On the relationship between regulatory liquidity and bank lending in the euro area

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Using an extensive bank-level dataset, we attempt to disentangle the impact of the introduction of regulatory liquidity ratios from other confounding events, such as the effects of unconventional monetary policy, on lending by eurozone banks. In a difference in difference setting, we exploit the variation in bank liquidity ratios prior to the introduction of Basel III to examine whether liquidity constrained banks cut lending more aggressively. We account for supply and demand factors and for the effect of the ECB's Very Long-Term Refinancing Operations and the more recent Targeted Longer-Term Refinancing Operations. Overall, lending does not appear to have been affected by the introduction of the Net Stable Funding Ratio, although medium and long-term lending are affected. The ECB's Targeted Longer-Term Refinancing Operations have yet to generate a positive impact on bank lending, whereas the Very Long-Term Refinancing Operations have been ineffective in stimulating the supply of credit to the economy, especially for those banks not compliant with the Basel III liquidity ratios.

Keywords: structural liquidity, Basel III, bank lending, ECB's unconventional liquidity injections.

JEL Classification: *G*01, *G*21

1. Introduction

In this paper we attempt to disentangle the impact of different regulatory actions, taken in the wake of the global financial crisis, on lending by EU banks. Basel III, the new regulatory framework issued by the Basel Committee for Banking Supervision in 2010, significantly increased capital requirements for banks and introduced new regulatory liquidity requirements, the Net Stable Funding Ratio (NSFR) and the Liquidity Coverage Ratio (LCR). However, the implications of these new regulatory liquidity requirements on bank strategic behaviour, in particular on bank lending, are still unclear (BCBS, 2016). Banks can implement diffierent strategies to meet the liquidity requirements, which are likely to have different welfare implications. For example, a bank could increase the NSFR, our variable of interest, by changing its balance sheet size or modifying the composition of its assets or liabilities (see Figure 1). While increasing liquidity is generally considered 'good', deleveraging has potentially negative consequences for the real economy.

[Insert Figure 1 about here]

The multiple potential adjustment dimensions and scarcity of historical episodes to evaluate the response of banks to a tightening of liquidity regulation has created a wide range of views about the impact of Basel III liquidity ratios on bank lending. Financial industry groups have argued that liquidity regulation substantially increases the cost of funding and could damage the real economy as banks reduce credit supply and pass on higher costs to borrowers (Institute of International Finance - IIF, 2011). Others have argued that liquidity regulation will have a more limited impact (Macroeconomic Assessment Group - MAG, 2010; European Banking Authority - EBA, 2015). The empirical evidence on the impact of liquidity requirements on the composition of assets is limited and it is based on the liquidity requirements (similar to the LCR) imposed in some countries prior to Basel III (such as United Kingdom and Netherlands). More specifically, these empirical analyses suggest that neither lending to the real economy nor output will be significantly affected

by the imposition of the LCR (Banerjee and Mio, 2015; Bonner, 2015). This is consistent with the reports of the MAG (2010) and EBA (2015). The empirical literature that has analysed the implications of Basel III, has mainly focused on the impact of regulatory capital requirements on bank lending (Berrospide and Edge, 2010; Mora and Logan, 2010; Rice and Rose, 2010; Carlson *et al.*, 2013; Gropp *et al*., 2018). There are currently no empirical studies investigating the potential impact of the NSFR on credit availability. Whereas the extant literature finds no significant impacts of liquidity regulation on credit, papers using simulations suggest a larger negative impact of liquidity regulation on lending (Covas and Driscoll, 2014; De Nicolò *et al.*, 2014; and De Bandt and Chahad, 2015). However, these findings are often driven by specific assumptions, which are not in line with the findings of the empirical studies regarding banks adjustment strategies to liquidity regulation.

Given the limited and mixed results in the literature, this paper aims to shed some light on the impact the newly introduced measure of structural liquidity, the NSFR, on bank lending.[1] Using an extensive bank-level dataset with quarterly data, we first analyse the impact of the NSFR on total lending activity. Then, we disaggregate total lending by maturity, looking at short, medium and long-term lending, in order to verify whether there are differences in the sensitivity of growth rates of loans of different maturities.

The empirical identification of the effect of the introduction of regulatory liquidity requirements on bank lending behaviour presents a number of challenges. The most important challenge is to find a truly exogenous variation in liquidity requirements. We exploit the introduction of the new NSFR and argue that prior to the financial crisis regulators paid little attention to bank liquidity. As exogenous shock we use the consultative document of the Basel III Accord published in December 2009, when for the first time the mechanism of the NSFR was spelt out.

[1] Although the Basel Committee on Banking Supervision (BCBS) outlines two liquidity ratios, this analysis focuses on the NSFR, because we are not interested in the day-to-day liquidity management that concerns the short-term (and consequently the LCR), but we want to see how the introduction of a longer-term liquidity ratio, which aims to reduce maturity transformation, impacts on banks' asset composition. We are aware that banks can meet the NSFR also by adjusting their liabilities, however, in this paper we focus on the assets side because our aim is to investigate the impact on bank lending.

The Basel III liquidity standards have undergone substantial revisions since they were first issued in December 2010 (see Figure 2). For example, with respect to the NSFR, the overall aim of the changes in October 2014 was to ensure that the indicator reflected a bank's structural liquidity risk rather than it being calculated for stress testing purposes only. These changes include greater differentiation in terms of maturity, to allow for the prompt identification of banks with excessive maturity mismatches and more fragile funding structures (BCBS, 2014).

[Insert Figure 2 about here]

To alleviate endogeneity concerns, we also use differences-in-differences-in-differences (DDD) regressions conditional on bank capital. The argument is that banks were increasing capitalisation levels at the same time, and an increase in equity results a mechanical increase in the NSFR. We therefore focus on banks whose NSFR was below the regulatory threshold but did not need to recapitalise.

The second challenge relates to the identification of supply and demand effects on bank lending. To control for supply and demand of credit, in line with the related literature (see Brei *et al.*, 2013; Carlson *et al.*, 2013; Kapan and Minoiu, 2013), we use the common bank-specific and country-specific variables based on accounting and macroeconomic data, respectively. Following Hempell and Kok Sorensen (2010) and Del Giovane *et al.* (2011), we combine these factors with qualitative information from Bank Lending Survey (BLS) of the European Central Bank (ECB), the quarterly survey on credit conditions carried out since 2003 in all countries of the euro area[2]. We also include a dummy variable accounting the large banks, i.e. those banks subjected to the EBA stress test exercise.

A third important challenge to the identification of the effect of regulatory liquidity requirements on bank lending relates to the effect of unconventional liquidity injections carried out by ECB during

[2] A detailed description of the survey can be found in Berg *et al.* (2005).

the period considered (see Figure 2). The ECB injected unprecedented liquidity into banks during the eurozone crisis. These operations, in particular the 3-years Very Long-Term Refinancing Operations (VLTROs) and the Targeted Longer-Term Refinancing Operations (TLTROs), aimed at restoring the monetary transmission mechanism encouraging banks to provide credit to households and firms. For this reason, through several additional analyses, we investigate the effects of both the ECB's VLTROs and TLTROs on bank lending at the aggregate level and by maturity. In addition, for a sub-sample of banks for which the information is available, we use information on VLTROs and TLTROs at the bank level.

This paper makes several contributions to the related literature. To the best of our knowledge, it is the first empirical study that estimates the impact of the NSFR on credit availability. Another contribution is related to the fact that we also take into account the maturity of bank loans. This allows us to identify the characteristics of bank loans that could be affected by the adjustment to the NSFR. Our third contribution relates to the frequency of the data of our analysis. We use quarterly data and this choice allows us to measure more accurately the impact of the NSFR on bank lending by considering intra-year variation. Ours is one of a handful of studies that controls for both supply and demand of credit also including qualitative information on credit conditions of the ECB's BLS (see Hempell and Kok Sorensen, 2010; Del Giovane *et al.*, 2011). Finally, it is the first study that attempts to disentangle the (potentially negative) impact of the newly introduced Basel III liquidity ratios on bank lending from the (potentially positive) impact of the recent unconventional ECB's liquidity measures, thus allowing us to verify their effectiveness in supporting banks' credit supply. Currently, the literature on the impact of the ECB unconventional monetary policy operations is limited and focused on the VLTROs of a specific European country. In addition, the results obtained are mixed. On the one hand, Andrade *et al.* (2017), Carpinelli and Crosignani (2017), and Garcia-Posada and Marchetti (2016), focusing on French, Italian and Spanish banking sectors, respectively, find that lending increases in response to the VLTROs of 2011–12. In addition, Andrade *et al.* (2017) find that the first VLTRO (December 2011) was more effective than the

second one (February 2012). On the other hand, Albertazzi *et al.* (2016), focusing on the Italian banking sector, do not find a significant effect on lending growth for the average bank–firm lending relationship. However, they do find that the VLTROs were more effective in improving lending supply to small-medium enterprises (compared to larger firms) for banks characterised by both a relatively large funding gap and a relatively favourable capitalisation. Finally, Crosignani *et al.* (2017), and Carpinelli and Crosignani (2017), focusing on Portuguese and Italian banking sectors, respectively, show that banks used some VLTRO financing to buy domestic sovereign bonds ('leakage'). On this, see also Drechsler *et al.* (2016) and Altavilla *et al.* (2017).

The main results of our empirical analysis can be summarised as follows. Overall, we find that lending does not appear to be affected by the introduction of the NSFR. We find evidence to suggest that eurozone banks have been able to meet the Basel III structural liquidity ratio by pursuing alternative strategies rather than decreasing lending. However, focusing on lending by maturity, we find a maturity swap effect that mainly took place via the substitution of long-term by short-term lending by the eurozone banks. This is an interesting result, as it is in line with the aim of the NSFR, i.e. to encourage banks to reduce their maturity risk transformation. We also find that EBA banks (that is, the largest EU banks subjected to the periodic EBA stress testing exercise) being subject to a greater monitoring from the authorities are more receptive to the recent ECB's pressures to give credit to the economy. Moreover, we show that the recent ECB's TLTROs operations have yet to generate a positive impact on bank lending, whereas VLTROs operations have been ineffective in stimulating the supply of credit to the economy, especially for those banks not compliant with the NSFR. More specifically, we find the presence of a 'portfolio substitution effect' for some VLTROs.

The findings of the analysis are of particular interest to both academics and policy makers as they show that, despite strong critics in the industry, banks may be compliant with the NSFR and at the same time give credit to the economy. Moreover, the results on the unconventional liquidity

injections support the decision of the ECB to adopt Quantitative Easing (QE) in 2015, in order to further stimulate the supply of credit to the economy.

The remainder of the paper is organised as follows. Sections 2 and 3 describe the empirical methodology, and the sample and the variables used in the empirical analysis, respectively. Section 4 discusses the main results. Additional analyses are presented in Section 5 and the robustness tests in Section 6. Finally, Section 7 concludes and offers some policy implications.

2. Empirical Strategy

To study the relationship between bank lending and the Basel III structural liquidity ratio (i.e. the NSFR), we use panel data regressions with bank and time fixed-effects (FE). Standard errors are clustered by bank and time in all estimations. The baseline model has the following function:

$$LOAN\_GROWTH\_RATE_{i,t} = \beta_1(NSFR)_{i,t-1} + \beta_2(CRED\_SUPPLY\_ACC\_DATA)_{i,t-1} + \beta_3(CRED\_DEMAND\_MACRO\_DATA)_{i,t} + \beta_4(CRED\_SUPPLY\_DEMAND\_ECB\_BLS)_{i,t-1} + \beta_5 d\_EBA + \delta_i + \gamma_t + \varepsilon_{i,t} \quad (1)$$

where δ_i is the bank fixed-effects, γ_t is the time fixed-effects at quarterly level, and ε_{it} is the error.

Our dependent variable is the growth rate of loans to customers (LOAN_GROWTH_RATE). We have different dependent variables, because we look at aggregate level and by maturity (short, medium, and long-term lending).

The Basel III NSFR is our variable of interest. As control variables, in our empirical analysis we incorporate both factors based on accounting data, to control for credit supply (CRED_SUPPLY_ACC_DATA), and factors based on macroeconomic data, to control for credit demand (CRED_ DEMAND_MACRO_DATA). This distinction is necessary because the lending activity can decrease not only because banks have been supplying less credit, but also because the demand of credit has been going down. Beside these common variables, to better assess the role of

supply and demand factors in bank lending, we also include qualitative information using the ECB's Bank Lending Survey - BLS (CRED_SUPPLY_DEMAND_ECB_BLS).[3]

Finally, we include a dummy variable (d_EBA) in order to control the bank lending behavior of the EBA large banks (that are those included in the EBA stress testing exercises), given that through the Banking Union of 2014 they are directly supervises by the ECB (i.e. the Single Supervisory Mechanism, SSM).[4]

All the explanatory variables, with the sole exception of the factors based on macroeconomic data (see Jiménez *et al.*, 2012), and the EBA dummy variable, are lagged by one quarter to address potential endogeneity problems.

3. Data Sample and Descriptive Statistics

3.1 Data

The analysis focuses on banks headquartered in those countries of the eurozone area with consolidated data available from the SNL (S&P Global – Market Intelligence) Database to compute our variable of interest (i.e. the Basel III NSFR).[5] The calculation of the NSFR is data demanding in terms of the granularity of the balance sheet items necessary for the calibration of the ratio and that significantly restricts the number of our sample.[6] Overall, the final sample consists of 160 banks. As shown in Table 1, around 39 per cent of our sample banks are large banks, and of this 39 per cent about 64 per cent are included in the EBA stress testing exercise of 2014.[7]

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[3] We also run the model without the ECB'BLS variables. We obtain qualitatively similar results.

[4] See: https://www.bankingsupervision.europa.eu/about/bankingunion/htm/index.en.html.

[5] Most of the information available on the Basel III NSFR are available only at the highest level of consolidation.

[6] A number of banks does not report to SNL (S&P Global – Market Intelligence) Database with the required level of detail, simply because these measures were not mandatory before the new regulation proposed by the BCBS (2010). Missing values in the relevant accounting variables are present for banks in all categories, size, specialisation, ownership, etc.

[7] The 2014 stress test exercise included 123 banking groups across the EU (Austria, Belgium, Cyprus, Germany, Denmark, Spain, Finland, France, Greece, Hungary, Ireland, Italy, Luxembourg, Latvia, Malta, Netherlands, Poland, Portugal, Sweden, Slovenia, United Kingdom) and including Norway with a total of EUR 28,000BN of assets covering more than 70 per cent of total EU banking assets (see EBA, 2014). The list of EU banks subjected to the 2014 stress test exercise is available at www.eba.europa.eu.

Our sample covers banks in the following 15 countries: Austria, Belgium, Cyprus, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia, and Spain.[8] We concentrate on the eurozone countries not only because they have been very affected by the Sovereign Debt crisis, but also because of the unconventional interventions of the ECB in the market targeted at encouraging banks to increase the lending supply. These factors influenced the choice of the time period observed that lasts from 2008Q1, the year in which the credit crisis started affecting the European banks, to 2015Q2, the quarter following the maturity date of the ECB's largest liquidity injections ever, that are the 3-years VLTROs, announced at end-December of 2011 and expired in 2015Q1.

[Insert Table 1 about here]

3.2 Dependent variable

The growth rate of loans to customers, computed as the natural logarithm of total gross loans (LOG_GL) at time *t* over *t-1* (the previous quarter), is our dependent variable (see Carlson *et al.*, 2013). Data on this variable are collected by SNL (S&P Global – Market Intelligence) Database.

Figure 3 shows the big fall in growth rate for total loans to customers in 2008, followed by some pick ups, but generally the lending growth rate remained much below the levels registered in the pre-crisis years. More specifically, after the sharply slowdown due to the credit crisis in 2008–09, LOG_GL shows a partial recovery in 2010, at the time of the first interventions of the ECB (see Cecioni *et al.*, 2011). However, the Sovereign Debt crisis of 2011 determines a further breakdown of total loans to customers that led the ECB to adopt the largest liquidity injections ever, i.e. the two tranches of VLTROs (in 2011Q4 and in 2012Q1), followed by several tranches of TLTROs during the period 2014Q3–2017Q4. The growth rate of loans to customers starts to grow again only during the year 2015.

[8] The fact that France, Germany and Italy cover the large part of our sample (see Table 1) is in line with their representativeness in the EBA stress test excercise of 2014, where these countries show the highest number of banks.

[Insert Figure 3 about here]

Moreover, focusing on the trend of bank lending by geographical area over the period 2008Q1–2015Q2, as expected, Figure 4 shows that the countries with the lowest loan growth rate are above all those most affected by the Sovereign Debt crisis. Indeed, Greece, Ireland, Portugal and Spain, the so-called GIIPS countries (with the exception of Italy), showed negative average value of LOG_GL during the period observed.

[Insert Figure 4 about here]

We look at total lending (LOG_GL), but we also distinguish about loan maturity, looking at short, medium and long-term lending (see Table A.1 in Appendix). Figure 5 shows that all the different loans maturities considered exhibit a significant reduction over the period 2008Q1–2015Q2, but especially medium and long-term loans (i.e. the loans with a maturity more than 1 year, but less than 5 years, LOG1y<t<5y; and those with a maturity more than 5 years, LOGt>5y).

[Insert Figure 5 about here]

3.3 The Net Stable Funding Ratio

The structural liquidity ratio of Basel III, i.e. the NSFR, is our target variable (see Box A.1). Data on this variable are collected by SNL (S&P Global – Market Intelligence) Database. Table A.2 in the Appendix summarises the weights and calibrations for each asset and liability items in NSFR computed following the last final version of October 2014. Since SNL Database does not cover all the detailed information specified in Basel III (see Box A.1), we assess the NSFR using the following assumption. Given that we can not split the loan portfolios according to their residual

maturity, which under Basel III entails different weights, corporate and retail loans are treated relatively conservatively (see Gobat *et al.*, 2014), with all these types of loans assumed to have a maturity of more than 1 year and hence a RSF weight of 85 per cent.[9]

The relationship between the NSFR and bank lending is unclear ex-ante, because it depends on the adjustment strategy chosen by non-compliant banks to meet the liquidity ratio (see Figure 1). On the one hand, we expect a negative sign when banks decide to increase the structural liquidity ratio either by cutting loans to non-financial sectors or by switching their asset composition from loans to securities with lower RSF weights. On the other hand, the sign could be positive when banks choose to improve the NSFR either by buying liquid assets with stable funding or by increasing their level of stable funding or by shifting its portfolio towards liquid assets by reducing other assets (different from loans) with a high RSF factor.

Focusing on the trend of the quarterly average of the NSFR for the full sample over the period 2008Q1–2015Q2, Figure 6 shows that it is below the threshold of 100 per cent up to 2013 and then most of the eurozone banks considered seem to have caught up with the Basel III liquidity ratio. This evidence is consistent with the results of the EBA report (2015).

[Insert Figure 6 about here]

However, significant differences emerge focusing on a cross-country analysis. More specifically, Figure 7 shows that the eurozone countries with the lowest average values of NSFR over the period 2008Q1 – 2015Q2 are mainly those particularly affected by the Sovereign Debt crisis, like Ireland, Greece, Portugal, and Spain. This evidence is consistent with the results reported by Gobat *et al.* (2014).

[Insert Figure 7 about here]

[9] Basel III establishes a RSF weight of 50 per cent for corporate and retail loans with a residual maturity of less than one year, and a RSF weight of 85 per cent for those with a residual maturity of one year or more.

3.4 Control variables

As control variables, following the related literature (see Del Giovane *et al.*, 2011; Brei *et al.*, 2013; Carlson *et al.*, 2013; Kapan and Minoiu, 2013; among others), we use factors based on accounting data to control for credit supply and factors based on macroeconomic data to control for credit demand. In addition, beside these common variables, we also consider the qualitatively information available on changes in the supply and demand of bank loans in the euro area collected by the ECB's BLS. Finally, we include a dummy variable for EBA large banks.

Table A.1 in the Appendix describes the control variables outlined below and summarises their hypothesised relationships with the dependent variable (irrespective of the maturity of the bank lending).

3.4.1 Credit supply variables based on accounting data

On the supply side, we compute the following variables based on accounting data collected from SNL (S&P Global – Market Intelligence) Database. We use the natural logarithm of a bank's total assets to proxy for bank size (SIZE). The sign of the relation linking SIZE to growth rate of gross loans is uncertain. The relationship can be interpreted positively when large banks might isolate themselves better from adverse shocks. On the other hand, the relationship may be negative for strong lending relationships between small firms and small banks.

We measure bank capital as equity to total assets (ETA). We expect a positive sign for the relationship between capital and bank lending, since banks well capitalized (high ETA) are more likely to expand supply of loans.

Furthermore, to measure bank earnings we consider the return on average assets (ROAA)[10]. We expect a positive sign for the relation between ROAA and growth rate of gross loans, since an increase in profitability should make banks more prone to supply lending.

Next, we include the cost-to-income ratio (CIR) as a proxy for bank operational efficiency. Since low values of CIR indicate better managerial quality, the relationship between CIR and bank lending is expected to be negative.

We employ the ratio of non-performing loans to gross loans (NPL_GL) as a proxy for credit risk. An increase of NPL_GL should determine a decrease in bank lending. So, we expect a negative sign.

3.4.2 Credit demand factors based on macroeconomic data

To take into account also the credit demand side, we include some macroeconomic variables. Following Jiménez *et al.* (2012), we use the quarterly percentage change of gross domestic product (GDPC) and the change in the three-month Euro Interbank Offered Rate (DIFF_EURIBOR)[11] during the period t and t-1 (i.e. the quarter before). We expected that high GDP growth and low interbank interest rates increase loan demand. Hence, we hypothesise a positive sign for GDPC and a negative sign for DIFF_EURIBOR. Data on these variables are collected by World Economic Outlook database of the International Monetary Fund (IMF).

3.4.3 Credit supply and demand factors based on the ECB's Bank Lending Survey

Following Del Giovane *et al.* (2011), beside the common variables described in the previous paragraphs, we also consider the qualitative information from the quarterly ECB's BLS.[12] We consider BLS responses on supply and demand conditions for loans to both enterprises (including

[10] As a robustness test, we also use the Return on Average Equity (ROAE) in place of ROAA, and we obtained very similar results in the regressions.

[11] As a robustness test, we also use the Euro Overnight Index Average (EONIA) rate in place of DIFF_EURIBOR, and we obtained very similar results in the regressions.

[12] The sample of banks partecipating in the ECB's BLS is mostly representative of large banks. As shown in Table 1, our sample of banks represents about 64 per cent of the EBA sample of banks included in the 2014 stress test exercise. We also perform our regressions without the ECB'BLS variables and we obtained very similar results.

small and large enterprises) and households (loans for house purchase and consumer credit, respectively). They are continuous variables that range from -1 to 1.

More specifically, on the supply side, we use the questions where banks were asked if they have changes lending standards for enterprises, mortgages, and consumer credit from the previous quarter. In this cases, the supply BLS variables (SUPPLY_ENTERPRISES, SUPPLY_HOUSE_PURCHASE and SUPPLY_CONSUMER_CREDIT) take the values from -1, when bank's credit standard as applied to the approval of loans to enterprises or to householders eased considerably, to 1, when bank's credit standard as applied to the approval of loans to enterprises or to householders tightened considerably. Hence, we expect a negative relationship between BLS supply variables and bank lending.

On the demand side, we use the question where customers were asked if they have changed their demand from the previous quarter. The demand BLS variables (DEMAND_ENTERPRISES, DEMAND_HOUSE_PURCHASE and DEMAND_CONSUMER_CREDIT) take the values from -1, when demand for loans decreased considerably, to 1, when demand for loans increased considerably. An increase of BLS demand variables should determine an increase in bank lending. So, we expect a positive sign.

3.4.4 The EBA dummy variable

Finally, in order to verify whether the lending behavior differs for large banks, we include the EBA dummy variable (d_EBA), which takes the value of 1 for banks belonging to the EBA stress test exercise 2014, and 0 otherwise. We expect a positive sign between d_EBA and the growth rate of bank lending, given that EBA large banks, being subject to a major monitoring from the ECB, due to the SSM, should be more sensible to the recent ECB's solicitations to give credit to the economy.

3.5 Descriptive statistics of control variables

Table 2 reports the descriptive statistics relating to the control variables over the period 2008Q1–2015Q2.[13] With reference to the proxies of credit supply based on accounting data (see Panel A), we find that the variables that show the major variation during the period considered are the bank capital measure (ETA), that increases its values (lower leverage) due to the deleveraging process; the profitability variable (ROAA), that shows negative values, especially during the Sovereign Debt crisis years; and the measure of credit quality (NPL_GL), that increases significantly due to a strong deterioration of the banks' quality loans; and finally the proxy for cost efficiency (CIR) that worsens (high values) during the Sovereign Debt crisis period, but in the recent years decreases due to an improvement in operational efficiency. The bank size measure (SIZE) remains unsubstantially unchanged over the period 2008Q1–2015Q2.

In addition, as expected, both macroeconomic variables (GDPC and DIFF_EURIBOR) decrease significantly in the period considered, also showing negative values especially during the crises years (see Panel B of Table 2). However, GDP in the recent years has started to growth again.

Among the ECB's Bank Lending Survey variables (see Panel C), we find that, during the credit crisis period (2008–09), enterprises were characterised by a strong tightening credit standards than those to the families. Only, in the last years, banks have eased credit standard applied to the approval of loans to both enterprises and families. In addition, from the ECB's qualitative information on the credit demand, Panel C of Table 2 shows that, after a long period of strong reduction from both side (enterprises and families), it starts to grow again in the last years of the analysis (2014–15).

[Insert Table 2 about here]

[13] Also the control variables are collected with quartertly frequency, however in Table 2 we show the annual average values of their descriptive statistics.

Finally, Table 3 presents the correlation matrix for our variable of interest (i.e. the NSFR) and the other explanatory factors (without the qualitative variables of the ECB's BLS and the d_EBA). We find that the correlation magnitudes are in general low.

[Insert Table 3 about here]

4. Main Results

4.1 Baseline analysis

Table 4 shows the results of the panel regressions for our sample of banks over the period 2008Q1–2015Q2, for both loans at aggregate level and by maturity. We find that the NSFR is insignificant for total lending (LOG_GL). These finding means that overall lending does not appear to have been affected by the introduction of the NSFR. However, this is not true across all maturities of lending, but we find a significant positive sign for short-term lending (LOG_GLt<3m) and a significant negative sign for long-term lending (LOG_GLt>5y). The latter results imply that banks have shifted their portfolio loans from long-term to short-term lending. This maturity swap effect is in line with the aim of the NSFR to reduce maturity transformation.

Focusing on the other variables that can affect lending at the same time, Table 4 shows that among the supply credit factors based on accounting data, SIZE, NPL_GL, and in some model also ROAA play a significant role in explaining bank lending during the period observed. All these variables show the expected sign. With reference to SIZE, the negative sign prevails (among the two hypothesized) and it means that customers are penalized by the increase of the bank size. Small banks, thanks to their proximity to the territory, should be able to create a strong lending relationship with their customers, allowing them to obtain more information on their insolvency risk. However, for the EBA large banks this is not true, but, as expected, we find a positive sign between d_EBA and bank lending. A possible interpretation of this result should be related to the

fact that EBA large banks, being subject to a direct control from the ECB, result more sensible to the recent ECB's solicitations to give credit to the economy.

We also find a negative sign for NPL_GL and a positive sign for ROAA. These findings mean that bank lending decrease with the deterioration of both the quality of bank loans and bank profitability. Moreover, among the credit supply variables from the ECB's BLS, only the SUPPLY_CONSUMER_CREDIT is significant, but only in one model (see Table 4). It shows a negative relationship with bank lending, as expected. It means that tighter bank's credit standards implies a decrease in credit supply.

With reference to credit demand factors based on macroeconomic data, Table 4 shows that both are significant, especially DIFF_EURIBOR. Both show the expected sign with reference to total lending: positive for GDPC and negative for DIFF_EURIBOR. So, we find that high GDP growth and low interbank interest rates increase loan demand. However, as expected, the negative relationship between DIFF_EURIBOR and loan growth rate is only true for lending at aggregate level and with a medium and long-term maturity.

Finally, with reference to the demand side based on ECB's BLS data, only DEMAND_CONSUMER_CREDIT is significant showing the expected positive sign. An increase of demand in consumer credit should determine an increase in bank lending.

[Insert Table 4 about here]

4.2 Differences-in-differences-in-differences (DDD) analysis

To alleviate the concern that bank lending could affect the NSFR (see Figure 1), we also use differences-in-differences-in-differences (DDD) regressions conditional on capital (computed as equity to total assets, ETA). The argument is that banks were increasing capitalization levels at the same time, and an increase in equity increases the NSFR. So, we are interested in banks below the NSFR threshold (this is our dummy treated, D_TREATED) that did not need to recapitalize (this is

our dummy capital, D_CAPITAL). More specifically, D_TREATED takes the value of 1 for banks with NSFR less than 0.95 in the quarter of the shock, and 0 otherwise[14]; while D_CAPITAL takes the value of 1 for banks with ETA equals to or above the median of ETA in the quarter of the shock, and 0 otherwise. As exogenous shock (D_SHOCK) we use the consultative document of the Basel III Accord published in December 2009, when for the first time the mechanism of the NSFR was spelt out. Thus, our target variables in this model are: D_SHOCK; its interaction with D_TREATED and D_CAPITAL, respectively; and the interaction between these three variables.

We find that the results for the triple interaction (D_TREATED*D_CAPITAL*D_SHOCK) reported in Table 5 are consistent with our main findings displayed in Table 4. More specifically, they confirm the maturity swap effect that takes place via the substitution of long-term by short-term borrowing for our sample banks. So, the results of DDD model show that it is not a case of endogeneity. This tells us that banks are able to increase the NSFR using alternative mechanism and not by decreasing lending.

Given that we use a DDD approach, we check the parallel trends. Figure A.2 in the Appendix, relating to loans maturities for which the triple interaction is significant, shows the trend of the quarterly average growth rate of loans to customers with a maturity less than 3 months (LOG_GLt<3m) and with a maturity more than 5 years (LOG_GLt>5y) in the period prior to the shock for both treatment and control groups. The treatment (control) group is relative to those banks with both a NSFR less than (equals to or above than) 0.95 and an ETA equals to or above its median. Figure A.2 shows that in absence of treatment (i.e. the shock) changes in bank lending are similar for the two groups of banks. Hence, it provides evidence to the parallel trends' assumption.

[Insert Table 5 about here]

[14] We decide to use a NSFR threshold equals to 0.95 because from the Figure A.1 in the Appendix, that shows the frequency distribution of the NSFR for our sample banks over the period 2008Q1–2015Q2, it emerges that banks have NSFR values mainly concentrated slightly below the threshold set by Basel III for the NSFR (equals to 1), and so potentially equals to 0.95. However, as a robustness check, we also run the regressions using the following threshold: 1; 0.90; 0.85, but we obtain qualitatively similar results.

5. The impact of unconventional monetary policy operations on bank lending

As discussed before, we decide to concentrate our analysis on the eurozone countries also because of the unconventional interventions of the ECB in the market targeted at restoring the monetary transmission mechanism encouraging banks to provide credit to households and firms. As shown in Table 6, the ECB's unconventional liquidity injections allotted to eurozone banks includes the two following types of measures: the 3-years Very Long-Term Refinancing Operations (VLTROs), announced for the first time on December 2011 and characterized by an early repayment after 1 year; and the most recent Targeted Longer-Term Refininancing Operations (TLTROs), announced for the first time on June 2014 and continued to be implemented with quarterly frequency until 2017, that are characterized by a maturity of up to 4 years, but with the possibility for banks of an early repayment after 2 years. The latter are targeted operations, as the amount that banks can borrow is linked to their loans to non-financial corporations and households.

Among the two operations, only the VLTROs are considered the ECB's largest liquidity injections ever, because the ECB, through the two tranches (the VLTRO1 in 2011Q4 and the VLTROs in 2012Q1, both ended in 2015Q1) introduced 1,018.720 billion of euros in the eurozone banking system against the 384.078 billion of euros introduced through the first four TLTROs (see Table 6).

[Insert Table 6 about here]

Given that both VLTROs and TLTROs are finalized to incentivizing bank lending to the real economy, we perform several additional analyses in which we account also for the effect of these ECB's unconventional interventions in order to see if they have been useful or not in restoring bank lending to customers.

First, we investigate the effects of both the ECB's VLTROs and TLTROs on bank lending at aggregate level and by maturity over our full sample period (see Table 7). To control this effect, we

include in our model two dummy variables, one for each unconventional liquidity injection.[15] As shown in Table 7, we first focus on our 'full sample of banks' (that are those belonging to the 15 eurozone countries reported in Table 1). In this instance the variables D_VLTRO and D_TLTRO take into account only when these ECB's liquidity injections occurred without making any difference between bank/country. So, D_VLTRO takes the value of 1 for the period in which the ECB gave liquidity to the eurozone banking system through the two VLTROs (2011Q4–2015Q1), and 0 otherwise. The same is true for the D_TLTRO, that takes the value of 1 for the period from 2014Q3 on, and 0 otherwise. Then, we focus the analysis on a 'sub-sample of banks' (see Table 7), that is composed by those credit institutions belonging to the eurozone countries (13 in total) for which Bloomberg, Reuters and/or Eikon Databases provide information on the ECB's VLTROs and/or TLTROs at the bank level, see Table 8. The latter shows the uptakes of allotment (in euros) for each tranches of VLROs and TLTROs by country during the period considered. As shown from Table 8, data on these ECB's unconventional liquidity injections are principally available for large banks (69 percent for the VLTROs, and 81 per cent for the TLTROs of our sample banks are included in the EBA stress testing exercise of 2014). Not only, Table 8 also confirms the evidence that Italian and Spanish banks had taken the largest share of VLTROs financing.[16] So, in light of these information available at the bank level, for our eurozone sub-sample banks the variables D_VLTRO_bank and D_TLTRO_bank take into account the effective uptake of each bank in the countries considered. More specifically, D_VLTRO_bank takes the value of 1 for the period in which the ECB gave liquidity to a specific bank belonging to the eurozone system through the VLTROs (2011Q4–2015Q1), and 0 otherwise. The same is true for the D_TLTRO_bank that takes the value of 1 from 2013Q3 on, and 0 otherwise. All the dummy variables used in Table 7 to control for unconventional liquidity injections are lagged by one year (i.e. the previous quarter).

Focusing on the results of the effect of these ECB's unconventional liquidity injections on bank lending, overall Table 7 shows a significant negative sign for the dummies variables VLTROs, and

[15] For the analysis based on the allotted amounts in place of the dummy variables, see Table 10.
[16] See: https://www.fitchratings.com/gws/en/fitchwire/fitchwirearticle/Correct%3A-Fitch%3A-Italian?pr_id=828276.

an insignificant sign for the dummies variables TLTROs (with the sole exception for LOG_GLt<3m, where we find a positive significant sign only for the full sample of banks). These findings imply both that the recent TLTROs have jet generate any positive impact on bank lending; and that the VLTROs have been ineffective in stimulating the supply of credit to the economy.

We also find that our results on the target variable (i.e. the NSFR) are robust also when we add the dummies variables VLTROs and TLTROs to the model. As a matter of fact, again Table 7 shows that total lending does not appear to have been affected by the introduction of the Basel III NSFR. Moreover, it confirms that this is not true across all maturities of lending, but eurozone banks shifted their portfolio loans from long-term to short-term lending.

[Insert Tables 7 and 8 about here]

Second, in order to verify whether the effect of the ECB's unconventional liquidity injections on bank lending varies on the basis of the banks' compliance to the Basel III NSFR, Table 9 shows the results obtained replicating the same analysis of Table 7, but splitting sample banks into the two following groups: banks with a NSFR equals or above to 1 vs. those with a NSFR below to 1.[17] Also in Table 9 we find that the dummies variables TLTROs are always insignificant, while the dummies variables VLTROs show an almost always negative significant sign. As expected, this is true especially for banks not compliant to the Basel III NSFR, given that they always show a stronger negative significance degree compared to those banks already in line with the Basel III structural ratio. It means that the latter seem to have decreased less the credit to their customers. Thus, we find that the VLTROs unconventional liquidity injections are used in a different way depending on whether the banks are already compliant or not to NSFR.

[17] As a robustness check, we also run the regressions using the following threshold: 0.95; 0.90; and 0.85, but we obtain qualitatively similar results.

[Insert Table 9 about here]

Finally, we verify if the amount of ECB's unconventional liquidity requested by our sample banks had an effect on lending. Being the TLTROs still in progress, we focus only on the amount of the two tranches of the ECB's largest liquidity injections ever: the VLTRO1 (implemented in 2011Q4) and the VLTROs (implemented in 2012Q1). Data on the amount of VLTROs are collected from Bloomberg, Reuters and/or Eikon Database at the bank level. As shown in Table 8, they are available for a sub-sample of banks belonging to the 13 eurozone countries. Thus, following Andreade *et al.* (2017), in Table 10 we distinguish between the effects of the two different rounds of VLTROs (scaled by bank total assets) used by the ECB to give liquidity to the eurozone banks. The VLTRO1 and VLTRO2 variables are observed in t-1 (i.e. the previous quarter). Given that both two tranches of VLTROs allowed to the borrower banks the possibility of an early repayment after 1 year (in 2013Q1), following Posada and Marchetti (2016) we focus the analysis on the period that lasts from 2008Q1 to 2013Q2, that is the quarter immediately after their early reimburse. This choice is also supported by the lack of public information on the remaining amount that the borrower banks can have to repay to the ECB during the two years remaining at the deadline of each VLTROs (in 2015Q1).

Unlike Andrade *et al.* (2017), who find a positive impact on bank lending for both rounds of VLTROs, also showing both that the first VLTRO was more effective than the second one, and that the effect mainly took place via the substitution of short-term by long-term, we find that only the VLTRO1 has been effective in stimulating the supply of credit to the economy (see Table 10). This is true for short and medium-term lending. On the other hand, we find a significant negative relationship between VLTRO2 and loan growth rate (again for both short and medium-term lending) as if the eurozone banks used the liquidity of the second round mostly to purchase government bonds or hoard cash rather than to increase lending. The presence of a 'portfolio substitution effect' for some VLTROs is confirmed by the results of Table A.3 in the Appendix that

shows a significant positive relationship between the lag of the amount of VLTRO2 (scaled by total assets) and some traditional proxies for bank liquid assets (see Cornet *et al.*, 2011, like for example: cash and balances with Central Banks to total assets, CASH_TA; and investments in government bonds to total assets, GOVBOND_TA).[18,19] The latter result supports the evidence of Crosignani *et al.* (2017) and Carpinelli and Crosignani (2017), who find that Portugues and Italian banks used some VLTROs financing to buy domestic sovereign bonds. Overall, a possible explanation of the different use of the two rounds of VLTROs could be related to a moral hazard behavior implemented by eurozone banks that benefited of the first round of VTLRO. In practice, eurozone banks may have used the first tranche of VLTRO to give credit to the customers only in order to get also the second ECB's tranche of liquidity, which, once received, it was then used to increase liquid assets. These results support the decision of the ECB to launch in 2014 a new group of unconventional liquidity injections, the TLTROs, where those banks which did not meet their lending benchmarks were required to repay their TLTRO borrowings early.

[Insert Table 10 about here]

6. Robustness Tests[20]

To test the robustness of our main results, particularly with reference to the behavior of our target variable, we perform a number of further regressions. Firstly, we assess the strength of our results with respect to the estimation methods. Following Brei *et al.* (2013), we carry out our estimations using a generalized method of moments (GMM) estimator for our sample of banks over the period 2008Q1–2015Q2. The GMM methodology has been used extensively in the bank lending channel

[18] As a robustness check, we also run the regressions using other proxies for liquid assets, such as liquid assets to total assets, but we obtain qualitatively similar results.

[19] The correlation magnitudes between our variable of interest (i.e. the NSFR) and the proxies for bank liquid assets (CASH_TA and GOVBOND_TA) are low (0.3716 and 0.2435, respectively).

[20] We also test the panel regressions using an alternative measure for our target variable: the liquidity creation indicator of Berger and Bouwman (2009) in place of the Basel III NSFR. We find that the liquidity creation variable is significant only for short-term lending (LOG_GLt<3m), showing a positive sign. Overall, this finding confirms that overall lending does not appear to have been affected by bank liquidity. Results are available upon request.

literature (see Brei *et al.*, 2013). The results are shown in Table 11. The findings confirm that lending does not appear to have been affected by the introduction of the NRSF, although medium and long-term lending are affected.

[Insert Table 11 about here]

Next, in order to control potential differences across countries, we distinguish the sample into GIIPS (i.e. Greece, Ireland, Italy, Portugal, and Spain) and no-GIIPS countries. As expected, Table 12 shows that the negative relationship between NSFR and medium and long-term lending is significant only for the GIIPS countries that were the most affected by the Sovereign Debt crisis. Indeed, these countries (with the sole exception of Italy) showed the worst values for both the lending growth rate and the Basel III structural liquidity ratio during the period observed (see Figures 4 and 7).

[Insert Table 12 about here]

Finally, we use an alternative measure to control for the unconventional liquidity injections. So, in place of the VLTROs and TLTROs variables, in Table 13 we use the total amount of liquidity introduced by each eurozone National Central Bank (NCB) in its relative banking system during the period 2008Q1–2015Q2. The latter variable is computed as the ratio between the amount of Total Long Term Refinancing Operations (TLTROs) to credit institutions of each eurozone NCB and its total lending[21] (hereafter TLTRO_NCB). Data are collected from Bloomberg Database and they are relative to 9 eurozone countries in total (see Table A.4 in the Appendix). Given that the amount of

[21] Total lending to euro area credit institutions is equal to the sum of Main Refinancing Operations - MROs, LTROs, Fine-tuning Reverse Operations, Structural Reverse Operations, Marginal Lending Facility, and Credits Related to Margin Calls.

TLTROs lent by each NCB includes both conventional and unconventional liquidity injections, we decide to split the analysis into the two following sub-periods: the years before and after the introduction of the ECB's largest liquidity injections ever (2008Q1–2011Q3 vs. 2011Q4–2015Q2). As shown in Table 13, we find that the proxy for NCB's liquidity injections (i.e. the lag of TLTRO_NCB) is significant only during the second sub-period (2011Q4–2015Q2), showing a negative sign for bank lending with a long-term maturity. Again this result supports the banks' unwillingness to use the liquidity received by NCBs to give credit to customers during periods of crisis.

[Insert Table 13 about here]

7. Conclusions

We investigate the impact of the Basel III liquidity ratio, the Net Stable Funding Ratio, on lending by eurozone banks. Our period of analysis starts from the outbreak of the Global Financial Crisis and covers the eurozone Sovereign Debt Crisis. This period is both very relevant to evaluate the impact of regulatory interventions, but also presents a number of challenges. The aim of introduction of the Net Stable Funding Ratio by the BCBS (2010) was to encourage banks to hold more stable and longer term funding sources against their liquid assets, thereby reducing maturity transformation risk. However, as bank can achieve the regulatory threshold by implementing different strategies, the impact of the introduction of the NSFR on bank lending, and consequently on the real economy is unclear. However, as our sample period is a crisis period, an observed reduction in bank lending might not imply that credit supply has decreased as a consequence of a reduction in demand by households and firms. In addition, banks may reduce lending as faced with higher capital requirements. On the other hand, unconventional monetary policy operations carried out by the ECB injected unprecedented amounts of liquidity in the Eurozone banking system, with the aim of supporting credit supply. We aim to disentangle all these different effects to evaluate the

impact of regulatory liquidity. We exploit the introduction of the new NSFR and argue that prior to the financial crisis regulators paid little attention to bank liquidity. As exogenous shock we use the consultative document of the Basel III Accord published in December 2009, when for the first time the mechanism of the NSFR was spelt out. To alleviate concerns that capital increases also increase the NSFR, we also use differences-in-differences-in-differences (DDD) regressions conditional on bank capital. To control for supply and demand of credit, we use the common bank-specific and country-specific variables based on accounting and macroeconomic data, respectively. We combine these factors with qualitative information from Bank Lending Survey (BLS) of the European Central Bank (ECB), the quarterly survey on credit conditions carried out since 2003 in all countries of the euroarea. Finally, we try to identify the effect of unconventional liquidity injections carried out by ECB during the period considered, in particular the 3-years Very Long-Term Refinancing Operations (VLTROs) and the Targeted Longer-Term Refinancing Operations (TLTROs).

Overall, the results show that lending does not appear to be affected by the introduction of the NSFR. However, considering the maturity of loans, we find that an increase in NSFR determines a reduction of medium and long-term bank lending. This is consistent with the aims of regulators, who intended to reduce maturity mismatch. The findings of the analysis are of particular interest to both academics and policy makers as they show that banks may be compliant with the NSFR to avoid liquidity crises and at the same time give credit to the economy.

In addition, we show that the recent ECB's unconventional liquidity injections did not success in providing banks with incentives to provide credit to the economy, especially for those banks not compliant with the NSFR. More specifically, we find the presence of a 'portfolio substitution effect' for some VLTROs. Hence, the results provide support the ECB efforts to introduce other unconventional monetary policy measures, among which the QE in 2015, in supporting banks' credit supply.

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Figure 1. Main strategies to increase the NSFR

This figure summarizes the main strategies that banks could follow to increase the new structural liquidity rule of Basel 3, i.e. the NSFR (our target variable). For a detailed description of these strategies and their impact on bank lending see Section 3.3.

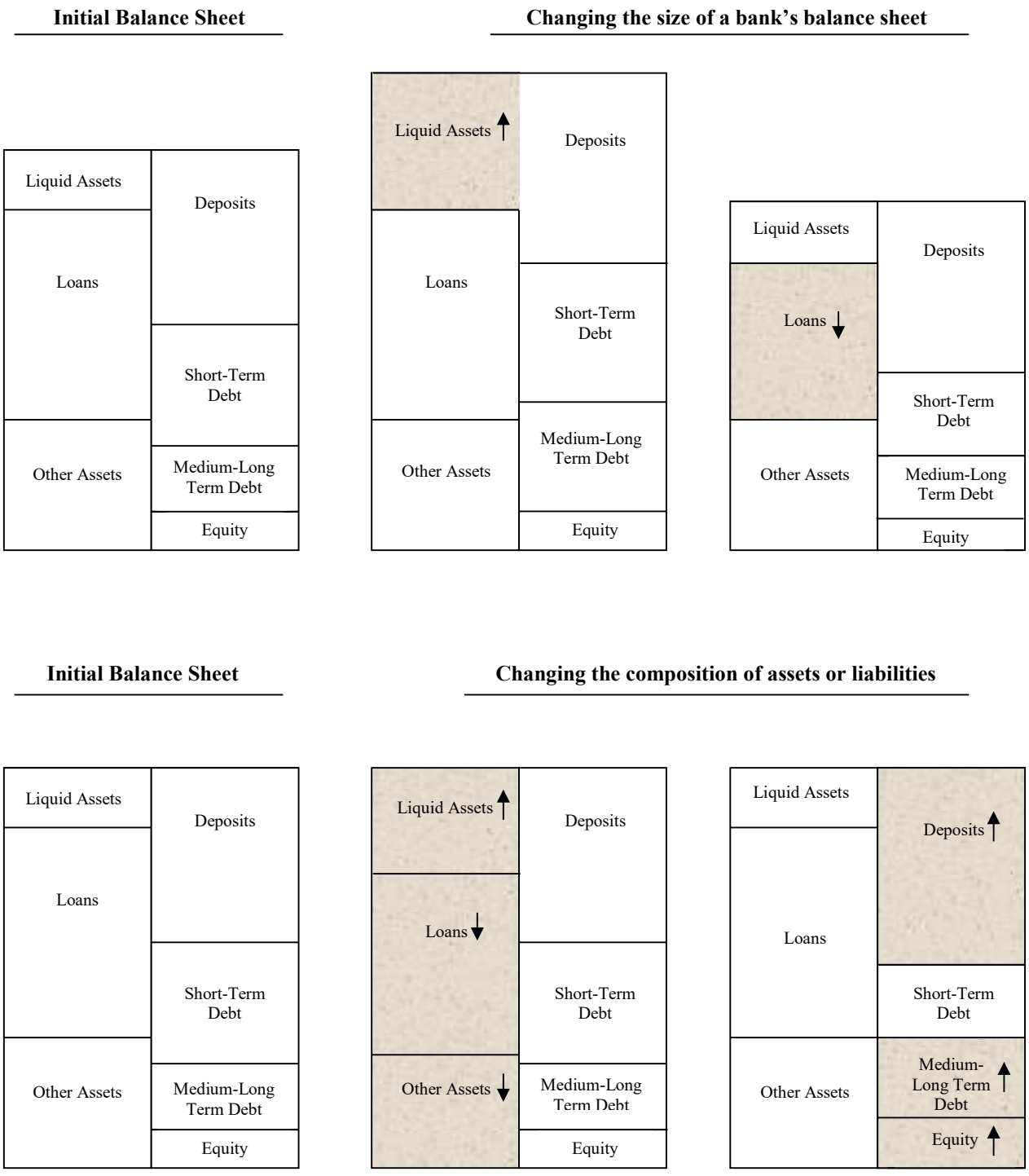


Figure 2. Timeline of the Basel III liquidity standards and of the ECB's unconventional liquidity injections VLTROs and TLTROs

This figure summarizes the periods in which the Basel III liquidity standards were spelt out for the first time by the consultative document of Basel III in December 2009. The liquidity ratios have undergone substantial revisions since they were first issued in December 2010 through the final document of Basel III. For example, with respect to the NSFR, our variable of interest, was subsequently revised in October 2014 (BCBS, 2014).
In addition, the figure shows the periods in which the ECB decided to adopt for the first time the following unconventional liquidity measures: the 3-years Very Long-Term Refinancing Operations (VLTROs); and the Targeted Longer-Term Refinancing Operations (TLTROs).

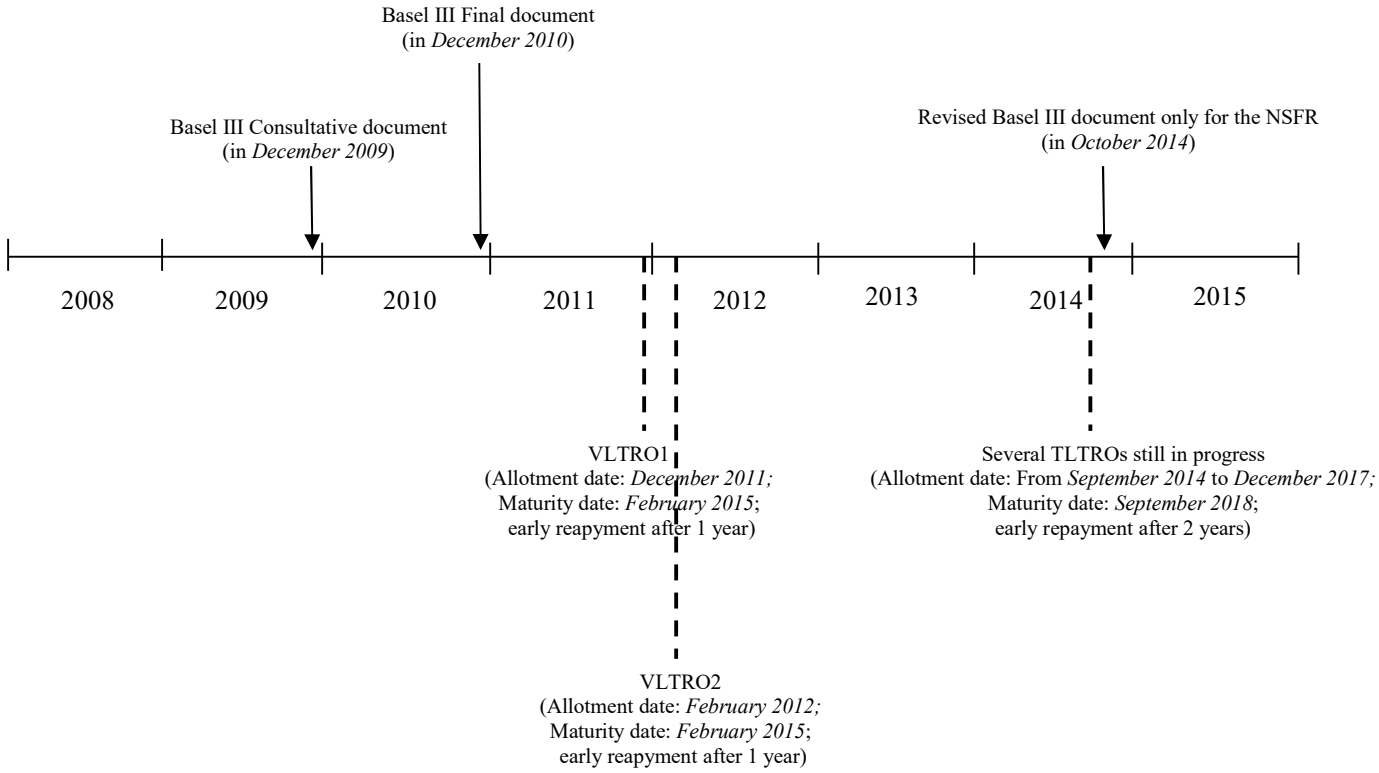


Table 1 – Sample distribution by country

This table illustrates the sample distribution by country of our sample of banks belonging to the 15 member states of the eurozone area over the period 2008Q1-2015Q2. The analysis focuses only on those banks with available data to compute our target variable (i.e. the Net Stable Funding Ratio, NSFR).
In the last column this table shows the number of banks of our sample that are also included in the EBA stress test exercise of 2014 and, in brackets, the total number of banks considered by EBA in each country.
* Slovakia is the only country of our sample not considered by EBA in its stress test exercise of 2014.

Country	Total n. of banks	of which:
		n. of sample banks included in the EBA stress test exercise of 2014 (total n. of EBA stress test banks)
Austria	13	6(6)
Belgium	2	2 (6)
Cyprus	3	2 (3)
France	6	6 (6)
Germany	23	13 (24)
Greece	7	1 (4)
Ireland	5	2 (3)
Italy	36	15 (15)
Luxembourg	2	2 (2)
Malta	2	1 (1)
Netherlands	10	2 (6)
Portugal	5	3 (3)
Slovakia*	2	Not included
Slovenia	1	1 (3)
Spain	43	10 (15)
Total	160	62 (97)

Figure 3 – Trend of total loans to customers

The figure shows the quarterly average growth rate of total loans to customers (computed as the natural logarithm of total gross loans at time t over t-1, LOG_GL) for the full sample over the period 2008Q1 – 2015Q2. Our sample of banks covers 15 countries of the eurozone area. The analysis focuses only on those banks with available data to compute our target variable (i.e. the Net Stable Funding Ratio, NSFR). Source: SNL (S&P Global – Market Intelligence) Database, authors' calculations.

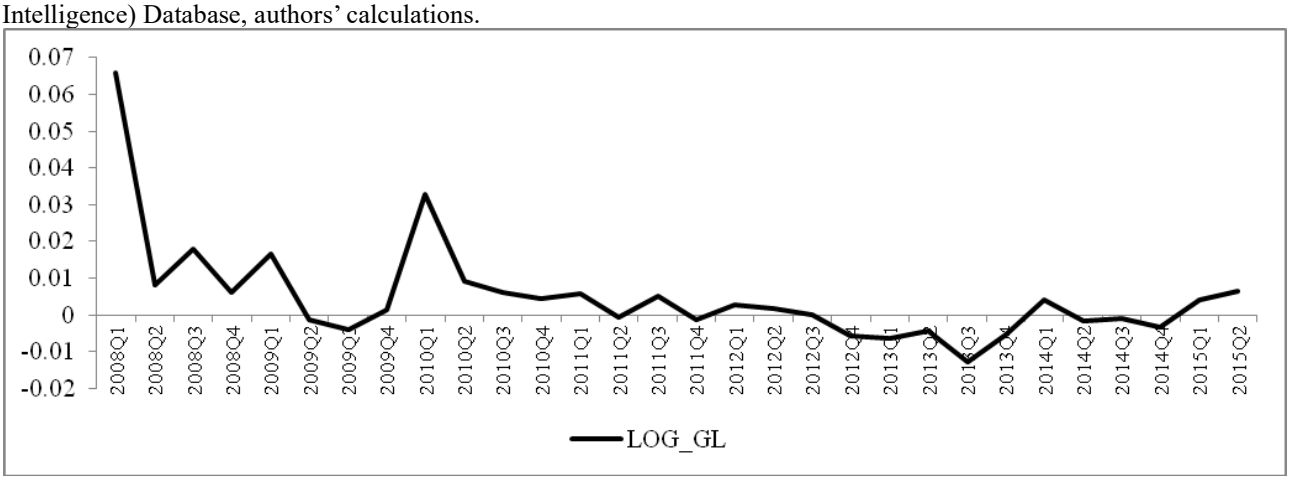


Figure 4 – Total loans to customers by country

This figure shows the average values of total loans to customers (computed as the natural logarithm of total gross loans at time t over t-1, LOG_GL) by country for the full sample over the period 2008Q1 – 2015Q2. Our sample of banks covers 15 countries of the eurozone area. The analysis focuses only on those banks with available data to compute our target variable (i.e. the Net Stable Funding Ratio, NSFR). Source: SNL (S&P Global – Market Intelligence) Database, authors' calculations.

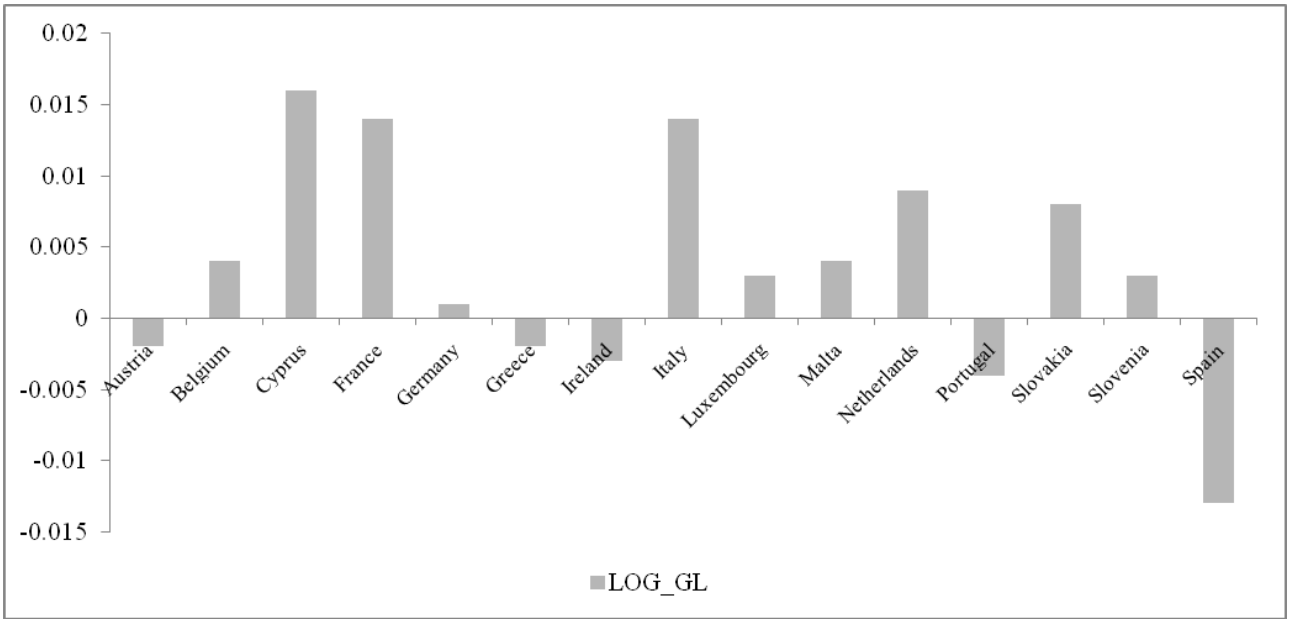
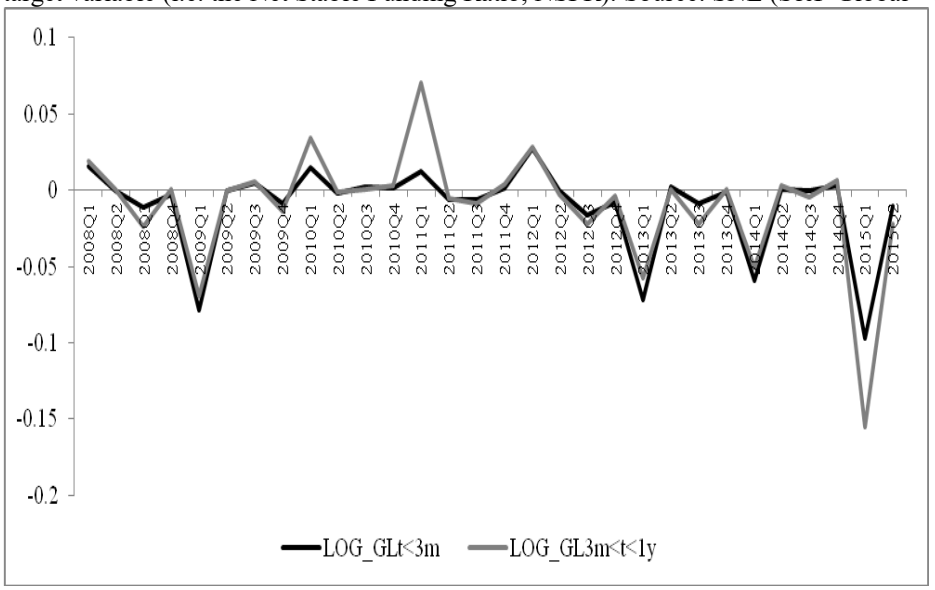


Figure 5 – Trend of loans to customers by maturity

The figure shows the quarterly average growth rate of loans to customers (computed as the natural logarithm of the ratio of gross loans in t to gross loans in t-1, LOG_GL) by maturity, over the period 2008Q1 – 2015Q2. The figure on the left shows the trend of loans with a maturity (i) less than 3 months (LOG_GLt<3m), and (ii) more than 3 months, but less than 1 year (LOG_GL3m<t<1y). The figure on the right shows the trend of loans with a maturity (i) more than 1 year, but less than 5 years (LOG_GL1y<t<5y), and (ii) more than 5 years (LOG_GLt>5y). Our sample of banks covers 15 countries of the eurozone area. The analysis focuses only on those banks with available data to compute our target variable (i.e. the Net Stable Funding Ratio, NSFR). Source: SNL (S&P Global – Market Intelligence) Database, authors' calculations.



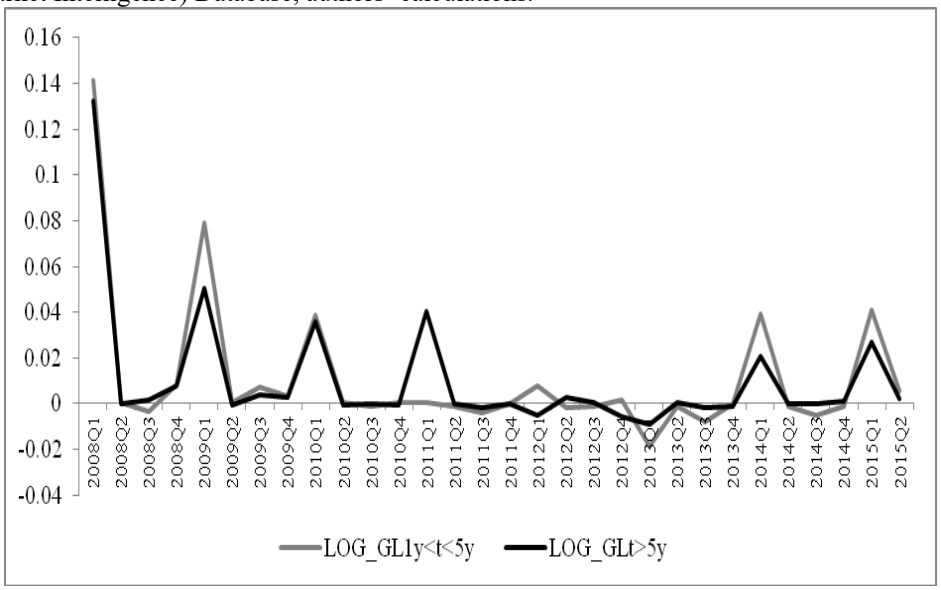


Figure 6 – Trend of the Net Stable Funding Ratio

The figure shows the average values of the Net Stable Funding Ratio – NSFR (i.e. our target variable) for the full sample over the period 2008Q1 – 2015Q2. To mitigate the effect of outliers, we winsorize observations in the outside 1% of each tail. Our sample of banks covers 15 countries of the eurozone area. The red line indicates the minimum threshold of the NSFR (equals to 1) required by Basel III. Source: SNL (S&P Global – Market Intelligence) Database, authors' calculations.

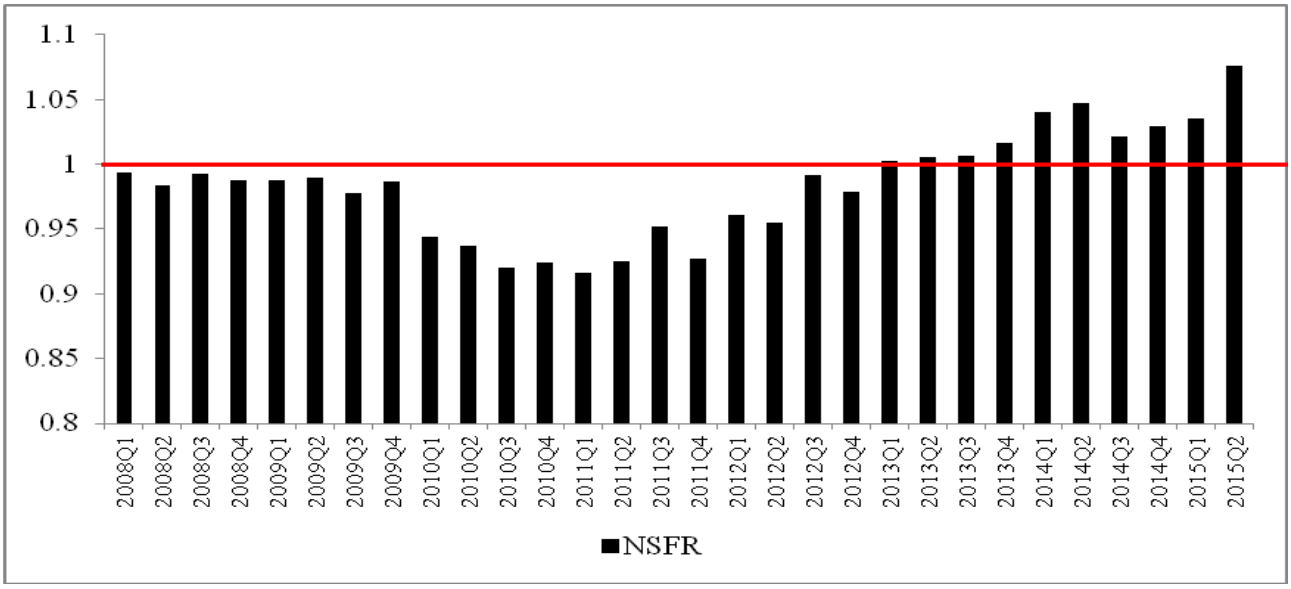


Figure 7 – Net Stable Funding Ratio by Country

The figure shows the average values of the Net Stable Funding Ratio – NSFR (i.e. our target variable) by country for the full sample over the period 2008Q1 – 2015Q2. To mitigate the effect of outliers, we winsorize observations in the outside 1% of each tail. Our sample of banks covers 15 countries of the eurozone area. The red line indicates the minimum threshold of the NSFR (equals to 1) required by Basel III. Source: SNL (S&P Global – Market Intelligence) Database, authors' calculations.

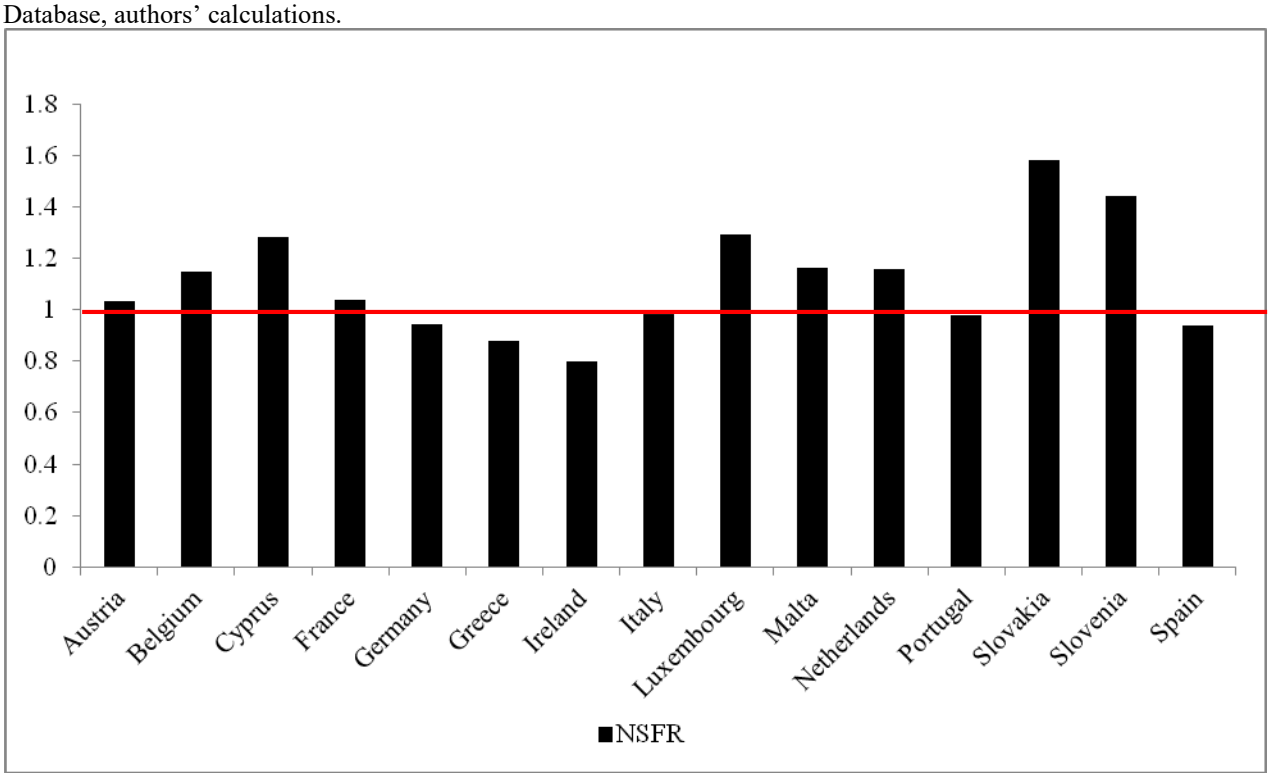


Table 2 – Summary statistics of the control variables

This table reports summary statistics of the control variables based on accounting data (the so-called bank level variables) - see Panel A; on macroeconomic data (the so-called macroeconomic variables) - see Panel B; and on the ECB's Bank Lending Survey (BLS) - Panel C, for the full sample of banks (belonging to the 15 countries of the eurozone area), over the period 2008Q1 – 2015Q2. See Table A.1 in Appendix for the description of the control variables. All variables based on accounting data are winsorised at the 1 per cent of each tail. Our sample of banks covers 15 countries of the eurozone area. The analysis focuses only on those banks with available data to compute our target variable (i.e. the NSFR). Data on control variables are collected with quarterly frequency, but they are showed in the table on annual basis. The year 2015 is relative to 2015Q1 and 2015Q2.

Panel A – Bank level variables

	SIZE		ETA		ROAA		CIR		NPL_GL	
Year	Mean (Std. Dev.)	Min. – Max.	Mean (Std. Dev.)	Min. – Max.	Mean (Std. Dev.)	Min. – Max.	Mean (Std. Dev.)	Min. – Max.	Mean (Std. Dev.)	Min. – Max.
2008	17.285 (1.606)	13.187 - 21.250	0.059 (0.034)	0.004 – 0.245	0.002 (0.009)	-0.068 – 0.031	0.622 (0.230)	0.156 – 1.722	0.028 (0.036)	-0.069 – 0.252
2009	17.331 (1.578)	13.187 - 21.250	0.062 (0.035)	0.004 – 0.245	0.0008 (0.011)	-0.068 – 1.722	0.599 (0.226)	0.156 – 1.722	0.033 (0.038)	-0.069 – 0.252
2010	17.424 (1.592)	13.187 - 21.250	0.063 (0.037)	0.004 – 0.245	0.001 (0.013)	-0.068 – 0.028	0.629 (0.239)	0.156 – 1.722	0.038 (0.042)	-0.069 – 0.252
2011	17.385 (1.584)	13.187 - 21.250	0.065 (0.038)	0.004 – 0.245	-0.001 (0.014)	-0.068 – 0.022	0.650 (0.225)	0.156 – 1.722	0.037 (0.042)	-0.069 – 0.252
2012	17.395 (1.631)	13.492 - 21.250	0.062 (0.038)	0.004 – 0.245	-0.003 (0.017)	-0.068 – 0.031	0.705 (0.315)	0.156 – 1.722	0.043 (0.047)	-0.069 – 0.252
2013	17.430 (1.600)	13.795 - 21.250	0.064 (0.031)	0.010 – 0.245	-0.001 (0.014)	-0.068 – 0.030	0.684 (0.263)	0.156 – 1.722	0.048 (0.052)	-0.069 – 0.252
2014	17.505 (1.674)	14.062 - 21.250	0.070 (0.031)	0.012 – 0.245	0.00001 (0.011)	-0.068 – 0.031	0.643 (0.233)	0.156 – 1.722	0.057 (0.055)	-0.069 – 0.252
2015	17.528 (1.565)	14.413 – 20.321	0.0693 (0.023)	0.125 – 0.125	0.004 (0.005)	-0.007 – 0.015	0.574 (0.213)	0.331 – 1.344	0.044 (0.047)	-0.039 – 0.138

Panel B – Macroeconomic variables

Year	GDPC		DIFF_EURIBOR	
	Mean (Std. Dev.)	Min. – Max.	Mean (Std. Dev.)	Min. – Max.
2008	-0.005 (0.011)	-0.058 – 0.017	-0.001 (0.004)	-0.007 – 0.003
2009	-0.005 (0.014)	-0.088 – 0.026	-0.008 (0.007)	-0.022 – -0.001
2010	0.004 (0.008)	-0.033 – 0.024	0.0007 (0.0009)	-0.0005 – 0.001
2011	0.00006 (0.007)	-0.029 – 0.018	0.001 (0.001)	-0.0006 – 0.003
2012	-0.003 (0.006)	-0.022 – 0.019	-0.003 (0.010)	-0.004 – -0.001
2013	0.001 (0.006)	-0.017 – 0.047	0.0001 (0.00009)	-0.00004 – 0.0001
2014	0.002 (0.004)	-0.005 – 0.040	-0.0004 (0.0007)	-0.001 – 0.0005
2015	0.006 (0.005)	0.001 – 0.021	-0.00044 (0.0008)	-0.0005 - -0.0003

Panel C - ECB's Bank Lending Survey variables

Year	BLS_SUPPLY_ENTERPRISES		BLS_SUPPLY_HOUSE_PURCHASE		BLS_SUPPLY_CONSUMER_CREDIT		BLS_DEMAND_ENTERPRISES		BLS_DEMAND_HOUSE_PURCHASE		BLS_DEMAND_CONSUMER_CREDIT	
	Mean (Std. Dev.)	Min. – Max.	Mean (Std. Dev.)	Min. – Max.	Mean (Std. Dev.)	Min. – Max.	Mean (Std. Dev.)	Min. – Max.	Mean (Std. Dev.)	Min. – Max.	Mean (Std. Dev.)	Min. – Max.
2008	0.287 (0.149)	0 – 0.700	0.219 (0.212)	-0.100 – 0.700	0.173 (0.189)	-0.110 – 0.700	-0.086 (0.232)	-0.750 – 0.490	-0.323 (0.212)	-0.700 – 0.444	-0.097 (0.263)	-0.550 – 0.627
2009	0.209 (0.177)	-0.100 – 0.800	0.155 (0.159)	-0.200 – 0.670	0.163 (0.148)	0 – 0.550	-0.195 (0.223)	-0.880 – 0.200	-0.171 (0.256)	-0.900 – 0.463	-0.182 (0.190)	-0.670 – 0.456
2010	0.046 (0.118)	-0.204 – 0.700	0.039 (0.092)	-0.289 – 0.500	0.064 (0.096)	-0.303 – 0.400	-0.029 (0.139)	-0.630 – 0.250	0.015 (0.179)	-0.461 – 0.569	-0.057 (0.111)	-0.483 – 0.250
2011	0.064 (0.145)	-0.071 – 0.800	0.071 (0.123)	-0.206 – 0.700	0.050 (0.123)	-0.308 – 0.700	0.016 (0.127)	-0.500 – 0.250	-0.038 (0.247)	-0.100 – 0.500	-0.054 (0.177)	-0.800 – 0.250
2012	0.134 (0.148)	-0.015 – 0.700	0.102 (0.124)	-0.111 – 0.500	0.052 (0.099)	-0.167 – 0.500	-0.157 (0.134)	-0.380 – 0.160	-0.199 (0.268)	-0.900 – 0.388	-0.150 (0.37)	-0.500 – 0.332
2013	0.066 (0.108)	-0.250 – 0.500	0.043 (0.091)	-0.130 – 0.400	0.022 (0.078)	-0.144 – 0.500	-0.118 (0.110)	-0.380 – 0.162	-0.086 (0.245)	-0.630 – 0.300	-0.053 (0.157)	-0.400 – 0.350
2014	0.006 (0.070)	-0.250 – 0.140	-0.023 (0.085)	-0.250 – 0.260	-0.006 (0.054)	-0.173 – 0.380	-0.007 (0.117)	-0.380 – 0.380	0.085 (0.161)	-0.300 – 0.800	0.014 (0.118)	-0.380 – 0.380
2015	-0.011 (0.066)	-0.130 – 0.100	-0.005 (0.045)	-0.012 – 0.134	-0.016 (0.063)	-0.200 – 0.206	0.105 (0.134)	-0.210 – 0.380	0.156 (0.214)	0 – 0.800	0.108 (0.101)	-0.140 – 0.346

Table 3 – Correlations

This table shows the correlation matrix for the explanatory variables based on accounting data used in the empirical analysis over the sample period (2008Q1-2015Q2). See Table A.1 in Appendix for the description of the explanatory variables. All variables are winsorised at the 1 per cent of each tail.

Variables	NSFR	SIZE	ETA	ROAA	CIR	NPL_GL
NSFR	1					
SIZE	-0.0694*	1				
ETA	0.0921*	-0.3240*	1			
ROAA	0.1165*	-0.0220	0.2522*	1		
CIR	-0.0556*	-0.0858*	-0.1436*	-0.3698*	1	
NPL_GL	0.0019	0.0820*	-0.0451*	-0.0040	0.0266	1

Table 4 – Panel estimations results: baseline model

This table presents the results of the estimation of panel regressions with bank and time fixed-effects (FE) on the full sample of banks (belonging to the 15 countries of the eurozone area), over the period 2008Q1-2015Q2. The dependent variable is loans to customers, both at aggregate level and by maturity. For total loans we use the quarterly average growth rate of gross loans (LOG_GL); and for loans by maturity we use: (i) the LOG_GL less than 3 months (LOG_GLt<3m); (ii) the LOG_GL more than 3 months, but less than 1 year (LOG_GL3m<t<1y); (iii) the LOG_GL more than 1 year, but less than 5 years (LOG_GL1y<t<5y); and (iv) the LOG_GL more than 5 years (LOG_GLt>5y). The Basel III structural liquidity ratio (the NSFR) is our target variable. The control variables include those based on accounting data (the so-called bank level variables, that are: SIZE, ETA, ROAA, CIR, and NPL_GL), those based on macroeconomic data (the so-called macroeconomic variables, that are: GDPC and DIFF_EURIBOR), the ECB's BLS variables (that are: BLS_SUPPLY_ENTERPRISES, BLS_SUPPLY_HOUSE_PURCHASE, BLS_SUPPLY_CONSUMER_CREDIT, BLS_DEMAND_ENTERPRISES, BLS_DEMAND_HOUSE_PURCHASE, and BLS_DEMAND_CONSUMER_CREDIT), and the dummy variable d_EBA. See Table A.1 in Appendix for the description of the explanatory variables. The latter are lagged by one quarter, except GDPC, DIFF_EURIBOR, and D_EBA. All variables based on accounting data are winsorized at the 1 per cent of each tail. Quarter dummy variables are also included in the model. Two-way clustered standard errors (bank and quarter) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

Variables	Total Loans	Loans by maturity			
	LOG_GL	LOG_GLt<3m	LOG_GL3m<t<1y	LOG_GL1y<t<5y	LOG_GLt>5y
NSFR (-1)	0.009	0.021***	-0.010	-0.012	-0.011**
	(0.007)	(0.007)	(0.014)	(0.010)	(0.005)
SIZE (-1)	-0.039**	-0.001	-0.020	-0.041	-0.053**
	(0.016)	(0.022)	(0.025)	(0.028)	(0.027)
ETA (-1)	-0.140	-0.301	0.202	-0.276	-0.012
	(0.091)	(0.322)	(0.328)	(0.319)	(0.143)
ROAA (-1)	0.152	1.786**	0.311	0.497	0.389
	(0.175)	(0.855)	(0.690)	(0.456)	(0.527)
CIR (-1)	0.006	0.031	0.006	-0.012	-0.006
	(0.010)	(0.041)	(0.027)	(0.020)	(0.021)
NPL_GL (-1)	-0.251***	-0.167	-0.048	-0.074	-0.198*
	(0.083)	(0.166)	(0.075)	(0.090)	(0.102)
GDPC	0.622*	0.136	-0.020	0.592	0.958
	(0.357)	(0.518)	(0.591)	(0.594)	(0.661)
DIFF_EURIBOR	-0.009**	0.028**	-0.007	-0.039***	-0.031***
	(0.005)	(0.012)	(0.007)	(0.007)	(0.008)
SUPPLY_ENTERPRISES (-1)	0.015	0.052	0.065	0.015	0.025
	(0.018)	(0.054)	(0.042)	(0.036)	(0.032)
SUPPLY_HOUSE_PURCHASE (-1)	-0.002				-0.018
	(0.009)				(0.027)
SUPPLY_CONSUMER_CREDIT (-1)	-0.028	-0.051	-0.100*	-0.021	-0.065
	(0.027)	(0.076)	(0.051)	(0.056)	(0.052)
DEMAND_ENTERPRISES (-1)	0.014	0.058	0.015	0.013	-0.018
	(0.010)	(0.056)	(0.028)	(0.015)	(0.021)
DEMAND_HOUSE_PURCHASE (-1)	-0.011				-0.023

	(0.008)				(0.015)
DEMAND_CONSUMER_CREDIT (-1)	0.025**	-0.064	-0.022	0.049	0.063*
	(0.011)	(0.064)	(0.023)	(0.030)	(0.034)
D_EBA	0.099	-0.050	0.483***	0.102	0.150**
	(0.076)	(0.134)	(0.144)	(0.085)	(0.061)
Bank FE	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes
Cluster standard errors (Bank, Quarter)	Yes	Yes	Yes	Yes	Yes
N. of obs.	2,539	2,539	2,539	2,539	2,539
R-squared	0.151	0.056	0.069	0.121	0.132

Table 5 – Differences-in-differences-in-differences estimations results

This table presents differences-in-differences-in-differences (DDD) estimations results on the full sample of banks (belonging to the 15 countries of the eurozone area) for loans to customers, both at aggregate level and by maturity, over the period 2008Q1-2015Q2. For total loans we use the quarterly average growth rate of gross loans (LOG_GL); and for loans by maturity we use: (i) the LOG_GL less than 3 months (LOG_GLt<3m); (ii) the LOG_GL more than 3 months, but less than 1 year (LOG_GL3m<t<1y); (iii) the LOG_GL more than 1 year, but less than 5 years (LOG_GL1y<t<5y); and (iv) the LOG_GL more than 5 years (LOG_GLt>5y). The target variables are: D_SHOCK, that takes the value of 1 for the years (2010Q1 – 2015Q2) before the shock (i.e. the the publication of the consultative document of Basel III in December 2009), and 0 otherwise; D_TREATED*D_SHOCK, that derives from the interaction between D_SHOCK and the variable D_TREATED, that takes the value of 1 for banks with a Net Stable Funding Ratio (NSFR) less than 0.95 in the quarter of the shock, and 0 otherwise; D_CAPITAL*D_SHOCK, that derives from the interaction between D_SHOCK and the variable D_CAPITAL, that takes the value of 1 for banks with an equity to total assets (ETA) equals to or above the median of ETA in the quarter of the shock, and 0 otherwise; and D_TREATED*D_CAPITAL*D_SHOCK. The control variables include those based on accounting data (the so-called bank level variables, that are: SIZE, ETA, ROAA, CIR, and NPL_GL), those based on macroeconomic data (the so-called macroeconomic variables, that are: GDPC and DIFF_EURIBOR), the ECB's Bank Lending Survey (BLS) variables (that are: BLS_SUPPLY_ENTERPRISES, BLS_SUPPLY_HOUSE_PURCHASE, BLS_SUPPLY_CONSUMER_CREDIT, BLS_DEMAND_ENTERPRISES, BLS_DEMAND_HOUSE_PURCHASE, and BLS_DEMAND_CONSUMER_CREDIT), and the dummy variable d_EBA. See Table A.1 in Appendix for the description of the explanatory variables. All the control variables are lagged by one quarter, except GDPC, DIFF_EURIBOR, and D_EBA. All variables based on accounting data are winsorized at the 1 per cent of each tail. Bank fixed-effects (FE) are included in the model. Two-way clustered standard errors (bank and quarter) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

Variables	Total Loans	Loans by maturity			
	LOG_GL	LOG_GLt<3m	LOG_GL3m<t<1y	LOG_GL1y<t<5y	LOG_GLt>5y
D_SHOCK	-0.005	-0.001	-0.018	-0.023	-0.048*
	(0.011)	(0.011)	(0.021)	(0.022)	(0.027)
D_TREATED*D_SHOCK	-0.010	-0.013	0.009	-0.002	0.038
	(0.010)	(0.030)	(0.025)	(0.022)	(0.020)
D_CAPITAL*D_SHOCK	0.004	0.015	0.039	0.013	0.037***
	(0.011)	(0.019)	(0.029)	(0.016)	(0.011)
D_TREATED*D_CAPITAL*D_SHOCK	0.012	0.028*	-0.008	0.018	-0.028**
	(0.014)	(0.015)	(0.044)	(0.034)	(0.013)
Control variables (-1)	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
Quarter FE	No	No	No	No	No
Cluster standard errors (Bank, Quarter)	Yes	Yes	Yes	Yes	Yes
N. of obs.	2,539	2,539	2,539	2,539	2,539
R-squared	0.148	0.060	0.071	0.113	0.122

Table 6 – Timeline and main characteristics of the ECB's VLTROs and TLTROs

The table illustrates the timeline and the main characteristcs of the ECB's unconventional liquidity injections allotted to eurozone banks during the period observed (2008Q1-2015Q2): the 3-years Very Long-Term Refinancing Operations (VLTROs), and the Targeted Longer-Term Refininancing Operations (TLTROs) with a maturity of up to 4 years.
*This amount includes €49.752 billion transferred from the 12-month Long-Term Refinancing Operation (LTRO) allotted in October 2011 to 114 banks.
Data are collected from the ECB website (see https://www.ecb.europa.eu/mopo/implement/omo/html/top_history.en.html).

Operation's type	Announcement date	Allotment Date	Settlement date	First date for early repayment	Maturity Date	Allotted amount in billion of euros (n. of banks that received the liquidity injection)	**Total allotted amount** (in billion of euros)
VLTRO1	20 Dec. 2011	21 Dec. 2011	22 Dec. 2011	30 Jan. 2013	29 Jan. 2015	489.1908* (523 banks)	**1,018.720**
VLTRO2	28 Feb. 2012	29 Feb. 2012	1 Mar. 2012	27 Feb. 2013	26 Feb. 2015	529.5308 (800 banks)	
TLTRO1	16 Sep. 2014	18 Sep. 2014	24 Sep. 2014	28 Sep. 2016	26 Sep. 2018	82.60157 (255)	**384.078**
TLTRO2	9 Dec. 2014	11 Dec. 2014	17 Dec. 2014	21 Dec. 2016	26 Sep. 2018	129.8401 (306 banks)	
TLTRO3	17 Mar. 2015	19 Mar. 2015	25 May 2015	29 Mar. 2017	26 Sep. 2018	97.84823 (143)	
TLTRO4	16 June 2015	18 June 2015	24 June 2015	28 June 2017	26 Sep. 2018	73.78917 (128 banks)	

Table 7 – Panel estimations results with the ECB's unconventional liquidity injections

This table presents the results of the estimation of panel regressions with bank fixed-effects (FE) for loans to customers, at aggregate level and by maturity, taking into account both the 3-years Very Long-Term Refinancing Operations (VLTROs) and the Targeted Longer-Term Refinancing Operations (TLTROs) realized by the ECB over the period 2008Q1 - 2015Q2. For the 'Full sample of banks' (i.e. those belonging to the 15 countries of the eurozone area, see Table 1), the variables D_VLTRO and D_TLTRO take into account only when these ECB's liquidity injections occurred without making any difference between bank/country. So, D_VLTRO takes the value of 1 for the period in which the ECB gave liquidity to the eurozone banking system through the VLTROs (2011Q4-2015Q1), and 0 otherwise; and D_TLTRO takes the value of 1 for the period in which the ECB started to give liquidity to the eurozone banking system through the TLTROs (from 2014Q3 on), and 0 otherwise. For the 'Sub-sample of banks' (i.e. those belonging to the 13 countries of the eurozone area for which Bloomberg, Reuters and/or Eikon Databases provide information on the ECB's VLTROs and/or TLTROs at the bank level, see Table 8), the variables D_VLTRO_bank and D_TLTRO_bank take into account the effective uptake of each bank in the countries considered. So, D_VLTRO_bank takes the value of 1 for the period in which the ECB gave liquidity to a specific bank belonging to the eurozone system through the VLTROs (2011Q4-2015Q1), and 0 otherwise; and D_TLTRO_bank takes the value of 1 for the period in which the ECB started to give liquidity to a specific bank belonging to the eurozone system through the TLTROs (from 2013Q3 on), and 0 otherwise. See Table 6 for the timeline and for the main characteristics of these operations. The dependent variable is loans to customers, both at aggregate level and by maturity. For total loans we use the quarterly average growth rate of gross loans (LOG_GL); and for loans by maturity we use: (i) the LOG_GL less than 3 months (LOG_GLt<3m); (ii) the LOG_GL more than 3 months, but less than 1 year (LOG_GL3m<t<1y); (iii) the LOG_GL more than 1 year, but less than 5 years (LOG_GL1y<t<5y); and (iv) the LOG_GL more than 5 years (LOG_GLt>5y). The Basel III structural liquidity ratio (the NSFR) is our target variable. The control variables include those based on accounting data (the so-called bank level variables, that are: SIZE, ETA, ROAA, CIR, and NPL_GL), those based on macroeconomic data (the so-called macroeconomic variables, that are: GDPC and DIFF_EURIBOR), the ECB's BLS variables (that are: BLS_SUPPLY_ENTERPRISES, BLS_SUPPLY_HOUSE_PURCHASE, BLS_SUPPLY_CONSUMER_CREDIT, BLS_DEMAND_ENTERPRISES, BLS_DEMAND_HOUSE_PURCHASE, and BLS_DEMAND_CONSUMER_CREDIT), and the dummy variable d_EBA. See Table A.1 in Appendix for the description of the explanatory variables. The latter are lagged by one quarter, except GDPC, DIFF_EURIBOR, and D_EBA. All variables based on accounting data are winsorized at the 1 per cent of each tail. Two-way clustered standard errors (bank and quarter) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

	Full sample of banks					Sub-sample of banks				
Variables	Total Loans	Loans by maturity				Total Loans	Loans by maturity			
	LOG_GL	LOG_GLt<3m	LOG_GL3m<t<1y	LOG_GL1y<t<5y	LOG_GLt>5y	LOG_GL	LOG_GLt<3m	LOG_GL3m<t<1y	LOG_GL1y<t<5y	LOG_GLt>5y
NSFR (-1)	0.010	0.022***	-0.009	-0.011	-0.010*	0.005	0.013*	-0.014	-0.026**	-0.011***
	(0.007)	(0.008)	(0.013)	(0.011)	(0.005)	(0.006)	(0.008)	(0.016)	(0.011)	(0.002)
D_VLTRO (-1)	-0.010**	-0.012**	-0.020***	-0.013	-0.019***					
	(0.004)	(0.005)	(0.007)	(0.008)	(0.007)					
D_TLTRO (-1)	0.001	0.024***	0.011	0.000	0.006					
	(0.005)	(0.009)	(0.009)	(0.011)	(0.009)					
D_VLTRO_bank (-1)						-0.009*	-0.018	-0.017**	-0.003	-0.011*
						(0.005)	(0.024)	(0.008)	(0.009)	(0.006)
D_TLTRO_bank (-1)						0.009	0.015	0.011	0.007	0.012
						(0.008)	(0.017)	(0.012)	(0.016)	(0.015)
Control variables (-1)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	No	No	No	No	No	No	No	No	No	No
Cluster standard errors (Bank, Quarter)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. of obs.	2,539	2,539	2,539	2,539	2,539	1,175	1,175	1,175	1,175	1,175
R-squared	0.156	0.056	0.072	0.123	0.138	0.179	0.056	0.068	0.133	0.141

Table 8 – The VLTROs and TLTROs uptakes by country for a sub-sample of eurozone banks

This table shows the uptakes of allotment (in euros) for the 3-years Very Long-Term Refinancing Operations (VLTROs) and for the Targeted Longer-Term Refinancing Operations (TLTROs) by country for a sub-sample of eurozone banks for which Bloomberg, Reuters and/or Eikon Databases provide information on these ECB's liquidity injections at the bank level, over the period 2008Q1-2015Q2. For both VLTROs and TLTROs, the table shows the total allotted amount, the allotted amount for each tranche (with in bracket the allotment date) and the number of banks that received the ECB's liquidity injections (with in bracket the number of banks belonging to the EBA stress test exercise of 2014). The abbreviation n.a. stands for not available.

	VLTROs				TLTROs					
Country	Total	VLTRO1 (2011Q4)	VLTRO2 (2012Q1)	N. of banks with data on VLTROs (of which included in the EBA stress test exercise of 2014)	Total	TLTRO1 (2014Q3)	TLTRO2 (2014Q4)	TLTRO3 (2015Q1)	TLTRO4 (2015Q2)	N. of banks with data on TLTROs (of which included in the EBA stress test exercise of 2014)
Austria	8,150,000,000	5,600,000,000	2,550,000,000	4 (3)	2,695,000,000	890,000,000	1,590,000,000	215,000,000	0	3 (3)
Belgium	43,900,000,000	23,500,000,000	20,400,000,000	4 (4)	8,050,000,000	800,000,000	3,500,000,000	0	3,750,000,000	3 (3)
Cyprus	3,500,000,000	1,000,000,000	2,500,000,000	1 (1)	736,000,000	0	736,000,000	0	0	2 (2)
France	67,000,000,000	10,000,000,000	57,000,000,000	2 (2)	19,000,000,000	5,000,000,000	14,000,000,000	0	0	2 (2)
Germany	32,200,000,000	15,500,000,000	16,700,000,000	5 (5)	22,000,000,000	11,000,000,000	11,000,000,000	0	0	2 (2)
Greece	11,000,000,000	5,000,000,000	6,000,000,000	2 (2)	7,740,000,000	5,200,000,000	2,540,000,000	0	0	4 (4)
Ireland	28,550,000,000	13,500,000,000	15,050,000,000	3 (3)	1,900,000,000	1,900,000,000	0	0	0	1 (1)
Italy	205,400,000,000	93,050,000,000	112,350,000,000	24 (15)	97,288,000,000	23,434,000,000	26,741,300,000	32,584,700,000	14,528,000,000	17 (14)
Malta	170,000,000	85,000,000	85,000,000	1 (1)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Netherlands	2,575,000,000	1,125,000,000	1,450,000,000	3 (1)	8,700,000,000	1,425,000,000	4,275,000,000	0	3,000,000,000	1 (1)
Portugal	24,725,000,000	11,300,000,000	13,425,000,000	5 (3)	9,002,600,000	0	4,993,600,000	1,109,000,000	2,900,000,000	3 (3)
Slovenia	2,000,000,000	750,000,000	1,250,000,000	3 (2)	208,000,000	0	208,000,000	0	0	2 (2)
Spain	184,535,000,000	111,180,000,000	73,355,000,000	14 (7)	104,294,400,000	15,270,000,000	24,159,000,000	19,260,700,000	45,604,700,000	14 (7)
Total	**613,705,000,000**	**291,590,000,000**	**322,115,000,000**	**71 (49)**	**281,614,000,000**	**64,919,000,000**	**93,742,900,000**	**53,169,400,000**	**69,782,700,000**	**54 (44)**

Table 9 - Panel estimations results with the ECB's unconventional liquidity injections by banks compliant (or not) to the Basel III structural liquidity ratio

This table presents the results of the estimation of panel regressions with bank fixed-effects (FE) for total loans to customers taking into the 3-years Very Long-Term Refinancing Operations (VLTROs) and the Targeted Longer-Term Refinancing Operations (TLTROs) realized by the ECB over the period 2008Q1 and 2015Q2, and distinguishing the sample into banks compliant or not compliant to the Basel III structural liquidity ratio (i.e. the NSFR, our target variable). The banks compliant (not compliant) to the Basel III structural liquidity ratio are those with NSFR equals or above (below) to 1. For the 'Full sample of banks' (i.e. those belonging to the 15 countries of the eurozone area, see Table 1), the variables D_VLTRO and D_TLTRO take into account only when these ECB's liquidity injections occurred without making any difference between bank/country. So, D_VLTRO takes the value of 1 for the period in which the ECB gave liquidity to the eurozone banking system through the VLTROs (2011Q4-2015Q1), and 0 otherwise; and D_TLTRO takes the value of 1 for the period in which the ECB started to give liquidity to the eurozone banking system through the TLTROs (from 2011Q4 on), and 0 otherwise. For the 'Sub-sample of banks' (i.e. those belonging to the 13 countries of the eurozone area for which Bloomberg, Reuters and/or Eikon Databases provide information on the ECB's VLTROs and/or TLTROs at the bank level, see Table 8), the variables D_VLTRO_bank and D_TLTRO_bank take into account the effective uptake of each bank in the countries considered. So, D_VLTRO_bank takes the value of 1 for the period in which the ECB gave liquidity to a specific bank belonging to the eurozone system through the VLTROs (2011Q4-2015Q1), and 0 otherwise; and D_TLTRO_bank takes the value of 1 for the period in which the ECB started to give liquidity to a specific bank belonging to the eurozone system through the TLTROs (from 2014Q3 on), and 0 otherwise. See Table 6 for the timeline and for the main characteristics of these operations. The dependent variable is loans to customers, both at aggregate level and by maturity. For total loans we use the quarterly average growth rate of gross loans (LOG_GL); and for loans by maturity we use: (i) the LOG_GL less than 3 months (LOG_GLt<3m); (ii) the LOG_GL more than 3 months, but less than 1 year (LOG_GL3m<t<1y); (iii) the LOG_GL more than 1 year, but less than 5 years (LOG_GL1y<t<5y); and (iv) the LOG_GL more than 5 years (LOG_GLt>5y). The Basel III structural liquidity ratio (the NSFR) is our target variable. The control variables include those based on accounting data (the so-called bank level variables, that are: SIZE, ETA, ROAA, CIR, and NPL_GL), those based on macroeconomic data (the so-called macroeconomic variables, that are: GDPC and DIFF_EURIBOR), the ECB's BLS variables (that are: BLS_SUPPLY_ENTERPRISES, BLS_SUPPLY_HOUSE_PURCHASE, BLS_SUPPLY_CONSUMER_CREDIT, BLS_DEMAND_ENTERPRISES, BLS_DEMAND_HOUSE_PURCHASE, and BLS_DEMAND_CONSUMER_CREDIT), and the dummy variable d_EBA. See Table A.1 in Appendix for the description of the explanatory variables. The latter are lagged by one quarter, except GDPC, DIFF_EURIBOR, and D_EBA. All variables based on accounting data are winsorized at the 1 per cent of each tail. Two-way clustered standard errors (bank and quarter) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

Variables	Total loans (LOG_GL)			
	Full sample of banks		Sub-sample of banks	
	NSFR>=1	NSFR<1	NSFR>=1	NSFR<1
D_VLTRO (-1)	-0.011*	-0.011**		
	(0.006)	(0.005)		
D_TLTRO (-1)	-0.001	0.005		
	(0.005)	(0.003)		
D_VLTRO_bank (-1)			-0.004	-0.012*
			(0.007)	(0.006)
D_TLTRO_bank (-1)			-0.004	0.020
			(0.015)	(0.014)
Control variables (-1)	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Quarter FE	No	No	No	No
Cluster standard errors (Bank, Quarter)	Yes	Yes	Yes	Yes
N. of obs.	1,190	1,349	514	661
R-squared	0.159	0.160	0.289	0.159

Table 10 – Panel estimations results with the amount of uptake in the two VLTROs for a sub-sample of eurozone banks over the period 2008Q1 – 2013Q2 (early repayment).

This table presents the results of the estimation of panel regressions with bank and time fixed-effects (FE) for loans to customers, both at aggregate level and by maturity, taking into the amount of uptake by banks in the first and second rounds of the the 3-years Very Long-Term Refinancing Operations (VLTROs) that are the VLTRO1 in 2011Q4 and the VLTRO2 in 2012Q1. Although the VLTROs had a maturity of 3 years (deadline in 2015Q1), they included the option of early repayment after one year (occurred in 2013Q1). However, data on early repayment are not public available, so for this reason, we stop the analysis to the quarter immediately after their early reimburse (2008Q1-2013Q2). The variables VLTRO1_bank and VLTRO2_bank are computed as the amount borrowed to the bank participating in each of the two VLTROs scaled to the bank's total assets. Both variables VLTRO1_bank and VLTRO2_bank are lagged by one quarter. Data on VLTROs are collected from Bloomberg, Reuters and/or Eikon Database at the bank level and are relative to a sub-sample of banks belonging to the 13 eurozone countries (see Table 8). See Table 6 for the timeline and for the main characteristics of these operations. The dependent variable is loans to customers, both at aggregate level and by maturity. For total loans we use the quarterly average growth rate of gross loans (LOG_GL); and for loans by maturity we use: (i) the LOG_GL less than 3 months (LOG_GLt<3m); (ii) the LOG_GL more than 3 months, but less than 1 year (LOG_GL3m<t<1y); (iii) the LOG_GL more than 1 year, but less than 5 years (LOG_GL1y<t<5y); and (iv) the LOG_GL more than 5 years (LOG_GLt>5y). The Basel III structural liquidity ratio (the NSFR) is our target variable. The control variables include those based on accounting data (the so-called bank level variables, that are: SIZE, ETA, ROAA, CIR, and NPL_GL), those based on macroeconomic data (the so-called macroeconomic variables, that are: GDPC and DIFF_EURIBOR), the ECB's BLS variables (that are: BLS_SUPPLY_ENTERPRISES, BLS_SUPPLY_HOUSE_PURCHASE, BLS_SUPPLY_CONSUMER_CREDIT, BLS_DEMAND_ENTERPRISES, BLS_DEMAND_HOUSE_PURCHASE, and BLS_DEMAND_CONSUMER_CREDIT), and the dummy variable d_EBA. See Table A.1 in Appendix for the description of the explanatory variables. The latter are lagged by one quarter, except GDPC, DIFF_EURIBOR, and D_EBA. All variables based on accounting data are winsorized at the 1 per cent of each tail. Quarter dummy variables are also included in the model. Two-way clustered standard errors (bank and quarter) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

Variables	Total Loans	Loans by maturity			
	LOG_GL	LOG_GLt<3m	LOG_GL3m<t<1y	LOG_GL1y<t<5y	LOG_GLt>5y
NSFR (-1)	0.005	0.023***	0.008	-0.016*	-0.009*
	(0.008)	(0.006)	(0.008)	(0.008)	(0.005)
VLTRO1_bank (-1)	0.086	0.588	0.577***	0.563***	0.136
	(0.084)	(0.419)	(0.177)	(0.201)	(0.299)
VLTRO2_bank (-1)	-0.023	-1.448**	-0.895***	-0.637***	-0.144
	(0.129)	(0.677)	(0.332)	(0.211)	(0.231)
Control variables (-1)	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes
Cluster standard errors (Bank, Quarter)	Yes	Yes	Yes	Yes	Yes
N. of obs.	950	950	950	950	950
R-squared	0.177	0.077	0.086	0.169	0.153

Robustness Tests

Table 11 – Two-step system GMM estimations results

This table presents the results achieved carrying out the GMM regressions on the full sample of banks (belonging to the15 countries of the eurozone area) for loans to customers, both at aggregate level and by maturity, over the period 2008Q1-2015Q2. For total loans we use the quarterly average growth rate of gross loans (LOG_GL); and for loans by maturity we use: (i) the LOG_GL less than 3 months (LOG_GLt<3m); (ii) the LOG_GL more than 3 months, but less than 1 year (LOG_GL3m<t<1y); (iii) the LOG_GL more than 1 year, but less than 5 years (LOG_GL1y<t<5y); and (iv) the LOG_GL more than 5 years (LOG_GLt>5y). The Basel III structural liquidity ratio (the NSFR) is our target variable. The control variables include those based on accounting data (the so-called bank level variables, that are: SIZE, ETA, ROAA, CIR, and NPL_GL), those based on macroeconomic data (the so-called macroeconomic variables, that are: GDPC and DIFF_EURIBOR), the ECB's BLS variables (that are: BLS_SUPPLY_ENTERPRISES, BLS_SUPPLY_HOUSE_PURCHASE, BLS_SUPPLY_CONSUMER_CREDIT, BLS_DEMAND_ENTERPRISES, BLS_DEMAND_HOUSE_PURCHASE, and BLS_DEMAND_CONSUMER_CREDIT), and the dummy variable d_EBA. See Table A.1 in Appendix for the description of the explanatory variables. The latter are lagged by one quarter, except GDPC, DIFF_EURIBOR, and D_EBA. All variables based on accounting data are winsorized at the 1 per cent of each tail. Quarter dummy variables are also included in the model. The standard errors of the estimated coefficients are reported in parentheses. We used the two‐step system GMM estimator (or linear dynamic panel data) with Windmeijer‐corrected standard errors. The Hansen p‐value is that of the Hansen test statistic of over‐identifying restrictions, while AR(2) is the p‐value of the second‐order autocorrelation test statistic. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

Variables	Total Loans	Loans by maturity			
	LOG_GL	LOG_GLt<3m	LOG_GL3m<t<1y	LOG_GL1y<t<5y	LOG_GLt>5y
Dependent variable (-1)	-0.075***	-0.029**	-0.046***	-0.067***	-0.051***
	(0.016)	(0.015)	(0.016)	(0.017)	(0.017)
NSFR (-1)	0.006	0.039	0.031	-0.028**	-0.030***
	(0.006)	(0.026)	(0.019)	(0.013)	(0.011)
Control variables (-1)	Yes	Yes	Yes	Yes	Yes
Bank FE	No	No	No	No	No
Quarter FE	Yes	Yes	Yes	Yes	Yes
N. of obs.	2,522	2,522	2,522	2,522	2,522
Hanse p-value	1.0000	1.0000	1.0000	1.0000	1.0000
AR (2)	0.6896	0.3257	0.0988	0.2706	0.4583

Table 12 – Panel estimations results: GIIPS vs no-GIIPS

This table presents the results of the estimation of panel regressions with bank and time fixed-effects (FE), distinguishing the sample into GIIPS countries and no-GIIPS countries, over the period 2008Q1-2015Q2. The GIIPS countries are: Greece, Ireland, Italy, Portugal, and Spain. In our analysis the no-GIIPS countries includes: Austria, Belgium, Cyprus, France, Germany, Luxembourg, Malta, Netherlands, Slovakia, and Slovenia. The dependent variable is loans to customers, both at aggregate level and by maturity. For total loans we use the quarterly average growth rate of gross loans (LOG_GL); and for loans by maturity we use: (i) the LOG_GL less than 3 months (LOG_GLt<3m); (ii) the LOG_GL more than 3 months, but less than 1 year (LOG_GL3m<t<1y); (iii) the LOG_GL more than 1 year, but less than 5 years (LOG_GL1y<t<5y); and (iv) the LOG_GL more than 5 years (LOG_GLt>5y). The Basel III structural liquidity ratio (the NSFR) is our target variable. The control variables include those based on accounting data (the so-called bank level variables, that are: SIZE, ETA, ROAA, CIR, and NPL_GL), those based on macroeconomic data (the so-called macroeconomic variables, that are: GDPC and DIFF_EURIBOR), the ECB's BLS variables (that are: BLS_SUPPLY_ENTERPRISES, BLS_SUPPLY_HOUSE_PURCHASE, BLS_SUPPLY_CONSUMER_CREDIT, BLS_DEMAND_ENTERPRISES, BLS_DEMAND_HOUSE_PURCHASE, and BLS_DEMAND_CONSUMER_CREDIT), and the dummy variable d_EBA. See Table A.1 in Appendix for the description of the explanatory variables. The latter are lagged by one quarter, except GDPC, DIFF_EURIBOR, and D_EBA. All variables based on accounting data are winsorized at the 1 per cent of each tail. Quarter dummy variables are also included in the model. Two-way clustered standard errors (bank and quarter) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

Variables	Total loans		Loans by maturity							
	LOG_GL		LOG_GLt<3m		LOG_GL3m<t<1y		LOG_GL1y<t<5y		LOG_GLt>5y	
	GIIPS	no-GIIPS	GIIPS	no-GIIPS	GIIPS	no-GIIPS	GIIPS	no-GIIPS	GIIPS	no-GIIPS
NSFR (-1)	0.009	0.008	0.047	-0.034	0.002	-0.031	-0.019**	-0.000	-0.019**	-0.001
	(0.009)	(0.011)	(0.032)	(0.023)	(0.011)	(0.034)	(0.009)	(0.030)	(0.007)	(0.008)
Control variables (-1)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster standard errors (Bank, Quarter)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. of obs.	1,506	1,033	1,506	1,033	1,506	1,033	1,506	1,033	1,506	1,033
R-squared	0.153	0.158	0.063	0.068	0.069	0.089	0.114	0.148	0.145	0.137

Table 13 - Panel estimations results with the amount of TLTROs allocated by the NCBs

This table presents the results of the estimation of panel regressions with bank and time fixed-effects (FE), taking into account the amount of the Total Long Term Refinancing Operations (TLTROs) allocated by the National Central Banks (NCBs) for the following 9 eurozone countries: Belgium, France, Germany, Greece, Italy, Ireland, Portugal, Slovenia, and Spain (i.e. the countries for which Bloomberg Database provides data on these operations, see Table A.4 in Appendix). The amount of the TLTROs of the NCBs of the 9 eurozone countries are collected by Bloomberg Database and includes both the NCBs' conventional and unconventional liquidity injections. Given that it is not possible to distinguish between NCB's conventional and unconventional liquidity injections, the analysis is splitted into the two following sub-periods: the period before and after the adoption of the VLTROs and of the TLTROs (2008Q1 – 2011Q3 vs. 2011Q4 – 2015Q2). The variable TLTRO_NCB is computed as the amount of TLTROs lent by the NCB of each countries to banks divided by its total lending (i.e. equals to the sum of Main Refinancing Operations - MROs, LTROs, Fine-tuning Reverse Operations, Structural Reverse Operations, Marginal Lending Facility, and Credits Related to Margin Calls). The variable TLTRO_NCB is lagged by one quarter. The dependent variable is loans to customers, both at aggregate level and by maturity. For total loans we use the quarterly average growth rate of gross loans (LOG_GL); and for loans by maturity we use: (i) the LOG_GL less than 3 months (LOG_GLt<3m); (ii) the LOG_GL more than 3 months, but less than 1 year (LOG_GL3m<t<1y); (iii) the LOG_GL more than 1 year, but less than 5 years (LOG_GL1y<t<5y); and (iv) the LOG_GL more than 5 years (LOG_GLt>5y). The Basel III structural liquidity ratio (the NSFR) is our target variable. The control variables include those based on accounting data (the so-called bank level variables, that are: SIZE, ETA, ROAA, CIR, and NPL_GL), those based on macroeconomic data (the so-called macroeconomic variables, that are: GDPC and DIFF_EURIBOR), the ECB's BLS variables (that are: BLS_SUPPLY_ENTERPRISES, BLS_SUPPLY_HOUSE_PURCHASE, BLS_SUPPLY_CONSUMER_CREDIT, BLS_DEMAND_ENTERPRISES, BLS_DEMAND_HOUSE_PURCHASE, and BLS_DEMAND_CONSUMER_CREDIT), and the dummy variable d_EBA. See Table A.1 in Appendix for the description of the explanatory variables. The latter are lagged by one quarter, except GDPC, DIFF_EURIBOR, and D_EBA. All variables based on accounting data are winsorized at the 1 per cent of each tail. Quarter dummy variables are also included in the model. Two-way clustered standard errors (bank and quarter) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

Variables	T: 2008Q1 - 2011Q3					T: 2011Q4 - 2015Q2				
	Total Loans	Loans by maturity				Total Loans	Loans by maturity			
	LOG_GL	LOG_GLt<3m	LOG_GL3m<t<1y	LOG_GL1y<t<5y	LOG_GLt>5y	LOG_GL	LOG_GLt<3m	LOG_GL3m<t<1y	LOG_GL1y<t<5y	LOG_GLt>5y
NSFR (-1)	0.016	0.047	-0.021	-0.035***	-0.016	0.000	-0.019	-0.020	-0.012	-0.013
	(0.018)	(0.037)	(0.017)	(0.013)	(0.018)	(0.010)	(0.032)	(0.024)	(0.026)	(0.015)
LTRO_NCB (-1)	-0.019	0.032	0.049	-0.024	-0.031	0.001	-0.014	-0.008	0.215	-0.025**
	(0.029)	(0.035)	(0.056)	(0.042)	(0.047)	(0.011)	(0.043)	(0.027)	(0.158)	(0.011)
Control variables (-1)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster standard errors (Bank, Quarter)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. of obs.	1,192	1,192	1,192	1,192	1,192	842	842	842	842	842
R-squared	0.180	0.105	0.110	0.194	0.193	0.229	0.158	0.152	0.157	0.169

Appendix

Table A.1 – Variables definitions

This table reports the description of all the variables used in our analyses and the source of data used to collect them.

Variables		Definition	Source
DEPENDENT VARIABLES			
Total customer loans	LOG_GL	The natural logarithm of total gross loans (GL) at time t over t-1 (i.e. the previous quartile).	SNL (S&P Global – Market Intelligence) Database (Authors' calculations)
Customer loans by maturity	LOG_GLt<3m	The natural logarithm of GL with a maturity less than 3 months at time t over t-1 (i.e. the previous quartile).	
	LOG_GL3m<t<1y	The natural logarithm of GL with a maturity more than 3 months, but less than 1 year at time t over t-1 (i.e. the previous quartile).	
	LOG_GL1y<t<5y	The natural logarithm of GL with a maturity more than 1 year, but less than 5 years at time t over t-1 (i.e. the previous quartile).	
	LOG_GLt>5y	The natural logarithm of GL with a maturity more than 5 years at time t over t-1 (i.e. the previous quartile).	
EXPLANATORY VARIABLES			
	Bank level variables:		
	NSFR (target variable)	The ratio of available stable funding to required stable funding (See Table A.2 in Appendix).	SNL (S&P Global – Market Intelligence) Database (Authors' calculations)
Control variables	SIZE	The natural logarithm of total assets.	SNL (S&P Global – Market Intelligence) Database
	ETA	The ratio of equity to total assets.	
	ROAA	The ratio of net income to average total assets.	
	CIR	The ratio of overheads to the sum of net interest income (defined as the difference between gross interest & dividend income and total interest expense) and other operating income.	
	NPL_GL	The ratio of non-performing loans to gross loans.	
	Macroeconomic variables:		
	GDPC	Quarterly GDP growth rate.	World Economic Outlook database of the International Monetary Fund (Authors' calculations)
	DIFF_EURIBOR	Quarterly difference between euribor in t and euribor in t-1 (i.e. the previous quarter).	
	ECB's Bank Lending Survey (BLS) variables:		
	BLS_SUPPLY_ENTERPRISES	Loans or credit lines to enterprises. It takes values from -1 (bank's credit standard as applied to the approval of loans to enterprises eased considerably) to 1 (bank's credit standard as applied to the approval of loans to enterprises tightened considerably).	ECB's Bank Lending Survey
	BLS_SUPPLY_HOUSE_PURCHASE	Loans to households (for house purchase). It takes the values from -1 (bank's credit standard as applied to the approval of loans to households eased considerably) to 1 (bank's credit standard as applied to the approval of loans to households tightened considerably).	
	BLS_SUPPLY_CONSUMER_CREDIT	Loans for consumer credit. It takes the values from -1 (bank's credit standard as applied to the approval of loans for consumer credit eased considerably) to 1 (bank's credit standard as applied to the approval of	

		loans for consumer credit tightened considerably).	
	BLS_DEMAND_ENTERPRISES	Loans demand by enterprises. It takes the values from -1 (demand for loans decreased considerably) to 1 (demand for loans increased considerably).	
	BLS_DEMAND_HOUSE_PURCHASE	Loans demand for house purchase. It takes the values from -1 (demand for loans decreased considerably) to 1 (demand for loans increased considerably).	
	BLS_DEMAND_CONSUMER_CREDIT	Loans demand for consumer credit. It takes the values from -1 (demand for loans decreased considerably) to 1 (demand for loans increased considerably).	
	D_EBA	Equals 1 for banks belonging to the EBA stress test exercise of 2014, 0 otherwise.	EBA stress test exercise of 2014 (Authors' calculationss)
Target variables used in the differences-in-differences-in-differences (DDD) estimations	D_SHOCK	The shock is the publication of the consultative document of Basel III in December 2009. So, the variable is equals 1 for the years 2010Q1 – 2015Q2, and 0 otherwise.	SNL (S&P Global – Market Intelligence) Database (Authors' calculations)
	D_TREATED	Equals 1 for banks with a Net Stable Funding Ratio (NSFR) less than 0.95 in the quarter of the shock (the publication of the consultative document of Basel III in December 2009), and 0 otherwise.	
	D_CAPITAL	Equals 1 for banks with an equity to total assets (ETA) equals to or above the median of ETA in the quarter of the shock (the publication of the consultative document of Basel III in December 2009), and 0 otherwise.	
	D_TREATED*D_SHOCK	The interaction between D_TREATED and D_SHOCK.	
	D_CAPITAL*D_SHOCK	The interaction between D_CAPITAL and D_SHOCK.	
	D_TREATED*D_CAPITAL*D_SHOCK	The interaction between D_TREATED, D_CAPITAL and D_SHOCK.	
Additional variables to control for the ECB's unconventional liquidity injections	D_VLTRO	Equals 1 for the period in which the ECB gave liquidity to the eurozone banking system through the VLTROs (2011Q4-2015Q1), and 0 otherwise.	ECB website (Authors calculations)
	D_TLTRO	Equals 1 for the period in which the ECB started to give liquidity to the eurozone banking system through the TLTROs (from 2014Q3 on), and 0 otherwise.	
	D_VLTRO_bank	Equals 1 for the period in which the ECB gave liquidity to a specific bank belonging to the eurozone system through the VLTROs (2011Q4-2015Q1), and 0 otherwise.	Bloomberg, Reuters and/or Eikon Database (Authors' calculations)
	D_TLTRO_bank	Equals 1 for the period in which the ECB started to give liquidity to a specific bank belonging to the eurozone system through the TLTROs (from 2014Q3 on), and 0 otherwise.	
	VLTRO1_bank	The amount of uptake by banks in the first round (in 2011Q4) of the 3-year Longer-Term Refinancing Operations (so-called Very Long-Term Refinancing Operations, VLTROs).	
	VLTRO2_bank	The amount of uptake by banks in the second round (in 2012Q1) of the 3-year Longer-Term Refinancing Operations (so-called Very Long-Term Refinancing Operations, VLTROs).	
	TLTRO_NCB	The amounts of Total Long-Term Refinancing Operations (TLTROs) lent by the NCB of each countries to banks divided by its total lending (i.e. equals to the sum of Main Refinancing Operations - MROs, LTROs, Fine-tuning Reverse Operations, Structural Reverse Operations, Marginal Lending Facility, and Credits Related to Margin Calls).	

Box A.1 – The Net Stable Funding Ratio (NSFR) of Basel III

The NSFR, our variable of interest, is the ratio between the amount of Available Stable Funding (ASF) relative to the amount of Required Stable Funding (RSF):

$$NFSR = \frac{ASF}{RSF} \tag{A.1}$$

The ASF comprises weighted liabilities reflecting their contractual maturity and is defined as the portion of capital and liabilities expected to be a reliable source of funding over a one-year time horizon. The RSF of a specific bank is a function of the liquidity characteristics and residual maturities of the various assets held by that institution. The ASF and RSF are calibrated to reflect the presumed degree of stability of a bank's liabilities and liquidity of a bank's assets. The weights for assets and liabilities range from 0% to 100%; these are primarily the result of internationally agreed definitions and calibrations (see BCBS, 2014). In this way, on the one hand, ASF categories are biased to a greater extent by more stable funding and to a lesser extent by less stable funding. On the other hand, assets that are more liquid and more readily available to act as a source of extended liquidity in the stressed environment receive lower RSF factors (and require less stable funding) than assets considered less liquid in such circumstances and, therefore, require more stable funding. Hence, more liquid assets (even in conditions of stress) are weighted by a lower RSF factor; in fact, asset components are weighted inversely to their degree of liquidity. While the level of detail necessary to estimate the NSFR is not publicly available, we can approximate the ratio consistently with the BCBS guidelines (see Equation 2). Table A.2 illustrates the calibrations we used, following the final 2014 document, and the relevant balance sheet items considered for the estimation of the NSFR.

$$NSFR = \frac{Equity + Total\ Long\ Term\ Funding + \binom{Total\ Time\ Deposits}{and\ Savings\ Accounts} * 0.95 + (Current\ Accounts) * 0.9 + \binom{Other\ Deposits\ and}{Short\ Term\ Borrowings} * 0.5}{\binom{Government}{Securities} * 0.05 + \binom{Other}{Securities} + Net\ Loans\ to\ Banks) * 0.5 + \binom{Mortgage}{Loans} * 0.65 + \binom{Retail\ and}{Corporate\ Loans} * 0.85 + Other\ Assets} \tag{A.2}$$

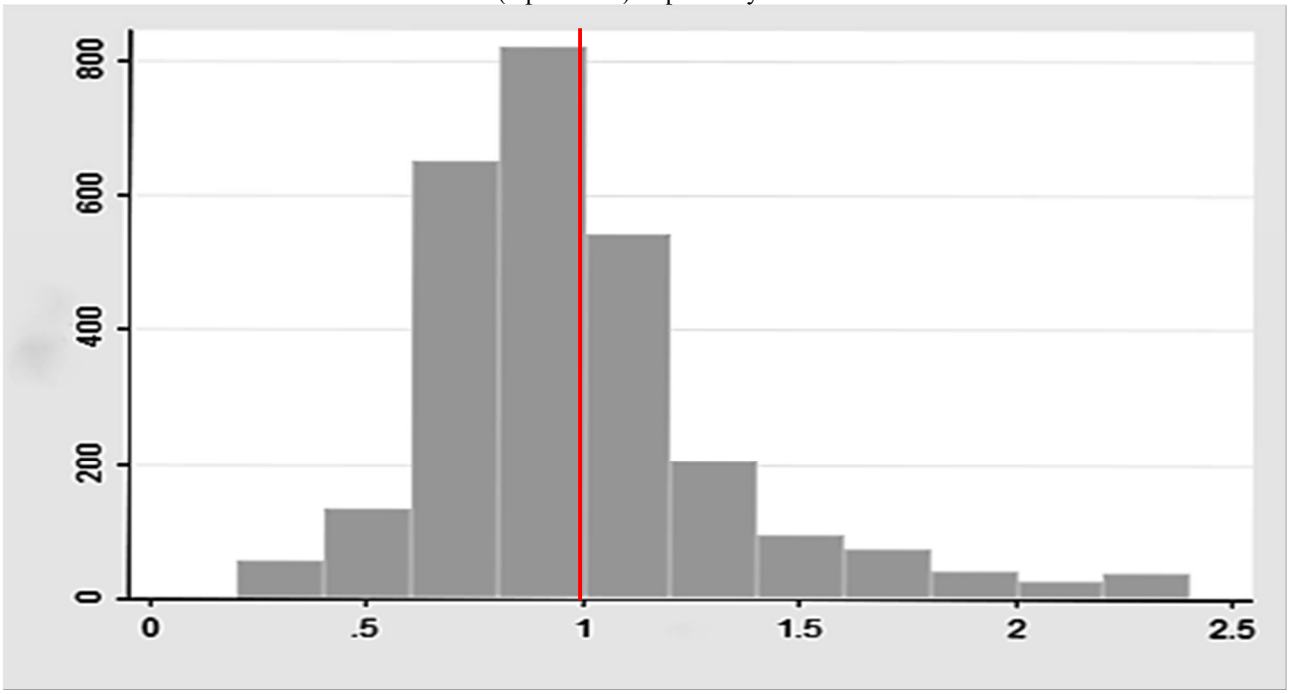
Table A.2. NSFR calculation

This table summarises the weights for each asset and liability items used to compute the final version of the NSFR of October 2014. NSFR is computed as the ratio of Available Stable Funding (ASF) to Required Stable Funding (RSF). We calculate NSFR using the publicly data available in SNL (S&P Global – Market Intelligence) Database.

ASF factor 2014	*SNL Liability & Equity Items*
100%	Total equity
	Total long-term funding
95%	Savings accounts
	Total time deposits
90%	Current accounts
50%	Other deposits and short-term borrowings
0%	Deposits from banks
RSF factor 2014	*SNL Asset Items*
0%	Cash and due from banks
5%	Debt issued or guaranted by National or Supranational Government
50%	Other securities (= Total Securities – Debt issued or guaranted by National or Supranational Government – at-equity investments in associates)
	Net loans to banks
65%	Mortgage loans
85%	Retail and corporate loans plus other retail loans
100%	Reserve for impaired loans/NPLs
	Non-earning assets (=Total assets – Total earning assets – Cash and due from banks)
	Fixed assets
	Insurance assets
	Net investments properties
	At-equity investments in associates

Figure A.1 – Frequency distribution of the Net Stable Funding Ratio

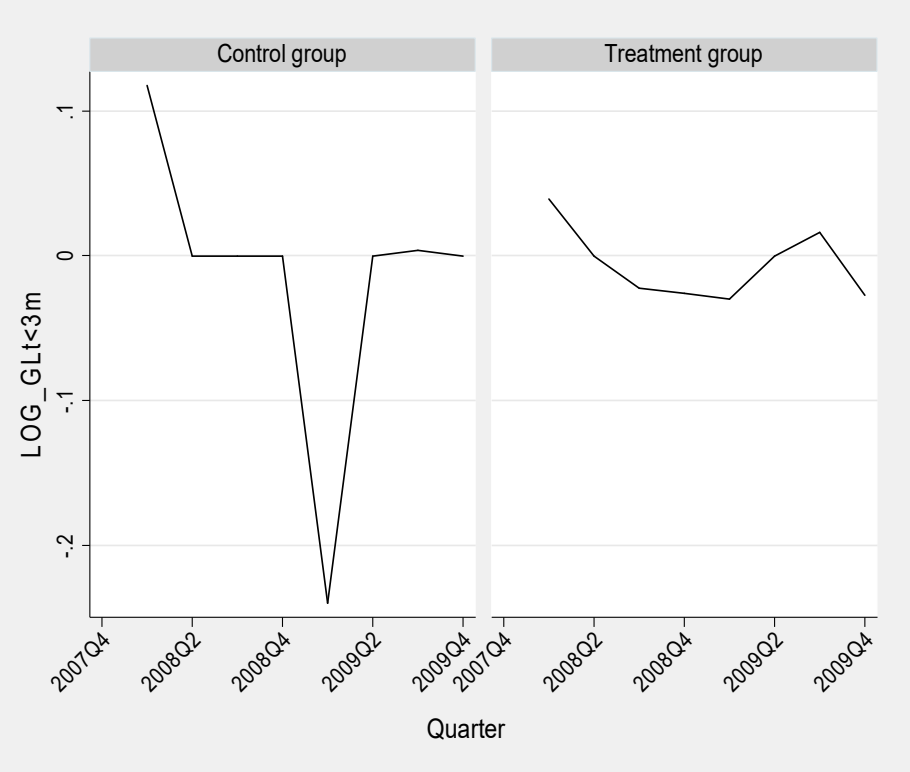
The figure shows the frequency distribution of the average values of the Net Stable Funding Ratio – NSFR (i.e. our target variable) for the full sample over the period 2008Q1 – 2015Q2. To mitigate the effect of outliers, we winsorize observations in the outside 1% of each tail. Our sample of banks covers 15 countries of the eurozone area. The red line indicates the minimum threshold of the NSFR (equals to 1) required by Basel III.



Source: SNL (S&P Global – Market Intelligence) Database, authors' calculations.

Figure A.2 – Parallel trends

This figure illustrates the behavior of the quarterly average growth rate of loans to customers with a maturity less than 3 months (LOG_LGt<3m) and with a maturity more than 5 years (LOG_GLt>5y), in the period prior to the shock or treatment (i.e. the publication of the consultative document of Basel III in December 2009) for both the treatment and the control groups. The treatment (control) group is relative to those banks with both a Net Stable Funding Ratio (NSFR) less than (equals to or above than) 0.95 and an equity to total assets (ETA) equals to or above the median of ETA. See also Table 5.



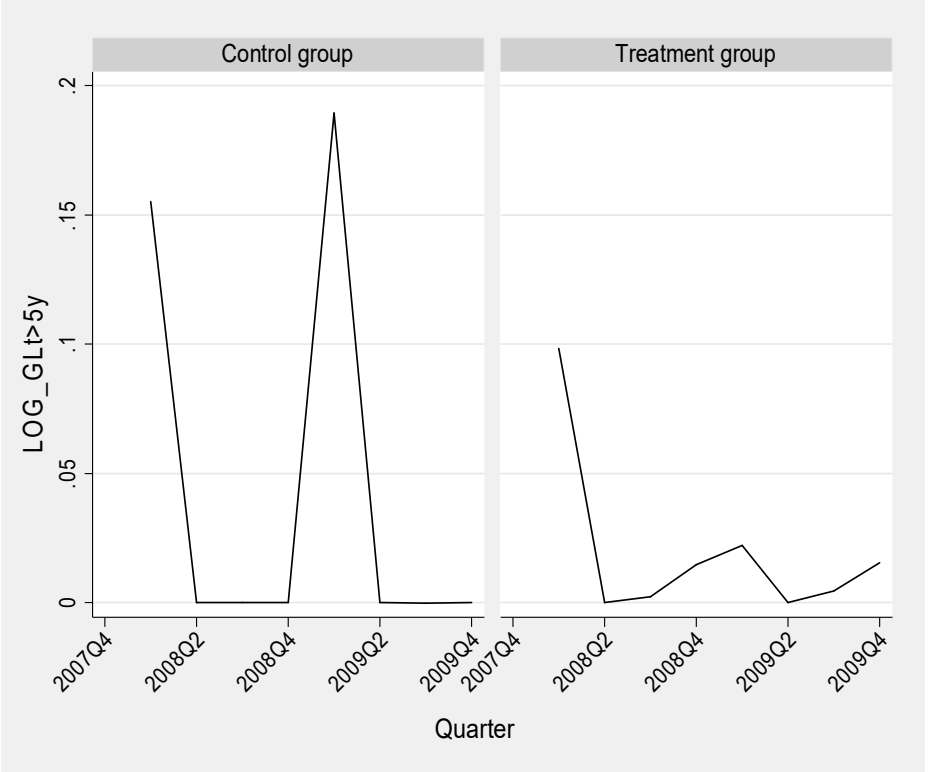


Table A.3 –Panel estimations results for some traditional proxies for bank liquid assets.

This table presents the results of the estimation of panel regressions with bank and time fixed-effects (FE) for some traditional proxy of bank liquid assets (that are: cash and balances with Central Banks to total assets, CASH_TA; and investments in government bonds to total assets, GOVBOND_TA), taking into the amount of uptake by banks in the first and second rounds of the the 3-years Very Long-Term Refinancing Operations (VLTROs), that are the VLTRO1 in 2011Q4 and the VLTRO2 in 2012Q1. Although the VLTROs had a maturity of 3 years (deadline in 2015Q1), they included the option of early repayment after one year (occurred in 2013Q1). However, data on early repayment are not public available, so for this reason, we stop the analysis to the quarter immediately after their early reimburse (2008Q1-2013Q2). The variables VLTRO1_bank and VLTRO2_bank are computed as the amount borrowed to the bank participating in each of the two VLTROs scaled to the bank's total assets. Both variables VLTRO1_bank and VLTRO2_bank are lagged by one quarter. Data on VLTROs are collected from Bloomberg, Reuters and/or Eikon Database and are relative to a sub-sample of banks belonging to the 13 eurozone countries (see Table 8). See Table 6 for the timeline and for the main characteristics of these operations. The Basel III structural liquidity ratio (the NSFR) is our target variable. The control variables include those based on accounting data (the so-called bank level variables, that are: SIZE, ETA, ROAA, CIR, and NPL_GL), those based on macroeconomic data (the so-called macroeconomic variables, that are: GDPC and DIFF_EURIBOR), the ECB's BLS variables (that are: BLS_SUPPLY_ENTERPRISES, BLS_SUPPLY_HOUSE_PURCHASE, BLS_SUPPLY_CONSUMER_CREDIT, BLS_DEMAND_ENTERPRISES, BLS_DEMAND_HOUSE_PURCHASE, and BLS_DEMAND_CONSUMER_CREDIT), and the dummy variable d_EBA. See Table A.1 in Appendix for the description of the explanatory variables. The latter are lagged by one quarter, except GDPC, DIFF_EURIBOR, and D_EBA. All variables based on accounting data are winsorized at the 1 per cent of each tail. Quarter dummy variables are also included in the model. Two-way clustered standard errors (bank and quarter) are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

Variables	CASH_TA	GOVBOND_TA
NSFR (-1)	0.008	0.021*
	(0.007)	(0.013)
VLTRO1 (-1)	0.028	0.645*
	(0.027)	(0.344)
VLTRO2 (-1)	0.065*	0.599*
	(0.035)	(0.354)
Control variables (-1)	Yes	Yes
Bank FE	Yes	Yes
Quarter FE	Yes	Yes
Cluster standard errors (Bank, Quarter)	Yes	Yes
N. of obs.	950	950
R-squared	0.786	0.746

Table A.4 - The amount of the TLTROs allocated by NCBs

This table reports the value of the amount (in euros) of the Total Long Term Refinancing Operations (TLTROs) allocated by the National Central Banks (NCBs) at the end of each year (with the exception for 2015) over the period 2008Q1 – 2015Q2 in the 9 eurozone countries for which Bloomberg Database provides data on these operations. The countries are: Belgium, France, Germany, Greece, Italy, Ireland, Portugal, Slovenia, and Spain. The amount of the TLTROs of the NCBs includes both the NCBs' conventional and unconventional liquidity injections. The abbreviation n.a. stands for not available.

Country	2008Q4	2009Q4	2010Q4	2011Q4	2012Q4	2013Q4	2014Q4	2015Q2
Belgium	52,050,000,000	36,275,000,000	4,115,000,000	27,965,000,000	39,920,000,000	14,285,000,000	10,335,000,000	7,438,000,000
France	n.a.	n.a.	32,100,000,000	63,400,000,000	174,400,000,000	71,200,000,000	33,400,000,000	63,000,000,000
Germany	201,644,000,000	170,004,000,000	33,460,000,000	47,112,000,000	69,651,000,000	13,771,000,000	32,944,000,000	40,728,000,000
Greece	9,594,000,000	47,300,000,000	78,383,000,000	60,942,000,000	36,810,000,000	1,385,000,000	8,890,000,000	10,500,000,000
Italy	36,975,600,000	25,192,700,000	31,012,600,000	160,605,900,000	268,295,800,000	213,709,200,000	168,778,600,000	154,801,700,000
Ireland	48,981,000,000	84,433,000,000	56,025,000,000	76,286,000,000	63,086,000,000	34,501,000,000	16,650,000,000	10,335,000,000
Portugal	5,165,000,000	15,410,000,000	22,975,000,000	39,026,000,000	49,261,000,000	42,694,000,000	23,441,000,000	18,311,000,000
Slovenia	1,064,000,000	2,114,000,000	539,000,000	1,687,000,000	3,857,000,000	3,337,000,000	1,098,000,000	815,000,000
Spain	67,110,000,000	78,640,000,000	47,540,000,000	285,300,000,000	316,150,000,000	186,930,000,000	120,510,000,000	105,230,000,000