Therefore, a pattern whereby domestic banks' purchases of domestically-issued debt are particularly high in those months during the height of the sovereign debt crisis when the domestic government needs to issue a large amount of debt cannot be explained by compliance with regulatory requirements.

Third, banks may engage in carry trading, funding themselves short-term in wholesale markets to buy sovereign bonds issued by countries under fiscal stress, in order to collect the spread (Acharya and Steffen, 2015). Such behaviour is voluntary and perfectly rational if banks expect bond yields to keep rising without any materialisation of default risk. There is, however, no reason to expect that domestic banks, all else equal, engage more in carry trading compared to foreign banks. Furthermore, banks' incentives to engage in carry trading are arguably highest

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<sup>8</sup> Recall that our sample period only includes the crisis period, so these fixed effects measure banks' incentives to risk-shift during a period of elevated sovereign stress.

<sup>9</sup> Branches of foreign banks would be mostly exempt from such pressure as they fall under the auspices of the home regulator.



when sovereign yields are high; however, when we formally control for month-on-month changes in the riskiness of sovereign bonds, our result does not change.

Fourth, some banks serve as prime dealers, being certified by the government to purchase sovereign debt in primary markets while other banks are not eligible to do so. If mainly domestic banks act as primary dealers, then our main result may be due to the fact that in high-need months, domestic prime dealers are purchasing elevated amounts of domestic sovereign debt not because they are pressured by the government, but because they are acting on behalf of non-eligible banks behest. However, in our stressed countries, the majority (or in the case of Ireland even *all*) of the prime dealers are large *foreign* banks, such as Barclays, Royal Bank of Scotland, and Société Générale. Furthermore, when we control for the differential behaviour of primary dealers, our results do not change.

Fifth, systematic differences in the propensity of domestic and foreign banks to load up on domestic sovereign debt may not arise because domestic banks are increasing their holdings of domestic debt, but because foreign banks are asked by their “own regulators at home” to decrease their holdings of foreign debt. While this would also constitute a case of “moral suasion”, it would be different from the one we document. However, our identification strategy is based on the comparison of domestic and foreign banks across high-need and low-need months, and it is highly unlikely that, e.g., the French regulator would ask the subsidiary of BNP Paribas in Italy to decrease its holdings of Italian government debt *relatively more* in months when the Italian government is facing high refinancing needs. Indeed, we find that there is no significant difference in the purchase of domestic sovereign debt by foreign banks in high need versus low-need months.

Finally, domestic banks may have an incentive to invest in sovereign bonds in periods with excess supply of deposits or when the return on private investment or the demand for loans by the real sector is low. If such periods also coincide with months when the government issues a large amount of sovereign debt and this especially affects domestic banks (e.g., because they are more exposed to the domestic real economy), our “moral suasion” channel can be contaminated by shocks to the deposit supply or to investment opportunities. However, we show that our main result “survives” in a specification where we formally control for bank-

specific average interest rates on deposits and for bank-specific time-varying average interest rates on loans to non-financial corporations.

In summary, using proprietary, bank-specific monthly data on sovereign bond flows and an unique identification strategy exploiting month-on-month fluctuations in governments' need to issue new debt, we provide strong and consistent evidence on the existence of "moral suasion" when governments under fiscal stress are faced with low demand for their securities. The remainder of the paper is organized as follows. Section 2 provides an overview of the literature. Section 3 describes the data and Section 4 the methodology. Section 5 provides the estimates of "moral suasion" and a large number of robustness tests. Section 6 concludes.

## **2. Literature review**

This paper most directly relates to the literature on the sovereign-bank "doom loop" and its implications for banks' willingness to hold domestic sovereign bonds. Recently, several theoretical models have been developed that provide arguments why domestic banks have a strong incentive to purchase risky domestic sovereign debt. Uhlig (2013), Acharya, Drechsler, and Schnabl (2014), Broner, Erce, Martin, and Ventura (2014), and Farhi and Tirole (2014) develop models in which domestic banks purchase risky domestic sovereign bonds because they expect to be bailed out, partially or fully, in the event of a sovereign default. Gennaioli, Martin, and Rossi (2014a) present a model where domestic banks choose to hold large amounts of domestic sovereign bonds for liquidity reasons. Acharya and Rajan (2013) argue that in the presence of financial repression in the form of a tax on real investment, banks voluntarily choose to increase their holdings of domestic public debt. Crosignani (2015) develops a model in which undercapitalized banks shift their portfolio towards domestic sovereign bonds in an attempt to gamble-for-resurrection. This shift benefits the government as these banks then act as buyers of last resort if the sovereign is in distress. These last two papers are closest to the empirical regularity we aim to identify.

A growing empirical literature documents the increasing holdings of sovereign bonds in times of sovereign stress and its impact on lending to the real sector. Studying banks active in a large number of countries, Gennaioli, Martin, and Rossi (2014b) find that during sovereign

defaults banks increase their holdings of sovereign debt and subsequently tend to lower their lending. Focusing on the European sovereign debt crisis, Popov and Van Horen (2015) show that non-GIIPS banks exposed to impaired sovereign debt contracted their (cross-border) lending. De Marco (2014) finds that both GIIPS and non-GIIPS banks exposed to peripheral sovereign debt, contracted their lending more. Furthermore, Altavilla, Pagano, and Simonelli (2015) find that due to peripheral countries' banks' large exposures to sovereign debt, increases in sovereign risk are associated with a stronger reduction of loans and a sharper increase of lending rates to firms by these banks.

Several papers study the different channels that can explain why banks increase their holdings of sovereign bonds in times of financial or fiscal stress. Using bank-level data on banks' borrowing from the ECB, Drechsler, Drechsel, Marquez-Ibanez, and Schnabl (2015) find that during the European sovereign debt crisis banks from both core and periphery countries engaged in risk-shifting, with weakly capitalized banks borrowing more and pledging riskier collateral to the ECB. Furthermore, Acharya and Steffen (2015) show that GIIPS and in particular non-GIIPS banks engaged in carry-trading by funding themselves short-term in wholesale markets to buy sovereign bonds issued by countries under fiscal stress. They argue that this behaviour can be explained by regulatory capital arbitrage, risk-shifting and "moral suasion" incentives.

Others have also found evidence that suggests that during the European sovereign debt crisis governments in fiscally stressed countries "morally swayed" their banks to support demand for sovereign debt. Battistini, Pagano, and Simonelli (2014) find that peripheral banks increased their holdings of domestic sovereign bonds in response to rising domestic bond yields, a phenomenon consistent both with a "moral suasion" and with a "risk shifting" hypothesis. Using data on sovereign debt holdings of the largest European banking groups from the stress tests conducted by the European Banking Authority, Horvath, Huizinga and Ioannidou (2015) show that the home bias in European banks' sovereign debt portfolios is stronger when the sovereign is more risky, shareholder rights are stronger and when the bank is government owned, suggesting that both "moral suasion" and "risk shifting" incentives drove the increase in home bias. Becker and Ivashina (2014) find that politically connected and state-owned banks

were less likely to extend loans to large firms during the sovereign debt crisis. A finding consistent with the use of financial repression or “moral suasion” by European governments. Acharya, Eisert, Eufinger, and Hirsch (2014), on the other hand, show that firms with a higher exposure to banks headquartered in the stressed countries, became financially constrained and that this had a negative impact on their real performance, but they argue that this is mainly the result of balance sheet shocks and risk-shifting behavior and not of “moral suasion”.

Different from these papers we employ detailed high-frequency bank-specific data on domestic government bond flows and map these into month-on-month differences in governments’ refinancing needs over a period when the governments of GIIPS experience severe fiscal stress. We show that domestic banks in these fiscally stressed countries were considerably more likely than foreign banks to increase their holdings of domestic sovereign bonds in months when the government needed to issue a large amount of public debt. Our unique, month-on-month identification strategy allows us to reliably isolate the adjustments in banks’ holdings of domestic sovereign debt as a result of “moral suasion” from adjustments as a result of other incentives such as risk-shifting, carry-trading or regulatory compliance.

Our paper also adds to the empirical literature on the impact of political factors on banks’ performance and business decisions. For example, La Porta, Lopez-de-Silanes, and Shleifer (2002), Sapienza (2004), Dinc (2005), Khwaja and Mian (2005), Micco, Panizza, and Yanez (2007), Claessens, Feijen, and Laeven (2008), Li, Meng, Wang, and Zhou (2008), and Shen and Lin (2012), among others, exploit variation across countries or regions within a country and identify how government ownership reduces banks’ profitability and how political favours arise through government banks, either in the form of cheaper lending in politically preferred regions or increased lending in election years. Another strand of this literature deals with the political determinants of bank behaviour that are unrelated to direct ownership. For example, Kroszner and Strahan (1999) document how special interests affected the timing of the removal of barriers to entry in the U.S. banking industry. Agarwal, Amromin, Ben-David, and Dinc (2012) show that during the recent financial crisis, banks delayed foreclosures on mortgages located in U.S. districts whose representatives in Congress were members of the Financial Services Committee. In addition, a number of papers provide evidence that politicians in power

routinely delay bad news about problems in the banking sector, both in developing and in industrialized countries (e.g., Brown and Dinc, 2005; Imai, 2009; Liu and Ngo, 2014). Our paper adds to this literature by demonstrating that government refinancing needs in times of fiscal stress affect domestic banks' choices to hold domestic sovereign debt.

Finally, our paper contributes to a large literature which has documented the existence of "home bias" in investors' behaviour. This home bias normally arises because investors exhibit a preference for geographically proximate (domestic) assets (Coval and Moskowitz, 1999, 2001; Grinblatt and Keloharju, 2001; Chan, Covrig, and Ng, 2005; Butler, 2008; Gianetti and Laeven, 2012). Our paper contributes to this literature by showing that in the case of domestic government bonds, part of the "home bias" in banks' behaviour can be explained by a mechanism whereby banks choose to support their government during times of stress.

### **3. Data and descriptive statistics**

The main data source we employ is the ECB's Individual Balance Sheet Statistics (IBSI) Dataset. This new and unique high-frequency data source contains end-of-month data on assets and liabilities for 247 individual financial institutions from 17 countries in Europe and it comprises around 70 percent of the domestic banking sector. It spans the period June 2007 to February 2015. Banks are observed at the unconsolidated level.

This dataset has a number of important advantages compared to other datasets used in the literature and that makes it very useful for our purpose. First, its monthly frequency allows us to study changes in banks' demand for sovereign bonds at a much higher frequency than studies that use sovereign bond data from the European Banking Authority (EBA) that are biannual (e.g., De Marco, 2014; Popov and Van Horen, 2015) or Bankscope that only provides information at an annual frequency (e.g., Gennaioli, Martin and Rossi, 2014b). Second, the data include both information on flows as well as stocks while EBA and Bankscope data only include stocks. This enables us to differentiate between adjustments due to new purchases of bonds and due to maturing debt which is not replaced. Third, the data are observed at an unconsolidated level, and it therefore includes changes in sovereign debt holdings of both domestic banks as well as branches and subsidiaries of foreign banks active in a country. EBA

data, on the other hand, are measured at the consolidated level. Finally, balance sheet data are available during a period covering the both the global financial crisis and the sovereign debt crisis (and its aftermath). This enables us to show that the differential behaviour of domestic banks in high-need months that we find is specific to periods when the sovereign is stressed.

For the purpose of our analysis, we focus on the 77 banks active in Greece, Ireland, Italy, Portugal, or Spain. We next use a number of data availability criteria which further concentrate the list of banks in the sample. First, we set aside 5 banks for which we could not determine their ownership status. Next, we do the same for 12 banks with no information on domestic sovereign bond holdings during the sample period (May 2010 – August 2012 for banks in Greece, Ireland, and Portugal, and August 2011 – August 2012 for banks in Italy and Spain). The resulting sample used in the analysis contains 60 banks for which we have all the information needed.

We use the bank ownership database of Claessens and Van Horen (2015) to determine whether a bank is domestic- or foreign-owned. Those banks that are not covered by the database (mainly foreign branches) we check manually. A bank is considered foreign owned if at least 50 percent of its shares are owned by foreigners (a definition commonly used in the literature). Of our sample of banks 47 are domestic and 13 are foreign-owned. Importantly, there is at least one domestic and at least one foreign bank active in each of our sample countries.<sup>10</sup>

Our main variable of interest is *Flow<sub>t</sub>/Stock<sub>t-1</sub> domestic sovereign securities*, defined as the ratio of the bank's net flow of securities issued by the domestic sovereign at time  $t$  to the bank's total holdings of securities issued by the domestic sovereign at time  $t-1$ . In robustness, we also look at the bank's net flow of securities issued by the domestic sovereign at time  $t$  (*Flow domestic sovereign securities*), at the change in the bank's stock of securities issued by the domestic sovereign at time  $t$  ( $\Delta$  *Stock domestic sovereign securities*), and at the ratio of the loans issued by the bank to the domestic sovereign at time  $t$  to the stock of the bank's total loans to the domestic sovereign at time  $t-1$  (*Flow<sub>t</sub>/Stock<sub>t-1</sub> loans to domestic sovereign*). The first variable allows us to distinguish absolute from relative changes. The second one allows us

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<sup>10</sup> Due to the strict confidentiality of the data it is not possible to provide a list of the banks in our sample.

to capture changes in the propensity to hold sovereign debt even for banks that are not buying or selling any new debt, but simply letting old debt mature. Finally, the third variable allows us to distinguish between different mechanisms whereby banks can support the domestic government in times of need. We trim all these variables at a 100 percent in either direction to mitigate the impact of potential outliers.

In terms of bank-specific control variables, we include the total assets of the bank (*Assets*) to capture changes in bank size, and three variables that capture (changes in) bank health or bank business model that may impact a bank's decision to increase its holdings of domestic sovereign debt: the ratio of deposits to assets (*Deposits/Assets*), the ratio of loans to deposits (*Loans/Deposits*), and the ratio of bank equity to total assets (*Capital*). All bank-level variables are observed with monthly frequency. All control variables are measured with a 12-month lag.

Table 1 provides summary statistics for all balance sheet items for the sample of 60 banks in stressed countries used in the analysis. It indicates that 76 percent of the bank-month-year observations come from domestic banks. Over the sample period, the average bank in the sample experiences a relative growth in its holdings of domestic sovereign debt equal to 2 percent on a month-to-month basis. Both gross flows and changes in the stock of total domestic sovereign debt holdings are on average positive over the sample period for the sub-sample of banks in stressed countries. In addition, over the sample period the average bank had €89.7 billion in assets, a deposit-to-assets ratio of 0.54, a loan-to-deposit ratio of 1.32, and was very well-capitalized, with a capital ratio of 0.11 (where capital in the IBSI dataset is defined as assets minus liabilities). It is worth noticing that there are some banks with zero capital, however, this is not inconsistent with positive regulatory capital as long as the latter is calculated at the level of the group and not at the level of the individual bank.

Table 2 illustrates the difference between domestic and foreign banks with respect to a number of observable characteristics (all measured as average values for the period before the European sovereign debt crisis). Interestingly, while domestic banks tend to hold a slightly higher share of their assets in debt securities issued by the domestic government already before the crisis (4.1 percent vs. 3.4 percent), this difference is not statistically significant. With respect to their balance sheet characteristics, domestic banks are on average larger, they issue more

loans, relative to the deposits they hold, and they are considerably better capitalized (9 percent vs. 7 percent for foreign-owned banks). At the same time, they have a smaller deposit base. However, only two of these differences are significant in the statistical sense: size and regulatory capital. Nevertheless, this test confirms that domestic- and foreign-owned banks are not necessarily observationally equivalent across a number of observable bank-specific characteristics.

As is evident from Figure 3, there is substantial heterogeneity between domestic and foreign banks, in terms of their propensity to increase their holdings of domestic sovereign debt securities during the height of the sovereign debt crisis. For example, while between August 2011 and August 2012 foreign-owned banks were reducing their net flows of domestic sovereign debt securities, relative to the stock of their holdings, by almost a quarter each month, domestic banks were instead increasing aforementioned flows by on average 5 percent each month.

#### **4. Empirical methodology**

The goal of this paper is to study whether during the European sovereign debt crisis, peripheral governments put pressure on “their” banks to purchase their own sovereign debt due to limited demand by other investors (“moral suasion”). To this end we exploit monthly data on the bank’s net purchase of securities issued by the domestic sovereign. The monthly frequency of the data allows us to employ a difference-in-differences type of methodology whereby we differentiate between the behaviour of banks that are more likely to be pressured by the government during periods in which one would expect the probability that banks would respond to pressures to support the government to be high.

We start by identifying, for each of the five stressed countries in the dataset, the period during the sovereign debt crisis in which pressure in the market was highest. As a starting point we use the month in which each country became eligible for the Securities Markets Program (i.e., the moment these countries became program countries from the point of view of the ECB). This means that for Greece, Italy and Portugal the sample period starts in May 2010, and for Italy and Spain in August 2011. We end the sample period for all countries in August 2012,



the month after the well-known speech by the ECB's president, Mario Draghi, in which he implicitly announced the Outright Monetary Transactions program by vowing to do "whatever it takes" to keep the Eurozone together.

While spreads were high in each country over the full sample period, there were large differences within the crisis period with respect to the amount of debt the government had to place. Such fluctuations are a natural feature of sovereign debt management not limited to crises periods. Figure 4 shows, for the case of Italy, the amount of sovereign debt that was placed during each month between August 2007 and March 2013, as well as during the sample period (shaded area). The figure shows large fluctuations at all times, including during the sovereign crisis: for example, the Italian government sold only €11.6 billion in November 2011, but €37.3 billion in March 2012, and then again only €20.4 billion in June 2012. These sharp monthly fluctuations are determined almost entirely by the need to roll-over maturing debt issued years ago, and they allow us to identify months in which there is a "high need" for the government to find investors to place their debt versus months in which there is "low need". Hence, the first step in our identification strategy exploits the idea that if governments put pressure on banks, they will be more likely to do so in months when they need to place relatively large amounts of freshly-issued debt on the market.

The second step in our identification strategy exploits the idea that some banks are more likely to be swayed by the domestic government than others. The most obvious distinguishing characteristic of banks that defines their likelihood of being pushed to buy domestic sovereign debt is whether they are domestic or foreign-owned, as governments are much more likely to successfully put pressure on domestic banks than on foreign branches or subsidiaries. In addition, domestic banks have a stronger incentive to collude with the government when demand for sovereign bonds is weak as an undersubscribed auction would imply higher sovereign spreads, which would directly translate into higher funding costs for domestic banks. As such, if banks are morally swayed by their own governments this should imply that during high-need months, domestic banks should purchase more domestic sovereign debt compared to foreign banks. Conversely, we expect to see little difference in the behaviour of domestic and

of foreign-owned banks during low-need months, when the government does not need to raise much new debt and therefore does not have a need to sway its banks.

Clearly, there are other reasons why—even in the absence of moral suasion—domestic banks would voluntarily choose to purchase more domestically-issued sovereign debt than foreign-owned banks during a period of elevated sovereign stress. For example, they may be betting on their own survival by acquiring a riskier asset portfolio when their sovereign is close to default (Broner, Erce, Martin, and Ventura, 2014; Drechsler, Drechsel, Marques-Ibanez, and Schnabl, 2015). In addition, domestic banks—especially undercapitalized ones—may be pushed to beef up their regulatory capital by the regulator, who holds no similar control over affiliates of foreign banks. Acquiring more zero-risk sovereign debt can be one obvious way to achieve this. Furthermore, while not necessarily affecting domestic banks differently from foreign banks, some banks with access to short-term unsecured funding in wholesale markets might be more willing to engage in a carry-trade-type behaviour by undertaking longer stressed countries' sovereign bond positions, hoping to pocket the spread between long-term bonds and short-term funding costs (Acharya and Steffen, 2015).<sup>11</sup> They can also be facing different investment opportunities. Finally, (large) domestic banks may act as market makers in their own country and as such are more likely to buy a larger share of the newly issued debt. In Section 5.5, we formally control for all of these alternative explanations. Moreover, our month-on-month identification strategy allows us to control for any unobservable time-invariant motives for banks to increase their holdings of domestic sovereign debt in times of a sovereign debt crisis by including bank fixed effects.

We model the net purchase of domestic sovereign debt (relative to the stock of domestic sovereign debt in the previous month) by bank  $i$  from country  $j$  in month  $t$  as follows:

$$DomSovDebt_{ijt} = \beta_1 HighNeed_{jt} \times Domestic_{ij} + \beta_2 X_{ijt} + \beta_3 \varphi_i + \beta_4 \mu_{jt} + \varepsilon_{ijt}, \quad (1)$$

where in the main tests,  $SovDebt_{ijt}$  is the ratio of the bank's net flow of securities issued by the domestic sovereign at time  $t$  to the bank's total holdings of securities issued by the

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<sup>11</sup> This type of behaviour that is voluntary and perfectly rational if banks expect bond yields to keep rising without any further materialisation of default risk.

domestic sovereign at time  $t-1$ . In robustness checks, we also look at net flows and at changes in stocks, to account for a behaviour whereby banks do not purchase new domestic sovereign debt, but simply let old domestic sovereign debt mature.  $HighNeed_{jt}$  is a dummy variable equal to 1 if the total amount of new debt auctioned by the government of country  $j$  in year-month  $t$  is above the country median for the sample period, and to 0 otherwise;<sup>12</sup>  $Domestic_{ij}$  is a dummy variable equal to 1 if the bank  $i$  in country  $j$  is a domestic bank (private or state-owned), and to 0 if it is foreign-owned;  $X_{ijt}$  is a vector of time-varying bank-specific control variables;  $\varphi_i$  is a vector of bank fixed effects;  $\mu_{jt}$  is a matrix of interactions of country and year-month dummies; and  $\varepsilon_{ijt}$  is an i.i.d. error term.  $HighNeed_{jt}$  and  $Domestic_{ij}$  are only included in the specification on their own in versions of Model (1) which exclude  $\mu_{jt}$  and  $\varphi_i$ , respectively, because otherwise the effect of the latter is subsumed in the bank fixed effects, and the effect of the former is subsumed in the country-year-month fixed effects. Our model is estimated using OLS and we cluster standard errors at the bank level to account for the fact that banks' monthly net purchases of domestic sovereign debt are likely correlated over time.

Our coefficient of interest is  $\beta_1$ . In a classical difference-in-differences sense, it captures the difference in the net purchase of domestic sovereign debt between high-need and low-need months for domestic banks (the treatment group) relative to foreign banks (the control group). A positive coefficient  $\beta_1$  would imply that—all else equal—domestic banks purchase more domestic sovereign debt in high-need months relative to foreign banks. The numerical estimate of  $\beta_1$  captures the difference in the overall acquisition of domestic sovereign debt between low-need months and high-need months induced by switching from the control group to the treatment group.

The vector of bank-level controls  $X_{ijt}$  allows us to control for a number of time-varying bank-specific factors, including changes in bank size, funding sources, and capital ratios that can impact a bank's decision to purchase domestic sovereign debt. In order to account for the fact that the effect of accounting variables may not be immediate, we use 1-year lags of these variables in the regression. In addition to bank fixed effects we also include the interaction of

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<sup>12</sup> In robustness tests, we use a continuous variable equal to the actual amount of domestic sovereign debt auctioned in a particular month.

country and year-month fixed effects. This alleviates concerns that our results might be driven by time-varying differences in the demand for sovereign debt or by differences in its quality (at the country level) that affects both domestic and foreign banks equally. Identification therefore comes from comparing the behaviour of domestic and foreign banks in the same country during the same month.

Our identification strategy relies on splitting the sample period in high need versus low need months based on the total amount of debt auctioned that month. There are two potential concerns with this strategy. First, auctioned debt is not fully exogenous to variation in the behaviour of domestic versus foreign banks as it may be related to current shocks to government spending which may be correlated with domestic banks' propensity to purchase sovereign debt. To that end, in alternative specification we employ maturing debt instead of auctioned debt, where maturing debt is fully exogenously determined by governments' past choices. Data on maturing debt come from the ECB's Centralized Securities Database (CSDB) which provides for each sovereign bond that has been issued the exact day it matures. This enables us to determine for each country in our sample how much sovereign debt is maturing in each month.

Second, choosing the mid-point of the distribution to separate months in high- and low-need can be questionable if in some countries the distribution of auctioned debt is more dispersed than in others. Table 3 shows that there is enough variation in auctioned debt within each country over the sample period, with the coefficient of variation ranging between 1.8 in Greece and 4 in Italy. Ireland is an exception, with a very low coefficient of variation (0.45), due to the fact that in most months during the sample period the Irish government was cut off from international bond markets. In robustness tests, we drop Ireland from the sample.

## **5. Moral suasion during the sovereign debt crisis**

### **5.1 Main result**

The main results of the paper are reported in Table 4. We estimate a number of different permutations of Equation (1). In column (1), we use the simplest version of this model without any control variables and without any fixed effects. The results show that, as expected, the net

purchase of domestic sovereign debt securities during the crisis period is higher for domestic banks compared to foreign owned banks. This likely reflects a home bias, or a persistently higher need for domestic banks to comply with regulatory capital requirements through the purchase of sovereign debt with zero risk-weight.

Crucially, when examining the differential purchase of new domestic sovereign debt in high- versus low-need months, the difference between domestic and foreign banks is striking. Domestic banks dramatically increase their holdings of sovereign debt during high-need months, while for foreign banks there is no difference in their net purchase of domestic sovereign debt (if anything, the coefficient is negative). The rest of the table demonstrates that the effect is robust to adding time-varying bank-specific controls (column (2)), and also to including bank fixed effects and interactions of country dummies and year-month dummies (column (3)).

In all cases, the effect is significant at the 1 percent significance level, and economically large too. In the most saturated (and therefore preferred) specification in column (3), the point estimate on  $\beta_1$  implies that during high-need months, domestic banks increase their holdings of domestically-issued sovereign debt by 0.45 of a within-sample standard deviation. Because we control for bank fixed effects, for country-year-month fixed effects, and for time-varying bank-specific characteristics, it is unlikely that our results are driven by unobservable time-invariant bank heterogeneity, by country-specific changes in the demand for domestic sovereign debt, or by the propensity of banks to adjust their holdings of domestic sovereign bonds in response to capital or liquidity shocks. Our results thus strongly suggest that during periods of elevated sovereign stress, when it is potentially hard to find interested investors, governments having to issue new debt put pressure on domestic banks to purchase their debt (“moral suasion”). We also find, in the specification without bank fixed effects and interactions of country dummies and year-month dummies (column (2)) that smaller banks, as well as banks with a higher ratio of loans to deposits, are on average more likely to purchase domestic sovereign bonds.

## 5.2. Falsification tests

The mechanism we aim to uncover is related to the propensity of domestic banks to engage in a behavior that has three components: 1) they are only purchasing government bonds; 2) these bonds are issued by the domestic sovereign; and 3) this only takes place during times of fiscal stress.

To make sure that we are indeed picking up this mechanism, in Table 5 we conduct a number of falsification tests. We first test for differences in the propensity of domestic versus foreign banks to purchase *foreign* sovereign bonds, in high- versus low-need months. We find that there is no statistical difference in the behaviour of domestic and foreign banks, in high- versus low-need months with respect to their purchases of foreign sovereign bonds (column (1)), suggesting that the difference in behaviour we have documented so far is restricted to the elevated propensity of domestic banks to purchase *domestic* sovereign bonds in high-need months. The evidence further suggests that our results are not contaminated by a carry-trade-type behaviour whereby banks use cheap wholesale funds to buy high-yield government debt. If this was the case, there would be no reason for banks in all five countries to increase their holdings of *domestic* debt, but they would rather go for the riskiest sovereign debt at the time (e.g., Greek).

The crucial part of our identification strategy is that governments only have an incentive to “morally sway” their banks during months when the government needs to issue large amounts of debt securities and it needs investors to buy those, at reasonable prices. In other words, it is not just about sovereigns needing additional funding in general. If banks wish to support their government in months of high financial need, they could also do so by lending directly to the domestic government. In the next regression, we construct a new dependent variable which equals the ratio of the loans issued by the bank to the domestic sovereign at time  $t$  to the stock of the bank’s total loans to the domestic sovereign at time  $t-1$ . The results show that during times of sovereign stress and in periods when the government needs to issue a relatively large amount of debt, domestic banks do not lend relatively more than foreign banks to the domestic sovereign (column (2)). In other words, the effect that we find is really about purchasing domestic sovereign bonds. This finding is consistent with the idea that moral suasion is driving the behaviour of banks during months of high need, because while in principle

governments could also convince banks to lend to them at very favourable rates, loans to the government are not zero-risk-weighted. Therefore, the domestic sovereign has a regulation-driven preference to sway banks to purchase government debt because banks can buy (infinitely) more of it without acutely facing binding capital requirements.

Finally, governments should only put pressure on their domestic banks to buy more of their own sovereign bonds during times of elevated stress on the sovereign when overall demand for its debt is low. This allows us to conduct two additional falsification tests. First, we run exactly the same regression model for our sample of 47 domestic and 13 foreign banks active in Greece, Ireland, Italy, Portugal and Spain but let the sample period start in September 2007 and end in April 2010. While this too is a period of heightened stress for banks in general due to the fall-out of the global financial crisis, market pressure during that time is not yet directed at the peripheral sovereigns themselves. As such, while during that period domestic (and foreign) banks might increase their holdings of sovereign debt for risk-shifting or regulatory purposes, one would not expect the sovereigns to put any additional pressure on their banks. We redefine the high-need months for this period as a month in which the total amount of new debt auctioned by the domestic government in that particular month is above the median for this period. Indeed, as the results in regression (3) show, the interaction between *High need*  $\times$  *Domestic* in this period is positive but insignificant. This suggests that the divergence in behaviour between domestic and foreign banks during high- versus low-need months does not pre-date the sovereign debt crisis, suggesting that the higher propensity of domestic banks to purchase domestic sovereign bonds in high-need months is not a long-run feature of government bond markets. The test also implies that the parallel trends assumption which is crucial for our difference-in-differences strategy to succeed is not violated. Furthermore, it shows that our results are not driven by domestic banks functioning as market-makers (or underwriters) which therefore always pick up excess liquidity in domestic government bond markets during periods of high supply, re-selling those bonds later on.

As an additional falsification test, we estimate the model for 49 domestic and 7 foreign banks active in Germany during our main sample period (May 2010 – August 2012). During this period there was ample demand for German bonds. Therefore, even if domestic banks were

increasing their holdings of sovereign debt for other reasons, there was no need for the German government to put additional pressure on their banks. Indeed, our results show that in those months where the German government was auctioning a relative large amount of new debt, domestic banks did not buy more of this debt relative to foreign banks (column (4)).

### 5.3. Alternative mechanisms

Our identification strategy is based on exploiting the fact that during the height of the sovereign debt crisis, there were months in which—mainly because of structural factors—governments had to issue relatively large amounts of debt, and months in which this amount was much lower. This strategy allows us to control both for unobservable time-invariant and for observable time-varying bank characteristics that can impact the decision of banks to buy sovereign bonds in a particular month, while at the same time controlling for unobservable time-varying country-specific factors that can impact all banks active in a particular country. However, there can still be lingering concerns related to the possibility that during high-need months, domestic banks are facing concurrent shocks to their propensity to increase their holdings of domestic sovereign bonds—unrelated to moral suasion—that foreign banks are not experiencing. The most obvious such alternative mechanisms include regulatory compliance, shocks to banks' net worth, risk shifting, market making, and shocks to investment opportunities. We address these in Table 6.

The fact that the high-amount government auctions are distributed rather randomly over the course of the sample period (Figure 4), suggests that our results are highly unlikely to be driven by a mechanism whereby domestic banks are buying more bonds for regulatory purposes, or facing shocks that hit banks' net worth in the same months when the government's refinancing needs are especially high. However, to make sure that this mechanism is indeed not driving our results, we allow the impact of our bank-specific control variables to vary across domestic and foreign banks. As can be seen in column (1), the parameter of the interaction *High need*  $\times$  *Domestic* hardly changes. All other interaction variables are insignificant. Importantly, the interaction between regulatory capital and the *Domestic* dummy is insignificant, confirming that undercapitalized domestic banks are not



more likely to purchase domestic sovereign debt than undercapitalized foreign banks during the same (high-need) month.

Riskier banks also have an incentive to increase their holdings of risky sovereign bonds, in order to place a bet on their own survival (Broner, Erce, Martin, and Ventura, 2014; Drechsler, Drechsel, Marquez-Ibanez, and Schnabl, 2015). If domestic banks are closer to default in months of high government refinancing need, then our estimates may be picking up a mechanism whereby domestic banks buy more domestic sovereign bonds in high-need months for reasons unrelated to “moral suasion”. In column (2), we add an interaction of the *Domestic* dummy with each bank’s CDS spread in each particular month. As we do not have information on all banks’ CDSs, the number of observations is reduced to 775. We do not find evidence that domestic banks are more likely to purchase domestic sovereign bonds in months when their own risk is elevated (if anything, the coefficient is negative). Importantly, the coefficient on the *High need* × *Domestic* interaction is once again positive, and significant at the 5 percent statistical level.<sup>13</sup>

Assuming that domestic banks have an incentive to tie their destiny to that of the domestic sovereign, they likely have a stronger interest to do so when the government itself is closer to default. If governments are perceived by investors to be riskier in months with high refinancing needs, our “moral suasion” mechanism would be contaminated by a risk-shifting one. However, the unconditional correlation between the *High need* dummy and the spread on 10-year government bond yields in our sample is -0.4, suggesting that government default risk is *lower* during high-need months. Moreover, in column (3) we formally test whether the incentives of (some) domestic banks to shift risk is affecting our results by adding an interaction between the spread on a 10-year domestic sovereign bond and the *Domestic* dummy. The estimates suggest that our baseline result is hardly affected, and moreover, the interaction with the 10-year bond spread is insignificant.

One other possibility is that domestic banks face lower returns on private investment during high-need months, for example, because of lower demand for credit from domestic non-

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<sup>13</sup> Note that the bank fixed effects already pick up the fact that some banks were perceived as much riskier than others by the market during the height of the sovereign debt crisis. Therefore, it is not entirely surprising that a shift in the bank’s CDS spread does not have a statistically significant independent effect.

financial corporations that domestic banks might be more exposed to compared to foreign banks. Alternatively, domestic banks may face an above-average inflow of deposits during such months, for example, because of social transfers that coincide with maturing government debt. If so, then domestic banks may have an incentive to park their liquidity in domestic sovereign bonds during such months, for reasons unrelated to “moral suasion”. In column (4), we test formally for this possibility by adding an interaction of the *Domestic* dummy with the spread between average bank-specific interest rates on loans to non-financial corporations and average bank-specific interest rates on deposits in each particular month. A decline in this spread implies that the supply of liquidity is increasing relative to the demand for loans. While the coefficient on this interaction is insignificant, the coefficient on the interaction term capturing the “moral suasion” channel is still positive and significant (at the 10 percent statistical level).

In column (5), we account for the fact that some banks may be serving as prime dealers, being certified by the government to purchase sovereign debt in primary markets while other banks are not eligible to do so. If mainly domestic banks are acting as primary dealers, then our main result may be due to the fact that in high-need months, domestic prime dealers are purchasing elevated amounts of domestic sovereign debt not because they are pressured by the government, but because they are acting on behalf of non-eligible banks behest. We determine the certified prime dealers in each country, and we create an interaction term *High need × Prime dealer*, which we then include as a control. The coefficient on the interaction is negative and significant, which reflects the fact that in most countries, the majority (and even all in the case of Ireland) of the prime dealers are large *foreign* banks, such as Barclays, Royal Bank of Scotland, and Société Générale. Importantly, the main effect—that domestic banks are more likely to purchase domestic sovereign bonds in high-need months—obtains in this specification, too.

Finally, systematic differences in the propensity of domestic and foreign banks to load on domestic sovereign debt may not be because domestic banks are increasing their holdings of domestic debt, but because foreign banks are asked by their regulators to decrease their holdings of risky foreign debt. While this would also constitute a case of “moral suasion”, it

would be different from the one we are after. However, our identification strategy is based on the comparison of domestic and foreign banks across high- and low-need months, and it is highly unlikely that, e.g., the French regulator would ask the subsidiary of BNP Paribas in Italy to decrease its holdings of Italian government debt *relatively more* in months when the Italian government is facing high refinancing needs. Nevertheless, we can formally test whether the purchase of domestic subsidiaries is lower for foreign banks in high need months versus low need months. Restricting our sample to foreign banks only (and replacing country-year-month fixed effects with year-month fixed effects) we show that for this group of banks there is no significant difference in the purchase of domestic sovereign debt between high-need and low-need months (column (6)).

#### 5.4. Model robustness

In Table 7, we test several modifications of our main empirical model. First, we recognize that there is a component to newly issued sovereign debt which may be correlated with contemporaneous shocks. For example, faced with a sudden decline in tax revenues or an increase in social spending due to recessionary pressures, the government may issue new sovereign debt above its refinancing need. This may put into question our identification strategy which is based on the predetermined structure of debt issuance, if such shocks are systematically more likely to take place in countries and at times when domestic banks have a higher appetite for domestic debt. While we note that the correlation between auctioned and matured debt in the sample and for the time period in question is very high (0.77), we nevertheless address this concern by replacing the *High need* dummy with one which is based on the amount of *maturing* government debt in each month, rather than on the amount of *auctioned* debt. Column (1) reports that the main result of the paper survives this modification, and the point estimate is once again significant at the 1 percent statistical level.

In column (2), we re-run our preferred specification using a different cut-off for high-versus low-need months. In particular, we replace the *High need* dummy with one equal to 1 in months when the government's refinancing need is in the top country-specific quartile for the sample period, and to 0 if it is in the bottom country-specific quartile for the sample period.

In this way, we compare months of severe refinancing need to months of very low refinancing need. The point estimate is of very similar magnitude, relative to the one in Table 4, column (3)), and is still statistically significant.

In column (3) we replace the *High need* dummy with a continuous variable equal to the actual amount of new sovereign debt auctioned by the government in each month. This procedure allows us to perform an alternative calculation of the effect of extreme sovereign fiscal need on banks' propensity to increase their holdings of domestic sovereign debt. The point estimate is still positive and significant, and it implies that in a high-need month increasing the amount of new debt auctioned by one standard deviation increases an individual domestic bank's holdings of domestic sovereign bonds by one half of a standard deviation more than it does for a foreign bank. This is a sizeable result given that the difference between the 25<sup>th</sup> and the 75<sup>th</sup> percentile of individual banks' domestic sovereign bond growth is about one third of a standard deviation.

#### 5.5. Dependent variable and sample robustness

In Table 8, we consider two alternative proxies for the dependent variable. First, we examine the net purchase of domestic sovereign securities without normalizing the flows by the stock of such holdings (column (1)). This does not affect our results, with the estimate on the *High need*  $\times$  *Domestic* positive and significant at the 1 percent significance level. We next note that when studying flows, we do not take into account that a bank might adjust its portfolio downward by not replacing debt that is maturing. To that end, in the next regression we take as the dependent variable the growth rate of the stock of domestic sovereign debt (column (2)). The estimate of  $\beta_1$  is again significant at the 1 percent level and is numerically larger than in our baseline regression. This suggests that in high-need periods domestic banks not only buy more additional new debt but also replace maturing debt, something which foreign banks do to a lesser degree.

We next check how robust our results are to analysing different samples. In Table 9, we first exclude the two countries that were most affected by the crisis, Greece (column (1)) and Ireland (column (2)). Reflecting the tensions it was facing in the market during the height of the

crisis the Greek government issued no new debt in May, June, August, and December 2010. Similarly, Ireland issued no new debt between October 2010 and June 2011. Importantly, dropping those two countries does not affect our results and even slightly increases the magnitude of the point estimate.

In column (3), we address the concern that the observed patterns are driven by the ECB's two Very Long Term Refinancing Operations (VLTRO) in December 2011 and March 2012, whereby the ECB distributed around €1 trillion to euro area banks in loans of longer-than-usual maturities at fixed rates. Acharya and Steffen (2015) point out that access to cheap wholesale funding may be one of the main determinants of European banks' increased propensity to load on high-yield sovereign bonds during the crisis. Andrade, Cahn, Fraise, and Mesonnier (2015) show that only about 15 percent of the funds absorbed by banks in these operations were converted into loans, making it plausible that the majority may have indeed been used to purchase freshly issued government debt. Figure 3 also shows an above-trend increase in sovereign bond holdings by banks in stressed countries in January 2012. However, we find that domestic banks are more likely than foreign banks to purchase domestic debt even outside of the two months immediately following the two ECB's VLTROs.

In column (4) we estimate a difference-in-difference-in-difference model where instead of focusing on the crisis period only, we make use of the whole sample period we have access to (September 2007 – June 2013). The variable of interest now is the triple interaction between the *Domestic* dummy, the *High need* dummy, and a *High risk* dummy equal to 1 for the period of the crisis (May 2010 – August 2012 for banks in Greece, Ireland, and Portugal, and August 2011 – August 2012 for banks in Italy and Spain), and to 0 otherwise. This approach primarily addresses the concern that our main estimation relies on a relatively small number of observations per country; in this specification, the number of bank-year-month observations increases to 3,244. Moreover, it also allows us to compare the behaviour of foreign and domestic banks during periods of sovereign stress and periods of calm. The point estimate on the double interaction *High need* × *Domestic* is insignificant, suggesting that in times when sovereigns are not stressed, domestic banks are on average not more likely than foreign banks to purchase domestic government bonds in months when the government is auctioning

relatively large amounts of new sovereign debt. On the other hand, the double interaction *High risk*  $\times$  *Domestic* is positive and significant, indicating that domestic banks on average were more likely to purchase domestic sovereign debt in periods of sovereign stress. Importantly, the positive and significant coefficient on the triple interaction suggests that this difference is especially strong in months where the sovereign has to issue a relatively large amount of sovereign debt and therefore points towards “moral suasion” playing an important role during the sovereign debt crisis.

Finally, as shown in Table 2, while before the start of the sovereign debt crisis domestic and foreign banks do not differ with respect to their holdings of domestic sovereign debt, they are systematically different with respect to their size and capital ratios. We control for these differences by including time-varying bank controls and we control for unobserved bank-specific time-invariant heterogeneity by including bank fixed effects. However, to account for the fact that the bank’s size and capital adequacy can potentially predict whether a bank is likely to be swayed, we also estimate our model using a sample which is chosen based on a Propensity Score Matching procedure. In practice, we calculate a propensity score for each bank’s likelihood of being domestic versus foreign-owned, based on pre-crisis values of the bank-specific controls. We next reduce the sample of domestic banks to the sub-set that is most similar to the sample of foreign banks. This allows us to estimate the effect of moral suasion as captured by the interaction *High need*  $\times$  *Domestic* while still accounting for all bank-specific variables that can predict whether the bank faces government pressure to buy domestic sovereign debt. The results, reported in column (5), show that even within the matched sample, domestic banks obtain higher amounts of domestic sovereign debt in high-need months compared to their foreign counterparts.

#### 5.6. Who is swayed?

So far, we have exploited the idea that domestic banks are more likely to be swayed by their governments than foreign affiliates of banks headquartered in another country. However, domestic banks as a group differ widely in their size, ownership structure, holdings of sovereign debt, and extent of government interventions during the crisis and this could potentially affect

the likelihood of the bank being pressured. As a way of further bolstering our argument, we now test for “moral suasion” within the sample of domestic banks, based on natural priors as to what banks are more likely to be swayed.

A priori, we expect that banks that are under the direct influence of the government, either because they are state-owned or because they recently received government support, are more likely to be swayed to buy sovereign bonds (e.g., Acharya and Steffen, 2015; Becker and Ivashina, 2015). To that end, we first determine whether a bank is state owned or not. Of the 47 domestic banks in our sample 18 are state-owned. All state-owned banks are in Ireland, Italy, Portugal, and Spain, meaning that a comparison of state-owned and of privately-owned banks excludes Greece. Next, we collect data on government support extended to domestic banks during the global financial crisis of 2008-09. 16 domestic banks in our sample received such support, and there is at least one such bank in each country in our data set.

The first three columns of Table 10 report the estimates from tests where we single out these groups of banks. The data suggest that state-owned banks are not more likely to purchase domestic bonds in high-need months than privately-owned domestic banks (1). The same is true for state-owned or supported banks compared to private domestic banks that did not receive government support during the financial crisis (column (2)). However, when we drop the group of supported banks (arguably less prone to government pressure than banks directly owned by the government), we find that state-owned banks are strictly more likely to purchase domestic sovereign bonds in high-need months compared to private banks that did not receive support during the crisis (column (3)). Coming off a comparison between banks that are most likely and banks that are least likely to be under the influence of the government, this result lends additional support to the “moral suasion” hypothesis.

In the fourth column of Table 10, we examine whether initial holdings of sovereign debt securities play a role. At the start of the sovereign debt crisis there was a large variation within the sample of domestic banks with respect to their holdings of sovereign debt. It is possible that governments make an informed decision to put more pressure on banks with relatively low holdings of sovereign debt as to not further burden the balance sheets of banks that are already holding too much domestic debt. To examine this, we split the banks according to their

holdings of domestic sovereign debt, relative to total assets, prior to the crisis. Indeed, the estimates reported in column (4) indicate that banks with relatively low (below-sample-median) initial holdings of sovereign debt are statistically more likely to purchase domestic sovereign debt in months when the government faced high refinancing needs, during periods of elevated fiscal stress. Furthermore, this result again alleviates concerns that the effect we document is driven by a few domestic market-makers that pick up excess liquidity in government bond markets during periods of high supply: such market-makers are likely to have relatively *high*, not relatively *low*, average domestic sovereign bond holdings. The evidence thus suggests that the government does choose the banks it prompts to purchase the debt it issues during times of stress, focusing on banks in which it has an ownership stake and on banks whose balance sheets are not yet saturated with domestic sovereign bonds.

#### 5.7. The effect of the ECB's LTRO in December 2011

The most significant monetary policy during our sample period took place in December 2011 when the European Central Bank (ECB) announced that it would conduct two fixed rate tender procedures with full allotment and with a maturity of 36 months, at a fixed 1 percent interest rate. What made this policy unprecedented was not the full allotment, which had been applied in the past, but the longer-than-usual 3-year maturity. European banks reacted enthusiastically, and the ECB ended up extending €489 billion (nearly \$640 billion) in loans to more than 500 European banks on 28<sup>th</sup> December 2011, and €530 billion more (or \$694 billion) on 1<sup>st</sup> March 2012. This very long-term refinancing operation (LTRO) was designed to prevent a credit freeze in the midst of the sovereign debt crisis, and it represented the largest such action in ECB's history.

While recent evidence suggests that some of these disbursed funds were used to increase bank lending (Andrade, Cahn, Fraise, and Mesonnier, 2015; Carpinelli and Crosignani, 2015), others have argued that cheap wholesale funding may have exacerbated some banks' incentives to load up on domestic sovereign bonds (Acharya and Steffen, 2015). Our evidence so far strongly suggests that banks that can be influenced by the government tend to purchase relatively more domestic sovereign bonds during times of stress and when the government's



refinancing needs are high. It is natural to hypothesize that this “moral suasion” mechanism will be facilitated by the supply of cheap long-term funding.

In Table 11, we put this hypothesis to the test. We first create a triple interaction of *High need* × *Domestic* with a *Post LTRO* dummy which equals one after December 2011. We also include all relevant double interactions in the regression. Column (1) reports that after the LTRO, domestic banks were not more likely than foreign banks to purchase domestic sovereign bonds in high-need months than they were before the LTRO. If anything, the estimates imply that domestic banks became less likely on average to increase their domestic sovereign exposures after December 2011.

In columns (2)–(4), we focus on different subset of domestic banks. We find that state-owned banks were marginally (significant at the 12 percent level) more likely than private domestic banks to purchase domestic sovereign bonds in high-need months than they were before the LTRO (column (2)). However, after the LTRO, state-owned banks did not become more likely to purchase domestic sovereign debt than private domestic banks that did not receive government support during the crisis (column (3)). The same applies to domestic banks with low initial holdings of domestic sovereign bonds relative to domestic banks with high such initial holdings (column (4)). We conclude that the large-scale provision of central bank liquidity at low rates in the midst of the sovereign debt crisis does not seem to have fuelled the “moral suasion” channel (even though it may still have affected banks’ behaviour through incentive-based mechanisms such as risk shifting or carry-trade-like behaviour).

## **6. Conclusion**

Using a unique high-frequency dataset of monthly securities holdings by 60 banks in Greece, Ireland, Italy, Portugal, and Spain, we show that during the sovereign debt crisis of 2010–2012, domestic banks were considerably more likely than foreign banks to increase their holdings of domestic sovereign debt in months when their government needed to roll over a large amount of outstanding debt. The effect is strongest for state-owned banks and for banks with low initial holdings of domestic sovereign bonds, and it is not driven by risk shifting, by a

carry-trade-like behaviour, by regulatory distortions, by shocks to banks' net worth, or by fluctuation in the supply of deposits and in the return on private investment. We argue that our results are consistent with governments prompting domestic banks to buy domestic sovereign debt when demand for such bonds is weak ("moral suasion").

Our results inform the policy debate surrounding the "deadly embrace" between sovereigns and banks. First, our findings show that banks and sovereigns can and do collude in times of fiscal stress. This can help stabilize the system at a moment when many other players (i.e., foreign banks and insurance companies, asset managers, money market funds, etc.) are retreating from the market. That is, domestic banks can and do act as a "buyers of last resort" for their sovereigns' debt, limiting the stress by stabilizing yields and spreads. This is especially beneficial when markets are overreacting as it reduces the risk of self-confirming expectations.

However, this comes at a cost as it reinforces the link between banks and their sovereigns in a period when sovereign bond spreads are already high. This increases the risk on the banks' balance sheets which in turn heightens systemic risk. To reduce this risk some change in regulation is warranted. An obvious first step is to reduce the chance that banks need to be bailed out by their governments. To this end, the introduction of higher capital ratios and the establishment of the European Banking Union with a common supervision and resolution system are important steps forward to break the sovereign-bank "doom loop". Supervision at European level, will at the same time reduce the scope for "moral suasion".

However, as long as governments to a large extent rely on their banks for their financing and banks have clear incentives to purchase sovereign debt for its favourable credit and liquidity characteristics and its use as collateral, common supervision and resolution will not be enough to break the sovereign-bank "doom loop". Therefore, to reduce the potential disruptive effect of large holdings of (domestic) sovereign debt on banks' balance sheets, a number of proposals for regulatory reform, which can complement The Banking Union, have been put forward.<sup>14</sup> These include putting a positive risk weight on sovereign debt, which takes into account that sovereign debt is in fact, as has become clear during the sovereign debt crisis, not risk free. In addition, introducing an exposure limit similar as the one applicable to holdings of

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<sup>14</sup>See for example, ESRB report on the regulatory treatment of sovereign exposures (March 2015) or Viral Acharya on the "Banking Union in Europe and other reforms", VoxEU, 16 October 2012.

other asset classes, will limit exposures of banks to the sovereign. This would reduce the negative feedback loop and would increase banks' resilience to sovereign risk. Finally, risk weights on all assets, including those on sovereign debt, could be allowed to vary with realized risk. These regulatory reforms should enhance banks' incentives to take sovereign risk into account, increase banks' resilience to such risk and limit systemic risk at EU-wide level, while at the same time allow banks to continue playing their market maker and stabilizing roles in sovereign debt markets .

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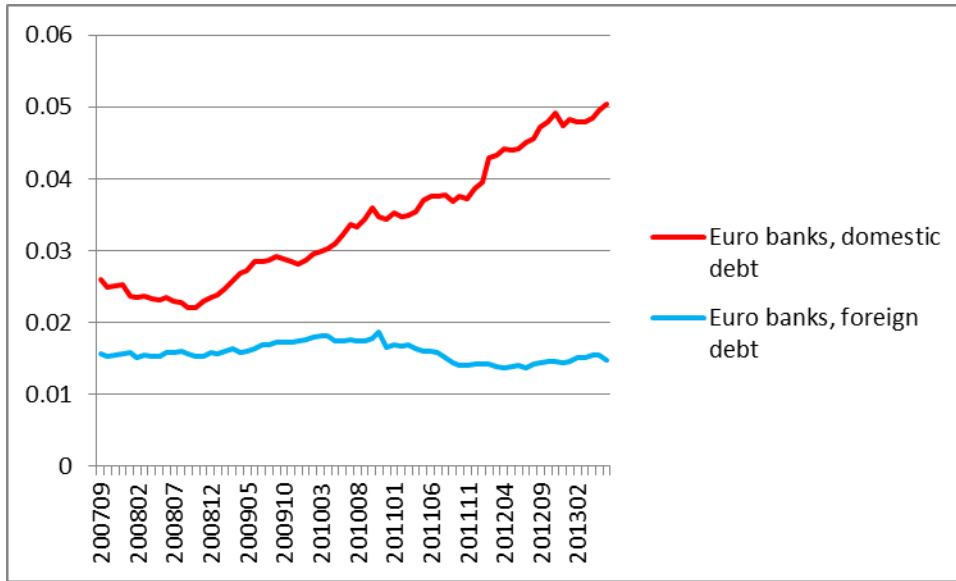
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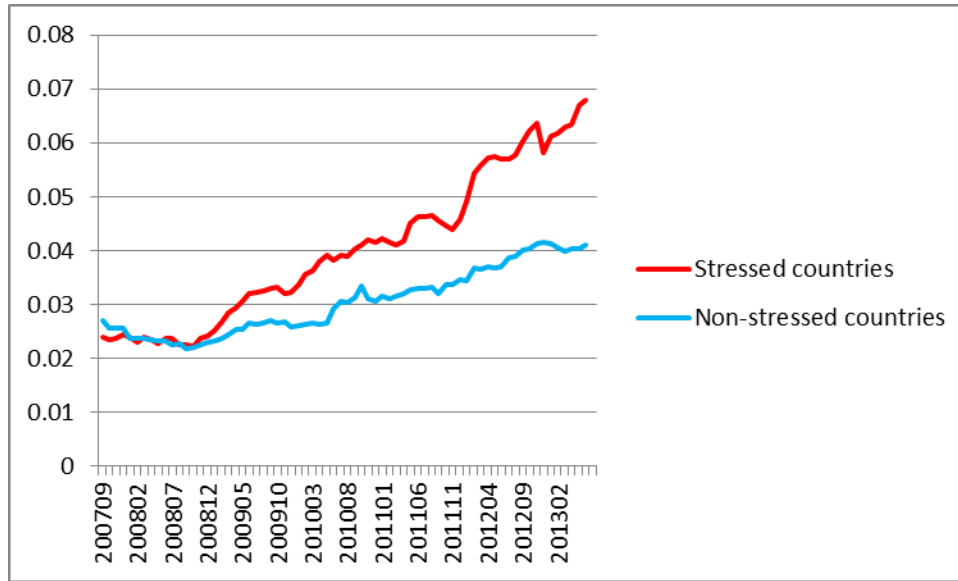
Figure 1. Domestic and foreign sovereign securities holdings: All euro area banks



Note: Average holdings of domestic and foreign sovereign securities, divided by total assets, for 207 banks in eleven euro area countries (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, and Spain), for the period September 2009 – February 2013.

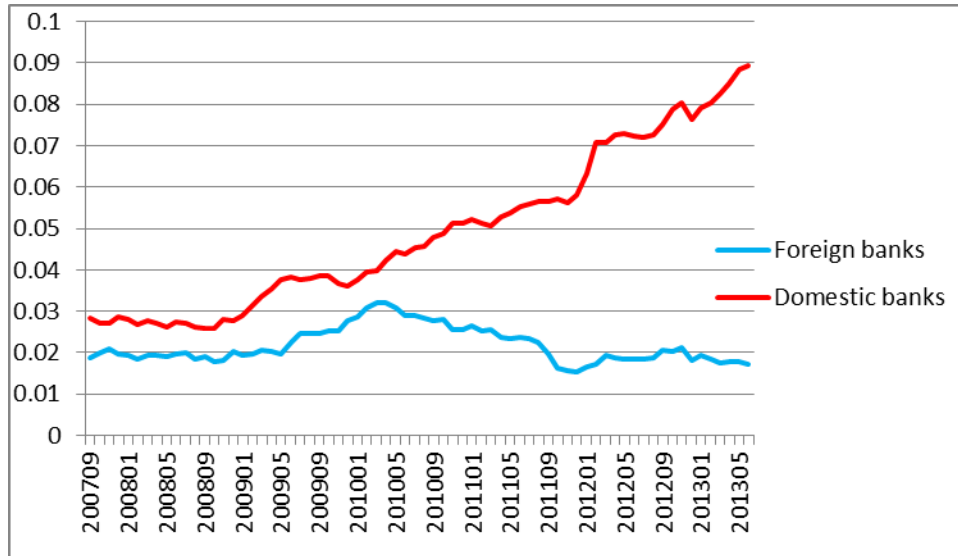


Figure 2. Domestic sovereign security holdings: Stressed versus non-stressed countries



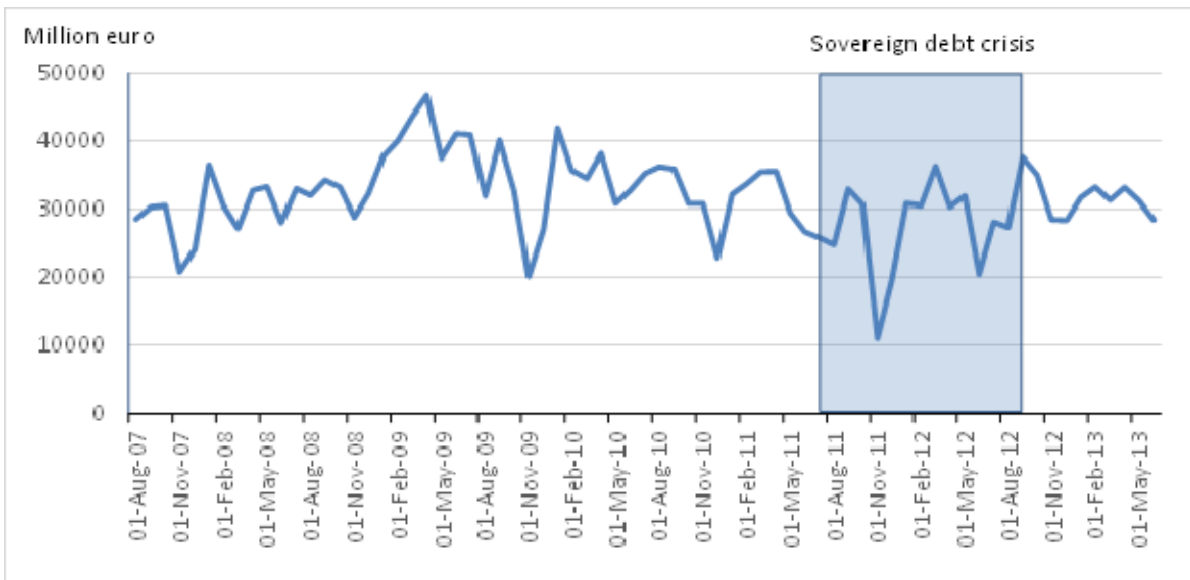
Note: Average holdings of domestic sovereign securities, divided by total assets, for 207 banks in five stressed (Greece, Ireland, Italy, Portugal, and Spain) and six non-stressed (Austria, Belgium, Finland, France, Germany, and the Netherlands), for the period September 2009 – February 2013.

Figure 3. Domestic sovereign security holdings: Domestic versus foreign banks in stressed countries



Note: Average holdings of domestic sovereign securities, divided by total assets, for 47 domestic banks in 13 foreign banks in five stressed euro area countries (Greece, Ireland, Italy, Portugal, and Spain), for the period September 2009 – February 2013.

Figure 4. Amount auctioned: Italy, 2007 – 2013



Note: Amount of sovereign bonds, in €millions, auctioned by the government of Italy over the period August 2007 – August 2013.

Table 1. Summary statistics

This table presents summary statistics for the variables used in the empirical tests. The sample includes 47 domestic and 13 foreign banks in Greece, Ireland, Italy, Portugal, and Spain. The sample period is May 2010 – August 2012 for banks in Greece, Ireland, and Portugal, and August 2011 – August 2012 for banks in Italy and Spain. All variables are observed with monthly frequency. ‘Domestic bank’ is a dummy variable equal to 1 if the bank is domestically-owned and to 0 otherwise. ‘Flow<sub>t</sub>/Stock<sub>t-1</sub> domestic sovereign securities’ denotes the ratio of the bank’s net flow of securities issued by the domestic sovereign at time t to the bank’s total holdings of securities issued by the domestic sovereign at time t-1. ‘Flow domestic sovereign securities/1,000’ denotes the bank’s net flow of securities issued by the domestic sovereign at time t, divided by 1,000. ‘Growth stock domestic sovereign securities’ denotes the change in the bank’s stock of securities issued by the domestic sovereign at time t. ‘Flow<sub>t</sub>/Stock<sub>t-1</sub> loans to sovereigns’ denotes the ratio of the loans issued by the bank to sovereigns at time t to the stock of the bank’s total loans to sovereigns at time t-1. ‘Flow<sub>t</sub>/Stock<sub>t-1</sub> private sector securities’ denotes the ratio of the bank’s net flow of securities issued by the domestic private sector at time t to the bank’s total holdings of securities issued by the domestic private sector at time t-1. ‘Flow<sub>t</sub>/Stock<sub>t-1</sub> loans to households’ denotes the ratio of the bank’s net flow of loans to domestic households at time t to the bank’s total stock of loans to domestic households at time t-1. ‘Flow<sub>t</sub>/Stock<sub>t-1</sub> loans to NFCs ≤ 1 year’ denotes the ratio of the bank’s net flow of loans to non-financial corporations (NFCs) with a maturity of less than 1 year issued at time t to the bank’s total stock of loans to NFCs with a maturity of less than 1 year at time t-1. ‘Flow<sub>t</sub>/Stock<sub>t-1</sub> loans to NFCs > 1 year’ denotes the ratio of the bank’s net flow of loans to NFCs with a maturity of more than 1 year issued at time t to the bank’s total stock of loans to NFCs with a maturity of less than 1 year at time t-1. ‘Domestic sovereign securities/Assets’ denotes the ratio of the bank’s total holdings of securities issued by the domestic sovereign to total assets. ‘Assets’ denotes the bank’s total assets, in mln. euro. ‘Deposit/Assets’ denotes the ratio of the bank’s total deposits to total assets. ‘Loans/Deposits’ denotes the ratio of the bank’s total loans issued to total assets. ‘Capital’ denotes the ratio of the bank’s equity to total assets. ‘Bank CDS’ denotes the bank’s CDS spread. ‘Loan spread’ denotes the difference between average rates on loans to non-financial corporations and rates on household deposits. ‘Auctioned debt’ denotes the amount of newly issued government bonds. ‘Maturing debt’ denotes the amount of existing government debt that is currently maturing. ‘10-year bond yield spread’ denotes the difference between the yield on a 10-year spread in a particular country and the yield on a German Bund.

Variable	Mean	Median	St. dev	Min	Max
Domestic bank	0.76	1.00	0.43	0.00	1.00
Flow <sub>t</sub> /Stock <sub>t-1</sub> domestic sovereign securities	0.02	0.00	0.15	-0.83	0.99
Flow domestic sovereign securities/1,000	0.10	0.00	0.74	-5.02	7.71
Growth stock domestic sovereign securities	0.02	0.00	0.17	-0.84	1.38
Flow <sub>t</sub> /Stock <sub>t-1</sub> loans to sovereigns	-0.01	0.00	0.17	-0.91	0.95
Flow <sub>t</sub> /Stock <sub>t-1</sub> private sector securities	-0.01	-0.01	0.13	-0.98	0.84
Flow <sub>t</sub> /Stock <sub>t-1</sub> loans to households	-0.01	-0.01	0.04	-0.34	0.87
Flow <sub>t</sub> /Stock <sub>t-1</sub> loans to NFCs ≤ 1 year	-0.01	-0.01	0.11	-0.87	0.95
Flow <sub>t</sub> /Stock <sub>t-1</sub> loans to NFCs > 1 year	-0.01	-0.01	0.03	-0.18	0.59
Domestic sovereign securities/Assets	0.06	0.05	0.05	0.00	0.25
Assets (mln.)	89,689.00	55,910.00	97,511.00	3,660.00	533,849.00
Deposit/Assets	0.54	0.53	0.16	0.04	0.90
Loans/Deposits	1.32	1.27	0.87	0.36	10.00
Capital	0.11	0.10	0.06	0.00	0.51
Bank CDS	640.64	474.37	504.71	71.10	3,884.53
Loan spread	7.44	7.56	4.63	0.00	18.52
Auctioned debt (mln.)	11,479.59	9,303.38	11,459.04	0.00	36,322.90
Maturing debt (mln.)	16,795.81	9,085.66	20,636.17	0.00	83,941.74
10-year bond yield spread	9.25	6.76	6.56	5.23	48.60

Table 2. Domestic vs. foreign banks, pre-sovereign debt crisis

This table presents difference-in-differences estimate from a Mann-Whitney two-sided test on pre-May 2010 mean values of the variables used in the empirical tests, for domestic vs. foreign banks. The sample includes 47 domestic and 13 foreign banks in Greece, Ireland, Italy, Portugal, and Spain. The sample period is September 2007 – April 2010 for banks in Greece, Ireland, and Portugal, and September 2007 – July 2011 for banks in Italy and Spain. All variables are observed with monthly frequency. ‘Domestic sovereign securities/Assets’ denotes the ratio of the bank’s total holdings of securities issued by the domestic sovereign to total assets. ‘Log (Assets)’ denotes the natural logarithm of the bank’s total assets. ‘Deposit/Assets’ denotes the ratio of the bank’s total deposits to total assets. ‘Loans/Deposits’ denotes the ratio of the bank’s total loans issued to total assets. ‘Capital’ denotes the ratio of the bank’s equity to total assets. \*\*\* indicates significance at the 1% level, and \*\* at the 5% level.

Variable	Foreign	Domestic	Difference
Domestic sovereign securities/Assets	0.034	0.041	-0.007
Log (Assets)	10.209	10.934	-0.725***
Deposit/Assets	0.554	0.491	0.063
Loans/Deposits	1.427	1.721	-0.294
Capital	0.066	0.090	-0.026**

Table 3. Auctioned sovereign debt, by country: Summary statistics

This table presents summary statistics for sovereign debt placed in monthly auctions by the governments of Greece, Ireland, Italy, Portugal, and Spain, in mln. euro. The sample period is May 2010 – August 2012 for Greece, Ireland, and Portugal, and August 2011 – August 2012 for Italy and Spain.

Country	Mean	Median	St. dev	Min	Max
Greece	1,761	2,000	968	0	3,750
Ireland	489	0	1,084	0	3,900
Italy	27,270	30,293	6,813	11,000	36,322
Portugal	2,604	2,171	1,342	0	5,576
Spain	13,602	13,857	3,565	9,268	21,479

Table 4. Change in domestic sovereign security holdings: Main results

This table presents difference-in-differences estimates of the propensity of banks to hold debt securities issued by the domestic government. The sample includes 47 domestic and 13 foreign banks in Greece, Ireland, Italy, Portugal, and Spain. The sample period is May 2010 – August 2012 for banks in Greece, Ireland, and Portugal, and August 2011 – August 2012 for banks in Italy and Spain. All variables are observed with monthly frequency. The dependent variable is the ratio of the bank's net flow of securities issued by the domestic sovereign at time  $t$  to the bank's total holdings of securities issued by the domestic sovereign at time  $t-1$ . 'High need' is a dummy variable equal to 1 if the total amount of new debt auctioned by the domestic government in a particular month is above the country-specific median for the sample period. 'Domestic bank' is a dummy variable equal to 1 if the bank is domestically-owned and to 0 otherwise. 'Log (Assets)' denotes the natural logarithm of the bank's total assets, in mln. euro. 'Deposit/Assets' denotes the ratio of the bank's total deposits to total assets. 'Loans/Deposits' denotes the ratio of the bank's total loans issued to total assets. 'Capital' denotes the ratio of the bank's equity to total assets. All bank controls are 1-year lagged. All regressions include fixed effects as specified. Standard errors clustered at the bank level appear in parentheses, where \*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

	Flow_t/Stock_t-1 domestic sovereign securities		
	(1)	(2)	(3)
High need × Domestic bank	0.081*** (0.022)	0.077*** (0.023)	0.068*** (0.027)
Domestic bank	0.030** (0.014)	0.034** (0.016)	
High need	-0.026 (0.019)	-0.026 (0.020)	
Log (Assets)		-0.009* (0.006)	-0.013 (0.021)
Deposits/Assets		-0.042 (0.042)	0.025 (0.140)
Loans/Deposits		0.010*** (0.003)	0.019 (0.039)
Capital		0.016 (0.114)	0.175 (0.139)
Bank fixed effects	No	No	Yes
Country × Year-month fixed effects	No	No	Yes
R-squared	0.06	0.08	0.30
No. observations	997	997	997

Table 5. Change in domestic sovereign security holdings: Falsification tests

This table presents difference-in-differences estimates of the propensity of banks to hold government debt securities or to issue loans to sovereigns. The sample includes 47 domestic and 13 foreign banks in Greece, Ireland, Italy, Portugal, and Spain (columns (1) – (3)), and 49 domestic and 7 foreign banks in Germany (column (4)). The sample period is May 2010 – August 2012 for banks in Greece, Ireland, and Portugal, and August 2011 – August 2012 for banks in Italy and Spain (columns (1) – (2)); September 2007 – April 2010 for banks in Greece, Ireland, and Portugal, and September 2007 – July 2011 for banks in Italy and Spain (column (3)); and May 2010 – August 2012 for banks in Germany (column (4)). The dependent variable is the ratio of the bank’s net flow of securities issued by the domestic sovereign at time  $t$  to the bank’s total holdings of securities issued by foreign sovereigns at time  $t-1$  (column (1)), the ratio of the bank’s net flow of loans to sovereigns at time  $t$  to the bank’s total stock of loans to sovereigns at time  $t-1$  (column (2)), and the bank’s net flow of securities issued by the domestic sovereign at time  $t$  to the bank’s total holdings of securities issued by the domestic sovereign at time  $t-1$  (columns (3) and (4)). ‘High need’ is a dummy variable equal to 1 if the total amount of new debt auctioned by the domestic government in a particular month is above the country-specific median for the sample period. ‘Domestic bank’ is a dummy variable equal to 1 if the bank is domestically-owned and to 0 otherwise. All regressions include all bank-specific variables from Table 3, as well as fixed effects as specified. Standard errors clustered at the bank level appear in parentheses, where \*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

	Flow_t/Stock_t-1	Flow_t/Stock_t-1	Flow_t/Stock_t-1 domestic	
	foreign sovereign securities	loans to sovereign	sovereign securities	
	(1)	(2)	Pre-crisis	Germany
	(1)	(2)	(3)	(4)
High need × Domestic bank	0.001 (0.040)	-0.040 (0.042)	0.011 (0.039)	-0.004 (0.008)
Bank controls	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Country × Year-month fixed effects	Yes	Yes	Yes	Yes
R-squared	0.27	0.27	0.20	0.10
No. observations	707	1,002	1,119	1,529



Table 6. Change in domestic sovereign security holdings: Alternative mechanisms

This table presents difference-in-differences estimates of the propensity of banks to hold debt securities issued by the domestic government. The sample includes 47 domestic and 13 foreign banks (columns (1)–(5)) and 13 foreign banks (column (6)) in Greece, Ireland, Italy, Portugal, and Spain. The sample period is May 2010 – August 2012 for banks in Greece, Ireland, and Portugal, and August 2011 – August 2012 for banks in Italy and Spain. The dependent variable is the ratio of the bank’s net flow of securities issued by the domestic sovereign at time  $t$  to the bank’s total holdings of securities issued by the domestic sovereign at time  $t-1$ . ‘High need’ is a dummy variable equal to 1 if the total amount of new debt auctioned by the domestic government in a particular month is above the country-specific median for the sample period. ‘Domestic bank’ is a dummy variable equal to 1 if the bank is domestically-owned and to 0 otherwise. All bank controls are 1-year lagged. ‘10-year bond yield spread’ is the spread on a 10-year domestic sovereign bond. ‘Bank CDS’ is the bank’s own CDS spread. ‘Loan spread’ is the difference between the average rate the bank charges on loans to NFCs and the average rate that the bank pays on household deposits. ‘Prime dealer’ is a dummy variable equal to 1 if the bank is certified by the government to participate in government bond auctions. All regressions include all bank-specific variables from Table 4, as well as fixed effects as specified. Standard errors clustered at the bank level appear in parentheses, where \*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

	Flow_t/Stock_t-1 domestic sovereign securities					
	Balance sheet shocks	Bank risk	Sovereign risk	Investment opportunities	Prime dealers	Foreign banks’ suasion
	(1)	(2)	(3)	(4)	(5)	(6)
High need × Domestic bank	0.067** (0.028)	0.056** (0.028)	0.064** (0.026)	0.060* (0.035)	0.065*** (0.020)	
Log (Assets) × Domestic bank	-0.233 (0.180)					
Deposits/Assets × Domestic bank	0.003 (0.236)					
Loans/Deposits × Domestic bank	0.114 (0.121)					
Capital × Domestic bank	-0.217 (0.223)					
Bank CDS × Domestic bank		-0.027 (0.020)				
Bank CDS		0.026 (0.020)				
10-year bond yield spread × Domestic bank			-0.003 (0.004)			
Loan spread × Domestic bank				-0.003 (0.006)		
Loan spread				-0.002 (0.004)		
High need × Prime dealer					-0.079*** (0.020)	
High need						-0.020 (0.029)
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country × Year-month fixed effects	Yes	Yes	Yes	Yes	Yes	No
Year-month fixed effects	No	No	No	No	No	Yes
R-squared	0.31	0.30	0.31	0.29	0.31	0.27
No. observations	997	775	997	879	997	239

Table 7. Change in domestic sovereign security holdings: Model robustness

This table presents difference-in-differences estimates of the propensity of banks to hold debt securities issued by the domestic government. The sample includes 47 domestic and 13 foreign banks in Greece, Ireland, Italy, Portugal, and Spain. The sample period is May 2010 – August 2012 for banks in Greece, Ireland, and Portugal, and August 2011 – August 2012 for banks in Italy and Spain. All variables are observed with monthly frequency. ‘High need (maturing)’ is a dummy variable equal to 1 if the total amount of existing sovereign debt maturing in a particular month is above the country-specific median for the sample period. ‘High need’ is a dummy variable equal to 1 if the total amount of new debt auctioned by the domestic government in a particular month is above the country-specific median for the sample period. ‘Domestic bank’ is a dummy variable equal to 1 if the bank is domestically-owned and to 0 otherwise. ‘Auctioned debt’ denotes the amount of newly issued government bonds. All regressions include all bank-specific variables from Table 4, as well as fixed effects as specified. Standard errors clustered at the bank level appear in parentheses, where \*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

	Flow_t/Stock_t-1 domestic sovereign securities		
			Auctioned
	Maturing debt	75% cut-off	debt
	(1)	(2)	(3)
High need (maturing) × Domestic bank	0.045*** (0.012)		
High need × Domestic bank		0.063* (0.043)	
Auctioned debt/1,000 × Domestic bank			0.007* (0.004)
Bank controls	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes
Country × Year-month fixed effects	Yes	Yes	Yes
R-squared	0.21	0.29	0.30
No. observations	997	652	997

Table 8. Change in domestic sovereign security holdings: Robust dependent variable

This table presents difference-in-differences estimates of the propensity of banks to hold debt securities issued by the domestic government. The sample includes 47 domestic and 13 foreign banks in Greece, Ireland, Italy, Portugal, and Spain. The sample period is May 2010 – August 2012 for banks in Greece, Ireland, and Portugal, and August 2011 – August 2012 for banks in Italy and Spain. All variables are observed with monthly frequency. In column (1), the dependent variable is the bank’s net flow of securities issued by the domestic sovereign at time  $t$ . In column (2), the dependent variable is the change in the bank’s stock of securities issued by the domestic sovereign at time  $t$ . ‘High need’ is a dummy variable equal to 1 if the total amount of new debt auctioned by the domestic government in a particular month is above the country-specific median for the sample period. ‘Domestic bank’ is a dummy variable equal to 1 if the bank is domestically-owned and to 0 otherwise. All regressions include all bank-specific variables from Table 4, as well as fixed effects as specified. Standard errors clustered at the bank level appear in parentheses, where \*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

	Flow domestic sovereign securities/1,000	$\Delta$ Stock domestic sovereign securities
	(1)	(2)
High need $\times$ Domestic bank	0.368*** (0.127)	0.109*** (0.035)
Bank controls	Yes	Yes
Bank fixed effects	Yes	Yes
Country $\times$ Year-month fixed effects	Yes	Yes
R-squared	0.28	0.33
No. observations	997	997

Table 9. Change in domestic sovereign security holdings: Robust sample

This table presents difference-in-differences estimates of the propensity of banks to hold debt securities issued by the domestic government. The sample includes 47 domestic and 13 foreign banks in Greece, Ireland, Italy, Portugal, and Spain. The sample period is May 2010 – August 2012 for banks in Greece, Ireland, and Portugal, and August 2011 – August 2012 for banks in Italy and Spain (column (1)–(3) and column (5)), and September 2007 – June 2013 (column (4)). All variables are observed with monthly frequency. The dependent variable is the ratio of the bank’s net flow of securities issued by the domestic sovereign at time  $t$  to the bank’s total holdings of securities issued by the domestic sovereign at time  $t-1$ . ‘High need’ is a dummy variable equal to 1 if the total amount of new debt auctioned by the domestic government in a particular month is above the country-specific median for the sample period (columns (1)–(2) and (4)–(5)), and a dummy variable equal to 1 if the total amount of new debt auctioned by the domestic government in a particular month is in the country-specific top quartile, and to 0 if it is in the country-specific bottom quartile, for the sample period (column (3)). ‘Domestic bank’ is a dummy variable equal to 1 if the bank is domestically-owned and to 0 otherwise. ‘High risk’ is a dummy variable equal to 1 during May 2010 – August 2012 for banks in Greece, Ireland, and Portugal, and August 2011 – August 2012 for banks in Italy and Spain. In column (1), all banks from Greece are excluded. In column (2), all banks from Ireland are excluded. Column (3) excludes the month immediately after the ECB’s first VLTRO (January 2012) and the month immediately after the ECB’s second VLTRO (April 2012). In column (5), the sample is chosen based on a Propensity Score Matching procedure using pre-crisis values of all explanatory variables. All regressions include all bank-specific variables from Table 4, as well as fixed effects as specified. Standard errors clustered at the bank level appear in parentheses, where \*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

	Flow <sub>t</sub> /Stock <sub>t-1</sub> domestic sovereign securities				
	Excluding Greece (1)	Excluding Ireland (2)	Excluding VLTRO months (3)	August 2007 – June 2013 (4)	Matched sample (5)
High need × Domestic bank	0.074*** (0.031)	0.087** (0.034)	0.073** (0.034)	-0.003 (0.027)	0.058** (0.027)
High risk × High need × Domestic bank				0.073** (0.030)	
High risk × Domestic bank				0.037* (0.022)	
Bank controls	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes
Country × Year-month fixed effects	Yes	Yes	Yes	Yes	Yes
R-squared	0.30	0.31	0.33	0.18	0.32
No. observations	858	791	885	3,244	711

Table 10. Change in domestic sovereign security holdings: Who is swayed?

This table presents difference-in-differences estimates of the propensity of banks to hold debt securities issued by the domestic government. The sample includes 47 domestic banks in Greece, Ireland, Italy, Portugal, and Spain. The sample period is May 2010 – August 2012 for banks in Greece, Ireland, and Portugal, and August 2011 – August 2012 for banks in Italy and Spain. All variables are observed with monthly frequency. The dependent variable is the ratio of the bank’s net flow of securities issued by the domestic sovereign at time  $t$  to the bank’s total holdings of securities issued by the domestic sovereign at time  $t-1$ . ‘High need’ is a dummy variable equal to 1 if the total amount of new debt auctioned by the domestic government in a particular month is above the country-specific median for the sample period. ‘State-owned bank’ is a dummy variable equal to 1 if the bank is more than 50% owned by the domestic government. ‘State-owned or supported bank’ is a dummy variable equal to 1 if the bank is more than 50% owned by the domestic government or if it received government support during the financial crisis of 2008-09. ‘Low initial share Domestic sovereign securities/Assets’ is a dummy variable equal to 1 if the bank is in the bottom 50% in terms of holdings of debt securities issued by the domestic government prior to the crisis. ‘State owned or supported bank and low initial share Domestic sovereign securities/Assets’ is a dummy variable equal to 1 if the bank is either more than 50% owned by the domestic government, or received support from the domestic government during the global financial crisis, and is in the bottom 50% in terms of holdings of debt securities issued by the domestic government prior to the crisis. In column (3), all domestic banks that received government support during the financial crisis of 2008-09 are excluded. All regressions include all bank-specific variables from Table 3, as well as fixed effects as specified. Standard errors clustered at the bank level appear in parentheses, where \*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

	Flow <sub>t</sub> /Stock <sub>t-1</sub> domestic sovereign securities			
	State-owned versus Private domestic (1)	State-owned and supported versus private domestic (2)	State-owned versus non-supported private (3)	Low versus high initial share domestic bond holdings (4)
High need × State-owned bank	0.032 (0.032)		0.073** (0.036)	
High need × State-owned or supported banks		0.023 (0.026)		
High need × Low initial share sovereign holdings				0.045** (0.021)
Bank controls	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Country × Year-month fixed effects	Yes	Yes	Yes	Yes
R-squared	0.34	0.34	0.38	0.34
No. observations	758	758	459	758

Table 11. Change in domestic sovereign security holdings: The ECB's LTRO in December 2011

This table presents difference-in-differences estimates of the propensity of banks to hold debt securities issued by the domestic government. The sample includes 47 domestic and 13 foreign banks (column (1)) and 47 domestic banks (columns (2)–(3)) in Greece, Ireland, Italy, Portugal, and Spain. The sample period is May 2010 – August 2012 for banks in Greece, Ireland, and Portugal, and August 2011 – August 2012 for banks in Italy and Spain. All variables are observed with monthly frequency. The dependent variable is the ratio of the bank's net flow of securities issued by the domestic sovereign at time  $t$  to the bank's total holdings of securities issued by the domestic sovereign at time  $t-1$ . 'High need' is a dummy variable equal to 1 if the total amount of new debt auctioned by the domestic government in a particular month is above the country-specific median for the sample period. 'State owned bank' is a dummy variable equal to 1 if the bank is more than 50% owned by the domestic government. 'Low initial share Domestic sovereign securities/Assets' is a dummy variable equal to 1 if the bank is in the bottom 50% in terms of holdings of debt securities issued by the domestic government prior to the crisis. 'State owned or supported bank and low initial share Domestic sovereign securities/Assets' is a dummy variable equal to 1 if the bank is either more than 50% owned by the domestic government, or received support from the domestic government during the global financial crisis, and is in the bottom 50% in terms of holdings of debt securities issued by the domestic government prior to the crisis. In column (3), all domestic banks that received government support during the financial crisis of 2008-09 are excluded. All regressions include all bank-specific variables from Table 3, as well as fixed effects as specified. Standard errors clustered at the bank level appear in parentheses, where \*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

	Flow <sub>t</sub> /Stock <sub>t-1</sub> domestic sovereign securities			
	Domestic versus foreign (1)	State-owned versus private domestic (2)	State-owned versus non-supported private (3)	Low versus high initial share domestic bond holdings (4)
Post LTRO × High need × Domestic bank	0.017 (0.056)			
High need × Domestic bank	0.057 (0.039)			
Post LTRO × Domestic bank	-0.111*** (0.040)			
Post LTRO × High need × State-owned bank		0.104 (0.067)	0.085 (0.084)	
High need × State-owned bank		0.013 (0.032)	0.050 (0.044)	
Post LTRO × State-owned bank		-0.017 (0.016)	-0.007 (0.020)	
Post LTRO × High need × Low initial share sov. holdings				-0.045 (0.046)
High need × Low initial share sovereign holdings				0.061*** (0.022)
Post LTRO × Low initial share sovereign holdings				0.020 (0.020)
Bank controls	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Country × Year-month fixed effects	Yes	Yes	Yes	Yes
R-squared	0.32	0.31	0.37	0.28
No. observations	997	758	459	758