Purchases of Sovereign Debt Securities by Banks During the Crisis: the Role of Balance Sheet Conditions

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Abstract

The literature exploring the determinants of the increase of sovereign debt securities in banks' portfolios during the crisis has generally adopted a macroeconomic perspective (Governments' moral suasion, redonomination risk). This paper adopts a different approach and analyses the main microeconomic determinants of these purchases investigating Italian banks' balance sheet conditions from 2007 to 2013. Results show that banks' specific characteristics and balance sheet features do matter and that banks buy government securities to support their financial conditions. The high liquidity of government bonds, their high yields and their convenience in terms of capital charges make them well suited to satisfying banks' needs in a period of declining bank profitability and loan quality. The two periods of the crisis – the global financial crisis following the Lehman Brothers collapse and the euro area sovereign debt crisis – differ both in the underlying reasons for banks' sovereign bonds purchases and in the size of banks most heavily engaged. In each phase, however, purchases are mainly made by banks, whose balance sheets are weaker in the period.

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JEL classification: G01, G21, H63.

1. Introduction[1]

Banks' exposure to domestic sovereign debt grew considerably during the crisis in most of the euro area countries (Figure 1). In Italy the share of total bank assets accounted for by sovereign debt securities increased by about 7 percentage points between 2007 and 2013. A large institutional and academic debate has been exploring causes and implications of

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this growth (Angeloni and Wolff (2012); Battistini et al. (2013); Gennaioli et al. (2014a); Angelini et al. (2014); Acharya and Steffen (2015)). So far the literature has adopted in most of the cases a macroeconomic perspective to investigate the determinants of the increase of sovereign debt securities in banks' portfolios during the crisis. One of the hypotheses put forward, known as the moral suasion hypothesis, claims that countries in financial distress may exert a kind of moral suasion on their domestic banks to buy domestic sovereign debt securities to ensure financing of the public debt (Battistini et al. (2013); Ongena et al. (2016); Asonuma et al. (2015); Acharya and Steffen (2015)). A second hypothesis, the renationalization hypothesis, is referred specifically to the euro area case: according to it banks invest massively in their own countries' government bonds during the crisis in order to match the redenomination risk. In fact, their perception of domestic sovereign debt risk is lower than that of foreign bondholders, given that a government default would entail for them consequences far beyond the capital loss which results from plunging government bond prices; in other words a banking system could not survive the default of its sovereign even without direct exposures towards it (Battistini et al. (2013); Broner et al. (2014); Angelini et al. (2014); Bocola (2016); Ari (2015); Andreeva and Vlassopoulos (2016)).

A less explored hypothesis is that banks' purchases of government bonds have been driven not by external and macroeconomic factors, but by banks' necessity to support their financial conditions, which just in the period were deteriorating because of the crisis. Yet, also from a general financial stability perspective, the existence of microeconomic determinants may change the overall impact of these purchases. In fact, it has been argued that, on the one hand, banks' direct exposures to sovereign bonds may be negative for financial stability because they are one of the channels through which a feedback loop between sovereigns and banks may thrive: large volumes of government securities on banks' balance sheets may expose banks to reductions in the value of securities, triggering collateral risk, capital losses and credit risks, potentially endangering financial stability (Bank for International Settlements (2011); Altavilla et al. (2016); Brunnermeier et al. (2016)). On the other hand, however, it also has been argued that large holdings of sovereign bonds by banks may be positive for financial stability because they act as a disciplining device for the government, reducing the ex ante likelihood of a sovereign default, preventing sovereign yields from reaching even higher levels balancing market overreactions (Giordano and Tommasino (2011); Gros (2011); Ichiue and Shimizu (2012); Coeurdacier and Rey (2013); Gennaioli et al. (2014b); Lanotte et al. (2016)). In any case, the overall impact on financial stability may be positive only if banks improve their balance sheet conditions when they buy government securities and help to absorb destabilizing macro shocks. Instead, if they worsen their balance sheet conditions, the prevailing overall impact is likely to be negative.

In this light, in order to verify whether the micro factors matter, we search out the determinants of the purchases in each bank's balance sheet conditions. More specifically, we use bank-by-bank data to find out whether and to which extent characteristics such as credit quality, capitalization, profitability and liquidity have influenced banks' portfolio choices. So far only a few papers have made an attempt in this direction. Hildebrand et al. (2012) show that the crisis has led German banks to invest mainly in securities eligible as collateral in the Eurosystem refinancing operations. Buch et al. (2016) show that there

are significant differences among German banks in adjusting sovereign debt holdings in the period 2005–2010 and that larger amounts of sovereign debt are held by the largest and less capitalized banks and by those more dependent on wholesale funding. (Lang and Schröder (2015); Bonner (2016)) mention that favourable regulatory treatments of sovereign bonds, concerning both capital and liquidity requirements, is another motive for banks' purchases.

This paper tries to go one step further studying and comparing a wide range of individual banks' determinants of sovereign debt securities purchases in Italy during the crisis. Italy is an interesting case for two reasons: the purchases of the Italian banking system have been particularly relevant all over the crisis, more than in other countries, and, because of the high Italian public debt and the direct involvement in the sovereign debt crisis, the implications for financial stability briefly reviewed above suit well its situation. Micro papers cited above focus on specific motives to explain banks' investment in government bonds (producing collateral, lowering riskiness, circumventing regulatory requirements), while we can assess the different channels through which the investment in sovereign bonds can support banks' financial conditions taking into account the whole structure of banks' balance sheet. The paper also contributes to the literature distinguishing between the two phases of the crisis and among size types of banks. The distinction between the global financial crisis and the sovereign debt crisis helps to show that the characteristics of individual banks constantly matter, even if they change during the two phases. The analysis by size types allows us to accurately identify the prevailing causal factors in each phase and confirm their constant relevance. Moreover, we have the advantage of using a unique dataset with quarterly micro data on banks' balance sheets and on purchases of sovereign bonds. So far most of the papers have used data on stocks; with respect to stocks, flows only include the amount of current financial transactions and exclude valuation effects, providing a better measure of banks' purchases of sovereign bonds.

Results show that banks' specific characteristics and balance sheet features do matter and that banks bought government securities to support their financial conditions. The high liquidity of government bonds, their high yields and their convenience in terms of capital charges made them well suited to satisfying banks' needs in a period of declining loan quality and profitability. The two periods of the crisis – the global financial crisis following the Lehman Brothers collapse and the euro area sovereign debt crisis – differ both in the underlying reasons for banks' sovereign bonds purchases and in the size of banks most heavily engaged. During the first phase, purchases are made mainly by the largest banks, whose balance sheets are weaker in the period, whereas during the second phase the sharp rise in purchases is led mainly by smaller banks.

The rest of the paper is structured as follows. Section 2 describes the data and their sources. Section 3 discusses the main balance sheet determinants of banks' purchases of government securities. Section 4 shows the results of the econometric analysis of those determinants. Section 5 contains some concluding remarks.

2. Data

Our analysis is mainly based on Bank of Italy supervisory report, an high frequency dataset containing end-of-month data on assets and liabilities, and end-of-quarter data on profit and loss statement, for all banks operating in Italy.

This dataset has several advantages compared to other data sources used in the literature. First, its frequency allows us to study changes in banks' demand for sovereign bonds at a much higher frequency than studies that use sovereign data from the European Banking Authority (EBA) that are biannual (e.g., Popov and Horen (2015); Horváth et al. (2015)) or Bankscope that only provides information at an annual frequency (e.g., Gennaioli et al. (2014a)).

Second, the data include both information on flows as well as on stocks while EBA and Bankscope data only include stocks. This enables us to differentiate between adjustments due to new effective purchases of bonds and due to maturing debt which is not replaced. The estimation period runs from March 2007 to December 2013, covering both the global financial crisis as well as the euro area sovereign debt crisis (and its aftermath).

The data are aggregated at banking-group level for all banks belonging to the same group. To eliminate the breaks resulting from the operations of mergers and acquisitions we employ the standard technique of simulating that all the M&As have occurred at the beginning of the sample period. Banks are classified into 5 size classes: the top 5 groups, other large banks and members of large groups, small banks, minor banks, and branches of foreign banks.[2]

Aggregated data shows that the evolution of banks' government securities purchases shows a clear distinction between the two phases of the crisis (Figure 2). During the first phase, net purchases of securities accelerate sharply between the second half of 2008, after the collapse of Lehman Brothers, and mid-2009, when the pace slows until mid-2011. During the second phase, in conjunction with the widening of the yield spread between Italian and German government securities, purchases once again accelerate sharply until the spring of 2012. In this phase of the crisis, banks' purchases of sovereign debt securities, quantitatively more substantial than in the first phase, follow the massive injection of liquidity by the Eurosystem through the two 3-year longer-term refinancing operations (LTROs) of December 2011 and February 2012.

Data also show that the different types of banks behave very differently during the two phases of the crisis. In the first phase, the rapid growth in sovereign debt securities purchases is led by the top 5 groups, whereas in the second phase the sharp increase is driven by the small and minor banks (Figure 2).

[2]The taxonomy is that used in Bank of Italy publications. Apart from the top 5 groups and the foreign banks, the categories 'large', 'small' and 'minor' include banks belonging to groups or independent banks with total assets respectively greater than 21.5 billion, between 3.6 and 21.5 billion, and less than 3.6 billion.

3. Testable hypotheses

This section reviews the main microeconomic determinants (individual banks' balance sheet indicators) of sovereign debt securities purchases proposed in the recent academic and policy debate.

(i) Liquidity strains and the precautionary motive

The first reason urging banks to buy government bonds is related to their liquidity conditions and has to do with a precautionary motive. Gennaioli et al. (2014a) present a theoretical model where banks may optimally choose to hold public bonds as a way to store liquidity for financing future investments. Indeed, both during the global financial crisis and the sovereign debt crisis, Italian banks face considerable difficulties in accessing the international bond markets. Since the drying-up of this funding channel makes more difficult the rollover of bank bonds, banks may have decided, especially right after the two LTROs, to temporarily invest part of the liquidity received from the Eurosystem in short-term government bonds, pending its use for the redemption of maturing bonds (Banca d'Italia (2012a); Broner et al. (2014)). The precautionary motive also concerns the need to build up a stock of securities eligible as collateral in the Eurosystem refinancing operations, which has become a relevant funding source in the course of the crisis.

(ii) Complying with capital adequacy requirements

Securities purchases may also be related to the compliance with capital regulatory requirements. Battistini et al. (2013) and Acharya and Steffen (2015), with reference to the euro area sovereign debt crisis, argue that undercapitalized banks may have gambled for resurrection, by engaging in carry trades exploiting the cheap liquidity from the Eurosystem and the high-yields from government bonds, which absorb little or no capital. Bonner (2016) shows that preferential treatment in microprudential liquidity and capital regulation significantly increases banks' demand for government bonds.[3]

At the end of 2007 the tier 1 ratio of the Italian banking system is 6.5 per cent, and is particularly low at the major banks. In the subsequent years the expected tightening of capital requirements, combined with market pressures, leads banks, especially the larger ones, to expand their capital and reserves. The capital ratio can be improved either by increasing

[3]Since 2013 a debate has widespread in the Eurosystem about whether and to what extent government securities should be taken into account in evaluating the riskiness of securities portfolios (see, among others, Weidman (2013)). The methodology later approved to implement the stress tests involves marking to market of the government securities held in the trading book and in the AFS (assets-for-sale) banking book portfolio. Public securities in the held-to-maturity portfolio are not to be marked to market. Practically all the banks' holdings of government securities are carried in the banking book, and specifically as available-for-sale (AFS) financial assets. The assignment of sovereign debt securities to the banking book and particularly to the AFS portfolio was encouraged by the introduction, in May 2010, of a rule on prudential filters to regulatory capital that allows banks, in calculating their revaluation reserves against central government securities of EU countries only to totally neutralize capital gains and losses as long as the securities are carried at cost.

capital or by decreasing risk-weighted assets. During the crisis raising capital is very costly given the tensions in the international financial markets and the banks' low profitability; even so, Italian banks, especially the larger ones, increase their capital substantially. The second route to higher tier 1 ratios is a shift in asset composition that lowers the volume of risk-weighted assets through a reduction in the share of loans and an increase in the share of sovereign debt securities, which are rated as risk-free.

As a consequence, one may presume that banks with lower capital ratios have a stronger incentive to invest in government securities.

(iii) Improving profitability and bad loans

Another factor which can induce banks to buy sovereign debt securities is the need to improve profitability, in particular when Italian banks' earnings, already low by international standards, decline further in the course of the crisis. The carry trade hypothesis mentioned above is also related to this motive, because higher profits allow increasing bank capital.

During the crisis government securities purchases represent a means of increasing earnings because their yields rise sharply. As the sovereign debt crisis progresses, the yield on sovereign debt securities grows exponentially owing to the need to compensate buyers for a rising sovereign risk. Meanwhile, the risk-adjusted yield on loans falls as a result of low interest rates and increased loss provisioning due to the growth of non-performing loans (Figure 3; see Banca d'Italia (2013b) and Angelini et al. (2014)).

Even more, the purchase of government securities is strengthened by a significant increase of bad loans. In fact, the difficulties to comply with the capital adequacy requirements and the need to boost earnings is more relevant for banks more heavily burdened with bad loans, since the deterioration of credit quality results in higher loan losses, cuts profitability and reduces the possibility of using retained earnings to bolster capital ratios.

(iv) Availability of low-cost funding

Purchases of government bonds during the crisis are facilitated as well by the ample low-cost liquidity supplied to banks by the Eurosystem, in particular during the December 2011 and February 2012 LTROs, because banks can exploit the spread between the rising yield on sovereign debt securities and the low cost of central bank funds. In our micro-econometric framework we test empirically the effect of the Eurosystem expansionary monetary policy through the bank-by-bank data on the amounts of central bank liquidity provided by the Eurosystem to each bank operating in Italy.

Finally, the availability of low-cost funding involves the central credit counterparties (CCPs) liquidity as well.[4] In fact, sovereign bonds purchases can be financed by using the same securities in money market repos, chiefly with CCPs, bringing to a partially self-funded mechanism and making the purchase of government securities particularly profitable (Banca d'Italia (2011)).

[4]CCPs are third parties that mediate the lending operations between two banks for the purpose of reducing counterparty risk for the lending bank.

4. The econometric analysis

(i) Baseline specification

To verify the empirical hypotheses set forth in the previous section, we estimate the following equation:

$$\begin{aligned} Net\ purchases_{i,t} =& \alpha_0 + \beta_1 Funding\ gap_{i,t-1} + \beta_2 Bond\ issued_{i,t-1} + \beta_3 Tier\ 1\ ratio_{i,t-1} + \\ & \beta_4 \Delta Bad\ debts_{i,t-1} + \beta_5 ROA_{i,t-1} + \beta_6 Yield\ spread_{i,t-1} + \\ & \beta_7 Central\ bank_{i,t-1} + \beta_8 CCP\ liability_{i,t-1} + \beta_9 CCP\ asset_{i,t-1} + \\ & \gamma_1 Size_{i,t} + \gamma_2 Initial\ share_{i,t-1} + \gamma_3 Total\ deposits_{i,t-1} + \\ & \phi_i + \pi_t + \epsilon_{i,t} \end{aligned} \tag{1}$$

where the dependent variable $Net\ purchases_{i,t}$ is the ratio between the net purchases of domestic government securities (gross purchases less gross sales) by bank i in quarter t and the stock of government securities held by the same bank at the end of the previous quarter.

We define the explanatory as follows:

- $Funding\ gap_{i,t-1}$, is the ratio of total customer loans to total customer deposits plus bonds not held by banks.[5] This ratio is a relevant indicator of liquidity mismatch risk because it measures the coverage of loans with stable sources of funding. We expect a positive correlation between sovereign holdings and funding gap.
- $Bond\ issued_{i,t-1}$ is the ratio of total securities issued to total assets.
- $Tier\ 1\ ratio_{i,t-1}$ is the ratio of core equity capital to total risk-weighted assets.
- $\Delta Bad\ debts_{i,t-1}$ measures the flow of new bad debts in current quarter over the stock the stock of outstanding loans at the end of the previous quarter.
- $ROA_{i,t-1}$ captures the overall profitability of banking activity. Buch et al. (2016) show that profitability and efficiency are positively correlated with capital buffers and a bank's ability to absorb shocks. In contrast, more profitable banks might also assume higher risk when searching for yields. On this basis, however, the of the relationship between profitability and sovereign debt holdings is no clear a priori.
- $Yield\ spread_{i,t-1}$ is the difference between unitary risk-adjusted yields on loans and on securities. In other terms it measures specifically banks' comparative advantage between investing in loans or in securities.
- $Central\ Bank_{i,t-1}$ is the ratio of net liability position with Eurosystem to total assets.

[5]Despite its conceptual simplicity, the use of the funding gap indicator is problematic in practice because the data needed to calculate the indicator are not always available in sufficient detail (Banca d'Italia (2012b)).

- $CCP\ Liability_{i,t-1}$ measures the ratio between gross liability funding via central counterparties and total assets.
- $CCP\ Asset_{i,t-1}$ is the ratio of gross lending via central counterparties and total assets.
- $Size_{i,t}$ is measured as logarithm of total assets.
- $Initial\ share_{i,t-1}$ is the proportion of government securities in the overall securities portfolio of each bank at the end of the previous quarter .
- $Total\ deposits_{i,t-1}$ is the ratio of total deposits to total assets.

All the explanatory variables are defined at the level of individual bank or banking group. To enhance the robustness of the estimates, the equation 1 includes both bank (ϕ_i) and time (quarter) fixed effects (π_t): the former to control for unobservable microeconomic factors, the latter for macroeconomic factors and trends; $\epsilon_{i,t}$ is an identically and independently distributed idiosyncratic error component. The sample period is from March 2007 to December 2013.

A description of each regressor, the descriptive statistics and the expected signs are provided in Table 1. The correlations between the variables are presented in Table 2.

Two covariates refer to what we indicate as the precautionary motive. The variable *Funding Gap* is expected to have a positive effect. When it increases, banks may decide to bring it back buying sovereign securities as they are easy to liquidate and may be used as collateral to access Eurosystem liquidity or as a reserve to redeem maturing bank bonds when funding and rolling-over on international markets become difficult.[6] The expected sign of the variable *Bonds Issued* is positive as well. Apart from the effect of the availability of funds, Bonds Issued also captures the need to refinance liabilities, which is particularly pronounced during the crisis because of episodes of tension in the international financial markets, and again sovereign securities may be used as reserves to redeem maturing bonds.

The complying with capital adequacy requirements hypothesis is tested through the variable *Tier 1 Ratio*, which enables to verify whether each bank's level of capitalization influences its sovereign debt securities purchases. The expected sign is negative if banks use government bonds to replace loans in order to decrease risk-weighted assets and boost capital ratios.

banks' profitability is tracked by two indicators: *ROA* and *Yield Spread*.[7] The expected sign of ROA is negative during the crisis insofar as the least profitable banks have a greater incentive to increase earnings through the purchase of high-yielding government securities.

[6]In the estimates the variable Funding Gap is measured, as shown in Table 4, by the ratio of total customer loans to total customer deposits plus bonds not held by banks. The definition of funding gap is even more specific where only bonds held by households are included. Data on the share of bonds held by households is only available from 2008 onwards. To check the robustness of our estimates, we have repeated them with the narrower notion only from end-2008 onwards and results are confirmed.

[7]As a robustness control, we have used alternative variables: ROE instead of ROA, the spread between interest rates on bank loans and government bond yields instead of Yield Spread. The results are unchanged.

The expected sign of Yield Spread is always negative because the relative advantage of investing in sovereign debt securities increases whenever the spread between the yield on lending and securities falls.

The expected sign of ΔBad Debts is positive, in that it toughens the previous effects as a deterioration in the credit quality worsens both the capital ratio and the profitability of the intermediaries and makes it less advantageous to engage in lending.

The effect of the availability of low-cost funding is investigated through two regressors. *Central Bank* is expected to have a positive influence on government securities purchases. CCP measures gross liability funding through central counterparties, whose expected sign is positive, especially if the sovereign debt securities are used to fund the transactions with the CCPs. The sign of the variable CCP is not definable a priori but is probably opposite to that of CCP-Liabilities.

Equation 1 includes also several controls. *Size* represents a standard control to capture the effect of bank size on portfolio choices. *Initial Share* aims to verify whether banks with an already large proportion of sovereign debt securities in their portfolios tend to make the most purchases or if the opposite is true in a catching-up mechanism. The third control regressor, *Total Deposits*, captures the effect of the most important form of funding on the decision of purchasing government securities. In this instance too the a priori effect is ambiguous: on the one hand, the greater the availability of this source of funding, the more banks should be able to invest in sovereign debt securities; on the other hand, banks with more abundant liquid resources may have less incentive to purchase government securities.

In order to better capture the influence of banks' balance sheet conditions, the explanatory variables generally are computed with a quarter lag. The exceptions are Size, by reason of its persistence, and the liquidity management variables (Central Bank, CCP-Liabilities and CCP-Assets), which tend to vary in the short or very short term. To obtain estimates with standard errors that are robust to heteroskedasticity and autocorrelation, the observations are clustered at bank or banking group level. The data are mostly monthly (only those from the profit and loss account are half-yearly).[8] The choice of using quarterly data in the estimates (the dependent variable net-purchases of sovereign debt securities is computed as the sum of monthly data in each quarter) is intended to eliminate or smooth single monthly outliers.

(ii) The issue of endogeneity

Under our empirical approach, a choice variable of banks (the quarterly purchases of government securities), which produces effects on the balance sheet, is explained by regressors that are themselves drawn from the balance sheet. This poses a problem of endogeneity, which is not limited to a single regressor but involves all the regressors, in that as balance sheet variables are determined simultaneously by the bank. Nevertheless, a similar empirical framework is widely adopted in the literature. For example, Jiménez et al. (2014) test

[8]The half-yearly data (the numerator of the variables ROA, ROE and Yield Spread) are dragged into the missing quarter.

whether the variation in the lending of each bank to individual firms is a function of balance sheet variables such as the level of capitalization and the volume of non-performing loans. Likewise, just in analysing banks' securities purchases, Hildebrand et al. (2012) take the securities in banks' portfolio as the dependent variable and various balance sheet items as regressors. Buch et al. (2016) use as dependent variable the bank's level of exposure to sovereign risk (measured as the log of each bank's sovereign debt securities holdings) and as covariates balance sheet variables.

We take into account the problem of endogeneity as follows.
a. Bank fixed effects are always included, which avoid the presence of unobservables correlated with the regressors.
b. The covariates are measured with a one-quarter lag, which apart from its better economic meaning is also a common method – though not exhaustive – for dealing with endogeneity.[9]
c. The endogeneity of all the regressors is tested through specific tests (Durbin, Wu and Hausman) and only 3 out of 12 independent variables turn out to be endogenous.
d. The results of the three variables affected by endogeneity (Central Bank, CCP-liabilities and Size) have been re-estimated using the instrumental variable method, with their respective lags as instruments.
e. The robustness of all results is tested by means of Arellano-Bond estimates, which treat all the causal variables simultaneously as endogenous.

The stability of the results throughout all these tests and econometric specifications supports our causal interpretation of the outcomes.

(iii) The overall results

Table 3 shows the results of Equation (1) for the entire period and for all types of banks. When estimated throughout the entire period three variables (Funding Gap, Bonds Issued and Tier 1 Ratio) result not statistically significant, while the remaining covariates are significant and have the expected signs.

The coefficients of the two profitability regressors are negative. Lower levels of ROA lead banks to invest more heavily in government securities, and coherently the smaller the yield spread (differential between the risk-weighted return on loans and securities), the more the banks tend to invest in government bonds. The variable ΔBad Debts has a positive impact, such as the availability of liquidity from the Eurosystem and funding via central counterparties. Public securities purchases correlate positively with bank size and negatively with the initial share of sovereign debt securities in the portfolio. The amount of deposits tends to expand securities investment. In general these results are robust to alternative specifications (Table 3, columns 2-4).

[9]In Jiménez et al. (2014) the dependent variable (change in the log of lending) is a function of one-period lagged bank balance sheet variables, and no variable is instrumented. Distinguin et al. (2013) also test for the effect of balance sheet conditions on banks' capital endowment and liquidity, measuring the former with a series of indicators (loans, bad debts, loan loss provisions) and lagging the causal variables. The approach is very common: see also Jiménez et al. (2012) and Bonaccorsi di Patti and Sette (2012).

In terms of quantitative impact, Table 3 also reports the marginal effect of each regressor, as the percentage change in the dependent variable when the regressor moves from the 25th to the 75th percentile, holding the other regressors constant. The exercise shows that the factors with the strongest impact on government securities purchases are those that measure bank profitability.

(iv) The results for different sub-periods and types of bank

Interesting insights for a deeper comprehension of banks' purchases of sovereign debt securities during the crisis are inferred re-estimating Equation (1) after splitting the entire period into the two phases of the crisis, separately for the periods March 2007–March 2011 and June 2011–December 2013.[10] In the estimates for the first phase of the crisis (Table 4) many of the causal factors described above are not statistically significant; that is, during that period the banks' large-scale government securities purchases are marginally driven by banks' balance sheet conditions. In any case, some of the factors are significant also during the first phase. Funding from the Eurosystem and via central counterparties both have a positive impact on securities purchases. Likewise, the coefficients of Size and Initial Share are significant and have the same sign as for the overall estimate. These two variables have also the greatest marginal effect during the period.

Our descriptive analysis also shows that the different types of bank display very different patterns of action during the two phases of the crisis. Since the first phase is marked by massive sovereign debt securities purchases by the five largest banking groups, we repeat the estimation of Equation (1) just for this period and separately for this group of banks. The results (Table 5) show that the largest banks' purchases during the first phase of the crisis are heavily influenced by their balance sheet conditions. During this period the largest banks' balance sheets are weaker than the other banks', in particular as regards liquidity and capital adequacy (Banca d'Italia (2013a)). Indeed the coefficients of Funding Gap and Tier 1 Ratio are significant and have the expected sign: sovereign debt securities purchases are higher at the major banks characterized by larger funding gaps and lower capital ratios. Instead, the coefficient of ROA is significant and positive, counter to expectations, but the yield spread coefficient is significant and negative. The effect is positive as for both the Eurosystem and central counterparty financing.

The estimates for the second phase of the crisis indicate that banks' balance sheet conditions are generally more significant than in the first phase; and the economic impact of nearly all the main variables is greater as well. Funding Gap, Bonds Issued, Tier 1 Ratio and *delta*Bad Debts all non-significant in the system-wide estimates for the first phase are now significant: the larger the funding gap and the volume of bonds issued, the faster the rise in

[10] We have included the run-up to the Lehman Brothers collapse (until the second quarter of 2008) as part of the first phase. Estimates excluding this period show the same results. More generally, the results are robust to some changes in the length of the two sub-periods, bringing the end of the first phase few months forward, or starting the second few months later. We have also run estimates for the period prior to the crisis only, although in this case the number of observations is severely reduced and as a consequence most of the regressors turn out to be statistically non-significant.

bad debts, and the lower the capital ratio, the greater the banks' investment in government securities (Table 6). The Eurosystem financing and bank profitability remain significant, while both asset and liability positions with central counterparties turn to non-significant.[11] Gauged by marginal effect, all the balance sheet variables have significant economic impact. The effect of the Eurosystem refinancing is greater than in the first period but still much smaller than that of the other variables.

As mentioned above, the second phase of the crisis is marked by sharply increasing sovereign debt securities purchases by smaller banks. This coincides with a deterioration in their balance sheets, which had weathered better the first phase. Equation (1) has been accordingly re-estimated for the second phase and the sub-sample of smaller (small and minor) banks. All the balance sheet variables prove to be statistically significant and present the expected signs (Table 7): the funding gap, the volume of bonds issued, the Eurosystem financing and the deterioration in credit quality have a positive impact on sovereign debt securities purchases, while profitability, yield spread and the tier 1 ratio have a negative effect.

As argued, the robustness of all our results is tested through the Arellano-Bond regression model in order to take care of the issue of endogeneity.[12] All our results are largely corroborated (Table 8), both for the entire sample and for sub-samples by period and bank type. As argued earlier, this outcome supports the causal interpretation of our results.

5. Conclusions

During the crisis the amount of banks' holdings of sovereign bonds increased substantially in several euro area countries, including Italy. From a financial stability point of view, the overall effect of banks' large domestic sovereign holdings is still under investigation. On the one hand, it has been argued that banks' sovereign debt holdings may be one of the channels through which the feedback loop between banks and the sovereign may operate; on the other hand, they may act as a commitment device for the sovereign reducing the probability of a government default.

Most of the literature proposes macroeconomic factors to explain banks' recent purchases, such as the governments' moral suasion on their domestic banks to contain the cost of its debt and ensure its financing, or the lower risk for banks holding domestic sovereign debt. Much less attention has been devoted so far to the microeconomic determinants, which are mainly represented by balance sheet conditions of banks. Yet, the implications on the overall financial stability may be very different depending on the underlying bank-by-bank factors driving the sovereign bond purchases, which in this respect may even entail an enhancement in the resilience of the system. This paper has shed light on the issue by inquiring into the main bank level determinants of purchases of sovereign bonds in Italy between 2007 and

[11] Central counterparty funding increases greatly during the first phase of the crisis and loses importance in the second phase (Affinito and Piazza (2015)).

[12] In the Arellano-Bond estimates the covariates include the lagged dependent variable, thus excluding the Initial Share of government securities.

2013. The analysis is run separately for the two phases of the crisis the global financial crisis and the sovereign debt crisis and for large and small banks.

Our results show that banks' characteristics, in particular balance sheet conditions, do matter. The high liquidity of government bonds and their convenience in terms of capital charges and high yield make them well-suited to satisfying banks' needs in a period of decline in bank profitability and loan quality. The two periods of the crisis differ both in the underlying reasons for banks' sovereign debt securities purchases and in the size type of banks most heavily engaged. During the first phase, purchases are made mainly by the largest banks, whose balance sheets are weaker in the period, whereas during the second phase the sharp rise in purchases is led mainly by smaller banks. The access by the single banks to the low-cost liquidity provided by the Eurosystem with the two LTROs contributes to banks' purchase decisions but much less than the other factors. As a whole, for Italian banks sovereign debt securities purchases have represented an important means to support balance sheet conditions at a time when they were heavily hit by the surge in credit and liquidity risk brought about by the crisis.

References

Acharya, V.V., Steffen, S., 2015. The greatest carry trade ever? Understanding eurozone bank risks. Journal of Financial Economics 115, 215–236.

Affinito, M., Piazza, M., 2015. Always look at the bright side? central counterparties and interbank markets during the financial crisis.

Altavilla, C., Pagano, M., Simonelli, S., 2016. Bank exposures and sovereign stress transmission. Working Paper Series 1969. European Central Bank.

Andreeva, D.C., Vlassopoulos, T., 2016. Home bias in bank sovereign bond purchases and the bank-sovereign nexus. Working Paper Series 1977. European Central Bank.

Angelini, P., Grande, G., Panetta, F., 2014. The negative feedback loop between banks and sovereigns. Questioni di Economia e Finanza (Occasional Papers) 213. Bank of Italy, Economic Research and International Relations Area.

Angeloni, C., Wolff, G.B., 2012. Are banks affected by their holdings of government debt? Working Papers 717. Bruegel.

Ari, A., 2015. Sovereign Risk and Bank Risk-Taking. Working Papers. Oesterreichische Nationalbank (Austrian Central Bank).

Asonuma, T., Bakhache, S.A., Hesse, H., 2015. Is Banks Home Bias Good or Bad for Public Debt Sustainability? IMF Working Papers 15/44. International Monetary Fund.

Banca d'Italia, 2011. Annual Report. Technical Report. Bank of Italy, Economic Research and International Relations Area.

Banca d'Italia, 2012a. Annual Report. Technical Report. Bank of Italy, Economic Research and International Relations Area.

Banca d'Italia, 2012b. Financial Stability Report. Technical Report 4. Bank of Italy, Economic Research and International Relations Area.

Banca d'Italia, 2013a. Annual Report. Technical Report. Bank of Italy, Economic Research and International Relations Area.

Banca d'Italia, 2013b. Financial Stability Report. Technical Report. Bank of Italy, Economic Research and International Relations Area.

Bank for International Settlements, 2011. The impact of sovereign credit risk on bank funding conditions. Number 43 in CGFS Papers, Bank for International Settlements.

Battistini, N., Pagano, M., Simonelli, S., 2013. Systemic Risk, Sovereign Yields and Bank Exposures in the Euro Crisis. CSEF Working Papers. Centre for Studies in Economics and Finance (CSEF), University of Naples, Italy.

Bocola, L., 2016. The Pass-Through of Sovereign Risk. Journal of Political Economy 124, 879–926.

Bonaccorsi di Patti, E., Sette, E., 2012. Bank balance sheets and the transmission of financial shocks to borrowers: evidence from the 2007-2008 crisis. Temi di discussione (Economic working papers) 848. Bank of Italy, Economic Research and International Relations Area.

Bonner, C., 2016. Preferential Regulatory Treatment and Banks' Demand for Government Bonds. Journal of Money, Credit and Banking 48, 1195–1221.

Broner, F., Erce, A., Martin, A., Ventura, J., 2014. Sovereign debt markets in turbulent times: Creditor discrimination and crowding-out effects. Journal of Monetary Economics 61, 114–142.

Brunnermeier, M.K., Garicano, L., Lane, P.R., Pagano, M., Reis, R., Santos, T., Thesmar, D., Nieuwerburgh, S.V., Vayanos, D., 2016. The Sovereign-Bank Diabolic Loop and ESBies. American Economic Review 106, 508–512.

Buch, C.M., Koetter, M., Ohls, J., 2016. Banks and sovereign risk: A granular view. Journal of Financial Stability 25, 1–15.

Coeurdacier, N., Rey, H., 2013. Home Bias in Open Economy Financial Macroeconomics. Journal of Economic Literature 51, 63–115.

Distinguin, I., Roulet, C., Tarazi, A., 2013. Bank regulatory capital and liquidity: Evidence from US and European publicly traded banks. Journal of Banking & Finance 37, 3295–3317.

Gennaioli, N., Martin, A., Rossi, S., 2014a. Banks, Government Bonds, and Default; What do the Data Say? IMF Working Papers 14/120. International Monetary Fund.

Gennaioli, N., Martin, A., Rossi, S., 2014b. Sovereign Default, Domestic Banks, and Financial Institutions. Journal of Finance 69, 819–866.

Giordano, R., Tommasino, P., 2011. What determines debt intolerance? The role of political and monetary institutions. European Journal of Political Economy 27, 471–484.

Gros, D., 2011. External versus Domestic Debt in the Euro Crisis. CEPS Papers 5677. Centre for European Policy Studies.

Hildebrand, T., Rocholl, J., Schulz, A., 2012. Flight to where? evidence from bank investments during the financial crisis.

Horváth, B., Huizinga, H., Ioannidou, V., 2015. Determinants and Valuation Effects of the Home Bias in European Banks' Sovereign Debt Portfolios. CEPR Discussion Papers 10661. C.E.P.R. Discussion Papers.

Ichiue, H., Shimizu, Y., 2012. Determinants of Long-term Yields: A Panel Data Analysis of Major Countries and Decomposition of Yields of Japan and the US. Bank of Japan Working Paper Series 12-E-7. Bank of Japan.

Jiménez, G., Ongena, S., Peydro, J.L., Saurina, J., 2012. Credit Supply and Monetary Policy: Identifying the Bank Balance-Sheet Channel with Loan Applications. American Economic Review 102, 2301–2326.

Jiménez, G., Ongena, S., Peydr, J., Saurina, J., 2014. Hazardous Times for Monetary Policy: What Do TwentyThree Million Bank Loans Say About the Effects of Monetary Policy on Credit RiskTaking? Econometrica 82, 463–505.

Lang, M., Schröder, M., 2015. What drives the demand of monetary financial institutions for domestic government bonds? Empirical evidence on the impact of Basel II and Basel III. Technical Report.

Lanotte, M., Manzelli, G., Rinaldi, A.M., Taboga, M., Tommasino, P., 2016. Easier said than done? Reforming the prudential treatment of banks sovereign exposures. Questioni di Economia e Finanza (Occasional Papers) 326. Bank of Italy, Economic Research and International Relations Area.

Ongena, S., Popov, A., Van Horen, N., 2016. The invisible hand of the government: Moral suasion during the European sovereign debt crisis. Working Paper Series 1937. European Central Bank.

Popov, A., Horen, N.V., 2015. Exporting Sovereign Stress: Evidence from Syndicated Bank Lending during the Euro Area Sovereign Debt Crisis. Review of Finance 19, 1825–1866.

Weidman, J., 2013. Stop encouraging banks to load up on state debt.

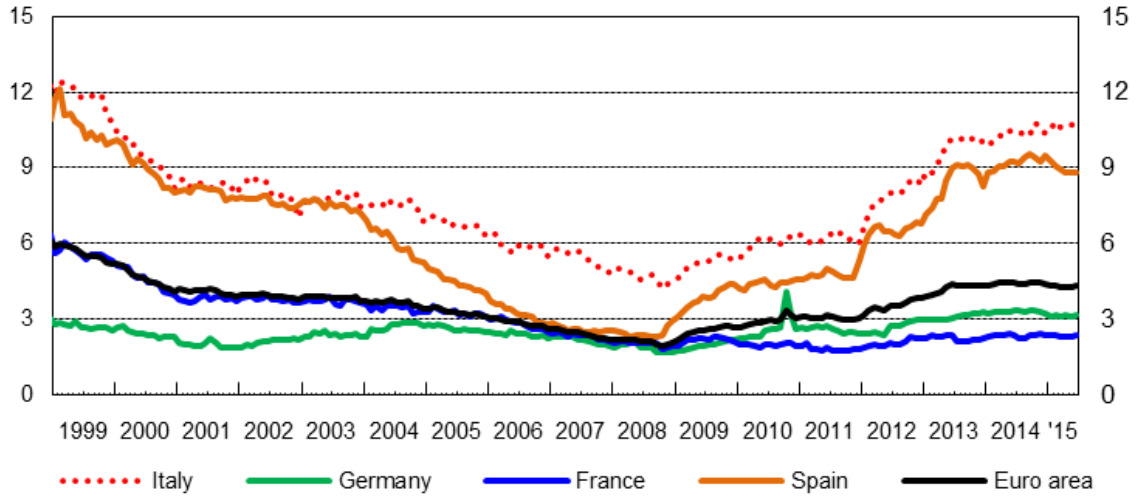

Figure 1: Public sector debt held in banks' portfolios: share of total assets (per cent). All types of public sector securities, including those issued by local government. Includes Cassa Depositi and Prestiti

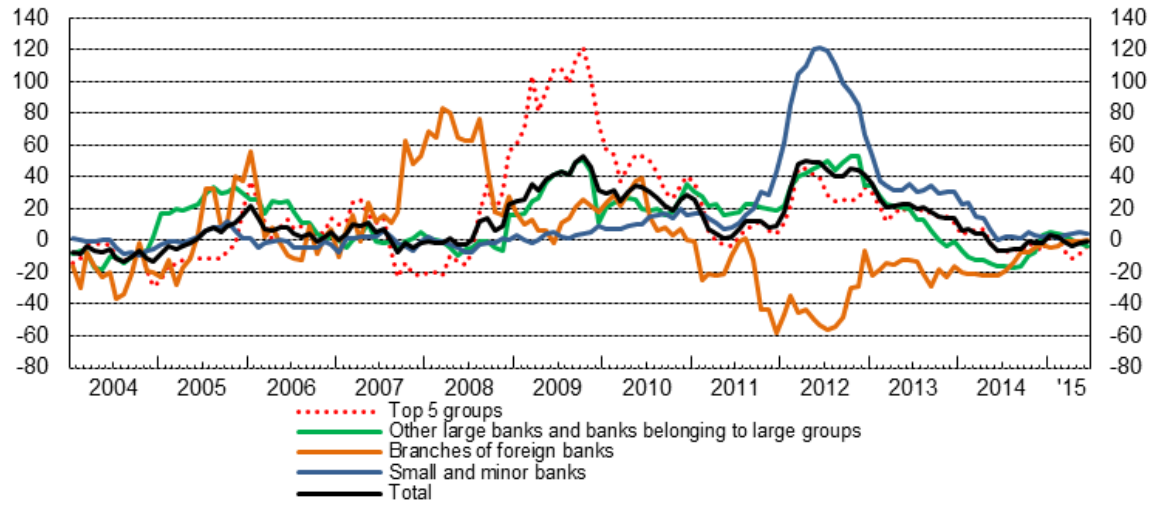

Figure 2: Public sector securities in Italian banks': annual growth rates. All types of public sector securities, including those issued by local government. Growth rates for each period are taken as the ratio of the flow of net purchases of government securities to the stock of the previous period. Excludes Cassa Depositi and Prestiti

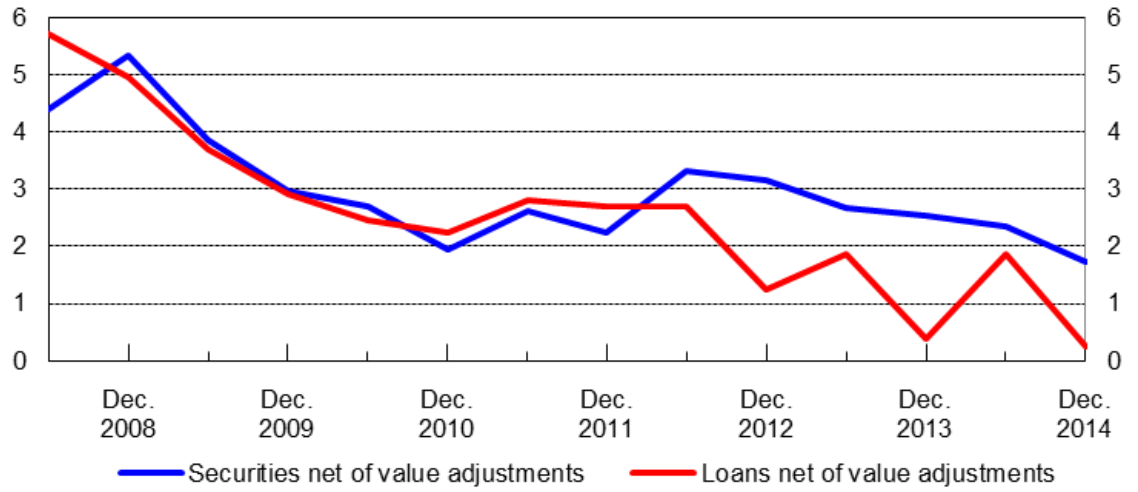

Figure 3: Rates of return on bank assets (per cent). Income as a percentage of the respective balance sheet items. The risk-adjusted yields of loans and total securities investment are calculated using their respective value adjustments. Excludes Cassa Depositi and Prestiti

Table 1: Variable description, summary statistics and expected signs.

This table reports the description and summary statistics of the variables used in Equation 1. In particular, the table reports the number of observations, mean, standard deviation, median and expected sign. The variable $Net\ purchases_{i,t-1}$ is the dependent variable in our baseline using equation 1.

Variable	**Description**	**Number of observations**	**Mean**	**Standard deviation**	**Median**	**Expected sign**
Net Purchases	Net purchases of government securities (gross purchases less gross sales) in quarter / Stock of government securities held at the end of previous quarter	13,458	0.044	0.209	0.003	
Funding Gap (t-1)	Total customer loans / (Total customer deposits + bonds not held by banks)	13,458	1.092	1.347	0.899	+
Bonds Issued (t-1)	Bonds issued/ Total assets	13,458	0.241	0.138	0.261	+
Tier 1 Ratio (t-1)	Core Tier 1 Ratio	12,962	14.062	3.629	14.358	-
Δ Bad debts (t-1)	Flow of new bad debts in quarter / Stock of loans at the end of previous quarter	13,458	0.004	0.033	0.000	+
ROA (t-1)	Return on Assets	12,962	0.003	0.016	0.003	+/-
Yield spread (t-1)	Differential between risk-adjusted yields on loans and on securities	12,882	1.223	11.155	1.525	-
Central Bank	Net liability position with Eurosystem / Total assets	13,458	0.006	0.037	0.000	+
CCP-Liabilities	Gross liability funding via central counterparties / Total assets	13,458	0.002	0.017	0.000	+
CCP-Assets	Gross lending via central counterparties / Total assets	13,458	0.001	0.012	0.000	+/-
Size	Logarithm of total assets	13,458	6.163	1.654	5.963	+/-
Initial Share (t-1)	Share of government securities in total securities portfolio	13,458	0.750	0.239	0.827	+/-
Total Deposits (t-1)	Total deposits / Total assets	13,456	0.501	0.144	0.487	+/-

Table 2: Matrix of correlation among variables.

This table reports the correlation matrix of all variables used in Equation 1 and described in Table 1.

	Net Purchases	**Size**	**Initial Share** (t-1)	**Funding Gap** (t-1)	**Central Bank**	**Yield Spread** (t-1)	**Δ Bad Debts** (t-1)	**Tier1 Ratio** (t-1)	**Total Deposits** (t-1)	**Bonds Issued** (t-1)	**CCP- Liabilities**	**CCP- Assets**	**ROA** (t-1)
Net Purchases	**1**												
Size	**0.0416***	**1**											
Initial Share (t-1)	**-0.1043***	**-0.5021***	**1**										
Funding Gap (t-1)	**-0.0284***	**0.1935***	**-0.0417***	**1**									
Central Bank	**0.1026***	**0.2503***	**-0.1400***	**0.0277***	**1**								
Yield Spread (t-1)	**-0.0161**	**-0.0321***	**0.0678***	**-0.1686***	**-0.0451***	**1**							
Δ Bad Debts (t-1)	**-0.0123**	**-0.0313***	**0.0094**	**0.0419***	**0.0077**	**-0.1643***	**1**						
Tier1 Ratio (t-1)	**-0.0388***	**-0.4849***	**0.3359***	**-0.0316***	**-0.1044***	**0.0721***	**0.0052**	**1**					
Total Deposits (t-1)	**-0.0250***	**-0.4242***	**0.3313***	**-0.4316***	**-0.1711***	**0.1402***	**-0.0381***	**0.1663***	**1**				
Bonds Issued (t-1)	**0.0263***	**0.1883***	**-0.1508***	**0.0318***	**-0.0418***	**0.0311***	**-0.0610***	**-0.2687***	**-0.5709***	**1**			
CCP-Liabilities	**0.0419***	**0.2294***	**-0.0689***	**-0.0293***	**0.1834***	**-0.0191**	**0.0285***	**-0.0549***	**-0.0539***	**-0.0839***	**1**		
CCP-Assets	**-0.0265***	**0.0912***	**-0.0355***	**-0.0183**	**0.0369***	**-0.0153**	**0.6055***	**0.0094**	**-0.0760***	**-0.0717***	**0.3250***	**1**	
ROA (t-1)	**-0.0298***	**0.0328***	**0.0346***	**0.0073**	**-0.0624***	**0.1864***	**0.0457***	**0.0445***	**0.0626***	**0.1037***	**-0.1502***	**-0.0055**	**1**

Table 3: Econometric analysis: Determinants of government securities purchases. Regressions for entire period, all banks. All regressions include bank and quarter fixed effects. Standard errors are clustered at bank or banking group level. The marginal effects of each causal factor are calculated, based on the estimates of specification (1), as the percentage change in the dependent variable when the regressors moves from the 25th to the 75th percentile, holding the other regressors constant. ***, **, and * indicate statistical significance at 1, 5 and 10 per cent respectively. Standard errors in italics.

Regressor	**(1)**	**(2)**	**(3)**	**(4)**	**Marginal effect**
Funding Gap (t-1)	0.005 *0.004*	0.003 *0.003*	0.002 *0.003*		ns
Bonds Issued (t-1)	0.129 *0.084*				ns
Tier 1 Ratio (t-1)	0.001 *0.002*	0.001 *0.002*	0.002 *0.002*	0.001 *0.002*	ns
Δ Bad Debts (t-1)	0.163* *0.095*	0.153* *0.094*	0.118 *0.094*	0.105 *0.092*	8.5
ROA (t-1)	-0.575*** *0.149*	-0.525*** *0.143*	-0.575*** *0.147*	-0.750*** *0.124*	-10.1
Yield Spread (t-1)	-0.00055* *0.000*	-0.00037 *0.000*	-0.00038 *0.000*		-56.2
Central Bank	0.438*** *0.079*	0.440*** *0.077*	0.449*** *0.080*		5.2
CCP-Liability	0.532** *0.267*	0.641** *0.261*			4.6
CCP-Asset	-0.906* *0.431*	-0.889** *0.428*			-4.4
Size	0.0642*** *0.022*	0.0648*** *0.022*	0.0721*** *0.022*	0.0815*** *0.020*	34.2
Initial Share (t-1)	-0.229*** *0.025*	-0.227*** *0.025*	-0.219*** *0.024*		-51.1
Total Deposits (t-1)	0.171** *0.070*				43.1
Constant	-0.350** *0.163*	-0.243* *0.148*	-0.300** *0.153*	-0.504*** *0.139*	
Observations	12,872	12,872	12,872	12,962	

Table 4: Econometric analysis: Determinants of government securities purchases. Regressions for the first phase of the crisis, all banks. All regressions include bank and quarter fixed effects. Standard errors are clustered at bank or banking group level. The marginal effects of each causal factor are calculated, based on the estimates of specification (1), as the percentage change in the dependent variable when the regressors moves from the 25th to the 75th percentile, holding the other regressors constant. ***, **, and * indicate statistical significance at 1, 5 and 10 per cent respectively. Standard errors in italics.

Regressor	**(1)**	**(2)**	**(3)**	**Marginal effect**
Funding Gap (t-1)	0.001	0.002	0.003	ns
	0.004	*0.004*	*0.004*	
Bonds Issued (t-1)	0.156			ns
	0.151			
Tier 1 Ratio (t-1)	0.001	0.001	0.001	ns
	0.003	*0.003*	*0.003*	
Δ Bad Debts (t-1)	-0.051	-0.047	-0.041	ns
	0.354	*0.355*	*0.356*	
ROA (t-1)	0.205	0.200	0.025	ns
	0.363	*0.355*	*0.323*	
Yield Spread (t-1)	0.001	0.001	0.001	ns
	0.001	*0.001*	*0.001*	
Central Bank	0.569*	0.569*	0.543	3.2
	0.349	*0.352*	*0.344*	
CCP-Liability	1.111*	1.049*		6.8
	0.627	*0.628*		
CCP-Asset	-1.545***	-1.548***		-5.6
	0.279	*0.288*		
Size	0.117***	0.113***	0.111***	33.4
	0.040	*0.041*	*0.041*	
Initial Share (t-1)	-0.320***	-0.320***	-0.317***	-44.4
	0.039	*0.039*	*0.039*	
Total Deposits (t-1)	-0.140			ns
	0.133			
Constant	-0.411*	-0.413	-0.410	
	0.251	*0.263*	*0.263*	
Observations	7,353	7,353	7,353	

Table 5: Econometric analysis: Determinants of government securities purchases. Regressions for the first phase of the crisis, top five banking groups only. All regressions include bank and quarter fixed effects. Standard errors are clustered at bank or banking group level. The marginal effects of each causal factor are calculated, based on the estimates of specification (1), as the percentage change in the dependent variable when the regressors moves from the 25th to the 75th percentile, holding the other regressors constant. ***, **, and * indicate statistical significance at 1, 5 and 10 per cent respectively. Standard errors in italics.

Regressor	**(1)**	**(2)**
Funding Gap (t-1)	1.472***	1.582***
	0.394	*0.403*
Bonds Issued (t-1)	2.773	
	3.132	
Tier 1 Ratio (t-1)	-0.139**	-0.114**
	0.058	*0.044*
Δ Bad Debts (t-1)	4.693	6.537*
	6.148	*3.601*
ROA (t-1)	19*	22.22***
	11.020	*7.312*
Yield Spread (t-1)	-0.0163*	-0.011
	0.010	*0.009*
Central Bank	7.358**	10.30***
	3.260	*3.178*
CCP-Liability	11.65**	
	5.634	
CCP-Asset	-2.805	
	5.837	
Size	0.450	0.162
	0.383	*0.318*
Initial Share (t-1)	-1.257***	-0.978**
	0.358	*0.487*
Total Deposits (t-1)	-2.290	
	3.292	
Constant	-7.116	-3.937
	5.356	*4.156*
Observations	74	74

Table 6: Econometric analysis: Determinants of government securities purchases. Regressions for the second phase of the crisis, all banks. All regressions include bank and quarter fixed effects. Standard errors are clustered at bank or banking group level. ***, **, and * indicate statistical significance at 1, 5 and 10 per cent respectively. Standard errors in italics.

Regressor	**(1)**	**(2)**	**(3)**	**Marginal effect**
Funding Gap (t-1)	0.0888**	0.0547**	0.0518**	21.6
	0.040	*0.023*	*0.021*	
Bonds Issued (t-1)	0.497***			42.1
	0.138			
Tier 1 Ratio (t-1)	-0.00802**	-0.00753**	-0.00717**	-57.4
	0.004	*0.004*	*0.004*	
Δ Bad Debts (t-1)	0.246***	0.249***	0.244***	14.5
	0.077	*0.077*	*0.076*	
ROA (t-1)	-0.873***	-0.728***	-0.756***	-20.2
	0.161	*0.142*	*0.171*	
Yield Spread (t-1)	-0.00138***	-0.000818***	-0.000838***	-32.2
	0.000	*0.000*	*0.000*	
Central Bank	0.345**	0.287*	0.260*	6.4
	0.158	*0.151*	*0.158*	
CCP-Liability	0.242	0.486		ns
	0.427	*0.444*		
CCP-Asset	-0.043	0.133		ns
	1.004	*1.025*		
Size	0.122**	0.103**	0.124**	35.9
	0.059	*0.050*	*0.060*	
Initial Share (t-1)	-0.348***	-0.329***	-0.317***	-53.8
	0.045	*0.048*	*0.049*	
Total Deposits (t-1)	0.701***			38.9
	0.119			
Constant	-0.821*	-0.242	-0.381	
	0.431	*0.331*	*0.401*	
Observations	5,519	5,519	5,519	

Table 7: Econometric analysis: Determinants of government securities purchases. Regressions for the second phase of the crisis, small and minor banks. All regressions include bank and quarter fixed effects. Standard errors are clustered at bank or banking group level. The marginal effects of each causal factor are calculated, based on the estimates of specification (1), as the percentage change in the dependent variable when the regressors moves from the 25th to the 75th percentile, holding the other regressors constant. ***, **, and * indicate statistical significance at 1, 5 and 10 per cent respectively. Standard errors in italics.

Regressor	**(1)**	**(2)**
Funding Gap (t-1)	0.0841**	0.0485***
	0.040	*0.020*
Bonds Issued (t-1)	0.550***	
	0.143	
Tier 1 Ratio (t-1)	-0.0082**	-0.00790**
	0.004	*0.004*
Δ Bad Debts (t-1)	0.250***	0.247***
	0.078	*0.078*
ROA (t-1)	-0.964***	-0.844***
	0.150	*0.148*
Yield Spread (t-1)	-0.00136***	-0.000796***
	0.000	*0.000*
Central Bank	0.404**	0.306*
	0.162	*0.163*
CCP-Liability	0.127	
	0.457	
CCP-Asset	0.375	
	1.138	
Size	0.102*	0.109*
	0.058	*0.061*
Initial Share (t-1)	-0.325***	-0.294***
	0.043	*0.048*
Total Deposits (t-1)	0.730***	
	0.121	
Constant	-0.699	-0.264
	0.411	*0.396*
Observations	5,299	5,299

Table 8: Econometric analysis: Robustness test, Arellano–Bond estimates. All regressions include bank and quarter fixed effects. Standard errors are clustered at bank or banking group level. ***, **, and * indicate statistical significance at 1, 5 and 10 per cent respectively. Standard errors in italics.

Regressor	**Entire period, all banks**	**First phase, all banks**	**Second phase, all banks**	**Second phase, small and minor banks**
Funding Gap (t-1)	0.033***	0.014**	0.179***	0.160***
	0.004	*0.005*	*0.047*	*0.042*
Bonds Issued (t-1)	1.479***	0.853***	2.486***	2.538***
	0.064	*0.176*	*0.144*	*0.141*
Tier 1 Ratio (t-1)	-0.011***	-0.004	-0.021***	-0.020***
	0.001	*0.003*	*0.003*	*0.003*
Δ Bad Debts (t-1)	0.135***	0.012	0.266***	0.298***
	0.037	*0.337*	*0.048*	*0.040*
ROA (t-1)	-1.446***	-1.068***	-1.481***	-1.521***
	0.083	*0.254*	*0.148*	*0.118*
Yield Spread (t-1)	0.000	0.001	-0.003**	-0.003**
	0.000	*0.001*	*0.001*	*0.001*
Central Bank	0.914***	0.345*	0.877***	1.011***
	0.070	*0.187*	*0.139*	*0.144*
CCP-Liability	-0.043	-0.047	-0.265**	-0.352***
	0.042	*0.294*	*0.092*	*0.087*
CCP-Asset	-0.527***	-0.639***	-0.138	0.147*
	0.040	*0.093*	*0.118*	*0.079*
Size	0.384***	0.203***	0.786***	0.827***
	0.020	*0.043*	*0.047*	*0.047*
Total Deposits (t-1)	0.384	-0.286	1.465	1.578
	0.039	*0.111*	*0.119*	*0.114*
Lagged dependent variable	0.031***	-0.018	0.096***	0.095***
	0.003	*0.011*	*0.007*	*0.007*
Constant	-2.741***	-1.231***	-5.963***	-6.106***
	0.145	*0.282*	*0.379*	*0.362*
Observations	12,097	6,707	5,390	5,171