



BANCA D'ITALIA
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Questioni di Economia e Finanza

(Occasional Papers)

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by Massimiliano Affinito, Giorgio Albareto and Raffaele Santioni

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PURCHASES OF SOVEREIGN DEBT SECURITIES BY ITALIAN BANKS DURING THE CRISIS: THE ROLE OF BALANCE-SHEET CONDITIONS

by Massimiliano Affinito*, Giorgio Albareto* and Raffaele Santioni*

Abstract

This paper analyses the main microeconomic determinants of Italian banks' purchases of sovereign debt securities from 2007 to 2013, with special reference to their balance-sheet conditions. The analysis distinguishes two phases of the crisis – the period following the Lehman Brothers collapse and the sovereign debt crisis – and different types of banks (large and small). Results show that banks' specific characteristics and balance-sheet features do matter and that banks use government securities purchases to support their financial and economic conditions. The influence of the balance-sheet conditions differs according to the phase of the crisis and the type of bank.

Keywords: financial crisis, securities portfolio, banks' balance sheets, sovereign risk.

JEL Code: G01, G21, H63.

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• Bank of Italy, Directorate General Economics, Statistics and Research, Statistical Analysis Directorate.
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1 – Introduction

Banks' exposure to domestic sovereign debt grew considerably during the recent financial crisis in most of the euro-area countries, in particular following the worsening of the sovereign debt crisis. 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 this growth (Angeloni and Wolff, 2012; Battistini, Pagano and Simonelli, 2013; Acharya and Steffen, 2013; Gennaioli, Martin and Rossi, 2013; Angelini, Grande and Panetta, 2014).

From a financial stability perspective, on the one hand it has been argued that banks' direct exposures to sovereign bonds may be 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 (e.g. CGFS, 2011; Altavilla et al., 2015; Brunnermeier et al., 2016). On the other hand, large holdings of sovereign bonds by banks may act as a disciplining device for the government, reduce the *ex ante* likelihood of a sovereign default, prevent sovereign yields from reaching even higher levels balancing market overreactions (e.g. Giordano and Tommasino, 2011; Gros, 2011; Ichiue and Shimizu, 2012; Coeudarcier and Rey, 2013; Gennaioli, Martin and Rossi, 2014; Lanotte *et al.*, 2016).

The overall impact on financial stability also depends on the underlying factors driving banks' behaviour. In fact, if banks help to absorb destabilizing macro shocks worsening their balance-sheet conditions, the overall implications for the financial stability could be negative; by contrast, if the financial and economic conditions of banks' balance-sheet improve, the overall financial stability perspectives improve as well. Yet, so far the literature has adopted in most of the cases only 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, Popov and van Horen, 2015; Asonuma, Bakhache and Hesse, 2015; Acharya and Steffen, 2015). A second hypothesis, the "renationalization hypothesis", is referred 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., 2013; Angelini, Grande and Panetta, 2014; Bocola, 2015).

A third, complementary hypothesis is that banks' purchases of government bonds may have been driven by their own economic convenience, in order to support their balance sheet conditions. To verify it, one needs to adopt a microeconomic approach searching out the determinants of those purchases in each bank balance sheet conditions. In other words, one needs to use microeconomic bank-by-bank data to find out whether and to which extent characteristics such as the individual size, the degree of liquidity, credit quality, capitalization have influenced banks' portfolio choices. So far only two papers, both concerning the German banking system, have made an attempt in this direction. Hildebrand, Rocholl and Schulz (2012) show that the crisis has led German banks to invest mainly in securities eligible as collateral in the Eurosystem refinancing operations and in domestic securities. Buch, Koetter and Ohls (2013) 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.

This paper joins this strand of the literature and tries to go one step further studying a wide range of individual banks' determinants of sovereign debt securities purchases in Italy during the crisis. The paper also contributes to the literature distinguishing between the two phases of the crisis and among size types of banks. The two phases of the crisis are the global financial crisis (whose beginning is usually dated in the Summer of 2007, although it reaches its peak with the collapse of Lehman Brothers in September 2008), and the sovereign debt crisis (which concerns chiefly the euro area and involves Italy since mid-2011). The distinction between the global financial crisis and the sovereign debt crisis helps to show that the importance of the characteristics of individual banks changes during the two phases. The analysis by size types of banks allows us to accurately identify the prevailing causal factors in each phase.

The rest of the paper is structured as follows. Section 2 describes the data and their sources. Section 3 presents some evidence on the economic importance of government securities holdings by banks in Italy and in the main euro-area countries. Section 4 describes the evolution of sovereign debt securities purchases during the crisis. Section 5 discusses the main balance sheet determinants of banks' purchases of government securities. Section 6 carries out an econometric analysis of those determinants. Section 7 contains some concluding remarks.

2 – The data

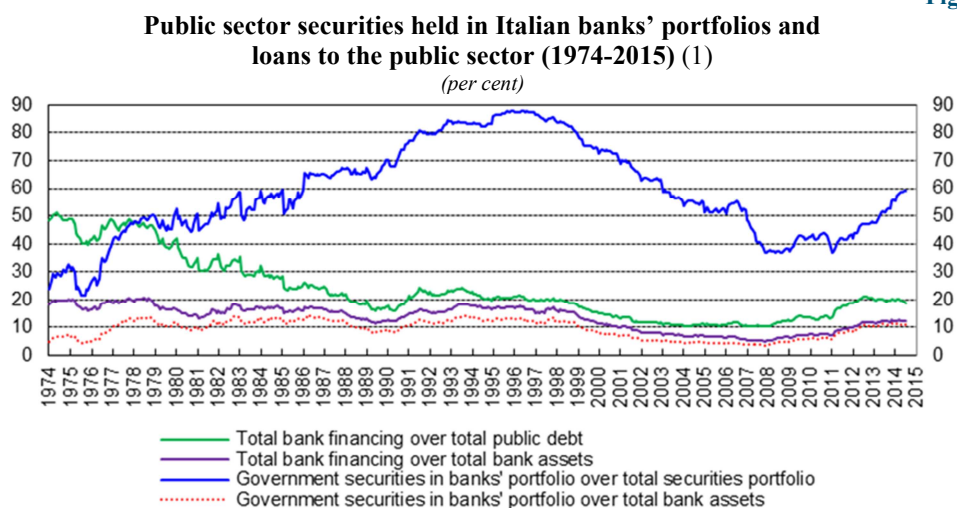
The data are taken from various sources. The international comparison is based on harmonized Eurosystem statistics collected by national central banks of the euro-area since 1998. The analysis of the Italian banking system is mainly

based on Bank of Italy supervisory data, available as a continuous series since the end of the 1990s and in some cases as far back as the mid-1970s (Affinito and De Bonis, 2013). The data are aggregated at banking-group level for all banks belonging to the same group. 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.¹

3 – Sovereign debt securities in banks’ balance sheets

The recent financial crisis has been characterized by a sharp growth in sovereign debt securities in banks’ portfolios. The share of banks’ assets consisting in Italian sovereign debt securities tripled from 3.5 per cent in 2007 to 10.1 in 2013 up to 10.5 per cent in June 2015; in the period December 2007-June 2015 the share on total securities doubled from 18.7 to 39.8 per cent (Table 1). The increase has concerned all types of bank except for branches of foreign banks. The weight of government securities on total assets is greater for small and minor banks (23.2 per cent in June 2015 against 8.2 per cent in December 2007) than for the banks belonging to the top five groups (7.5 and 1.8 per cent respectively at the end of 2007 and in June 2015)². Notwithstanding the recent increase, the amount of other euro-area government securities counts for 9 per cent of the banks’ holdings of Italian sovereign debt securities.

Figure 1



Sources: Bank of Italy, Supervisory reports and Affinito-De Bonis (2013).

(1) All types of public sector securities, including those issued by local government. Excludes Cassa Depositi e Prestiti.

¹ 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.

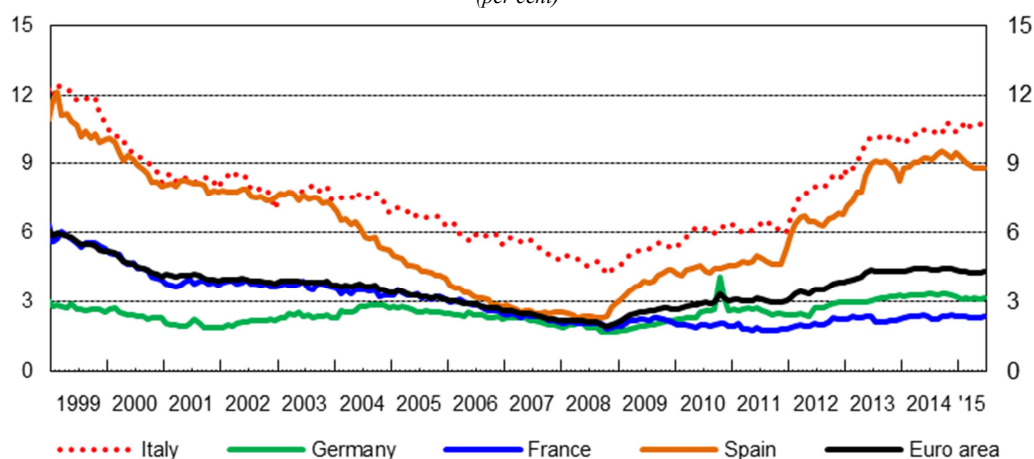
² This is a structural feature of the Italian banking system, where small banks have always had a greater share of sovereign bonds in their portfolio than large banks.

Within the total sovereign debt securities portfolio, central government securities account for 98 per cent; local government securities have fallen by more than 11 percentage points compared with their end-2007 peak. In June 2015 out of about 600 banks and banking groups operating in Italy, only 80 banks hold no sovereign debt securities in their portfolio: 67 of them are foreign banks.

Taking a long-term view, the share of government securities on bank's balance sheets is decidedly smaller today than in the past. In the mid-1990s, on the eve of the launch of the common monetary policy, their shares on the securities portfolio and on total assets are 86 and 11 per cent respectively (Figure 1). In the following years, and until the onset of the financial crisis in 2007, banks' government securities holdings decline considerably, as a result of massive disposals as Italian long-term interest rates converge to the levels prevailing in the euro area and credit grows at a fast rate.

Figure 2

Public sector debt held in banks' portfolios: share of total assets (1)
(per cent)



Source: Eurosystem.

(1) All types of public sector securities, including those issued by local government. Includes Cassa Depositi e Prestiti.

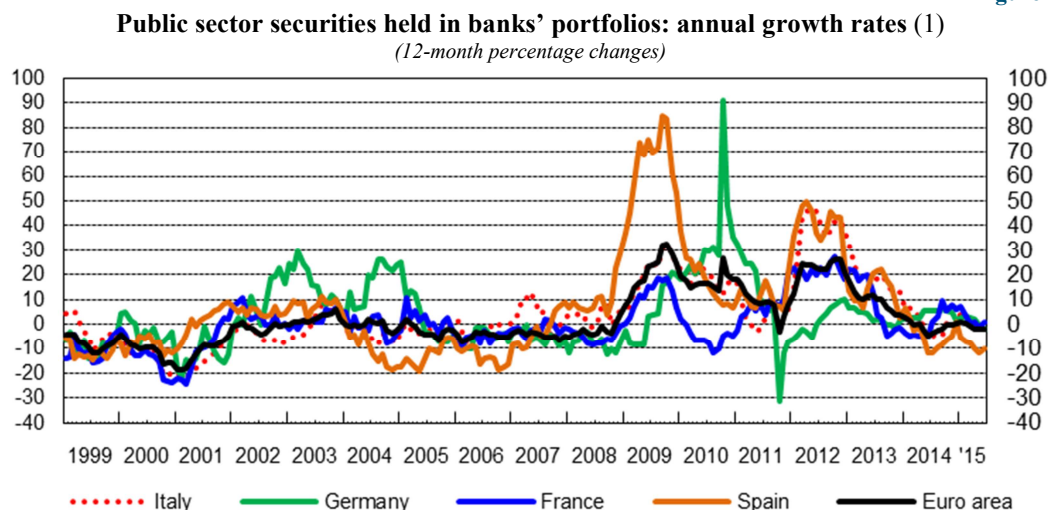
Compared to those in the other larger European countries, Italian banks have had a greater share of government securities on total assets since the 1990s. Only Spanish banks show comparable levels (Figure 2 and Table 2). The gap with the euro-area average, narrowing until end-2008, widens at the time of the financial crisis, and especially when the sovereign debt crisis becomes severe: in June 2015 there is a difference of 6.2 percentage points (Table 2).

4 – Purchases of sovereign debt securities during the crisis

In the last 15 years, the growth of sovereign debt securities in banks' balance sheets has been at its strongest during the crisis (Figure 3). Spanish banks record

high growth rates all over the crisis, while German banks do so only during the first phase, prior to the deepening of the sovereign debt crisis.

Figure 3

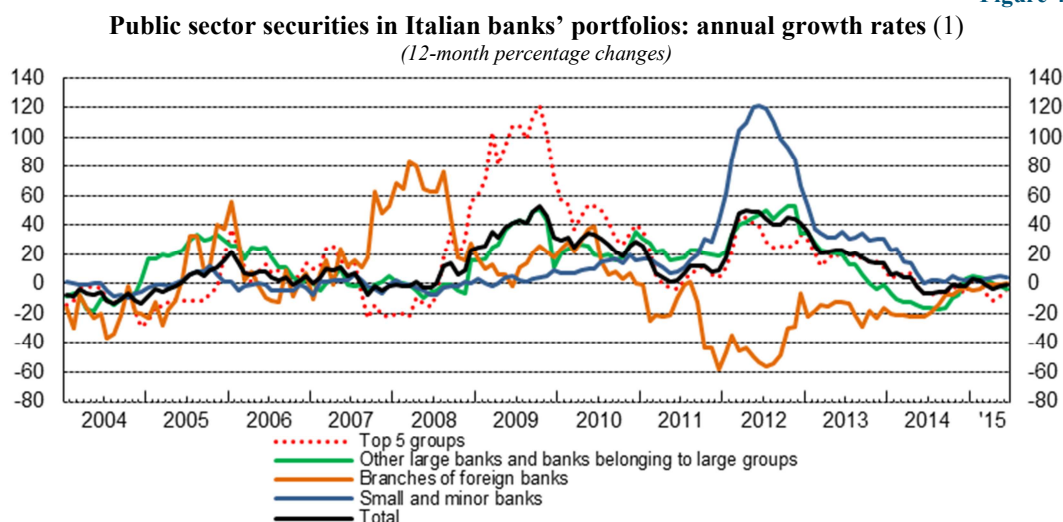


Source: Eurosystem.

(1) All types of public sector securities, including those issued by local government. Includes Cassa Depositi e Prestiti. 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.

In Italy the twelve-month rate of change rises from an average of around 1 per cent in the period 2004-2007 to about 20 per cent during the crisis (Figure 4). The evolution of banks' government securities purchases shows a clear distinction between the two phases of the crisis. 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.

Figure 4



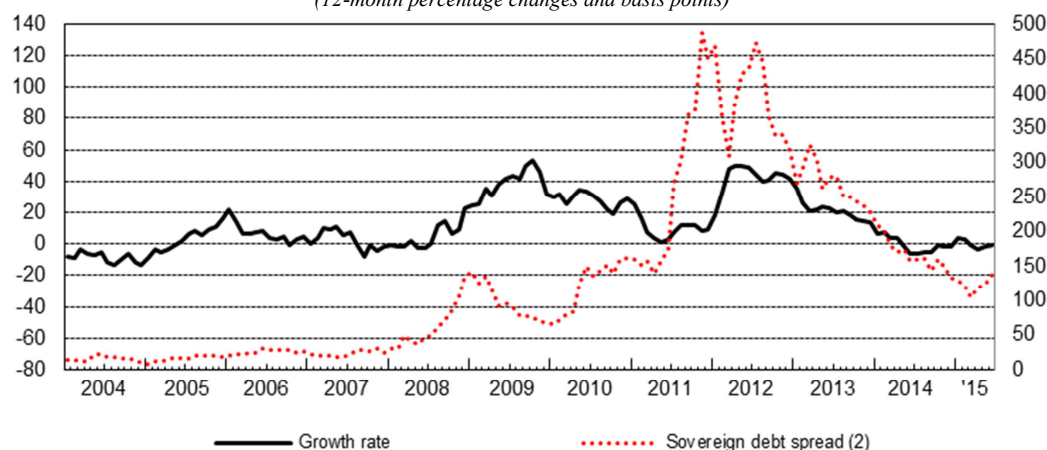
Source: Bank of Italy, Supervisory reports.

(1) All types of public sector securities, including those issued by local government. Excludes Cassa Depositi e Prestiti. 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.

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 (Figures 4 and 5).

Figure 5

Sovereign spread and growth rates of public sector securities in Italian banks' portfolios (1)
(12-month percentage changes and basis points)



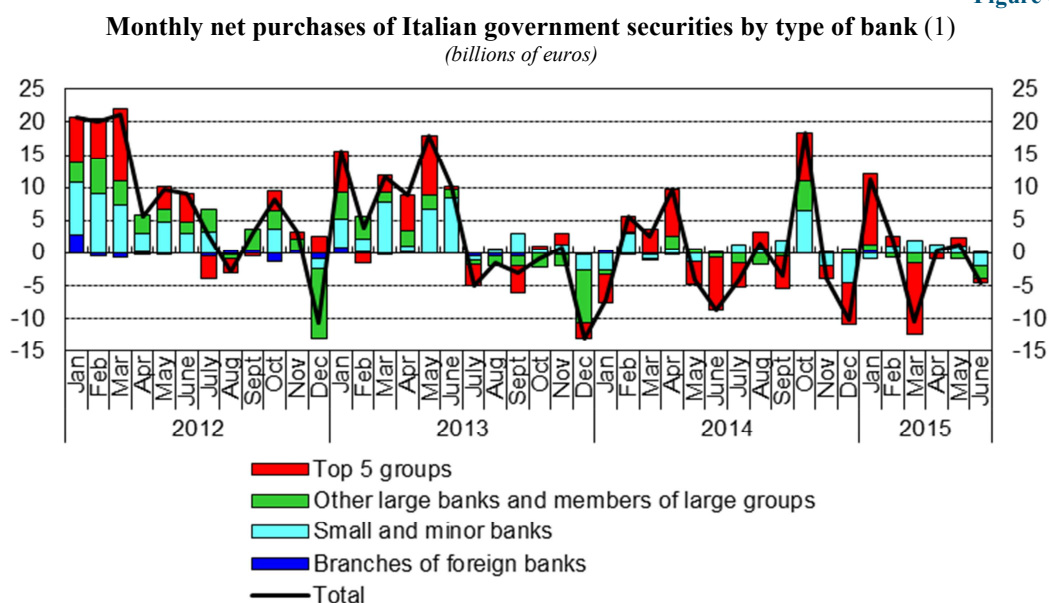
Source: Bank of Italy, Supervisory reports.

(1) All types of public sector securities, including those issued by local government. Excludes Cassa Depositi e Prestiti. 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. – (2) Right-hand scale. The spread is the difference between the average monthly yield of 10-year BTPs and that of the corresponding German Bund.

In the second 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. In the period since October 2011 to March 2012 the banks that participate in the two LTROs make net purchases totalling €64 billion, compared with net sales of €2 billion by the rest of the banking system. In the three previous years, the net purchases by the two groups of banks had been similar. Net purchases continue until June 2013. From July 2013 onwards net sales tend to prevail, following the fall in the yields (Figure 6)³; they show a more volatile monthly pattern after the beginning of the targeted longer-term refinancing operations (TLTROs) in September 2014. The share of sovereign bonds on total assets remains between 10 and 11 per cent since mid-2013.

³ In addition to the capital gains due to the declining yields, sales of government securities in the second half of 2013 could also be linked to a 'window dressing' behavior by banks in view of the Asset Quality Review (planned for 2014 on the basis of end-2013 balance sheets) preceding the Single Supervisory Mechanism of the Banking Union. In the autumn of 2013 there is a debate 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.

Figure 6

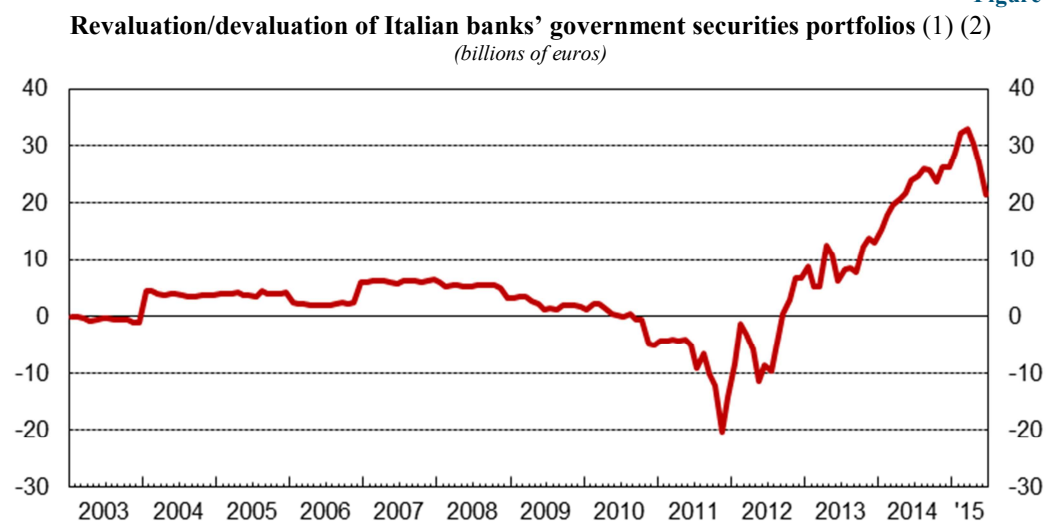


Source: Bank of Italy, Supervisory reports.

(1) Amounts of purchases are net of fluctuations in market prices. All types of government securities, including those issued by local government. Excludes Cassa Depositi e Prestiti.

Between November 2011, when government securities reach their lowest values during the crisis, and June 2015 it is estimated that banks' securities portfolio is revalued by €42 billion (Figure 7).

Figure 7



Source: elaborations on Bank of Italy supervisory data.

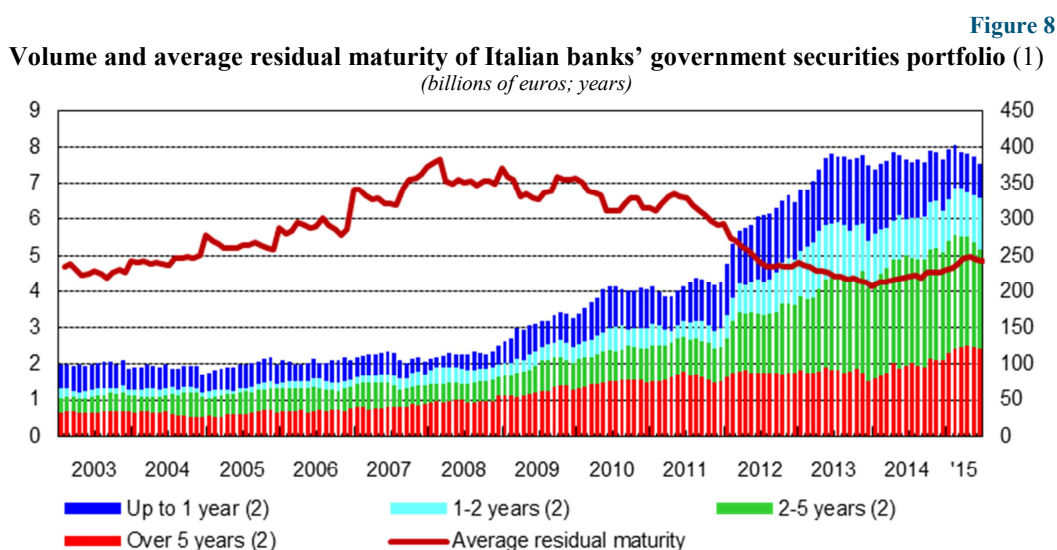
(1) The revaluation is the difference between the change in the value of the government securities at market prices since the start of the period and the cumulative sum of net purchases for the same period. – (2) All types of government securities, including those issued by local government. Excludes Cassa Depositi e Prestiti.

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 4).

The behaviour of foreign banks often diverges from the rest of the system. In the period 2007-2008 the purchases of sovereign securities by the banking system as a whole are low and the 5 top groups record net sales, while the foreign banks greatly increase their purchases of Italian government securities. Conversely, in the spring and summer of 2012, as the sovereign debt crisis worsens and Italian banks – especially minor ones – record a sharp increase, the foreign banks record substantial net-sales. As mentioned before, this choice is likely to be influenced by the euro-area financial system “retrenching” caused by the sovereign debt crisis. Owing to the euro area reversibility risk, Italian banks’ preference for domestic sovereign securities is probably driven in that period by a lower perception of sovereign risk with respect to foreign banks.

In both phases of the crisis, the purchases mostly involve bonds with residual maturity between 1 and 5 years. After increasing in the period before the crisis, the average residual maturity of the sovereign debt securities in banks’ balance sheets shortens all over the crisis up to just over 4 years at the end of 2013, about the same as it had been at the start of 2003 (Figure 8). It restarts growing since 2014 reaching about 5 years in June 2015.



Source: Bank of Italy, Supervisory reports.

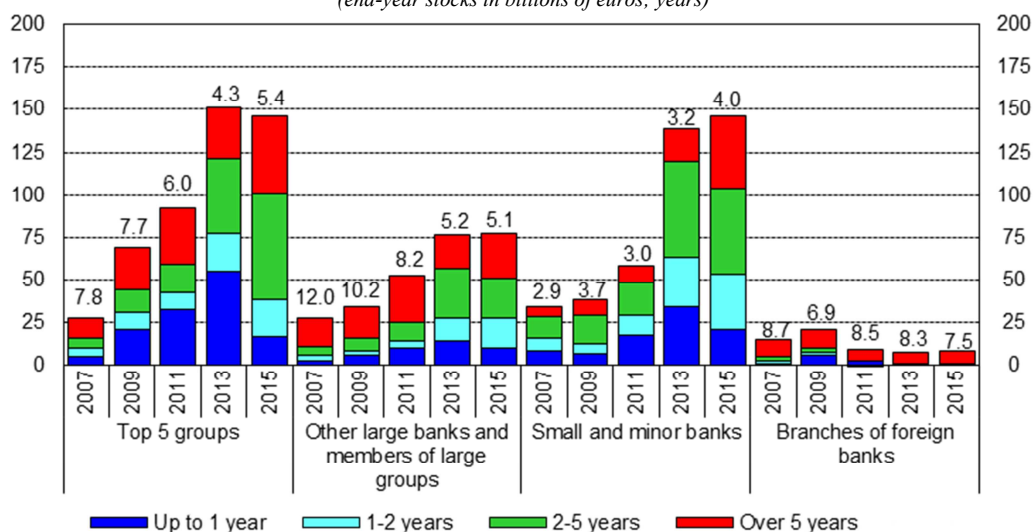
(1) All types of government securities, including those issued by local government. Excludes Cassa Depositi e Prestiti. – (2) Right-hand scale.

Sovereign bonds holdings by small and minor banks have shorter average residual maturity virtually throughout the period (between 3 and 4 years; Figure 9). Large banks and large groups other than the top five, by contrast, have considerably longer residual maturity than the other banks, averaging more than 10 years between 2007 and 2009.

Figure 9

Sovereign securities in Italian banks' portfolio by average residual maturity and type of bank (1) (2) (3)

(end-year stocks in billions of euros; years)



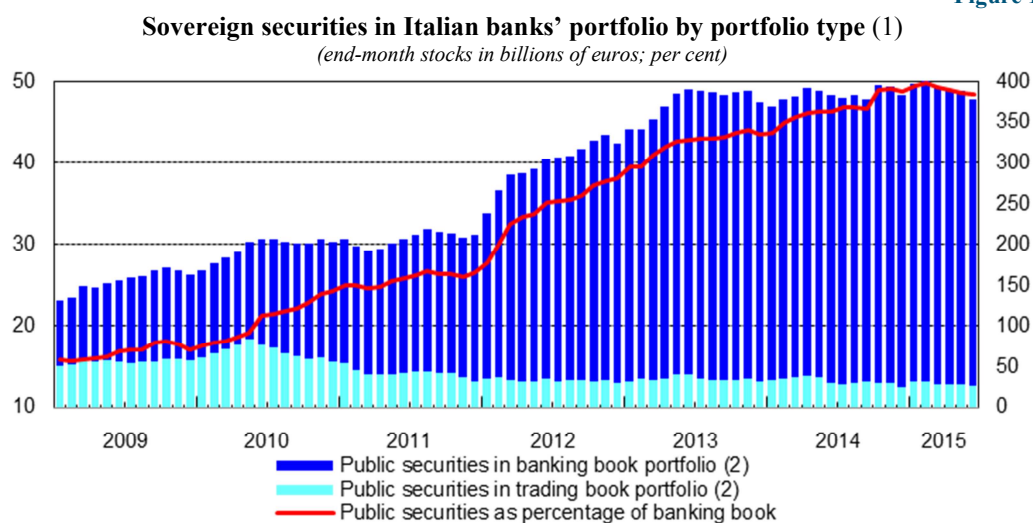
Source: Bank of Italy, Supervisory reports.

(1) All types of government securities, including those issued by local government. Excludes Cassa Depositi e Prestiti. – (2) The figures at the top of the bars are the average residual maturity of the portfolio. – (3) 2015 data refer to June.

Practically all the banks' holdings of government securities are carried in the banking book, and specifically as 'available-for-sale' (AFS) financial assets (Figure 10 and Table 3).⁴ In June 2015 sovereign debt securities registered in the banking book account for 41.4 per cent of the banks' total portfolio compared with less than 15 per cent at the end of 2008. The assignment of sovereign debt securities to the banking book and particularly to the AFS portfolio is 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.

⁴ The banking book comprises all assets apart from those for which the bank expresses a trading intent, while the trading book is embodied by assets and liabilities for which a trading intention exists, approximately corresponding with those classified as held for trading from an accounting perspective. For more details, see Pepe (2013).

Figure 10



Source: Bank of Italy, Supervisory reports.

(1) All types of government securities, including those issued by local government. Excludes Cassa Depositi e Prestiti. – (2) Right-hand scale.

5 – Empirical hypotheses and preliminary evidence

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. This section also provides some preliminary (univariate) evidence on the correlations between sovereign debt securities purchases and bank balance-sheet indicators. However, the determinants are often linked, so that a thorough evaluation of their contribution requires a multivariate approach through an econometric analysis, which is set out in section 6.

(i) Liquidity strains and the precautionary motive

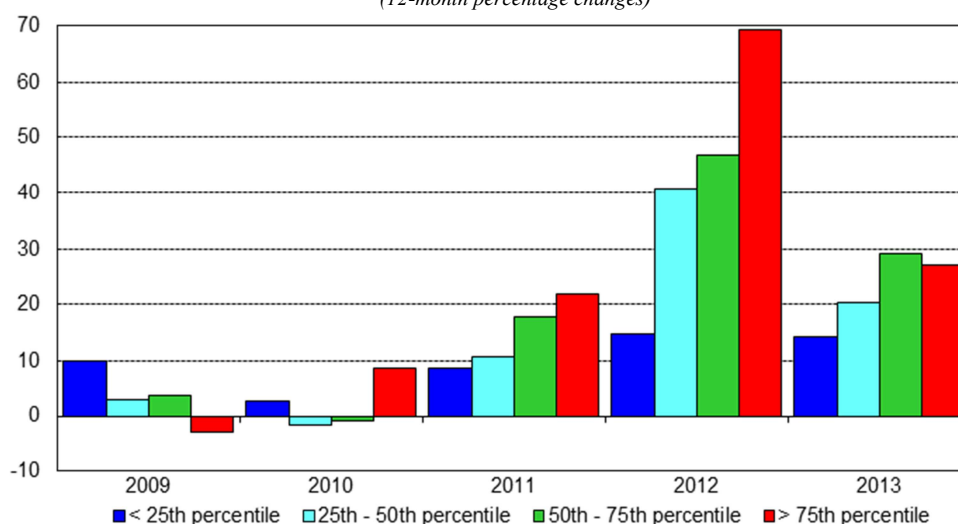
The first reason urging banks to buy government bonds is related to their liquidity conditions and has to do with a precautionary motive. Gennaioli, Rossi and Martin (2013) present a theoretical model where banks may optimally choose to hold public bonds as a way to store liquidity for financing future investments. Indeed, both during the global financial crisis and the sovereign debt crisis, Italian banks have to face considerable difficulties in accessing the international bond markets. Since the drying-up of this funding channel makes more difficult the bank bonds' roll over, 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, 2012; Broner, Erce, Martin and Ventura, 2013). The aggregate evidence is consistent with this hypothesis. In the first quarter of 2012, a third of banks' net purchases concerns government securities with less than

two-year residual maturity, whereas in the two previous years banks had made net disposals of securities with the same maturity. 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.

The idea of the precautionary motive is that the more vulnerable to financial market turmoil banks' funding is, the greater their government securities purchases should be. Therefore, this hypothesis may be tested through the analysis of the 'funding gap', an indicator of funding vulnerability which captures the portion of lending not covered by retail funding.

Figure 11

Growth rates of government securities holdings by funding gap quartiles (1)
(12-month percentage changes)



Source: Bank of Italy, Supervisory reports.

(1) All government securities, including local government issues. Excludes Cassa Depositi e Prestiti. 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. For each year the quartiles of the funding gap are computed at December of the previous year.

During the crisis Italian banks' funding gap increases substantially from 17 per cent at the end of 2006 to 21 per cent in mid-2008; then it narrows, but widens again during the sovereign debt crisis, topping 19 per cent in September 2011. In order to bring the indicator back into line with pre-crisis levels, banks can act on the liability side (by increasing their retail funding) or on the asset side (by substituting sovereign debt securities for customer loans). Since during the crisis banks have difficulties with retail funding (as their products already make up a good portion of households' portfolios and because of the high cost of such funding during the most acute phases of the crisis) a more feasible way to bring

the funding gap back down towards its pre-crisis level is by a shift in asset composition.⁵

The evidence of Figure 11 supports the “precautionary hypothesis” showing that during the crisis there is a positive correlation between funding gap and government securities purchases. With one year lag, the banks in the top quartiles of the funding gap distribution present a higher increase in their sovereign debt securities portfolios except in 2009, when the tensions in the international financial markets ease.

ii) Complying with capital adequacy requirements

Securities purchases may also be related to the compliance with capital regulatory requirements. Battistini, Pagano and Simonelli (2013) and Acharya and Steffen (2013), 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.

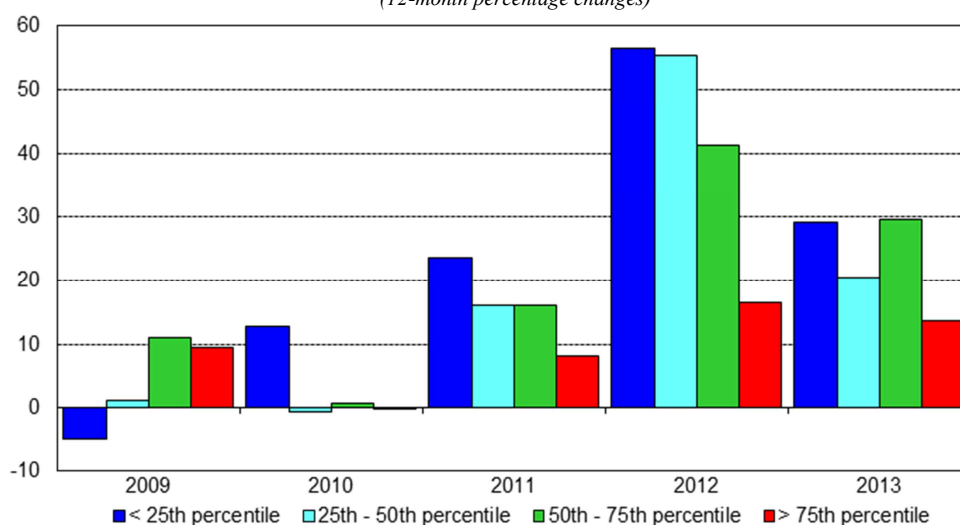
At the end of 2007 the tier 1 ratio of the Italian banking system is 6.5 per cent, and is particularly low at the major banks. In the subsequent years the expected tightening of capital requirements, combined with market pressures, leads banks, especially the larger ones, to expand their capital and reserves. The capital ratio can be improved either by increasing 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. Consistently with this hypothesis Figure 12 shows that, with one year lag, the banks in the lower quartiles of the tier 1 distribution increase their sovereign holdings more rapidly, in the entire crisis period except for 2009.

⁵ On the other hand, for a given amount of funding the government securities purchases create a ‘funding gap’ relative to the bank’s securities portfolio. However, this imbalance is much less worrying thanks to the liquidity of the securities, which can be readily liquidated or used to gain access to the Eurosystem refinancing. Analysing the very long term trends of the main banking assets, De Bonis et al. (2012) and Bartoletto et al. (2015) find, after the 1970s, a negative correlation between loans and bonds holdings.

Figure 12

Growth rates of government securities holdings by core tier 1 ratio quartiles (1)
(12-month percentage changes)



Source: Bank of Italy, Supervisory reports.

(1) All government securities, including local government issues. Excludes Cassa Depositi e Prestiti. 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. For each year the quartiles of the tier 1 ratio are computed at December of the previous year.

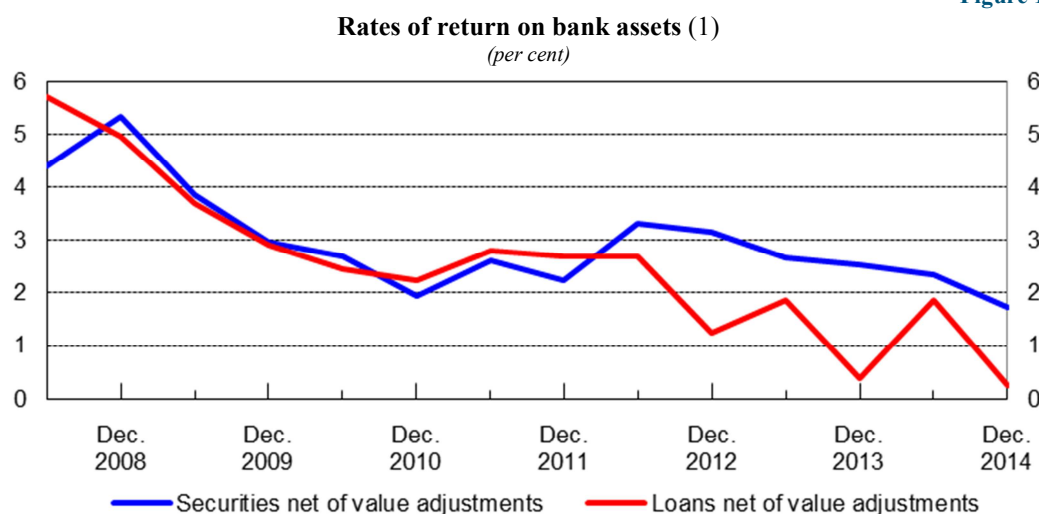
(iii) Improving profitability and bad loans

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, declines 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 13 shows that since the end of 2011 the risk-adjusted yields on Italian debt securities are higher than those on loans⁶ (see also Banca d'Italia, 2013b and Angelini, Grande and Panetta, 2014).

⁶ Yields data on government securities portfolios alone are not available.

Figure 13



Source: Bank of Italy, Supervisory reports.

(1) 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 e Prestiti.

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.⁷ 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).

⁷ CCPs are third parties that mediate the lending operations between two banks for the purpose of reducing counterparty risk for the lending bank.

6 – The econometric analysis

i) Baseline specification

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

$$np_{i,t} = \alpha' K_{i,t-1}^R + \beta' C_{i,t-1}^R + \gamma' b_i + \delta' p_t + \varepsilon_{i,t}, \quad (1)$$

where the dependent variable $np_{i,t}$ is the ratio between the net-purchases (gross purchases less gross sales) of domestic sovereign debt securities by bank i in quarter t and the stock of government securities held by the same bank at the end of the previous quarter. The explanatory variables are contained in the matrices $K_{i,t-1}^R$ (matrix of the key regressors) and $C_{i,t-1}^R$ (matrix of the control regressors). All the explanatory variables are defined at the level of individual bank or banking group. To enhance the robustness of the estimates, the equation incorporates both bank (b_i) and time (quarter) fixed effects (p_t): the former to control for unobservable microeconomic factors, the latter for macroeconomic factors and trends. α , β , γ and δ are coefficient vectors; $\varepsilon_{i,t}$ is an identically and independently distributed idiosyncratic error component.⁸ The sample period is March 2007-December 2013.

A description of each regressor, the descriptive statistics and the expected signs are summarized in Table 4. The correlations between the variables are presented in Table 5. The regressors in matrix $K_{i,t-1}^R$ are proxies for the microeconomic determinants of government securities purchases reviewed in the previous section. More in detail, the matrix $K_{i,t-1}^R$ contains 9 covariates.

Two covariates refer to what we indicate as the “precautionary motive”. The variable *Funding Gap*, measured as the share of loans to the economy not financed by retail funding, 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.⁹ The expected sign of the variable *Bonds Issued* (over total assets) is positive as well. Apart from the effect of the

⁸ 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.

⁹ 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 in Figure 10 where only bonds held by households are included. We adopt a different definition for the estimates because detailed 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.

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* (return on assets) captures the overall profitability of banking activity. The *Yield Spread* is a spread between the unitary risk-adjusted yields of loans and securities, and measures specifically banks’ comparative advantage between investing in loans or in securities.¹⁰ 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. 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.

ΔBad Debts measures the flow of new bad debts and is calculated as the ratio between new bad debts in the quarter to the stock of outstanding loans at the end of the previous quarter. The expected sign is positive, in that it toughens the previous effects as a deterioration in the quality of credit 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 each bank’s net liability position with respect to the Eurosystem over total assets and is expected to have a positive influence on government securities purchases. *CCP-Liabilities* 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-Assets* is not definable a priori but is probably opposite to that of *CCP-Liabilities*.

The regressors in matrix $C_{i,t-1}^R$ are incorporated in the estimates as controls. *Size* (log of the bank’s total assets) constitutes a standard control to capture the effect of bank size on portfolio choices. *Initial Share*, the proportion of government securities in the overall securities portfolio of each bank at the start of the quarter, 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*

¹⁰ 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.

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 estimation period runs from March 2007 to December 2013. The data are mostly monthly (only those from the profit and loss account are half-yearly).¹¹ 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, Jimenez et al. (2014) test 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. (2013) 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.

¹¹ The half-yearly data (the numerator of the variables *ROA*, *ROE* and *Yield Spread*) are dragged into the missing quarter.

- 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.¹²
- 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 casual interpretation of the outcomes.

iii) The overall results

Table 6 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 $\Delta Bad Debts$ 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 6, columns 2-4).

In terms of quantitative impact, Table 6 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.

¹² In Jimenez 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 Jimenez et al. (2012) and Bonaccorsi and Sette (2012).

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 2013.¹³

In the estimates for the first phase of the crisis (Table 7) 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 8) 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 Δ *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 bad debts, and the lower the capital ratio, the greater the banks' investment in government securities (Table 9). The Eurosystem financing and bank profitability remain significant, while both

¹³ 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.

asset and liability positions with central counterparties turn to non-significant.¹⁴ 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 10): 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.¹⁵ All our results are largely corroborated (Table 11), 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.

7 – 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, reduce the probability of a government default and prevent sovereign yields from reaching even higher levels balancing market overreactions.

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

¹⁴ Central counterparty funding increases greatly during the first phase of the crisis and loses importance in the second phase (Affinito and Piazza, 2015).

¹⁵ In the Arellano-Bond estimates the covariates include the lagged dependent variable, thus excluding the *Initial Share* of government securities.

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 government securities in Italy between 2007 and 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.

Table 1

Banking system's exposure to general government (1)
(billions of euros and per cent)

PERIOD	Loans to general government	General government non-equity issues			(a) + (b) as % of total assets
	(a)	(b)	as % of total securities portfolio	as % of total assets	
Total					
2007 - Dec.	61.3	113.9	18.7	3.5	5.3
2008 - Dec.	57.6	124.8	17.3	3.5	5.1
2009 - Dec.	57.9	162.3	19.7	4.5	6.1
2010 - Dec.	55.0	202.4	24.3	5.8	7.3
2011 - Dec.	52.0	211.7	23.1	5.6	7.0
2012 - Dec.	52.8	322.7	30.0	8.3	9.6
2013 - Dec.	47.9	374.4	34.4	10.1	11.3
2014 - Dec.	44.4	382.9	38.8	10.5	11.7
2015 - Mar.	43.9	392.3	40.0	10.6	11.8
June	44.7	378.0	39.8	10.5	11.7
Top 5 groups					
2007 - Dec.	34.2	36.0	9.5	1.8	3.6
2008 - Dec.	34.0	39.9	8.7	1.9	3.4
2009 - Dec.	34.5	69.1	12.7	3.2	4.7
2010 - Dec.	31.5	93.7	17.4	4.7	6.2
2011 - Dec.	30.4	92.3	15.4	4.3	5.7
2012 - Dec.	31.1	134.2	21.5	6.3	7.8
2013 - Dec.	26.2	151.3	24.9	7.6	8.9
2014 - Dec.	25.6	146.7	27.0	7.5	8.8
2015 - Mar.	25.1	151.8	28.2	7.6	8.9
June	25.7	146.2	27.6	7.5	8.9
Other large banks and members of large groups					
2007 - Dec.	19.4	27.7	25.2	4.6	7.8
2008 - Dec.	18.0	31.5	22.7	4.7	7.4
2009 - Dec.	17.7	34.2	23.0	4.9	7.5
2010 - Dec.	17.4	44.7	29.1	6.2	8.7
2011 - Dec.	15.2	52.3	29.6	6.7	8.6
2012 - Dec.	15.1	75.7	33.0	8.7	10.5
2013 - Dec.	14.3	76.9	33.7	9.2	10.9
2014 - Dec.	12.9	81.6	40.9	10.2	11.9
2015 - Mar.	13.1	81.6	42.1	10.4	12.1
June	13.2	77.0	42.2	10.1	11.9

(cont'd)

PERIOD	Loans to general government	General government non-equity issues			(a) + (b) as % of total assets
	(a)	(b)	as % of total securities portfolio	as % of total assets	
Small and minor banks					
2007 - Dec.	3.4	34.0	49.3	8.2	9.1
2008 - Dec.	3.0	34.3	44.9	7.6	8.3
2009 - Dec.	2.9	38.2	41.9	8.1	8.7
2010 - Dec.	3.3	43.0	45.2	8.8	9.5
2011 - Dec.	3.6	58.3	51.4	11.3	12.0
2012 - Dec.	4.5	104.4	56.5	17.4	18.2
2013 - Dec.	5.5	138.9	63.6	22.2	23.0
2014 - Dec.	5.5	146.5	68.9	23.3	24.2
2015 - Mar.	5.5	150.1	69.8	23.5	24.3
June	5.6	146.6	70.3	23.2	24.1
Branches of foreign banks					
2007 - Dec.	4.3	16.2	30.5	5.0	6.3
2008 - Dec.	2.5	19.2	43.0	6.0	6.8
2009 - Dec.	2.8	20.8	54.0	7.4	8.4
2010 - Dec.	2.8	21.0	47.1	7.2	8.1
2011 - Dec.	2.6	8.8	30.7	2.9	3.7
2012 - Dec.	2.2	8.5	23.8	2.7	3.4
2013 - Dec.	1.9	7.3	22.5	2.7	3.5
2014 - Dec.	0.3	8.1	25.4	2.9	3.1
2015 - Mar.	0.2	8.7	27.9	3.1	3.1
June	0.2	8.2	26.7	3.0	3.0

Source: Bank of Italy, Supervisory reports.

(1) All Italian government securities, including those issued by local government. Excludes Cassa Depositi e Prestiti.

Table 2

Public securities in banks' portfolios: per cent of total assets (1)

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015 (June)
Austria	5.4	4.3	3.5	2.7	2.5	2.0	1.8	1.5	1.2	0.9	0.9	1.5	1.8	1.8	2.5	2.8	3.9	4.0
Belgium	18.6	15.5	13.6	11.2	10.3	8.9	7.2	6.1	5.4	3.5	3.6	4.5	5.0	5.1	6.0	5.8	5.0	5.0
Germany	3.0	2.5	2.3	1.9	2.2	2.3	2.7	2.5	2.2	1.9	1.7	2.2	2.6	2.4	3.0	3.3	3.2	3.2
Greece	24.9	22.2	21.5	19.8	19.1	13.9	11.3	11.0	9.2	6.0	5.1	6.8	8.7	9.4	4.2	3.1	3.1	3.5
Spain	10.9	10.1	8.0	7.8	7.5	7.2	5.2	4.0	2.8	2.5	2.9	4.4	4.6	5.3	6.8	8.3	9.5	8.8
Finland	8.0	5.9	5.2	4.3	3.0	1.3	0.9	0.8	0.6	0.5	0.4	0.4	0.7	0.6	0.6	0.8	0.7	0.9
France	6.3	5.3	3.9	3.7	3.7	3.6	3.3	3.1	2.5	2.1	1.9	2.1	1.9	1.8	2.3	2.3	2.4	2.3
Ireland	2.5	2.0	1.2	0.9	0.7	0.6	0.4	0.3	0.2	0.0	0.1	0.5	0.8	1.0	1.7	2.0	1.9	1.7
Italy	12.3	10.8	8.2	7.9	7.0	7.4	6.8	6.3	5.5	4.8	4.5	5.3	6.3	6.0	8.3	10.0	10.4	10.5
Luxembourg	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Netherlands	4.2	3.4	2.3	1.7	1.6	1.6	1.3	1.3	1.1	0.8	0.9	0.8	1.4	1.3	1.8	2.1	1.9	1.9
Portugal	5.1	2.6	2.3	1.9	1.4	1.1	1.1	1.1	1.2	0.9	0.9	2.0	4.1	4.0	5.5	6.1	6.5	6.4
Slovenia									7.7	4.5	3.7	5.6	5.2	7.0	7.7	11.8	14.0	14.8
Cyprus										3.7	2.2	2.5	2.6	3.2	4.3	4.9	4.0	3.3
Malta										3.2	2.9	3.9	3.4	3.6	3.5	4.0	3.6	4.1
Slovakia											12.6	20.2	20.1	18.9	19.9	17.9	16.4	16.2
Estonia													0.4	0.4	0.4	0.5	0.4	0.5
Latvia																2.1	2.2	2.9
Lithuania																	5.4	5.2
Euro area	6.1	5.2	4.1	3.9	3.8	3.7	3.4	3.1	2.6	2.2	2.1	2.7	3.0	3.0	3.8	4.3	4.4	4.3

Source: Eurosystem.
(1) Includes Cassa Depositi e Prestiti.

Table 3

Composition of banks' securities portfolio (1)
(per cent)

PERIOD	Banking book (2)				Trading book (3)			
	Public debt securities	Equity	Other debt securities	Other	Public debt securities	Equity	Other debt securities	Other
	Total							
2008 – Dec.	13.0	29.5	37.0	2.3	7.3	1.1	9.2	0.7
2009 – Dec.	14.6	26.7	42.8	1.4	7.9	0.5	5.7	0.4
2010 – Dec.	20.7	26.0	37.1	1.4	7.9	0.9	5.6	0.3
2011 – Dec.	23.0	22.1	40.0	1.3	3.9	0.5	9.0	0.2
2012 – Dec.	31.0	16.4	33.1	0.9	3.1	0.2	15.1	0.2
2013 – Dec.	35.7	15.6	29.9	1.0	3.2	0.3	14.1	0.2
2014 – Dec.	40.9	16.6	25.2	1.1	2.9	0.5	12.7	0.2
2015 – Mar.	41.8	16.1	25.7	1.2	3.1	0.5	11.3	0.2
June	41.4	16.4	26.4	1.4	3.1	0.4	10.8	0.2
	Top 5 groups							
2008 – Dec.	4.9	38.0	39.9	1.9	5.3	0.3	9.0	0.7
2009 – Dec.	7.7	32.7	46.9	0.9	6.8	0.2	4.3	0.4
2010 – Dec.	12.7	32.3	41.1	1.1	7.7	0.2	4.5	0.4
2011 – Dec.	14.0	27.4	43.6	1.0	3.8	0.2	9.8	0.2
2012 – Dec.	20.2	21.1	34.2	0.7	3.1	0.1	20.5	0.2
2013 – Dec.	23.2	20.9	30.5	0.7	3.6	0.2	20.7	0.2
2014 – Dec.	26.0	22.8	27.6	0.7	3.1	0.3	19.4	0.2
2015 – Mar.	26.7	21.9	29.1	0.7	3.6	0.3	17.5	0.2
June	25.8	22.2	30.3	0.7	3.8	0.3	16.6	0.2
	Other large banks and members of large groups							
2008 – Dec.	18.5	19.3	39.2	2.4	8.6	0.7	10.3	1.0
2009 – Dec.	20.2	18.7	42.3	2.6	6.6	0.7	8.5	0.4
2010 – Dec.	29.4	16.7	34.5	2.0	5.2	1.9	9.8	0.4
2011 – Dec.	31.2	12.3	39.5	1.9	2.9	1.8	10.1	0.2
2012 – Dec.	36.1	10.5	38.3	1.1	2.6	0.6	10.7	0.1
2013 – Dec.	36.6	10.1	39.6	1.2	3.3	0.6	8.4	0.1
2014 – Dec.	43.9	10.0	31.9	1.4	4.1	1.7	6.6	0.2
2015 – Mar.	45.8	10.3	32.7	1.4	3.4	1.5	4.6	0.3
June	46.7	9.8	33.4	1.8	2.3	1.3	4.4	0.3

(cont'd)

PERIOD	Banking book (2)				Trading book (3)			
	Public debt securities	Equity	Other debt securities	Other	Public debt securities	Equity	Other debt securities	Other
Small and minor bank								
2008 – Dec.	38.6	7.9	29.6	3.1	10.9	0.1	9.5	0.4
2009 – Dec.	36.4	7.5	35.3	2.5	9.0	0.1	8.7	0.5
2010 – Dec.	45.3	7.9	33.2	2.2	5.5	0.2	5.6	0.2
2011 – Dec.	56.2	6.6	28.4	2.1	3.0	0.1	3.4	0.1
2012 – Dec.	65.7	4.2	25.5	1.4	1.5	0.1	1.5	0.1
2013 – Dec.	72.2	3.3	19.9	1.5	1.9	0.1	1.0	0.1
2014 – Dec.	77.8	3.7	14.4	1.7	1.4	0.1	0.8	0.1
2015 – Mar.	78.0	3.7	12.6	2.5	1.9	0.1	1.1	0.1
June	77.9	3.9	12.3	2.7	2.1	0.1	1.0	0.1
Branches of foreign banks								
2008 – Dec.	31.5	13.2	14.9	4.0	17.5	11.2	6.9	0.8
2009 – Dec.	36.7	20.6	4.5	0.5	26.1	4.4	6.9	0.3
2010 – Dec.	34.6	21.5	3.9	0.5	26.2	8.6	4.8	0.0
2011 – Dec.	27.4	36.6	6.6	1.2	17.8	1.4	9.0	0.0
2012 – Dec.	24.2	36.3	10.4	0.9	21.0	0.5	6.6	0.0
2013 – Dec.	38.2	41.2	7.3	1.8	6.3	0.3	4.8	0.0
2014 – Dec.	50.8	42.5	0.7	1.6	0.2	0.2	4.0	0.0
2015 – Mar.	52.5	41.2	0.9	1.6	0.3	0.3	3.2	0.0
June	50.7	42.4	0.1	1.4	0.5	0.2	4.7	0.0

Source: Bank of Italy, Supervisory reports.

(1) All Italian government securities, including those issued by local government. Excludes Cassa Depositi e Prestiti. – (2) Held to maturity, Available for Sale, Loans and receivables, Fair value options. – (3) Held for trading.

Table 4

Econometric analysis: Description of variables, descriptive statistics and expected signs

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 5

Econometric analysis: Matrix of correlation among variables

	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 6

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

Table 7

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

Table 8

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

Table 9

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

Table 10

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

Table 11

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

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