DNB Working Paper

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No. 433 / July 2014

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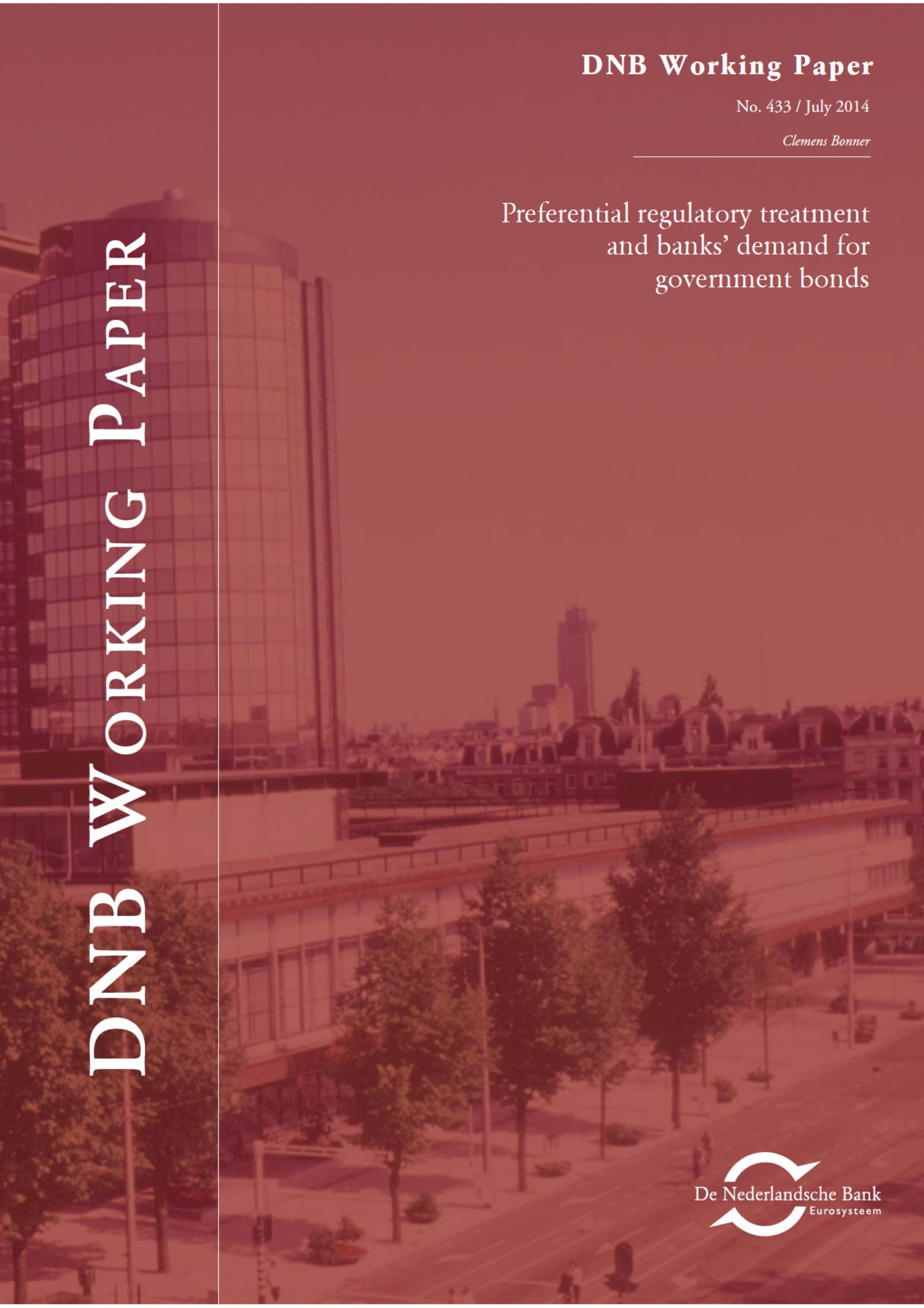


De Nederlandsche Bank
Eurosysteem

Preferential regulatory treatment and banks' demand for government bonds

Clemens Bonner *

* Views expressed are those of the author and do not necessarily reflect official positions of De Nederlandsche Bank.

Working Paper No. 433

July 2014

De Nederlandsche Bank NV
P.O. Box 98
1000 AB AMSTERDAM
The Netherlands

Preferential regulatory treatment and banks' demand for government bonds *

Clemens Bonner [a,b]

[a] De Nederlandsche Bank, P.O. Box 98, 1000 AB Amsterdam, The Netherlands
[b] CentER, Tilburg University, PO Box 90153, 5000 LE Tilburg, The Netherlands

Abstract

Government bonds receive preferential treatment in financial regulation. The purpose of this paper is to analyze the impact of this preferential treatment on banks' demand for government bonds. Using unique transaction-level data, our analysis suggests that preferential treatment in liquidity and capital regulation increases banks' demand for government bonds beyond their own risk appetite. Liquidity and capital regulation also seem to incentivize banks to substitute other bonds with government bonds. On top of that, we find evidence that regulation leads to a longer-term increase in government bond holdings. Finally, our results suggest that higher government bond holdings are associated with more lending and lower profits during normal times but not during stress.

Keywords: Government bonds, financial markets, regulation, liquidity, capital.
JEL classification: G18, G21, E42.

* We would like to thank Jack Bekooij and Richard Heuver for providing data. I am grateful to seminar participants at DNB, Tilburg University as well as Sylvester Eijffinger, Michel Heijdra, Paul Hilbers, Iman van Lelyveld andWolfWagner for comments and suggestions. The opinions expressed in this paper are the author's personal views and do not necessarily represent those of DNB or Tilburg University. Corresponding author: c.bonner@dnb.nl.

1. Introduction

European banks hold sizeable shares of government debt securities.[1] Popov and Van Horen (2013) argue that the 0% risk-weight in the context of capital regulation is a key driver of banks' holdings of government bonds. Besides capital regulation, government debt securities also receive preferential treatment in the newly proposed Basel III liquidity requirements as well as in the context of regulatory efforts to limit large exposures to individual countries and counterparts.[2] While they also bring forward the argument of preferential regulatory treatment, Gennaioli et al. (2013) formulate two more hypotheses explaining banks' holdings of government bonds. The first one follows a large stream of literature arguing that banks hold government bonds as source of liquidity and collateral making them operating more effectively during normal times but not necessarily during stress.[3] The second hypothesis follows Acharya and Steffen (2013) and is based on the idea that banks hold lower quality government bonds, allowing them to both gain from preferential regulatory treatment and to chase high returns without internalizing the systemic consequences of doing so.

Especially the sovereign debt crisis in Europe raised interest in the interaction of banks' holdings of government bonds, government defaults and lending to the real economy. Gennaioli et al. (2012) for instance show that government defaults shrink the net worth of banks with large holdings of government bonds, causing private credit to decline. Brutti and Saure (2013) analyze the demand of European banks for government bonds during the recent sovereign debt crisis while Acharya and Steffen (2013) assess German banks' stock market returns to draw conclusions on banks' returns for government bonds during the recent crisis.

The evidence presented in these studies raises the question whether the relatively favorable treatment of government bonds in financial regulation is justified or whether there are arguments to treat government bonds in a more risk-sensitive

[1] See for instance EBA (2013a).

[2] See BCBS (2010a), BCBS (2010b) and BCBS (2013) as well as EU No 575/2013 ("CRD IV").

[3] See for instance Gennaioli et al. (2012) or Holmstroem and Tirole (1993).

way and therefore similar to other bonds.[4] However, there is very little evidence of whether regulatory treatment is truly the main driver of banks' large holdings of government bonds or whether this is not rather caused by banks' own targets and risk management processes.

The correlation between banks' funding and liquidity needs and their compliance with regulatory requirements poses a challenge to establishing a causal link from the various incentives for banks to hold government bonds and their actual holdings. To distinguish whether a change in banks' government bond holdings is caused by regulation or by its funding and liquidity needs, one would need detailed information on banks' targets used in their internal risk management frameworks.

Since such data is not available in a structural form, an alternative approach is to distinguish whether the proximity of a bank to its regulatory liquidity and capital threshold changes its demand for government bonds during the entire following month or only around the reporting date. The hypothesis is that if banks' regulatory capital and liquidity position changes their demand for government bonds over the entire month, it cannot be established whether this is caused by regulation (henceforth *regulatory effect*) or internal risk management targets (henceforth *internal effect*). However, a change of demand only around the reporting date would point towards the presence of a *regulatory effect*. Finally, if banks do not rebalance and increase their supply right after reporting, it can be hypothesized that we observe at least a somewhat longer-term effect as opposed to regulatory arbitrage.

Using unique transaction-level data obtained from the Markets in Financial Instruments Directive (MiFID) database, we attempt to distinguish *regulatory* from *internal* effects and aim to answer the question whether financial regulation increases banks' demand for government bonds beyond their own risk appetite.

Due to the presence of long-running liquidity and capital requirements in the Netherlands, it is possible to assess the impact of both requirements, allowing us to draw the link to Basel III. Along with other control variables, we also include banks' proximity to fulfilling their minimum central bank reserve requirement.

[4]The main criticism on the current regulatory treatment of government bonds is that government bonds of an institution's home jurisdiction get the most favorable treatment across most regulatory frameworks, independent of their riskiness. See also Weidmann (2013) and Buch et al. (2013).

The analysis in this paper suggests that liquidity and capital requirements cause banks' demand for government bonds to increase beyond their internal risk management targets. The relative preferential treatment seems to cause a substitution effect with banks buying more government bonds while selling more other bonds. The analysis also shows that these dynamics are likely to cause a longer-term increase of government bond holdings.[5]

Further, holdings of high quality government bonds seem to be positively associated with banks' lending to the real economy but have a negative impact on profits. During both sovereign and liquidity stress, however, the negative impact on banks' profitability diminishes while high government bond holdings seem to have a negative impact on private sector lending.[6]

When drawing policy implications from these results, it is important to note that the purpose of this paper is to analyze whether financial regulation increases banks' demand for government bonds and whether increased government bond holdings have an adverse impact on the real economy and banks' profitability. While the paper provides new insights into these dynamics, it does not comprehensively answer the question whether increased government bond holdings are desirable. However, since the analysis suggests that even high quality government bond holdings have a negative impact on banks' lending during stress, our analysis can be interpreted as giving reason to at least consider treating exposures to governments in a more risk-sensitive way and therefore similar to other bonds. The fact that even high rated government bonds had a negative impact on lending suggests that there are additional factors, such as price volatility, which should be taken into consideration when estimating the risk of government exposure.

[5]It could also be that banks not rebalancing their increased holdings right after reporting is a lagged holding effect with banks waiting for good opportunities to sell. However, we excluded this possibility with checking the correlation coefficients of banks' demand in one month with the following 6 months. If banks rebalance at some point during the next months, one would expect a negative correlation coefficient. However, the coefficient of the current month with the following month is 0.43 and steadily decreases to 0.22 during the next 5 months.

[6]Although we do not have structural data on this, available information suggests that the banks in our sample hold mainly Dutch and German government bonds. This is additionally confirmed by the negative impact of government bond holdings on profitability. In case of peripheral European countries, one would expect a positive impact on profit as found by Acharya and Steffen (2013).

2. The regulatory environment

2.1. The MiFID Database

The primary data source of this paper are the MiFID transaction reports obtained from the Netherlands Authority for the Financial Markets (AFM). MiFID was implemented as part of the EU financial market integration in November 2007 with the purpose to regulate the provision of financial instruments and to clarify the responsibilities and powers of national competent authorities regarding these activities.[7] Article 25(3) and (4) of the MiFID Directive requires financial institutions to report trading activities for any instrument admitted to trading on a regulated market. As such, the MiFID database is the most comprehensive dataset on bond transactions in the EU.[8]

Along with a large number of other information, each transaction in the dataset includes the international securities identification number (ISIN) of the traded security, the two trading counterparts, volume, time to maturity, the exact time as well as whether the reporting institution acted as a buyer or a seller.

2.2. Government bonds in regulatory frameworks

While national capital requirements date back even further, the national implementation of Basel I in 1992 harmonized capital regulation across the globe. Since then, both the definition of eligible capital and the risk weights (RW) of an institution's assets have been subject to continuous changes. The most recent development is the Basel III accord and its implementation in national legislation.[9] To understand the interaction of capital requirements and government bond holdings, it is useful to begin with a closer look at the calculation of regulatory capital ratios:

$$Capital\ requirement = \frac{Total\ capital}{Risk-weighted\ assets(RWA)} \geq 8\% \tag{1}$$

Since our dataset covers June 2009 to December 2012, the definition of capital under Basel 2.5 is applicable. Total capital therefore consists to at least 50% of

[7] Directive 2004/39/EC.

[8] See EBA (2013b), which provides evidence for the comprehensive coverage of the database.

[9] See BCBS (2010a) and EU No 575/2013 ("CRD IV").

Tier 1 capital (equity capital and disclosed reserves) complemented by undisclosed reserves, revaluation reserves, general provisions and loan-loss reserves, hybrid debt capital instruments as well as some subordinated debt (Tier 2).

As can be seen, the denominator of the capital requirement is determined by multiplying the notional amounts of an institution's assets by their respective RW. Thus, if an institution holds an asset with a 20% RW, it needs to hold capital amounting to at least 8% (the minimum capital ratio) of the notional amount of the respective asset multiplied by 20%. Due to their 0% RW, foreign government bonds rated AAA to AA- or any domestic government bond do not require banks to hold any capital, making government bonds relatively more attractive.[10]

To increase its capital ratio, a bank can therefore either raise capital or reduce its RWA. While banks are able to raise capital in the long run, it is not a feasible way to correct a short-term capital shortfall. As institutions need sufficient assets for funding purposes, only selling large amounts of assets with high RW is not realistic either. As such, the seemingly easiest way to address a capital shortcoming is to substitute bonds with high RW by government bonds.

Turning to liquidity regulation, we can see the same dynamics. As proxy for the Basel III Liquidity Coverage Ratio (LCR), we use the Dutch liquidity requirement DLCR which was introduced in July 2003.[11] The LCR and the DLCR are very similar in their design and are both based on classic liquidity "coverage" considerations. Both ratios require banks to hold an amount of high quality liquid assets to cover their net cash outflows over a 30 day stress scenario:

$$DLCR = (Actual\ Liquidity) - (Required\ Liquidity\ within\ 30\ days) \geq 0 \tag{2}$$

Actual Liquidity (*AL*) is calculated as the sum of liquid assets minus haircuts plus contractual cash inflows weighted by degree of liquidity. Required Liquidity (*RL*)

[10] Usually government bonds have lower yields than other securities. Under normal circumstances institutions balance the gains from holding government bonds (safe asset, preferential regulatory treatment) with the opportunity costs of doing so (lower return). During the sovereign debt crisis, bonds issued by European peripheral countries had very high yields while banks could still gain from the preferential regulatory treatment.

[11] For the legal background on the DLCR, please refer to DNB (2003). For two recent papers, please refer to Bonner and Eijffinger (2013) or De Haan and van den End (2013).

is a combination of assumed calls on off-balance sheet items (i.e. committed credit facilities) and withdrawals of deposits. While the DLCR allows a number of asset classes to be included as AL, cash and government bonds are the only categories which receive a 0% haircut.

Similar to capital, an institution can steer its DLCR by either increasing its AL or by reducing its RL.[12] Again, however, reducing liabilities seems to be a less feasible option than increasing liquid assets. Buying government bonds appears to be the most efficient strategy to correct a DLCR deficiency.

2.3. The average reserve requirement

Apart from liquidity and capital requirements, banks usually also face a minimum central bank reserve requirement. Most central banks - among which the European Central Bank (ECB) - require credit institutions to hold a minimum amount of reserves with them. An institution's reserve requirement is determined by multiplying the reserve base with the reserve ratio. The reserve base includes retail deposits and a selection of short-term liabilities while the ECB's reserve ratio is currently set at 1%.[13] Compliance with minimum reserve requirements is determined on the basis of banks' average daily balances on the central bank reserve accounts over one reserve maintenance period.

Given it being an average requirement, the reserve requirement can be subject to "frontloading" or "backloading". This means that a bank can fulfil this requirement by holding very large reserves only at the very beginning ("frontloading") or at the end of the month ("backloading"). The maintenance period for EMU banks begins on Wednesday after the first Governing Council meeting and ends the same day of the following month. In the dataset used in this paper, the maintenance period ranges from 19 to 42 days and usually begins between the 10th and 15th day of the respective month. The main function of the minimum reserve requirement is to stabilize money market rates.

The average reserve requirement is likely to have some indirect impact on banks' demand for government bonds. As long as a bank does not fulfil its reserve

[12] Note that for the purpose of this analysis, we calculate a DLCR ratio reflected by AL in percentage of RL.

[13] The ECB reserve ratio was reduced from previously 2% to 1% on January 18th 2012.

requirement, it has an incentive to obtain more cash. Presumably this will lower an institution's demand for debt securities, including government bonds. Once an institution fulfils its reserve requirement, it is likely to substitute cash for other more profitable investment opportunities, such as government bonds or other types of bonds. Anecdotal evidence suggests that most banks "frontload" their reserve requirement and then gradually substitute cash with debt securities until the end of the remittance period.

3. Data Description

3.1. Data Sources

In order to analyze the impact of regulatory treatment on banks' demand for government bonds, we bring together data on 1) bilateral transactions of Dutch securities between Dutch banks; 2) banks' regulatory liquidity and capital holdings; 3) the fulfillment of the minimum central bank reserve requirement; 4) risk indicators and other measures calculated from the balance sheet, as well as 5) macroeconomic factors.

The data on bilateral transactions of securities stems from the MiFID database. The dataset covers June 2009 to December 2012. Each recorded transaction in the dataset includes the identification number (ISIN) of the traded security, the two trading counterparts, volume, time to maturity, the exact time as well as whether the reporting institution acted as buyer or seller. The MiFID regulation requires institutions to report transactions per entity as opposed to the full consolidation of the balance sheet information. To match the two data sources, we calculate banks' demand for government bonds and other bonds (includes financial bonds, covered bonds and asset-backed securities) per consolidated entity. As control variables, we additionally calculate the yield of the respective bond type. To ensure as clear identification as possible, only transactions in which both counterparts can be uniquely identified as banks and at least one of the two counterparts is a Dutch bank are included. This way we can ensure that all considered transactions are executed by a bank subject to prudential regulation of DNB. Finally, we clean the data following the same procedure as Dick-Nielsen et al. (2012). Specifically, we are correcting

for double reporting which occurs when both institutions are EU financial institutions, erroneous reporting of counterpart codes and banks' reporting of (reverse) repos which should not be reported in MiFID.

The regulatory liquidity data stems from banks' reporting of the DLCR. The DLCR is very similar to the Basel III LCR and was introduced in July 2003. It applies to all banks, clearing as well as settlements institutions and grants only a few waivers for foreign branches.[14] The capital ratio is taken from banks' reporting in the context of Basel 2.5 while the data on the reserve requirement is obtained from DNB's payment systems data. All other bank-specific and demand-related variables stem from DNB's prudential reporting.

As macroeconomic variables, we include the EONIA interest rate, the GDP growth rate of the European Union, total government debt over GDP of the Netherlands as well as the relative rating of the Netherlands compared to its peers (Germany, Finland, France, Austria and Belgium). With the exception of the relative rating, which comes directly from the S&P database, all macroeconomic variables are retrieved from the ECB's statistical data warehouse.

3.2. Bond holdings and gross demand and supply

Although we are mainly interested in banks' daily net demand for government bonds, it is worth to first have a look at banks' holdings as well as gross demand and supply of government bonds.

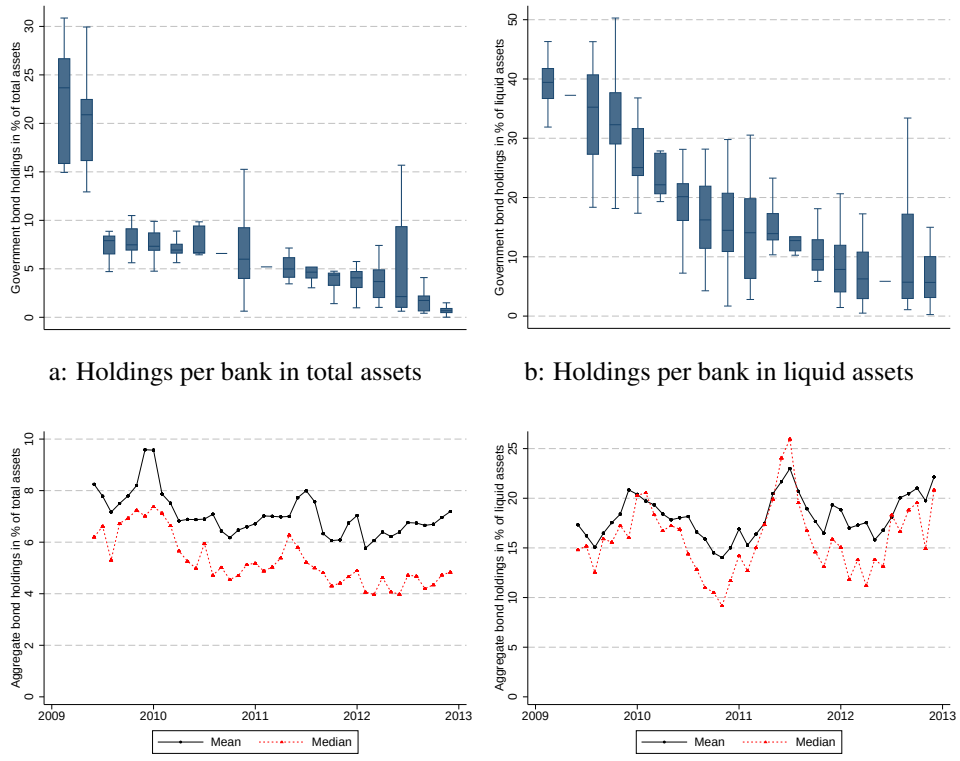
Figure 1a shows that banks' holdings of government bonds differ substantially both between banks but also over time. For two banks, government bonds amount to about 25% of total assets. Other banks hold between 3% and 10% of government bonds in total assets.

Looking at Figure 1b, which illustrates banks' holdings of government bonds in liquid assets (as defined by the DLCR), we see no particular outliers. The distribution of banks is smooth with the highest bank holding on average about 40% of government bonds in liquid assets while the lowest holdings amount to 5% of liquid assets. Again, however, banks show large variations over time.

[14] Please note that we drop all foreign branches and subsidiaries to avoid any issues regarding consolidation and subsequent identification.

Figures 1c and 1d show aggregate bond holdings over time. Aggregate bond holdings vary between almost 10% at the beginning of 2010 to just below 6% in 2012. Although bond holdings are relatively stable, we can see a downward tendency in both mean and median bond holdings. Government bond holdings in liquid assets, on the other hand, do not show such a pattern. After a low of 14% at the end of 2010, average government bond holdings increase to almost 25% by mid-2011.

Figure 1: Holdings of government bonds



a: Holdings per bank in total assets

b: Holdings per bank in liquid assets

c: Holdings in total assets over time

d: Holdings in liquid assets over time

Turning to banks' gross supply and demand of government bonds and other bonds (Figure 2), it is important to note that while holdings include all government bonds with a 0% RW under the Basel 2 Standardized Approach, the data on supply and demand only includes Dutch government bonds.

Figure 2: Supply and demand of government and other bonds

a: Buying (left) and selling (right)

b: Buying (left) and selling (right)

c: Government bonds in total assets

d: Other bonds in total assets

Looking at banks' demand and supply of government bonds (Figure 2a), we can see large differences among banks but also over time. One bank buys government bonds amounting on average to 3% of total assets while most other banks buy on average 1% of total assets in government bonds. Most banks show larger demand than supply. While one bank's supply amounts on average to 2% of total assets, most banks sell about 0.5%. The fact that banks' supply appears smaller than demand is confirmed by Figure 2c, which shows that except for two months, aggregate demand is larger than supply. Comparing this to Figure 1 where we can observe decreasing holdings, the data suggests that Dutch banks seem to have decreased their government bond holdings in general while at the same time buying more Dutch government bonds. A likely reason for this is that the rating of the

Netherlands remained stable at AAA while several European countries suffered (significant) downgrades during the sample period. This pattern can either be interpreted as a flight-to-quality or a potential home bias.

Banks' demand and supply of other bonds follows a similar pattern (Figure 2b). However, volumes are considerably smaller (roughly a factor of 10) and show higher volatility across banks and over time.

Finally, it is important to understand whether there is a structural correlation between banks' capital and liquidity position and their gross demand and supply of government bonds. It could for instance be that banks which trade large volumes rationally decide to hold lower liquidity buffers. The reason for this could be that liquidity buffers are an insurance against liquidity shocks. A bank with large trading volumes has very good market access and therefore less need to insure itself against large shocks.[15]

The data shows no evidence of banks' regulatory capital and liquidity position playing a significant role in determining their gross demand and supply of government bonds or other bonds.[16] Rather, current prices and the relative rating of the Netherlands compared to its peers seems to determine banks' behavior in this regard.

3.3. Daily net demand

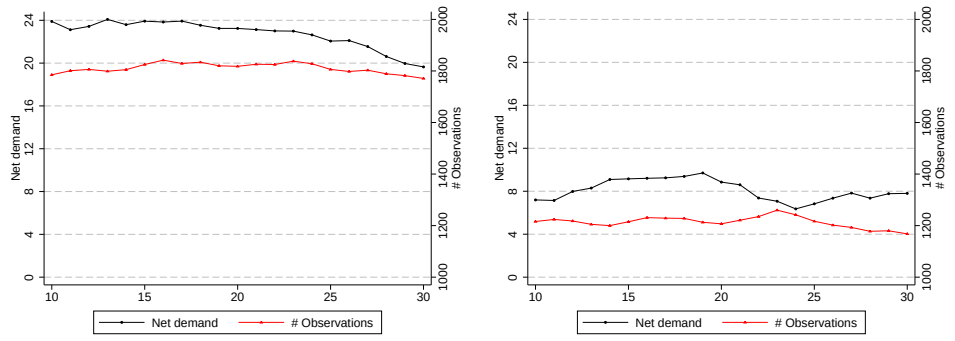
Since the purpose of this paper is to distinguish *regulatory* from *internal* effects, it is important to understand banks' trading patterns throughout a month. Figure 3 shows banks' average net demand for government bonds (Figure 3a) and other bonds (Figure 3b) over buckets consisting of 10 days as well as the corresponding number of observations.[17] Day 12, for instance, refers to banks' average net demand between day 3 and day 12.

[15] For more information on the incentives of banks to hold liquidity buffers, see for instance Bonner et al. (2013).

[16] See Tables 4 and 5 in the appendix.

[17] Banks' net demand is calculated as the difference between institution i's gross demand and gross supply of bond b (government bond or other bonds) in percentage of its average daily gross demand during the year. The number of observations corresponds with the total number of trades executed by banks that are at least once every day active as buyer and seller.

Figure 3: Net buying volume of government bonds and other bonds



a: Government bonds

b: Other bonds

Figure 3a shows that banks' net demand for government bonds is fairly stable throughout a month and only shows a slight downward slope towards the end of the month. The average over the entire month is 22.74% with 19.65% and 24.08% being the minimum and maximum respectively. A similar pattern can be observed for the number of observations. An important takeaway from Figure 3a is that on aggregate banks do not seem to increase but rather decrease their demand for government bonds towards the reporting date.

Figure 3b shows that, similar to government bonds, banks' demand for other bonds is stable during the course of the month. However, net demand of other bonds is significantly smaller than net demand for government bonds. The average over the entire sample is 8.08% with the maximum and minimum being 6.36% and 9.70% respectively. In contrast to government bonds, banks' demand for other bonds somewhat increases towards the end of the month. Our data does not suggest the presence of a general *regulatory effect* with all banks buying more government bonds while selling more other bonds right before reporting.

4. Methodology

4.1. General Approach and Endogeneity

The graphical analysis suggests that on aggregate banks do not increase their government bond holdings towards the end of the month. However, since we are

mainly interested in the impact of financial regulation, it is important to distinguish banks according to their regulatory position. To understand the impact of regulation, we are assessing on which days of the month a bank's regulatory capital and liquidity position has a significant impact on its net demand for government bonds and other bonds.

The hypothesis is that if a low regulatory liquidity or capital position in month m-1 affects banks' demand over the entire month m, it cannot be established whether this is caused by a *regulatory effect* or an *internal effect*. If, however, a bank's demand is only affected during the last few days before reporting, we have a strong indication for the presence of a *regulatory effect*. To conduct this analysis, the regression function is looped over 10 day buckets.

Since we are analyzing banks' demand for government bonds compared to other bonds, the application of Seemingly Unrelated Regressions (SUR) seems the appropriate approach.[18] SUR is a system of linear equations with only exogenous regressors. The key difference to OLS is that it assumes that the errors are correlated across equations but not individuals. It is very likely that banks' demand for government bonds is partially driven by some unobserved factors which are highly correlated to the unobserved factors driving the same banks' demand for other bonds. SUR allows nonzero covariance between the error terms of the equations with government bonds and other bonds as dependent variables.

While SUR seems a suitable approach for the purpose of this analysis, there are shortcomings which need to be addressed. Firstly and similar to pooled OLS, SUR requires all explanatory variables to be exogenous. While the assumption of exogeneity is likely to hold for the macroeconomic controls, the bank-specific factors might be subject to endogeneity. To address this issue, we instrument all bank-specific variables with their lags. Since it is implausible that an institution's demand for government bonds in period t affects its profitability and return on equity in t-1, the issue of endogeneity seems sufficiently addressed.

A bank's capital and liquidity positions are also instrumented by their lags, since the purpose of this paper is to analyze whether a bank's capital and liquidity ratios in month m-1 affect its demand for government bonds in period m.

[18] See the seminal contribution of Zellner (1962) and a literature overview by Fiebig (2001).

Another potential problem is that SUR assumes that there is no correlation of the error term across individuals. However, in case of an unobserved macroeconomic shock there would be correlation of the error terms. Although this does not make SUR a biased estimator, we address this issue with including time-dummies which correct for these potential correlations.

In addition, we perform Hausman tests, which indicate that fixed effects would be preferred over random effects as the independent variables and bank-specific effects are correlated. These results motivate the inclusion of bank dummies in the SUR regressions.

4.2. The Model

The baseline regression takes the following form:

$$\begin{aligned} \textit{Net Demand}_{i,b,d} = {} & \beta_0 + \beta_1 (\textit{Liquidity ratio} - 100\%)_{i,m-1} + \beta_2 (\textit{Capital ratio} - 100\%)_{i,m-1} \\ & + \beta_2 \textit{Reserves}_{i,d} + \beta_3 \textit{Controls}_{(i,b),m(-1)} + \varepsilon_{i,m} \end{aligned} \tag{3}$$

where $\textit{Net Demand}_{i,b,d}$ refers to the difference between institution i's gross demand and gross supply of bond b (government bond or other bonds) on day d in percentage of its average daily gross demand during the year.

$(\textit{Liquidity ratio} - 100\%)_{i,m-1}$ describes the distance of an institution's actual liquidity position in month m-1 from its regulatory threshold of 100%. Similarly, $(\textit{Capital ratio} - 100\%)_{i,m-1}$ refers to the difference between an institution's capital ratio in month m-1 and the regulatory threshold of 8%. Defining the ratios that way ensures that the intercepts reflect the value of the regressions functions at the regulatory threshold.[19] $\textit{Reserves}_{i,d}$ refers to an institution's daily fulfilment of its minimum central bank reserve requirement.

$\textit{Controls}_{(i,b),m(-1)}$ includes a combination of macroeconomic, bond-specific (b) and other bank-specific (i) variables in month m (for the macroeconomic and bond-specific variables) or m-1 (for the other bank-specific variables). Specifically, the additional control variables include an institution's profitability (net income as percentage of total assets), return on equity (income as percentage of total equity), the

[19] See for instance Lee and Lemieux (2010).

EONIA interest rate, the GDP growth rate of the European Union, the government debt of the Netherlands as percentage of GDP, the average price of an institution's monthly trades as well as the relative rating of the Netherlands compared to its peers (Germany, Finland, France, Austria and Belgium).[20] We run all regressions both with and without including bank-specific dummies.

The error term $\varepsilon_{i,m}$ is standard for SUR, meaning that it is institution-specific and period-specific but the same across different types of bonds.

5. Results

5.1. Reading the figures

Figures 4 and 5 present the results obtained using SUR with and without including bank-specific dummies. The analysis aims at explaining the impact of banks' regulatory capital and liquidity position on their demand for government bonds.

The dependent variable reflects the difference between institution i's gross demand and gross supply of bond b (government bond or other bonds) on day d in percentage of its average daily gross demand for bond b during the year.

Apart from the presented coefficients for the *DLCR* (distance of an institution's DLCR to the 100% regulatory threshold) and *Capital* (distance of an institution's regulatory capital holdings to the 8% threshold), all regressions include a large number of additional control variables.

The regressions are looped over blocks consisting of 10 days over the course of the month, plotted on the x-axis in the figures below. For instance, on day 13 in Figure 4 we can see the coefficient of regressing the DLCR in month m-1 on banks' daily net demand during day 4 to 13 of month m. Day 28 reflects banks' daily net demand from day 19 to 28. Areas represent statistically significant values while "x" points to insignificance.[21]

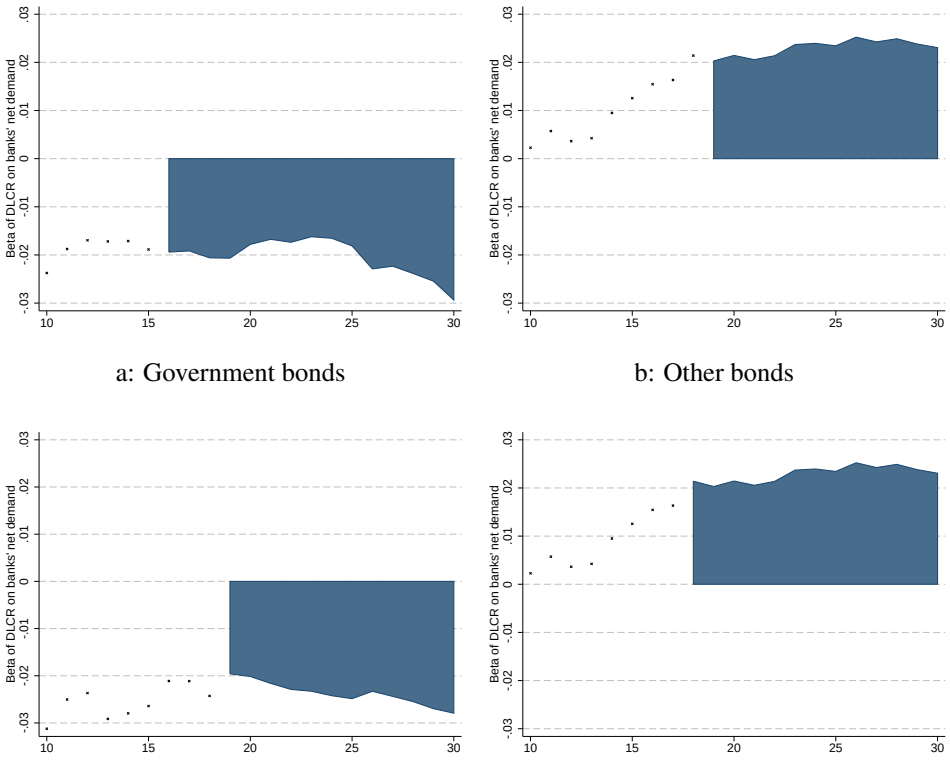
[20] To calculate the relative rating we convert the country-specific ratings to numeric values (AAA=1) and divide the Netherlands' rating by the average rating of its peers. In case a country is put on "negative watch", we reduce the rating by 0.5.

[21] Please note that the figures exclude insignificant outliers.

5.2. Liquidity

Figure 4 shows that banks' regulatory liquidity position significantly affects their demand for government bonds. The liquidity requirement seems to cause a substitution effect with banks close to their regulatory threshold buying more government bonds while selling other bonds. Figure 4 also suggests that banks' increased demand is a persistent rather than a short-term change, suggesting increased long-term holdings of government bonds due to a liquidity requirement.

Figure 4: Impact of regulatory liquidity on banks' daily demand



a: Government bonds

b: Other bonds

c: Government bonds (bank dummies)

d: Other bonds (bank dummies)

Figure 4 shows that banks' liquidity position determines their demand for government bonds as well as other bonds. More specifically, we can see that a higher DLCR in the previous period causes banks to reduce their demand for government bonds while it increases their supply of other types of bonds. This effect is in line

with the previously described theory regarding the functioning of a liquidity ratio. Government bonds can be counted fully towards the liquidity requirement while other bonds can only be included up to a certain extent. As such, when running the risk of becoming non-compliant with the requirement, banks are incentivized to substitute other bonds with government bonds.

Figure 4a presents the regression coefficients of the DLCR on banks' demand for government bonds when bank dummies are not included. We can see that banks' regulatory liquidity position does not seem to affect banks' demand for government bonds in the first half of the following month. However, from the 16th day until the end of the month, a 1% higher DLCR reduces banks' net demand for government bonds between 0.016% and 0.029% of average demand. Alternatively, an increase of the DLCR from the 25th percentile to the 75th percentile, reduces banks' demand for government bonds between 1.49% and 2.08%. On top of that, we can observe a downward slope towards the end of the month.

Figure 4b shows that a bank's regulatory liquidity position in period m-1 does not affect its demand for other bonds during the first half of month m. However, from day 19 banks with lower liquidity holdings seem to increase their supply of other bonds, substituting them for government bonds. Specifically, a 1% lower DLCR increases banks net supply of other bonds between 0.020% and 0.025% and is therefore in terms of economic significance very similar to Figure 4a. Similarly, an increase from the 25th percentile to the 75th percentile causes supply to increase between 1.49% and 1.86%.

Including bank-specific dummies (Figures 4c and 4d) does not change the overall pattern of our results. Starting from day 19, a 1% higher DLCR reduces banks' demand for government bonds between 0.020% and 0.028% of average demand while it increases their net demand for other bonds.

If a bank's regulatory liquidity position affects its demand for government bonds for the entire month, it cannot be established whether this effect comes from regulation or from banks' internal risk management targets. With the DLCR affecting banks' demand earliest from day 16, we conclude that there is limited evidence of an *internal effect* incentivizing banks with lower liquidity holdings to attract more government bonds or sell more other bonds. The combined evidence of the DLCR affecting banks' demand only towards the end of the month and the slopes presen-

ted in Figure 4 shows clear signs of a *regulatory effect*, suggesting that the DLCR incentivizes banks to substitute government bonds for other bonds. On top of that, banks do not seem to sell their government bonds right after reporting, pointing towards a longer-term increase of government bonds.[22]

5.3. Capital

Figure 5 shows that the capital requirement significantly increases banks' demand for government bonds while it decreases demand for other bonds. Similar to liquidity, we do not find evidence of banks increasing their supply after reporting, leading us to hypothesize that capital regulation has a longer-term impact on banks' government holdings.

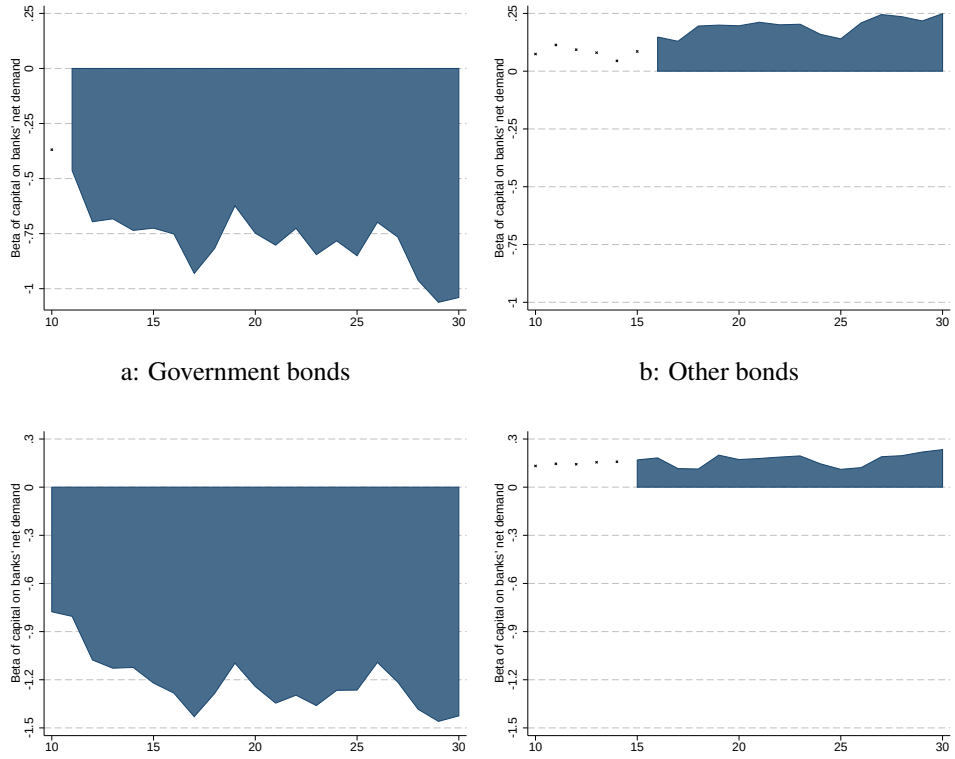
Similar to liquidity, Figure 5 shows that the regulatory capital position is an important determinant of banks' demand for government bonds. Specifically we can see that a lower regulatory capital ratio in the previous month causes banks to buy considerably more government bonds and sell moderately more other bonds.

Figure 5a shows that a 1% higher capital ratio reduces banks' demand for government bonds by 0.46% and 1.06%. The effect is already significant from the beginning of the month or day 11 when bank dummies are not included. On top of that, we can see a downward trend towards the end of the month. To put these results in perspective to liquidity, an increase of the capital ratio from the 25th to the 75th percentile reduces banks' demand between 2.60% and 5.96%. As such, the economic significance of capital regulation is significantly larger compared to liquidity regulation.

Capital regulation seems to cause a similar substitution effect as liquidity regulation. As can be seen in Figure 5b, a 1% higher regulatory capital ratio increases banks' demand for other bonds between 0.11% (0.13%) and 0.23% (0.25%) when bank dummies are (not) included. Again, the coefficient is highest right before reporting and significant results appear from day 15.

[22] It could also be that banks not rebalancing their increased holdings right after reporting is a lagged holding effect with banks waiting for good opportunities to sell. However, we excluded this possibility with checking the correlation coefficients of banks' demand in one month and the following 6 months. In any case, banks not rebalancing right away at least suggests that we observe a somewhat longer-term effect as opposed to regulatory arbitrage.

Figure 5: Impact of regulatory capital on banks' daily demand



a: Government bonds

b: Other bonds

c: Government bonds (bank dummies)

d: Other bonds (bank dummies)

Our results point to capital regulation causing a substitution effect with banks buying more government bonds while selling more other bonds. There are no signs of banks increasing their supply of government bonds right after reporting, indicating that capital regulation leads to a longer-term increase in banks' government bond holdings.

5.4. Average reserve requirement and other variables

Banks' daily fulfillment of the average reserve requirement significantly affects their demand for government bonds in the first half of the month. Specifically, we can see that the closer a bank is to fulfil its reserve requirement, the lower its demand for government bonds. The closer a bank is to the end of the remittance

period of the reserve requirement, the larger is its demand for government bonds. The combination of these results suggests that banks "frontload" their fulfilment of the average reserve requirement (higher demand for government bonds closer to the remittance date) and that central bank reserves are a substitute for government bonds (the higher a banks' reserves before reporting, the lower its demand for government bonds).

The results suggest that being 1% closer to fulfilling the reserve requirement causes banks to reduce their demand for government bonds between 0.005% and 0.010%. An increase from the 25th to the 75th percentile reduces the demand between 0.18% and 0.35%. In contrast to the regulatory liquidity and capital position, however, the effect is only significant during the first half of the month. It is likely that this effect stems from the end of the remittance period of the reserve requirement. Since those banks need more cash and less government bonds, the fact that demand for government bonds is higher for banks with lower reserves around the end of the remittance period is counterintuitive at first. However, this effect is likely to be caused by cash being a substitute for government bonds in the liquidity and capital requirement. With the exception of a very small number of outliers, all banks in the sample are very close to fulfilling the average reserve requirement already one week before the end of the remittance period. As such, banks with higher reserves demand less government bonds because they are holding a perfect substitute.[23] The average reserve requirement does not seem to affect banks' demand for other bonds.

Looking at the role of the other control variables during the course of the month, we can see that most of them only play a role at the beginning of the month but not afterwards.

Until day 18, the EONIA interest rate has a significant positive impact on banks' demand for government bonds while it turns insignificant afterwards. Similarly, the GDP growth rate of the EU as well as the relative rating of the Netherlands play an important role until the 16th and 18th day of the month but not afterwards.

[23] Please note that the difference between the interest rates on the ECB deposit facility and the yield on Dutch government bonds was negligibly small during the period June 2009 to December 2012.

The yield on government bonds, on the other hand, reduces banks' demand thereof over the entire month while banks' profitability shows a positive interaction with demand for government bonds from day 9 until the end.

Although the evidence is less clear in this regard, these results can be interpreted that at the beginning of the month, the demand for government bonds is driven by several bank-specific and macroeconomic variables. Closer to reporting, however, most of these determinants are substituted by regulatory effects.

6. Government bond holdings and bank behavior

The previous section suggests that regulation increases banks' demand and holdings of government bonds while it decreases the stock of other bonds. While this is an important insight, it is important to understand the potential impact of banks substituting other types of bonds with government bonds.

The existing literature points to two variables of interest: 1) banks' profitability, and 2) banks' lending to the private sector. Additionally, one would like to specifically understand the interaction of government bond holdings with these two variables during normal times and during stress.

Analyzing the European sovereign debt crisis, Acharya and Steffen (2013) find that high government bond holdings of peripheral European countries (e.g. Greece or Portugal) increase banks' returns while high holdings of bonds issued by core European countries (especially Germany) have a negative impact on banks' returns. Since Dutch government bonds are usually traded in a peer group with German bonds, we expect a negative impact on banks' returns.[24]

Regarding lending, one can distinguish two ways through which government bond holdings affect credit supply.[25] The first one is direct and also explained in Gennaioli et al. (2012). A sovereign crisis has a relatively larger negative impact on the asset value of institutions with high government bond holdings.[26] Losses on

[24] Please note that we do not have structural, detailed information on the distribution of banks' government bond holdings. The available information, however, suggests that the banks in our sample mainly hold German and Dutch government bonds.

[25] Also see Popov and Van Horen (2013).

[26] This reduction in the value of banks' assets is likely to occur during crisis and since it is equivalent to a large counterparty default, straightforward in case of a government default.

sovereign debt can reduce the profitability of the bank and also raise concerns about counterparty risk, which in turn will have an adverse impact on the availability and cost of funding. Second, Holmstroem and Tirole (1993) as well as Popov and Van Horen (2013) argue that sovereign debt is usually a reliable source of liquidity and collateral. Increased sovereign risk would therefore reduce the value of an important funding source.

Most analyses studying the link from increased government bond holdings and credit issuances argue that regulation is a key driver of banks' government bond holdings. For their analysis, Gennaioli et al. (2012) as well as Popov and Van Horen (2013), use an absolute measure of government bond holdings (e.g. government bond holdings in percentage of total assets). As shown by our analysis, rather than only increasing banks' absolute holdings of government bonds, financial regulation is likely to increase banks' relative holdings of government bonds compared to other bonds.

Against this background, we are analyzing the impact of banks' relative holdings of government bonds on lending and profitability during sovereign and banking crises.

Since we do not use the MiFID data for this final step, it is possible to obtain data for the period from July 2003 to December 2012. The main advantage of using such a long time series is that it allows the identification of both pure sovereign and banking stress as well as a period of combined sovereign and banking stress.

Although setting the start and end date of a crisis is always connected to some form of subjective judgement, we believe defining October 2009 as the beginning of the sovereign debt crisis to be appropriate. In October 2009, Greece revealed that it significantly underreported its budget deficit. Large upward corrections were not limited to Greece but also affected other countries, such as the United States and the United Kingdom. Latest by December 2009, fears of European sovereign defaults have developed among investors. The end date is set at December 2012 which coincides with the latest observation in the dataset.

Regarding banking stress, a recent study by the European Systemic Risk Board (ESRB) points to two recent periods: 1) October 6th 2008 to February 2nd 2009,

and 2) September 26th 2011 to February 8th 2012.[27] As such, the first period is defined as banking crisis while the second period reflects a combination of banking and sovereign stress.
The regression function is defined as follows:

$$\begin{aligned} Impact_{i,m} = \beta_0 + \beta_1 Bondratio_{i,m-1} + \beta_2 Crisis\ dummy_m + \beta_3 Bondratio * crisis_{i,m-1} \\ + \beta_4 Bond\ holdings_{i,m-1} + \beta_5 Demand_{i,m} \beta_6 Controls_{i,m(-1)} + \varepsilon_{i,m} \end{aligned} \tag{4}$$

where $Impact_{i,m}$ refers to either institution i's lending to the private sector or its net income in month m. Both dependent variables are expressed as percentage of total assets. The key explanatory variable $Bondratio_{i,m-1}$ describes the share of government bonds in other bonds of institution i in month m-1. $Crisis\ dummy_m$ is a dummy describing banking, sovereign or combined crises while $Bondratio * crisis_{i,m-1}$ is an interaction term. $Bond\ holdings_{i,m-1}$ is defined as institutions' total bond holdings (sum of government bonds and other bonds) in percentage of total assets. As common in the literature, we also include $Demand_{i,m}$ to capture the demand side of bank lending.[28] $Demand_{i,m}$ is calculated as the exposure weighted average growth rate of the economic sectors, institution i is lending to in month m. Finally, $Controls_{i,m(-1)}$ include institutions' lagged net income in percentage of total assets, the GDP growth rate of the Netherlands as well as the EONIA interest rate.[29] All regressions are estimated with pooled OLS and include clustered robust standard errors and bank dummies.[30]

The variable *Bondratio* has a mean of 11.73 and a median of 1.74. The 25th percentile is 0.63 while the 75th percentile amounts to 6.02. These figures imply that the median institution's government bond holdings are about twice its holdings of other bonds. The mean of almost 12, however, implies that there are institutions with substantially larger government bond holdings compared to other bonds. This is confirmed by the 99th percentile amounting to 181.

[27] See ESRB (2014).
[28] See for instance Popov and Van Horen (2013) as well as Brown et al. (2010), Fabbro and Hack (2011) or Deans and Stewart (2012).
[29] The extended version of Table 1 can be found in the appendix (Table 6).
[30] Results without bank dummies are presented in Table 7 in the appendix.

Table 1: Bond holdings, lending and profitability

	Lending				Profitability			
	1	2	3	4	5	6	7	8
Bondratio (gov. bonds over other bonds, lagged) 0.102***	0.108***	0.116***	0.103***	-0.003***	-0.003***	-0.002***	-0.002***	
	(0.021)	(0.018)	(0.020)	(0.021)	(0.000)	(0.000)	(0.001)	(0.000)
Bondratio * sov.crisis		-3.785***				0.000		
		(1.355)				(0.001)		
Sovereign crisis		-12.908***				0.122*		
		(1.580)				(0.063)		
Bondratio * bank. crisis			-2.458***				-0.001	
			(0.651)				(0.001)	
Banking crisis			-4.460*				-0.053	
			(2.437)				(0.087)	
Bondratio * combined				2.285				-0.001
				(3.314)				(0.001)
Combined crisis				-7.958				-0.065
				(5.518)				(0.119)
Total bonds in % total assets (lagged)	-0.320**	-0.053	-0.094	-0.307**	0.007***	0.007***	0.007***	0.007***
	(0.139)	(0.136)	(0.151)	(0.140)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	224	224	224	224	3020	3020	3020	3020
R^2	0.745	0.808	0.761	0.749	0.437	0.437	0.437	0.437

*Note: The table presents results of regressions estimated with pooled OLS estimations including lagged variables, bank dummies and clustered standard errors. The dependent variable is either banks' lending to the private sector or their net income over total equity. Apart from the presented variables, the regressions includes a number of bank-specific and macroeconomic variables. An extended version of this table can be found in the appendix. Statistical significance is indicated by *** p<0.01, ** p<0.05, * p<0.1 while standard errors are in parentheses.*

Table 1 shows that higher relative government bond holdings have a positive impact on lending during normal times but reduce banks' lending during sovereign and banking crises. Profitability is negatively affected by relatively higher government bond holdings during normal times but not during stress.

Table 1 shows that a relative increase of government bond holdings by 1 unit (1 standard deviation) increases banks' lending to the private sector by 0.10pp (5.5pp).[31] During sovereign and liquidity stress, however, a 1 unit relative increase in government bond holdings reduces lending by 3.8pp and 2.5pp respectively. While the three crisis dummies show the expected negative impact, banks' *Bondratio* does not seem to affect lending during the combined scenario.

The analysis further shows that 1 unit higher government bond holdings reduce banks' profitability by 0.003pp. However, during the 3 different crises this negative impact diminishes, making government bond holdings an insignificant factor.[32]

Summarizing, Table 1 shows that during normal times high government holdings seem to increase banks' lending to the private sector and reduce profitability.

[31] To recall, unit refers in this regard to a bank's holdings of other bonds.

[32] Our OLS estimations show even a positive impact of government bond holdings on banks' returns during stress (Table 7).

During banking and sovereign crises, however, government bond holdings reduce banks' lending but do no longer have a negative impact on banks' profitability.

The negative effect of higher government bond holdings, especially when rated AAA, on banks' profits is straightforward and also found in Acharya and Steffen (2013). However, during the most severe crises this negative impact on banks' profitability diminishes, suggesting that at least high quality government bonds are a relatively stable source of liquidity and collateral, giving banks access to funding. As such, the relatively higher opportunity costs of holding government bonds is offset during stress, when government bonds continue to be a stable source of funding.

Our results regarding lending are related to Gennaioli et al. (2012) and Popov and Van Horen (2013). However, while these two studies focus on failed or nearly failed governments, the banks in our sample hold mainly Dutch and German government bonds.[33] Our results therefore suggest that even high quality government bonds have a negative impact on banks' lending during stress. A likely reason for this effect is that, although they maintained their high ratings, also European core government bonds were subject to high price volatility and uncertainty.

7. Shortcomings

Although this is the first study, attempting to directly estimate the impact of capital and liquidity regulation on banks' demand for government bonds, a few caveats are due.

As the MiFID data only includes Dutch government bonds, the time series does not include a rating downgrade. However, the Netherlands has been put on "negative watch" a few times during our sample period, allowing us to at least partially control for the impact of downgrades. Additionally, all our regressions include the relative rating of the Netherlands compared to its peers (Germany, France, Belgium, Finland and Austria), which can be expected to additionally account for these dynamics.

[33] Note that this is additionally confirmed by the negative impact of government bond holdings on profitability. In case of peripheral countries, one would expect positive returns as found by Acharya and Steffen (2013).

As we combine two datasets with different means of consolidation, there is a risk of a measurement bias.[34] To address this bias and although it implies dropping parts of the dataset, we exclude all entities which do not belong to a Dutch group. Since we have more detailed information on the Dutch entities, we are able to match the different datasets minimizing a measurement bias.

The analysis in this paper aims at capturing the impact of preferential treatment on banks' demand for government bonds and, in a second step, the impact of high government bond holdings on bank lending and profitability. Although the paper includes a clear link to the real economy, it remains a partial analysis. To draw firm policy conclusions from this analysis one would need to more broadly account for the impact of increased government spending on the economy as a whole.

8. Conclusion

Government bonds receive preferential treatment in financial regulation. The purpose of this paper is to analyze whether this preferential treatment increases banks' demand for government bonds beyond their own risk appetite. The final step of the analysis aims at capturing the impact of high government bond holdings on banks' profitability and lending to the real economy.

The results in this paper suggest that preferential treatment in both capital and liquidity regulation increases banks' demand for government bonds. On top of that, it seems to cause a substitution effect with banks buying more government bonds while selling more other bonds. The analysis also points to both types of regulation leading to a permanent increase of banks' government bond holdings.

The results in this paper further suggest that high government bond holdings were associated with higher lending and lower profits during normal times. During liquidity or sovereign crises, however, high government bond holdings are associated with less lending to the real economy but not with lower profits.

Financial regulation changes banks' behavior and is therefore an important determinant of banks' government bond holdings. The rationale behind favorable

[34] The MiFID database is reported on a solo level while the bank-specific supervisory data refers to the fully consolidated balance sheet.

treatment in financial regulation is the view that government bonds are risk-free assets making them a reliable source of liquidity and collateral. While there seems to be a positive impact during normal times, the results in this paper suggest that government bond holdings have a negative impact on lending during stress. At the same time, the opportunity costs of holding government bonds and the implied negative impact on profits seem to be compensated by government bonds being a reliable source of funding, even during stress. This combination of positive and negative effects during stress suggests that there is scope to consider a more risk-sensitive approach to government bonds. The fact that our sample mainly includes high rated government bonds, further suggests that there are additional factors, such as price volatility, which should be taken into consideration when estimating the risk of government exposure.

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Appendix

Table 2 – Summary statistics

Variable	Mean	Std.Dev.	Min	Max
Net demand government bonds	22	25	-61	123
Net demand other bonds	8	42	-98	152
Liquidity ratio - 100%	151	155	-47	809
Capital ratio - 8%	10	5	-0.09	32
Net income in % total assets	0.23	0.74	-1	5
Net income in % total capital	0.82	4	-18	17
EONIA	0.49	0.28	0.07	1
GDP growth rate EU	0.19	0.37	-0.48	0.90
Government debt in % GDP	55	2	49	57
Rating NL over average peers' rating	0.77	0.06	0.68	0.83
Government bonds as share of other bonds	14	53	0.03	235
Private sector lending in % total assets	39	13	12	62

Note: The above table shows summary statistics for all relevant variables.

Table 3: Results of Figures 4 and 5 - Examples of Day 5 and 22

	Government Bonds				Other bonds			
METHOD	Day 12	Day 22	Day 12	Day 22	Day 12	Day 22	Day 12	Day 22
DLCR (lagged)	-0.017	-0.017***	-0.024	0.023***	0.004	0.021***	0.004	0.021***
	(0.014)	(0.005)	(0.016)	(0.007)	(0.016)	(0.007)	(0.018)	(0.005)
Capital (lagged)	-0.696**	-0.726***	-1.077***	-1.296***	0.093	0.200***	0.142	0.187***
	(0.280)	(0.270)	(0.293)	(0.281)	(0.142)	(0.074)	(0.128)	(0.078)
Reserve	-0.009**	-0.002	-0.008**	-0.002	0.000	0.002	0.000	0.001
	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
Days to remittance	-0.042	-0.267**	-0.047	-0.275**	0.128	-0.120	0.126	-0.103
	(0.115)	(0.119)	(0.125)	(0.129)	(0.131)	(0.132)	(0.130)	(0.151)
Net income (lagged)	25.855*	20.046	20.009	9.904	4.822	25.946	13.121	23.828
	(14.836)	(16.758)	(14.714)	(16.552)	(19.252)	(17.926)	(18.728)	(17.719)
RoE (lagged)	-0.911	-0.600	-0.678	-0.197	-0.536	-1.736**	-1.030	-1.726**
	(0.688)	(0.749)	(0.681)	(0.739)	(0.894)	(0.816)	(0.866)	(0.798)
EONIA	-5.504	10.483*	-2.865	12.791**	18.660***	12.780**	17.446***	12.086*
	(5.524)	(5.445)	(5.992)	(5.812)	(6.964)	(6.195)	(6.589)	(6.953)
GDP EU	-0.209	4.817	0.807	5.680	8.926	3.354	9.965*	3.120
	(5.204)	(5.026)	(5.644)	(5.384)	(6.344)	(5.543)	(6.028)	(6.282)
Spread	-41.442***	-24.745	-39.116***	-17.225	-35.166	-87.100***	-39.430	-86.195***
	(15.242)	(20.407)	(15.136)	(20.198)	(29.140)	(23.925)	(26.838)	(23.759)
Government debt	1.010	-0.291	0.939	-0.248	-1.876*	-0.873	-1.988*	-0.869
	(0.964)	(0.902)	(1.040)	(0.966)	(1.135)	(0.977)	(1.075)	(1.111)
Peers rating	6.122	-63.237	-4.175	-73.847	-100.115*	-31.349	-103.516*	-37.343
	(46.812)	(43.810)	(50.790)	(47.125)	(55.935)	(48.527)	(53.598)	(55.122)
Bank dummies	NO	NO	YES	YES	NO	NO	YES	YES
Observations	1769	1794	1769	1794	1068	1205	1185	1205
R^2	0.233	0.213	0.349	0.272	0.249	0.220	0.394	0.240

Note:The table is an example of the results presented in Figure 4 and 5.

Table 4: Total buying entire month

	OLS		IV FE		SUR	
Dependent	Government bonds	Other bonds	Government bonds	Other bonds	Government bonds	Other bonds
DLCR (lagged)	0.00	-0.00	0.00	-0.00	0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Capital (lagged)	0.07***	0.00	0.02	-0.00	0.03	-0.00
	(0.02)	(0.00)	(0.03)	(0.00)	(0.03)	(0.00)
Net income (lagged)	-0.16	-0.00	-0.24**	0.00	-0.25**	0.00
	(0.10)	(0.01)	(0.10)	(0.01)	(0.10)	(0.01)
RoE (lagged)	0.01	-0.00	0.05	-0.00	0.05	-0.00
	(0.04)	(0.00)	(0.04)	(0.00)	(0.04)	(0.00)
EONIA	-0.02	-0.11**	-0.39	-0.12**	-0.37	-0.12**
	(0.67)	(0.06)	(0.63)	(0.06)	(0.73)	(0.05)
GDP EU	-0.43	0.03	-0.73	0.04	-0.70	0.04
	(0.60)	(0.05)	(0.54)	(0.05)	(0.62)	(0.05)
Price	0.03	-0.01**	-0.00	-0.01**	0.00	-0.01**
	(0.04)	(0.00)	(0.04)	(0.00)	(0.04)	(0.00)
Government debt	-0.09	-0.01	-0.04	-0.01	-0.07	-0.01
	(0.12)	(0.01)	(0.11)	(0.01)	(0.13)	(0.01)
Peers rating	-1.26	-0.41	0.61	-0.43	-0.58	-0.43
	(5.28)	(0.45)	(4.82)	(0.45)	(5.60)	(0.43)
Observations	430	354	430	354	354	354
R^2	0.057	0.044	0.236	0.134	0.236	0.134

Note: The table presents results regarding the impact of banks' capital and liquidity position on their gross demand for government and other bonds.

Table 5: Total selling entire month

	OLS		IV FE		SUR	
Dependent	Government bonds	Other bonds	Government bonds	Other bonds	Government bonds	Other bonds
DLCR (lagged)	0.00	-0.00	0.00	-0.00	0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Capital (lagged)	0.07***	0.00	0.02	-0.00	0.03	-0.00
	(0.02)	(0.00)	(0.03)	(0.00)	(0.03)	(0.00)
Net income (lagged)	-0.16	-0.00	-0.24**	0.00	-0.25**	0.00
	(0.10)	(0.01)	(0.10)	(0.01)	(0.10)	(0.01)
RoE (lagged)	0.01	-0.00	0.05	-0.00	0.05	-0.00
	(0.04)	(0.00)	(0.04)	(0.00)	(0.04)	(0.00)
EONIA	-0.02	-0.11**	-0.39	-0.12**	-0.37	-0.12**
	(0.67)	(0.06)	(0.63)	(0.06)	(0.73)	(0.05)
GDP EU	-0.43	0.03	-0.73	0.04	-0.70	0.04
	(0.60)	(0.05)	(0.54)	(0.05)	(0.62)	(0.05)
Price	0.03	-0.01**	-0.00	-0.01**	0.00	-0.01**
	(0.04)	(0.00)	(0.04)	(0.00)	(0.04)	(0.00)
Government debt	-0.09	-0.01	-0.04	-0.01	-0.07	-0.01
	(0.12)	(0.01)	(0.11)	(0.01)	(0.13)	(0.01)
Peers rating	-1.26	-0.41	0.61	-0.43	-0.58	-0.43
	(5.28)	(0.45)	(4.82)	(0.45)	(5.60)	(0.43)
Observations	430	354	430	354	354	354
R^2	0.057	0.044	0.253	0.305	0.236	0.134

Note: The table presents results regarding the impact of banks' capital and liquidity position on their gross demand for government and other bonds.

Table 6: Bond holdings, lending and profitability - Extended

	Lending				Profitability			
	1	2	3	4	5	6	7	8
Bondratio (gov. bonds over other bonds, lagged) 0.102***	0.108***	0.116***	0.103***	-0.003***	-0.003***	-0.002***	-0.002***	
	(0.021)	(0.018)	(0.020)	(0.021)	(0.000)	(0.000)	(0.001)	(0.000)
Bondratio * sov.crisis		-3.785***				0.000		
		(1.355)				(0.001)		
Sovereign crisis		-12.908***				0.122*		
		(1.580)				(0.063)		
Bondratio * bank. crisis			-2.458***				-0.001	
			(0.651)				(0.001)	
Banking crisis			-4.460*				-0.053	
			(2.437)				(0.087)	
Bondratio * combined				2.285				-0.001
				(3.314)				(0.001)
Combined crisis				-7.958				-0.065
				(5.518)				(0.119)
Total bonds in % total assets (lagged)	-0.320**	-0.053	-0.094	-0.307**	0.007***	0.007***	0.007***	0.007***
	(0.139)	(0.136)	(0.151)	(0.140)	(0.002)	(0.002)	(0.002)	(0.002)
GDP NL	0.877	1.235*	0.094	0.680	0.077***	0.062**	0.062	0.074***
	(0.661)	(0.707)	(0.951)	(0.669)	(0.027)	(0.028)	(0.039)	(0.027)
EONIA	2.951***	0.397	2.235***	2.893***	0.005	0.034	0.004	0.004
	(0.412)	(0.480)	(0.443)	(0.412)	(0.016)	(0.022)	(0.016)	(0.016)
Return on equity (lagged)	0.002	-0.011	0.007	0.001				
	(0.030)	(0.027)	(0.030)	(0.030)				
Demand	6.071	11.044***	8.505**	6.100				
	(4.191)	(3.709)	(4.133)	(4.196)				
Observations	224	224	224	224	3020	3020	3020	3020
R^2	0.745	0.808	0.761	0.749	0.437	0.437	0.437	0.437

Note: The table is the extended version of Table 1.

Table 7: Bond holdings, lending and profitability without bank dummies

	Lending				Profitability			
	1	2	3	4	5	6	7	8
Bondratio (gov. bonds over other bonds, lagged)	0.100***	0.072***	0.079***	0.097***	0.001	0.000	0.001	0.000
	(0.027)	(0.028)	(0.028)	(0.027)	(0.000)	(0.000)	(0.001)	(0.000)
Bondratio * sov.crisis		-4.672**				0.003**		
		(2.152)				(0.001)		
Sovereign crisis		-10.014***				0.206***		
		(2.556)				(0.077)		
Bondratio * bank. crisis			-2.310***				0.000	
			(0.852)				(0.001)	
Banking crisis			-9.172**				-0.032	
			(3.774)				(0.114)	
Bondratio * combined				-4.488				0.004***
				(5.471)				(0.001)
Combined crisis				-0.357				-0.323**
				(9.412)				(0.155)
Total bonds in % total assets (lagged)	0.290***	0.322***	0.304***	0.287***	0.001	0.001	0.001	0.001
	(0.059)	(0.058)	(0.058)	(0.059)	(0.002)	(0.002)	(0.002)	(0.002)
GDP NL	-0.740	-1.525	-3.414**	-1.093	0.047	0.035	0.036	0.040
	(1.094)	(1.331)	(1.617)	(1.112)	(0.034)	(0.036)	(0.051)	(0.035)
EONIA	1.928***	-0.203	1.157	1.788***	-0.032	0.020	-0.030	-0.035*
	(0.635)	(0.820)	(0.702)	(0.639)	(0.019)	(0.028)	(0.020)	(0.019)
Return on equity (lagged)	-0.093*	-0.094*	-0.085*	-0.094*				
	(0.050)	(0.049)	(0.049)	(0.050)				
Demand	11.269	15.781**	13.740*	10.782				
	(7.148)	(7.060)	(7.148)	(7.147)				
Observations	224	224	224	224	3020	3020	3020	3020
R^2	0.214	0.270	0.251	0.226	0.092	0.096	0.092	0.095

Note: The table presents the same analysis as Table 1 but without bank dummies.

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