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THE IMPACT OF THE BASEL III LIQUIDITY REGULATIONS ON THE BANK LENDING CHANNEL: A LUXEMBOURG CASE STUDY

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The Impact of the Basel III Liquidity Regulations on the Bank Lending Channel: A Luxembourg case study*

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Abstract

In this paper we study the impact of the Basel III liquidity regulations, namely the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR), on the bank lending channel in Luxembourg. For this aim we built, based on individual bank data, time series of the LCR and NSFR for a sample of banks covering between 82% and 100% of total assets of the banking sector. Additionally, we simulated the optimal balance sheet adjustments needed to adhere to the regulations.

We extend the existing literature on the identification of the bank lending channel by adding as banks characteristics the estimated shortfalls in both the LCR and NSFR. We find a significant role for the bank lending channel in Luxembourg which mainly works through small banks with a large shortfall in the NSFR. We also show that big banks are able to increase their lending following a contractionary monetary policy shock, in line with the fact that big banks in Luxembourg are liquidity providers.

Our extrapolation and simulation results suggest that the bank lending channel will no longer be effective in Luxembourg once banks adhere to the Basel III liquidity regulations. We find that adhering to the NSFR may reduce the bank lending channel more strongly than complying with the LCR.

JEL classification: E51, E52, E58, G21, G28.
Keywords: bank, bank lending channel, monetary policy, Basel III, LCR, NSFR.

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Résumé non-technique

Le nouveau cadre réglementaire pour la surveillance de la liquidité développé par le Comité de Bâle en réponse à la récente crise financière a pour objectif l'amélioration de la capacité de résistance des banques face à l'émergence des chocs de liquidité. Avec l'introduction du Liquidity Coverage Ratio (LCR) et du Net Stable Funding Ratio (NSFR), les régulateurs cherchent à encourager un renforcement de la gestion de la liquidité des banques. Les changements attendus de la composition des bilans bancaires suite à la mise en oeuvre de ces nouvelles règles (i.e. Bâle III) auraient potentiellement un impact sur le mécanisme de transmission de la politique monétaire. Dans cet article nous étudions, à partir d'estimations économétriques et de simulations, la façon dont Bâle III affecterait le canal de transmission dit des crédits bancaires. A cette fin, nous utilisons des données relatives au secteur bancaire Luxembourgeois.

En premier lieu, nous avons identifié le canal des crédits bancaires en utilisant des données individuelles pour un échantillon représentatif des banques établies au Luxembourg. La littérature empirique sur l'estimation du canal des crédits bancaires suggère l'utilisation des données individuelles afin d'évaluer si des banques avec des compositions bilantaires distinctes réagissent différemment face à un choc de politique monétaire. Nous avons appliqué cette stratégie en utilisant comme caractéristique bilantaire une mesure continue du degré de conformité avec les ratios de liquidité de Bâle III. Aussi, nous avons préalablement construit des séries temporelles du LCR et du NSFR à partir des données bilantaires propres à chaque banque.

En second lieu, nous analysons quantitativement l'impact des nouveaux ratios de liquidité sur le mécanisme de transmission de la politique monétaire, en l'occurrence le canal des crédits bancaires. Dans cet objectif, nous utilisons deux approches différentes. Premièrement, nous quantifions, à partir des résultats des estimations économétriques, le changement dans l'effet de la politique monétaire sur l'offre des crédits suite à une progression du degré de conformité avec les ratios de liquidité. Ceci nous permet de prédire, au regard de l'information véhiculée par les données, l'impact sur le canal des crédits bancaires de la mise en oeuvre des nouvelles règles en matière de liquidité.

Les données historiques peuvent seulement fournir des informations limitées sur la façon dont le LCR et le NSFR affecteraient la transmission de la politique monétaire. Plus l'impact de la réglementation sur les bilans des banques est important, moins précise est cette information. Notre deuxième approche est alors un exercice contrefactuel qui consiste, dans un premier temps, à simuler les bilans des banques en maximisant, sous les contraintes de la nouvelle régulation, leurs fonctions de profit. Par la suite, nous utilisons les données simulées pour analyser empiriquement l'impact sur le canal des crédits bancaires.

Nos résultats indiquent que la transmission de la politique monétaire à travers le canal des crédits bancaires s'effectue par le biais des banques les plus petites et dont le degré de conformité avec le NSFR est le moins élevé.

Ce résultat donne un aperçu des effets potentiels que le respect des ratios de liquidité peut avoir sur le mécanisme de transmission de la politique monétaire. Nos analyses révèlent que l'adhésion au NSFR permettrait de réduire l'importance du canal des crédits bancaires au Luxembourg parce que les banques seraient mieux préparées pour résister à une politique monétaire restrictive. Toutefois, le respect du LCR ne ferait que réduire la pertinence de ce canal pour les banques proches d'être en conformité avec le NSFR tandis qu'il l'accroîtrait pour les autres. Ainsi, plus la banque sera proche de respecter le niveau légal du LCR, plus les fonds disponibles pour alimenter la croissance de ses prêts seront moindres. Par ailleurs, si les banques sont contraintes par un financement moins stable, la réaction de l'offre de crédits à un resserrement de la politique monétaire serait plus forte.

Le résultat de l'exercice contrefactuel confirme l'analyse précédente et nous amène à la conclusion générale qu'au Luxembourg, et après le respect des normes de Bâle III, la transmission de la politique monétaire se fera dans une moindre mesure à travers le canal des crédits bancaires.

1 Introduction

The recent financial crisis uncovered the importance of liquidity positions and maturity mismatches in banks' portfolios. This led to a widespread agreement that there is a need for closer monitoring of the financial sector and for an improvement in the standards and regulatory practices. The Basel Committee on Banking Supervision (BCBS) recognizes the need for further regulatory action and suggests the introduction of the Liquidity Coverage Ratio (LCR) and the Net Stable Funding ratio (NSFR) within a new regulatory framework called Basel III (Basel Committee [5]). These ratios address the resilience of the liquidity risk profile of banks by building upon the main lessons of the financial crisis 2007-2010. Regulators expect to improve financial stability through Basel III by demanding banks to have a sounder liquidity management. As the liquidity risk regulations are likely to induce behavioral changes that will be reflected in the composition of banks' balance sheets, one can expect an effect on monetary policy transmission. Given that these new regulations will be put in practice after an observation period starting in 2011, then it is obviously important for policy makers to assess whether these will be complementary instruments to the traditional business cycle fine-tuning tools of monetary policy, or whether they will partly substitute away the effectiveness of monetary policy. Thus, in this article we study how the new Basel III liquidity regulations are likely to alter the bank lending channel of monetary policy transmission[1] in Luxembourg.

The novelties presented in this paper are as follows. Firstly, this study is the first that assesses the bank lending channel using Luxembourg bank level data. Secondly, we estimate and analyze the LCR and NSFR using individual bank data for a representative sample of the Luxembourgish banking sector. Such an approach helps in identifying Luxembourg's position with respect to the LCR and NSFR, the evolution of those ratios over time, and the sources of their shortfalls. Thirdly, this study is the first one, to the authors' knowledge, that quantitatively analyzes the impact of the new liquidity standards on monetary policy transmission.

We start off by estimating the effect of the Basel III liquidity regulations on monetary policy transmission using historical individual bank data for a sample of banks covering between 82% and 100% of total assets of the banking sector in Luxembourg from 2003q1 to 2010q4. Under the assumption of imperfect information the bank lending channel operates when, after a policy-driven increase in short-term interest rates, banks are not able to compensate the reduction of core deposits with alternative sources of funding, inducing then a reduction

[1]The economic literature provides an extensive analysis of the mechanism underlying the transmission of monetary policy to the real economy. Surveys are available, among others, in Bernanke and Getler [9], Ceccheti [11].

in assets. This is likely to be the case for banks that hold neither sufficient liquidity nor capital buffers, or for small banks with a worse prospect to access wholesale funding markets (Angeloni et al. [2], Kashyap and Stein [18], Ehrmann et al. [13], Kishan and Opiela [20] and Chatelain et al. [12], Peek and Rosengren [23]). Therefore, we study the role of the bank characteristics that have been identified in the literature as being important for monetary policy transmission and add new ones which we derive based on the LCR and NSFR.

Our analysis based on the historical data remains valid in the case that the introduction of the regulations does not induce significant changes to the balance sheet of banks. However, the objective of the regulations is exactly the opposite, namely to change the structure of banks' balance sheets toward one that is resilient to liquidity shocks. The historical balance sheets might, thus, only provide limited information on the way that the LCR and NSFR would change monetary policy transmission, and the information is bound to be less correct the larger the impact of the regulations on banks' balance sheets. In order to get an idea of how large the impact of the regulations on banks is likely to be, we simulate banks' balance sheets by maximizing banks' profits subject to the balance sheet constraints and the requirements of the new regulations. We, thus, identify potential changes to the banking sector in Luxembourg. We then use this simulated data to study how the monetary policy transmission would have been if the regulations had already been put in place in 2003q1. This exercise is different from the regressions and predictions based on the historical data since we take into account the optimal balance sheet adjustments induced by the regulations.

Our results are as follows. We find a significant role for the bank lending channel in Luxembourg, which mainly works through small banks with a large shortfall in the NSFR. Thus, small banks that are suffering from relatively large maturity mismatches, as measured by the NSFR shortfall, and that are relatively under-capitalized, are those that are most affected by contractionary monetary policy shocks. We also show that size matters. Specifically, big banks are able to increase their lending following a policy-driven increase in the short-term interest rate. This result confirms that Luxembourgish banks are liquidity providers to the European banking sector[2].

These results, thus, qualify further on previous findings in studies for other European countries that do not find that the size of a bank is a relevant characteristic for explaining distributional effects of monetary policy shocks (Angeloni et al. [2]). We show that a bank's size is a significant driver of monetary policy distributional effects but only if one also takes into account the current liquidity and maturity mismatch structure of a bank itself.

Additionally, we provide a more detailed description of the underlying mechanism of the

[2]In case of Luxembourg, interbank lending mainly refers to intra-group lending activities. Throughout, the article we will interchangeably use interbank and intra-group activities.

bank lending channel in Luxembourg by disaggregating the shortfalls into their components (i.e. the stock of high quality liquid assets, the net outflows, the required stable funding and the available stable funding). The results suggest that indicators of the width of the funding bases (i.e. net outflows, available stable funding) are more relevant bank characteristics for the identification of the bank lending channel in Luxembourg than qualifiers on the assets (e.g. liquidity).

Our findings regarding the impact of the new liquidity regulations lead us to the conclusion that the bank lending channel is likely to vanish as banks make their way to compliance. Adhering to the NSFR may reduce the reaction of the loan supply to monetary policy shocks more strongly than complying with the LCR. This was to be expected as any reduction in the maturity mismatch of a bank strengthens the bank's position to cope with funding run-offs.

The article is organized as follows. Section 2 introduces the bank lending channel of monetary policy transmission and briefly reviews the related empirical literature. Additionally, we discuss the LCR and NSFR more deeply in order to understand how these ratios relate to the bank lending channel. Section 3 describes the data and the empirical specification of the econometric model. The estimation results are presented in Section 4, while Section 5 concludes.

2 Basel III liquidity regulations and monetary policy transmission mechanism

Our focus in this section is to introduce both the bank lending channel and the Basel III liquidity standards on a more detailed level. We start by reviewing established results on the bank lending channel and then discuss the potential roles that the LCR and NSFR would have in altering the impact of monetary policy on bank lending.

2.1 The bank lending channel

One of the channels through which monetary policy may affect the real economy is the so-called credit channel[3], and it distinguishes two sub-channels, namely a balance sheet channel (Bernanke and Gertler [7], [8]) and a bank lending channel (Bernanke and Blinder [6]). The credit channel operates through the supply side as a consequence of the external finance premium that private investors face due to imperfections in financial markets (e.g. asymmetric information between borrowers and lenders). The balance sheet channel assumes that changes in monetary policy affect a borrower's net worth and thereby influence

[3]For surveys see, among others, Bernanke and Gertler [9] and Cecchetti [11].

his costs of raising external funding. For instance, a firm depending on bank lending might see an increase in the cost of its loans if its net worth decreases following a monetary policy shock.

A bank lending channel of monetary policy transmission would be at work if two conditions are fulfilled (Kashyap and Stein [18]). First, many borrowers must be constrained at the margin by the supply of bank loans in such a way that they cannot freely substitute them with alternative sources of credit. They are then forced to deleverage in response to a contraction in bank lending. Second, banks face funding frictions that make core deposits less expensive than alternative funding sources. Then, as a bank's external funding premium depends on its creditworthiness, banks with healthier balance sheets are likely to be less sensitive to monetary policy shocks.

Building upon that, the empirical literature on the bank lending channel circumvents the challenging identification problem of separating the changes of the supply and the demand for loans by using bank level data. The main focus has been on showing that banks of different types react differently to changes in monetary policy. If banks face a homogeneous demand for loans and banks react differently to monetary policy this should only be due to their different balance sheet characteristics. Articles within this strand of literature have studied various bank-specific variables as determinants of changes in loan supply. These bank-specific variables include the size (Kashyap and Stein [18] ; Kishian and Opiela [20]), liquidity (Kashyap and Stein [19]), the level of capitalization (Peek and Rosengren [23] ; Kishian and Opiela [20]), and combinations of them. Most of these studies have been undertaken on the U.S. case. It is shown that small banks face larger asymmetric information problems than large banks and thus have greater difficulty to raise unsecured funds (Kashyap and Stein [18]). Similarly, banks with lower capitalization also face greater difficulty of accessing non-deposit financing (Peek and Rosengren [23]). Finally, small banks with larger liquidity buffers may reduce their liquidity in times of tighter monetary policy and can thereby cushion themselves more easily from monetary policy shocks (Kashyap and Stein [19]).

Similar results are not expected to hold in European countries as several features in the European banking sector are quite different from the US case. For instance, Ehrmann et al. [13] argue that informational asymmetries should be lower in European countries because of the active role of governments in the sector and mainly because there have only been a few bank failures during the past decades. Similarly, the widely applied deposit insurance schemes reduce the pertinence of asset size bank characteristic.

A series of studies has been devoted to measuring the relevance of the bank lending channel in the Euro Area[4]. Although a common finding to each country-level study is that a

[4]See Angeloni, Kashyap and Mojon [2].

bank's size is not a relevant characteristic for identifying the bank lending channel, there are also country-wide differences underlying this result (see Ehrmann et al. ; Worms ; Hernando and Martinez-Pagés ; Loupins, Sauvignac and Sevestre ; Gambacorta in [2]). More recent studies have analyzed the implications of new practices, namely securitisation, market funding and financial innovation, on the bank lending channel (Altunbas et al. [1], Loutskina and Strahan [22], Hirtle [16]). Their findings show that these practices have helped banks to isolate their asset portfolio from monetary policy shocks.

The results of these studies depend mainly on how good the considered bank characteristics are for capturing the different bank types across the many countries in which these variables have been used to analyze the bank lending channel. The two variables that we add to the literature, namely the degree of compliance with the LCR and NSFR (i.e. the shortfalls in the standards), are potentially important drivers of monetary policy distributional effects since the LCR ratio is a "measure of a bank's exposure to short-run liquidity risk" while the NSFR is essentially a measure of maturity mismatch. In the following we introduce the ratios and discuss preliminary predictions as to how both ratios might affect the relevance of this channel of monetary policy transmission.

2.2 The Liquidity Coverage Ratio

The LCR requires that banks hold high quality liquid assets to meet liquidity needs over a 30-day time horizon under an acute liquidity stress scenario. The LCR is thus a constraint on how much short-run liquidity risk a bank is allowed to hold. It is supposed to "promote short-term resilience of a bank's liquidity risk profile by ensuring that it has sufficient high-quality liquid assets to survive a significant stress scenario lasting for one month" (Basel Committee [5], p.1).

The LCR is defined as :

$$\text{LCR}_{it} = \frac{\text{High Quality Liquid Assets}_{it}}{\text{Outflows}_{it} - \min(\text{Inflows}_{it}, 0.75 \cdot \text{Outflows}_{it})}.$$

The Basel committee's regulation then demands that banks have an LCR that exceeds one, suggesting that the stock of high-quality liquid assets (HQLA) covers the net outflows (NO). The net outflows for each bank in period t (NO_{it}), is defined as : $\text{NO}_{it} = \text{Outflows}_{it} - \min(\text{Inflows}_{it}, 0.75 \cdot \text{Outflows}_{it})$. Thus, the LCR shortfall is given by :

$$\text{LCR shortfall}_{it} = \text{NO}_{it} - \text{HQLA}_{it}. \tag{1}$$

The HQLA encompasses cash, high-quality securities and government debt. One would expect that banks with more HQLA are, *ceteris paribus*, more liquid banks and, therefore, be able to more easily offset monetary policy shocks through selling their liquid assets. The NO encompasses all the expected outflow minus the expected inflow of money during one month. The main focus of the Basel Committee's definition of Outflows is on stable versus unstable deposit financing and off-balance sheet activities. Funding from unstable sources receives a higher run-off factor in the definition of NO than stable funding. Similarly, the Inflows compound different sources of revenues within the 30-days horizon. In order to encourages banks to hold higher HQLA, the Inflows are bounded at 75% of the Outflows. On the one hand, one would expect that a bank with higher NO faces a higher external finance premium because of the presumed lower resiliency of the bank's short-term liquidity risk profile. On the other hand, since bigger Outflows imply a bigger funding base due to a wider access to wholesale funding, one would expect that, during non stress periods, NO might be positively related to the ability of the bank to compensate for a reduction of core deposits.[5]

The introduction of the LCR as a regulatory standard is likely to improve the liquidity position of banks by encouraging them to modify their asset portfolio and the strategy for funding it. Banks are induced to hold a higher stock of highly liquid low-risky securities (i.e. government bonds) and fewer short-term loans to financial institutions. This might reduce the impact of contractionary monetary policy shocks. Regarding the liability side, one would expect that banks tend to rely less on the market and on deposits from financial institution, and more on retail and on non-financial corporate deposits. Unlike the restructuring that we expect to happen on the asset side, the expected changes to the liability side should increase the reaction of the supply of loans to monetary policy developments.

2.3 The Net Stable Funding Ratio

The NSFR is established to "promote resiliency over longer-term time horizons by creating additional incentives for banks to fund their activities with more stable sources of funding on an ongoing basis " (Basel Committee [5], p.1). It is defined as :

$$\text{NSFR}_{it} = \frac{\text{Available Stable Funding}_{it}}{\text{Required Stable Funding}_{it}}.$$

The Basel regulation requires the NSFR ratio to exceed one. Then, the NSFR shortfall is given by :

$$\text{NSFR shortfall}_{it} = \text{Required Stable Funding}_{it} - \text{Available Stable Funding}_{it}. \tag{2}$$

[5]Given the cap on inflows, the relationship between the Outflows and the NO is expected to be monotonic.

The Available Stable Funding (ASF) consists of capital, liabilities with maturity greater than a year or those that are expected to be stable during a crisis. The amount of Required Stable Funding (RSF) places more weight on those assets that are less liquid during stress periods and therefore require a more stable source of funding. Thus, one could say that the NSFR focus is on a bank's maturity mismatch.

One would expect that the loan supply of those banks with a higher NSFR will be less responsive to monetary policy. Firstly, given that a bank's capital is one of the components of the available stable funding, a higher NSFR might be associated with less reliance on outside funding and a lower external finance premium. Secondly, the bigger the ASF the larger a bank's stable funding base which increases the resiliency of a bank to liquidity shocks. Additionally, banks that have a higher amount of ASF are, *ceteris paribus*, less subject to maturity mismatch. Finally, the amount of RSF consists mainly of long-term assets (i.e. exceeding one year) and loans to retail clients or non-financial corporate clients of maturity less than one year. It also includes off-balance sheet exposures. A bank with assets that have a maturity structure that tends to be longer is more likely to face significant maturity mismatch risk and might face a higher external finance premium. As a consequence, a bank with large RSF would tend to be affected more strongly by monetary policy than a bank with fewer RSF.

3 The econometric model and the data

3.1 Model specification and variables definition

The empirical specification, based on the standard literature for identifying the bank lending channel, is designed to test whether banks that show different balance sheet structures react differently to monetary policy shocks. This approach is in line with the works conducted by the ECB on monetary policy transmission (Angeloni, Kashyap and Mojon [2]). Our contribution is to use, as additional bank characteristics, the shortfalls in the LCR and NSFR. Therefore, the regression model is specified as :

$$\begin{aligned}\Delta \log(L_{it}) &= \alpha_i + \beta_1 \Delta \log(L_{i,t-1}) + \beta_2 \Delta r_t + \beta_3 OGap_{t-1} \\ &\quad + \sum_{h=1}^{z} \beta_{4h} x_{ih,t-1} + \sum_{h=1}^{z} \beta_{5h} x_{ih,t-1} \cdot \Delta r_t \\ &\quad + \beta_6 \prod_{h=1}^{z} x_{ih,t-1} \cdot \Delta r_t + c_t + \epsilon_{it} \qquad (3)\end{aligned}$$

where $i = 1, ..., N$ and $t = 1, ..., T$ and where N denote the number of banks and T the number of quarters in the sample. L_{it} are the total loans of bank i in quarter t. Δr_t is the first difference of a nominal short-term interest rate, and represents a proxy for the change in monetary policy. $OGap_{t-1}$ is the output-gap which is defined as the difference between the potential and the observed output of the economy divided by the potential output[6]. It allows us to control for the evolution of loan demand. The dummy variable c_t equals one for those quarter within the last liquidity crisis period[7] and zero otherwise. The lagged bank-specific characteristics are given by $x_{ih,t-1}$. We include an interaction term between bank characteristics and the change in the level of monetary policy indicator, $\prod_{h=1}^{z} x_{ih,t-1} \cdot \Delta r_t$, aiming at testing for non-linear reactions of banks to monetary policy shocks. All bank characteristics are calculated as shares of total assets. Finally, the model allows for individual fixed effects.

We consider as bank characteristics the ratios of the LCR and NSFR estimated shortfalls over total assets (equations 1 and 2 respectively) and their components (i.e. the stock of HQLA, NO, ASF and RSF). Through this we aim at assessing to which extent the degree of compliance to the ratios captures the heterogeneous reactions of the banks to monetary policy shocks. Indeed, this give us a hint about the effectiveness of monetary policy transmission following the implementation of the new liquidity regulation. Additionally, we check the robustness of our results by following the literature and considering indicators of size (i.e. the logarithm of total assets), capitalization (i.e. the ratio of capital over total assets) and liquidity (i.e. the ratio of HQLA over total assets[8]). Size and capitalization are largely used as measures of a bank's health and related to its external finance premium. The level of a bank's liquidity is not a clear-cut measure of bank health. However, liquidity may reduce the effects of a monetary policy tightening to the extent that it allows quicker adjustments to the asset side after a change in the external funding.

3.2 The data

In this study we make use of data from the statistical reporting of banks to the Banque centrale du Luxembourg. We build an unbalanced panel for the period spanning 2003q1 to 2010q4 and have quarterly observations on balance sheet characteristics for a maximum of 157 banks per quarter (and a minimum of 68 banks)[9]. Our monetary policy indicator comes from the ECB Statistical Warehouse and is the Euribor 3 month interest rate.

[6]The potential output is estimated through the Hodrick-Prescott filter.

[7]We consider 2007q3 as the starting quarter which corresponds to the beginning of the financial turbulence (ECB Monthly Bulletin [14]).

[8]The definition of HQLA in the LCR is more restrictive than the definition of liquid assets as used in the mainstream literature. This is due to the particular stress scenario defined by the BCBS.

[9]In the last three quarters we make use of a sample of banks representing between 82% and 95% of the sector's total assets. This is due to a change in the reporting rules of the Eurosystem of Central Banks which made the statistical reporting non-mandatory for small banks.

Table 1 depicts descriptive statistics on the variables used in the econometric analysis by quartile of the distribution of the bank size variable[10]. This table points out the significant role of the size variable to summarize other balance sheet characteristics of banks. Big banks' average growth rate of loans is higher than the one of small banks[11]. Also, small banks have a higher ratio of LCR shortfall over total assets than big banks, mainly because of the differences in the ratio of HQLA over total assets rather than in the NO ratio. Conversely, the NSFR shortfall is lower for the smaller banks because of the differences in both the RSF and ASF. One can see that small banks are better capitalized.

In order to identify the bank lending channel of monetary policy transmission, standard practice considers the loans to non-financial corporates and retail customers in the econometric analysis. We deviate from that by using total loans. Since NFC and retail loans of Luxembourgish banks only add-up to less than 14 percent of total assets (see Table 2) and less than 18 percent of total loans, the standard practice would give a constrained picture of the ECB monetary policy transmission through Luxembourg's banking sector[12]. In the case of Luxembourg, combining loans granted to different sectors is likely to be neutral for the analysis of monetary policy transmission as they tend to react similarly to a monetary policy shock. Table 3 shows that the correlation between the growth rate of total loans and the one of loans to the different sectors is positive and significant in every case. Moreover, Table 3 also shows that there are no significant negative correlations between the growth rate of loans to the different counterparties. This indicates that there are no substitution effects that the use of total loans would hide. In addition, the differences in the distribution of total loans among the economic sectors for banks of different sizes (see Table 2) do not seem to invalidate the assumption of a homogeneous demand for loans in the Luxembourgish banking sector.

[10]We have cleaned the sample from outliers by cutting the tails of the relevant variables at the 1th and 99th percentiles. Table 1 is based upon the cleaned sample.

[11]We consider as small (big) banks those in the first (fourth) quartile of the total assets distribution. Medium-sized banks are those in the second and third quartiles.

[12]The assumption underlying the consideration of total loans in the regression analysis is that loans to financial institutions will feed, sooner or later, European economic activity and the price level. This assumption is likely to hold as, on average, two thirds of loans granted to financial institutions by banks in Luxembourg remain within the geographical limits of the current Euro-zone. Additionally, taking into account that the Euro-zone is one of the biggest open economies in the world, any modification to the real exchange rate of its' commercial partners is likely to impact, in the medium-term, the European price level and activity.

3.2.1 A closer look at the evolution of the LCR and NSFR

In the following paragraphs we provide a description of the evolution of the LCR and NSFR for a representative sample of banks in Luxembourg from 2003q1 to 2010q4.

Figure 1 shows descriptive statistics of the LCR. A distinction should be made for the last three periods of the series because of the changes in the sample that followed the modifications in the reporting rules (see footnote 9). We draw box plots for the full sample, as well as the median value for the first (i.e. small banks) and fourth (i.e. big banks) quartiles of total assets. The median of the LCR declined from a maximum of 80% in 2003 Q4 to a minimum of 30% in 2010. Currently it stands at 71%, but potentialy due to the reduced sample. In the aftermath of the crisis the LCR started to recover essentially due to big banks.

Figure 2 shows that the median of the NSFR was initially above 100% before 2005, but declined continuously until the start of the crisis to a level of 80%. It then recovered mainly due to small banks. The evolution of the NSFR over time should be ascribed to a process of change in financial practices. Loans to NFCs have been increasing as well as longer-term loans that are secured by real estate. The increases in capital are too small to compensate for these enlargements on the asset side, which are funded by wholesale borrowing. The cuts in the loan supply due to the dry-out of money markets and the re-capitalizations observed during the crisis have triggered the recovery of the NSFR.

It is worth noting the significant differences in the median of the LCR and NSFR between big and small banks. Big banks fare better in terms of the LCR but worse in terms of the NSFR. This can be attributed to several crucial differences in the balance sheet characteristics. As discussed above, the main differences lie in the share of NO, ASF and RSF over total assets (see Table 1). These differences also help to explain the jumps observed in the series of the LCR and the NSFR in 2010q2 when smaller banks were released from reporting obligations.

This short description hints at the potentially sizable modifications of banks' balance sheets that compliance with the ratios is likely to require. We, thus, argue that it is necessary to forecast the potential restructuring of banks' balance sheets and the implications for policy making. In the next subsection we describe the outcome of a simulation exercise we performed with this aim.

3.2.2 Balance sheets adjustments toward compliance : a simulation exercise

We carried out a simulation exercise in order to assess the optimal balance sheet adjustments that compliance with the LCR and NSFR would require[13]. The simulated model[14] assumes that, in each period and given a vector of prices and adjustment costs, the banks maximize profits by selecting the amount of total loans, Level 1 and Level 2 securities (i.e. securities to be included in the stock of high quality liquid assets of the LCR[15]), capital, and different categories of deposits[16], under the constraint of complying with the LCR, NSFR and minimum capital requirements.

The outcome is summarized in Table 4. It presents descriptive statistics, by quartiles of size, of the components of the standards, namely the ratios of HQLA, NO, ASF and RSF over total assets, as well as the share of the shortfalls in LCR and NSFR over total assets and the leverage ratio.

The comparison of Table 4 with Table 1 reveals how banks of different sizes comply with the standards in our simulation. On average, banks in the third and fourth quartiles of total assets mainly increase the ASF, rather than reducing the RSF, in order to adhere to the NSFR requirements. Regarding the LCR, moderate changes in the HQLA and the NO suffice for these larger banks to comply. The most sizable changes are undertaken by medium-sized banks with increases in basically all components of the LCR and NSFR while small banks increase both their HQLA and their RSF.

The adjustments in the components of the ratios suggest a restructuring of balance sheets that potentially affects the transmission of monetary policy shocks through the bank lending channel. If the LCR and NSFR sufficiently summarize the structure of a bank's balance sheet then they should be able to explain distributional effects of monetary policy shocks. The next section deals with this issue.

4 Estimation results

In this section we present the results of the econometric estimation of alternative specifications of the model introduced in equation 3. In our estimation we resort to GMM type estimators since we include the lag of the dependent variable and other potentially endoge-

[13] Appendix A details the optimization program and the simulation procedure.

[14] See Kopecky and VanHoose [21] for applications of a similar approach.

[15] See items 39 to 42 in [5].

[16] The categories of deposits fit the definition of the cash outflows by counterparties of the LCR. See items 54 to 83 in [5]

nous variables as regressors such as the balance sheet characteristics[17] (Holtz et al. [17], Arellano and Bond [3] ; Arellano and Bover [4] ; Blundell and Bond [10]).

4.1 Monetary Policy Transmission

This section is based on the historical data series. We, firstly, ask whether the shortfalls in the LCR and NSFR ratios are able to explain heterogeneous movements in the growth rate of total loans driven by a monetary policy shock. Secondly, we add granularity to our analysis by disaggregating the shortfalls into their components. Our main concern is whether there is a significant interaction between the shortfalls in Basel III liquidity ratios and the short-term interest rate. If the coefficients of these interactions are statistically significant, then the shortfalls explain the distributional effects of monetary policy shocks[18]. Tables 5 and 6 depict the estimated coefficients of the alternative specifications discussed in this subsection. Given that the estimated models include terms interacting bank characteristics with the monetary policy indicator, the marginal effect of a bank characteristic or a monetary policy shock can not be read directly from these tables. The estimated long-term marginal effects of a contractionary monetary policy shock on the growth rate of total loans are shown in Tables 7 to 10.

The estimation results of specifications that consider as regressors the shortfalls in the ratios are depicted in Table 5[19]. We can see in this table that for all three models the coefficients of the terms interacting the change in the short-term interest rate and the banks characteristics are statistically significant. We analyze the monetary policy effects using the specification that combines the shortfalls in both ratios (model 3 in third column of Table 5). Table 7 presents the long-term marginal effects of a contractionary monetary policy shock estimated using this model. The main bank characteristics that drive the heterogeneous reactions of the growth rate of total loans are the size and the NSFR shortfall. As can be seen in Table 7, the bank lending channel in Luxembourg works through the smallest banks with a large shortfall in the NSFR. On average, banks in the first quartile of total assets and in the last quartile of the NSFR shortfall over total assets reduce total loans by 0.165% after an increase of one percentage point in the short-term interest rate[20]. This result prevails

[17]We consider the interest rate as exogenous given the relatively small size of Luxembourgish loans in the European economy.

[18]From now “a monetary policy shock” refers to a one point increase in the short-term interest rate.

[19]The estimated models shown in this table are constrained specifications of a more general one which includes all the regressors listed in the table (in addition to crisis and seasonal dummies). We performed Wald tests to compare the nested models with the full one and we can not reject the hypothesis null in any case.

[20]The coefficients in Table 7 can be interpreted as the elasticity of total loans with respect to the short-term interest rate.

since banks with a lack of stable funding are prone to lose funds following a contractionary monetary policy shock. Moreover, if these banks are small it would be harder for them to access alternative sources of funding.

A further look at Table 7 reveals that medium-sized banks do not react to monetary policy shocks, while big banks with a small NSFR-shortfall increase their loans by 0.122%. The explanation for the positive reaction of bigger banks' loan supply following a tightening in the monetary policy is that Luxembourg's banking sector plays the role of a liquidity provider to their group. A stricter monetary policy increases the demand for funds which is partly satisfied by an increase in loans from Luxembourg's banks[21]. In addition, Luxembourg's large banks have a lower ratio of loans over total assets (compared to small banks) which gives them additional degrees of freedom to adjust other assets when faced with a reduction of deposits. Of course, larger banks also tend to have a better access to short-term wholesale funding.

We turn now to the analysis of models disaggregating the shortfalls into their components. The estimated coefficients of the specifications which include NO and HQLA (the two components of the LCR) are shown in the first two columns of Table 6[22]. Even if the estimated coefficients of the interaction terms between the bank characteristics and the monetary policy indicator are statistically significant, our analysis of the long-term marginal effects indicates that liquidity is not a relevant characteristic for the identification of the bank lending channel in Luxembourg. We can not discard, however, that the limited role played by liquidity in the bank lending channel may be due to the restrictive definition of high quality liquid assets. In contrast, as can be seen in Table 8, the long-term marginal effects of a contractionary monetary policy shock are equal to 0.07% for big banks with a low ratio of HQLA. This suggests that HQLA do not play the fundamental role of safeguarding portfolios against liquidity problems but may be used instead as collateral or for the purpose of long-term investment. Clearly, banks with few HQLA are those that are more active loan issuers and tend to function as liquidity providers. Conclusively, they are more likely to react positively to monetary policy shocks. However, small banks mainly funded by unstable sources (i.e. big net outflows) are better prepared to cushion monetary policy shocks than other small banks with more limited NOs. As can be seen in Table 9, the average long-term marginal effect

[21] Giordana and Schumacher [15] show that assets of Luxembourg's banking sector are positively correlated with the spread between Euribor 3 month rate and the EONIA rate. This means that in times of enhanced liquidity needs of Luxembourguish banks' counterparties, the demand for intra-group credits from banks in Luxembourg increases.

[22] These two specifications are reduced versions of a model that includes all the regressors considered in models 4 and 5. The full model correspond to the disaggregated version of model 1. We performed Wald test to compare the nested models with the full one and we can not reject the null hypothesis in any case.

of a contractionary monetary policy shock is equal to -0.092% for the former banks but it is not significantly different from zero for the latter ones. Conversely, the ability of big banks to shelter monetary policy shocks is reduced the bigger are the NOs. For instance, the biggest banks with low net outflows increase their loans by 0.094% after a monetary policy tightening but do not react if their net outflows are too important (see Table 9). Intuitively, larger funding bases prevent contractions of the loan supply more robustly than a bigger stock of HQLA may do. Furthermore, as big banks tend to have a higher leverage ratio compared to small ones, exceedingly unstable funding bases tend to overcompensate, for such banks, the positive effect of bank size.

Finally, we analyze a specification that includes the NSFR shortfall's components (i.e. ASF and RSF) as regressors (i.e. model 6). The estimated coefficients are shown in the third column of Table 6. As anticipated, the availability of stable funding prevents total loans to diminish after a monetary policy shock but this effect is smaller the bigger the banks and/or the higher the ratio of RSF over total assets. Also, the ratio of RSF over total assets enhances the transmission of contractionary monetary policy shocks. Even if the results are consistent with those obtained in model 3, the exclusion of the LCR shortfall in this specification may have biased downwards the reaction of small banks toward monetary policy tightenings. The long-term marginal effects of contractionary monetary policy are given in Table 10 for the small and big banks subsamples. On average, small banks reduce total loans by 0.223% following a 100 basic point policy driven increase in the short-term interest rate. Moreover, while the average reaction is not significantly different from zero for banks in the first quartile of required stable funding, it reaches -0.498% for those banks in the fourth quartile. The long-term marginal effects of small banks with low RSF increase as the ASF ratio grows, though these effects are not significantly different from zero. Nevertheless, the negative effect from RSF overcomes the positive effect from ASF for banks which are big enough (see Table 10) or for those with an exceedingly high RSF ratio (see in Table 10 the columns corresponding to the third and fourth quartiles of RSF). The long-term marginal effects of a monetary policy tightening estimated for small banks using this specification are significantly lower than those estimated on the basis of model 3. This points out the fundamental role that short-term wholesale funding (i.e. NO) plays in helping small banks to cushion monetary policy shocks.

Robustness

We check the robustness of the previous results by estimating more detailed specifications not presented but available from authors. We explore models combining components of LCR and NSFR shortfalls. Given that the previous conclusions regarding the long-term marginal effects are not qualitatively modified we state that our analysis above is robust to a multitude of different specifications and fit previous results in the literature. We conclude then that the LCR and NSFR convey relevant information for measuring the impact of monetary policy on bank lending.

4.2 The impact of compliance with the new standards on the bank lending channel

The results presented in the previous section give us an understanding of how banks with different ratios of the Basel III liquidity regulations reacted to monetary policy shocks in Luxembourg during the past years. In order to understand the potential impact of compliance with the Basel III regulations we perform two complementary analysis in this sub-section. First, using the results from model 3 we calculate the elasticities of the long-term marginal effects of a contractionary monetary policy shock with respect to changes in the shortfalls. Second, we use the simulated data to econometrically estimate the long-term marginal effects of a monetary policy shock directly.

4.2.1 Analysis based on historical data

Table 11 depicts the elasticities of the monetary policy marginal effects with respect to changes in the shortfall of the NSFR and LCR standards. The analysis of these tables allows us to conclude that complying with the NSFR would reduce the importance of the bank lending channel in Luxembourg. However, complying with the LCR would only reduce the relevance of the bank lending channel for some banks whilst for others it would increase.

In the last row of Table 11 we can see that one percent increase of the ratio of NSFR shortfall over total assets would reduce, on average, the long-term marginal effect of a monetary policy contractionary shock by 4.75%. Thus, a higher NSFR shortfall implies larger reactions of the loan supply after a shock. The elasticities are negative and statistically significant for all the quartiles of the LCR shortfall with the exception of the last one. In other words, the impact of a monetary policy shock on loans is not sensitive to changes in the NSFR shortfall for banks having more unstable funding bases or lower shares of HQLA over total assets. This result obtains since these banks can substitute unstable sources of funding by stable ones.

This table also shows the impact of changes in the LCR shortfall on the monetary policy shock's long-term effect on loans[23]. Following a one percent reduction in the LCR short-

[23] These effects are slightly statistically non-significant (p-value $= 0.108$), we will analyze them as if they were significant. The p-values are equal for every quartile because the calculation of the long-term marginal effect

fall ratio, banks in the first two quartiles of the NSFR shortfall over total assets distribution would see their reaction to monetary policy reduced by, respectively, 0.501% and 0.355%. Conversely, those banks in the last two quartiles of the NSFR shortfall distribution would see an increase in their reaction to monetary policy. As shown in the previous section, those banks significantly reduce their total loans after a contractionary monetary policy shock. Then, complying with the LCR is likely to enhance the bank lending channel such as it currently operates in Luxembourg. The intuition of this result is straight-forward if we take into consideration the fact that a higher LCR shortfall is related to a larger funding base relative to the stock of HQLA. Thus, complying with the LCR would tend to reduce the availability of funds to feed the growth of loans. Further, if banks already lack stable funding (i.e. high NSFR shortfall), the reaction of the loan supply to a monetary policy tightening should be stronger after compliance with the LCR.

4.2.2 Counterfactual analysis

A potential limitation of the previous analysis relies on the neutrality assumption of the balance sheet modifications adopted to reach compliance with the standards. Indeed, a reduction in the shortfalls can hide substitution effects between the banks' balance sheet components that might modify the mechanism of monetary policy transmission. In order to overcome this weakness we adopt an alternative approach. We perform a counterfactual exercise that consists in fitting alternative specifications of equation 3, similar to the previously described regression models, but using simulated bank level data. The coefficients of our preferred model are exposed in Table 12. This specification includes the components of the LCR and NSFR shortfalls. We can see that the coefficients of the bank characteristics interacted with the monetary policy indicator are statistically significant. Therefore, a bank lending channel may be still at work after compliance with Basel III.

However, a general conclusion from the following analysis would be that the bank lending channel effectiveness for cooling down the economy is likely to be strongly limited after compliance with the standards. The estimated long-term marginal effects of a contractionary monetary policy shock are exposed in Table 13. A visual inspection is enough to see the differences in the effects compared to those currently at work that are shown in Tables 8 to 10. Firstly, big banks are no longer able to cushion monetary policy shocks, as can be seen in the last row of Table 13 the effects are even negative though not significant. Small banks are better prepared after compliance with the standards to shelter a monetary policy tightening ; 100 basic points increase in the short-term interest rate triggers an increase of

engages only two estimated coefficients.

0.143% of the loan supply of small banks. Secondly, while NO continues to play a similar role as before compliance, HQLA tend to help small banks to better cushion the impact of the contractionary shock in monetary policy. In contrast, for bigger banks the sheltering effect is not significant. Finally, the higher the RSF ratio the lower the marginal effect.

The results confirm the previous statements, the effectiveness of the bank lending channel in Luxembourg tends to disappear. The striking result concerning the ability of small banks to protect their loan portfolio from monetary policy tightening stems from their increase in HQLA, which is positively related to the marginal effects, as well as from the softer burden that adhering to the NSFR imposes on them compared to big banks. As a corollary we conclude that the distributional effects of monetary policy shocks have not been conceptually modified after compliance with the ratios. Rather, the balance sheet structures of banks of different sizes have been modified in such a way that alters the cohort of relevant banks for the identification of the bank lending channel.

5 Conclusion

The aim of this article is to study the potential impact of the Basel III liquidity standards on monetary policy transmission through the bank lending channel in Luxembourg using bank level data.

A first contribution of this paper is the assessment of the relevance of the bank lending channel in Luxembourg. For doing this we follow the standard approach in the literature. We identify heterogeneous reactions of bank lending to monetary policy shocks by introducing in the regression model a vector of balance sheet characteristics that are potentially related to the bank's external finance premium. One of the novelties of this articles is that, in addition to those bank characteristics usually considered in the literature, we test the explanatory power of the new liquidity standards for identifying distributional effects of monetary policy shocks. Our results indicate that the LCR and NSFR are vehicles of relevant information for identifying the bank lending channel. More precisely, we find that the bank lending channel in Luxembourg mainly works through small banks with a large shortfall in the NSFR.

Moreover, in contrast to the findings of studies focusing on other European countries, we find a significant asymmetry between the lending responses to monetary policy shocks of small and big banks. The small banks are less able to shelter their loan portfolio from contractionary monetary policy shocks, although the ability of small banks to absorb monetary policy shocks is improved as they have a higher ratio of Available Stable Funding (essentially composed of liabilities with maturity greater than one year) or benefit from a better access to short-term funding (i.e. bigger Net-Outflows over total assets). Conversely, liquidity does not play a highly significant role for small banks. On the other hand, big banks are able to increase their loans following a monetary policy tightening which supports our argument that they are liquidity providers. In comparison to the results for small banks, higher ratios of ASF, NO or HQLA tend to reduce the ability of big banks to cushion contractionary monetary policy shocks. This arises since big banks with a high ASF ratio are those that also have a high ratio of RSF over total assets. The negative effect of the latter overcompensates the positive effect of the former. Also, big banks tend to have higher leverage ratios than small banks and thus, for those banks, exceedingly high NO ratios are likely to overcompensate the positive effect of the bank size. Finally, if banks hold HQLA for the purpose of long-term investment or as collateral then a higher share of HQLA is likely to reduce the effect of bank size.

The second novelty in the paper is the estimation and the analysis of LCR and NSFR time series. With this we help to identify Luxembourg's position with respect to these ratios, the developments underlying the evolution of these ratios over time, and the potential sources of the shortfalls. We show that the liquidity of Luxembourg's banks, as measured by the LCR, declined during the build-up to the crisis in 2008 from a maximum of 80% in 2003q4 to a minimum of 30% in 2010. Currently it stands at 71%. Regarding the evolution of the NSFR we show that its median was above 100% before 2005, but declined steadily until 2008 to a level of 80%. It then recovered mainly due to small banks, reaching 100% in 2010q3.

Our analysis of the LCR and NSFR position of Luxembourg's banks suggests that further balance sheet restructuring is likely to take place in the medium term. We estimate the optimal balance sheet adjustments using a constrained optimization based on the historical data, where banks maximize their profits given that they have to adhere to both liquidity ratios and the Basel III leverage standard. The simulation outcome suggests deep balance sheet modifications. Furthermore, we uncover large differences in the adjustments of small and big banks. While small banks tend to be pushed toward wholesale sources of funding, big banks are pointed toward retail and small NFC customers even if they have already a significant share of these types of deposits.

Based on the identified mechanism of monetary policy transmission, we estimate the impact of compliance with the liquidity standards using historical bank level data. The results suggest that complying with the NSFR will significantly reduce the relevance of the bank lending channel as it has just been identified in this paper. Conversely, complying with the LCR can potentially enhance the reaction of some banks, i.e. small banks with large NSFR shortfalls, to monetary policy shocks. The intuition is straight-forward since a higher LCR shortfall relates to a larger funding base. Complying with the LCR would tend to reduce the availability of loanable funds, because they would be fewer or because they would be funding the HQLA stock. Then, those banks which are already lacking stable funding (i.e. high NSFR shortfall), are likely to reduce the loan supply after compliance with the LCR by more once they face a contractionary monetary policy shock. However, the statistical significance of the last result is low.

One can argue that complying with the new liquidity regulations might potentially modify the channel of monetary policy transmission. Then, adopting a counterfactual approach we further analyze the potential modifications that complying with the new standards would introduce to the bank lending channel of monetary policy transmission. With this aim, we estimate a set of models based on the simulated bank level data. The results from the preferred model confirm previous conclusions, the bank lending channel in Luxembourg would tend to be less effective for cooling down the economy. However, a striking result comes out, small banks are better able to cushion contractionary monetary policy shocks than big banks. The reason is that the big banks need significant changes to their balance sheets in order to comply with the NSFR which then constrains their ability to continue lending following a monetary policy shock.

The introduction of the Basel III liquidity regulations in Luxembourg is, therefore, likely to lead to a banking sector that is, on the one hand, more resilient to crises but, on the other hand, also less likely to react to monetary policy shocks. We conclude that the short-term interest rate may lose part of its power as an instrument for central bank intervention.

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A Simulation of optimal balance sheet adjustments

In order to calculate the adjusted balance sheet that would allow a bank to comply with both the LCR and NSFR we assume that each bank i selects, in quarter t, eleven endogenous variables : total loans (L_{it}), Level 1 $(S1_{it})$ and Level 2 $(S2_{it})$ securities of the stock of high quality liquid assets, Tier 1 and Tier 2 capital Cap_{it}, and deposits of category *c*, $c = D_{Si}$, D_{LSi},D_{NFCnr}, D_{PSEnr}, D_{MFInr}, D_{MFIr}, D_{UWFr},. Where,

_ D_S is the amount of stable retail deposits,

_ D_{LS} is the amount of less stable retail deposits,

_ D_{NFCnr} is the amount of non-financial corporate deposits without operational relationship,

_ D_{PSEnr} is the amount of sovereigns and public sector entities deposits without operational relationship,

_ D_{MFInr} is the amount of deposits from monetary and financial institutions without operational relationship,

_ D_{MFIr} is the amount of deposits from monetary and financial institutions with operational relationship,

_ D_{UWFr} is the amount of other deposits from wholesale funding counterparties with operational relationship.

We perform a static optimization. We suppose banks behave myopically focusing only on quarter t and disregard any information about the future. We introduce some additional simplifying assumptions :

1. The interest rate of deposits, loans and the rate of return of securities are bank-level rates taken from the statistical reporting to the Banque Centrale du Luxembourg. For simplicity sake, we assume that these rates are given in the optimization procedure. This assumption implies that the demand for the different types of deposits and loans as well as the supply of securities will sufficiently adjust leaving prices constant. In other words the market behavior is not modeled. For instance, the interbank market is assumed “infinitely” liquid at the current interest rates.

2. Banks act individually, no strategic behavior is modeled. Each bank maximizes its profits without internalizing the impact of his decision on market behavior (related to the previous assumption).
3. The bank's business model is considered as partially constant. By adjusting the eleven endogenous balance sheet variables listed previously, each bank silently modifies other assets and liabilities components whose amounts are modeled as fixed proportions of the endogenous variables.
4. Banks' balance sheets are assumed to show some stickiness. In other words, it is costly to alter the current level of the endogenous variables. Moreover, the higher the level of the change, the higher the cost. Further, in order to consider, at least to some extent, feasibility restrictions the model is solved for a particular vector of adjustment costs parameters. In line with empirical regularities, we assume that capital has the highest adjustment cost parameter and that securities have the lowest one compare to all the other endogenous variables.

A.1 The optimization program

For simplifying the notation we drop the bank and period subscripts. Then, bank *i* in quarter *t* maximizes its profits (equation 4) under constraints (which are explained in the next subsection).

$$\begin{aligned} \max_{L,S1,S2,D_j,Cap} \pi &= L \cdot r_L + (S1 \cdot r_{rf} + S2 \cdot 2 \cdot r_{rf}) \cdot (1+\beta) - \\ & r_D \cdot \sum_{\forall c} D_c \cdot (1+f_c) - \Psi. \end{aligned} \tag{4}$$

Where, β is a proportionality factor linking Level 1 and Level 2 securities (i.e. as defined in the LCR regulation) to all the remaining securities held by the bank ; f_c are proportionality factors linking the different categories of deposits (i.e. LCR's classification of deposits) to the remaining amount of deposits from the same counterparty. Additionally, Ψ is the adjustment cost term. As explained previously in item 4, this term represents the stickiness of the balance sheets :

$$\begin{aligned} \Psi_i &= \lambda_L \cdot (L - L_{t-1})^2 + \sum_{\forall c} \lambda_{Dc} \cdot (D_c - D_{c,t-1})^2 + \\ & + \sum_{\forall l} \lambda_{Sl} \cdot (S_l - S_{l,t-1})^2 + \lambda_{Cap} \cdot (Cap_i - Cap_{i,t-1})^2 \end{aligned}$$

The λs in the previous equation are the adjustment cost parameters. We assume $\lambda_{Sl} < \lambda_L (= \lambda_{Dc}) < \lambda_{Cap}$.

A.1.1 The constraints

LCR constraint

$$LCR = \frac{C + S1 + CBR + \min(S2, 0.4 \cdot (C + S1 + CBR))}{OUTFLOWS - INFLOWS} \geq 1, \tag{5}$$

where, C is cash, S1 and S2 compound respectively Level 1 and Level 2 securities and CBR are central bank reserves,

$$CBR = 0.02 \cdot \left(\sum_{\forall c \neq MFI} D_c + \delta \cdot (L + S1 + S2) \right) \tag{6}$$

In equation 6, δ links total loans, Level 1 and Level 2 securities to the amount of debt securities issued by the bank with a residual maturity of less than 2 years.[24]

$$\begin{aligned} OUTFLOWS \;=\; & \alpha_{ds} \cdot D_S + \alpha_{ls} \cdot D_{LS} + \alpha_{Dnfcnr} \cdot D_{NFCnr} + \alpha_r \cdot \Big(D_{UWFr} + \\ & D_{MFIr} \Big) + \alpha_{Dpsenr} \cdot D_{PSEnr} + D_{MFInr} + \alpha_{OFF} \cdot OFF + O. \end{aligned} \tag{7}$$

where, α_c are the run-off factor of deposit category *c* as assumed in the LCR/NSFR stress scenario, OFF is off-balance sheet (OBS) commitments, O represents others outflows.

NSFR constraint

$$NSFR = \frac{ASF}{RSF} \geq 1. \tag{8}$$

$$\begin{aligned} ASF \;=\; & Cap + f_4 \cdot \sum_{\forall c \neq MFI} D_c \\ & + \gamma_{DS} \cdot f_3 \cdot D_S + \gamma_{DLS} \cdot f_2 \cdot D_{LS} + \gamma_{NFC} \cdot f_1 \cdot D_{NFCnr} \\ & + \gamma_{UWF} \cdot f_5 \cdot D_{UWFr} + \gamma_{MFInr} \cdot f_6 \cdot D_{MFInr} + \gamma_{MFIr} \cdot f_7 \cdot D_{MFIr}. \end{aligned} \tag{9}$$

In equation 9, γ_c is the "available" stable funding factor of deposit category c as defined in the LCR/NSFR stress scenario. The f_h's are factors of proportionality linking the ASF

[24] See the European Central Bank documentation about reserves requirements for more details. For simplicity sake, we do not consider any deduction.

components to the endogenous variables of the model. Then, f_1 is the share of unsecured wholesale funding (UWF) with maturity lower than one year to D_{NFCnr}, f_2 is the share of less stable deposits with maturity lower than one year to D_{LS}, f_3 is the share of stable deposits with maturity lower than one year to D_S, f_4 is the share of preferred bonds not included in Tier 2 with effective maturity of one year or greater to total deposits minus MFI deposits, i.e. $\sum_{\forall d \neq MFI} D_d$, f_5 is the ratio of UWF deposits with maturity lower than one year over D_{UWFr}, f_6 is the share of UWF deposits with maturity lower than one year to D_{MFInr}, and f_7 is the share of UWF deposits with maturity lower than one year to D_{MFIr}.

The required stable funding (RSF) is defined as,

$$\begin{aligned} RSF &= \gamma_1 \cdot k_1(S1 + S2) + \gamma_2 \cdot k_2(S1 + S2) + \gamma_3 \cdot k_3(S1 + S2) \\ &\quad + \gamma_4 \cdot k_4(S1 + S2) + L \cdot (0.5 \cdot k_5 + 0.65 \cdot k_6 + 0.85 \cdot k_7 + 0.05 \cdot k_8) + RA \end{aligned} \quad (10)$$

where, k_j are proportionality factors linking the RSF terms as defined in the regulation with the endogenous variables of the model ; the γ_l is the “required” stable funding factor of asset type l as defined in the NSFR stress scenario. Additionally, RA refers to the residual assets which are defined in what follows by equation 14.

Leverage ratio Constraint

$$LEV = \frac{Cap}{TA} \geq 0.06, \quad (11)$$

where TA equals :

$$TA = TA_o + (L - L_o) \cdot (1 + 0.02 * \delta) + (1 + 0.02 * \delta + \sum_{1}^{4} k) \cdot (S1 + S2 - S1_o - S2_o) \quad (12)$$

In equation 12 the subscript o refers to observed values.

Residual Assets constraint (from NSFR)

$$RA \geq 0 \quad (13)$$

Residual assets (RA) equal,

$$RA = TA_o - L \cdot \left(\sum_{k=5}^{8} k_k \right) - (S1 + S2) \cdot \left(\sum_{k=1}^{4} k_k \right) \quad (14)$$

where TA_o is the observed total assets.

Balance Sheet Constraint

$$
\begin{aligned}
(L - L_o)\,(1 + 0.02\delta) + (S1 - S1_o + S2 - S2_o) \cdot \left(1 + 0.02\delta \sum_{k=1}^{4} k_k\right) \quad &= \\
(Cap - Cap_o) + (1 + 0.02) \cdot \big[\, (D_S - D_{S,o}) + (D_{LS} - D_{LS,o}) + \\
+ (D_{NFCnr} - D_{NFCnr,o}) + (D_{NFCr} - D_{NFCr,o}) + (D_{PSEnr} - D_{PSEnr,o}) + \\
+ (D_{PSEr} - D_{PSEr,o}) \,\big] + (D_{MFI} - D_{MFI,o})
\end{aligned} \tag{15}
$$

B Descriptive statistics

TAB. 1: Descriptive statistics on historical data by quartile of total assets.

Quartiles of Size	**Variables**	Statistics N	Mean	St.Dev.	Min	Max
1	△ ln(loans)	794	0.002	0.194	-0.875	0.669
	Size	794	19.184	0.705	17.251	20.102
	LCR shortfall	794	0.029	0.091	-0.278	0.600
	NSFR shortfall	794	-0.156	0.281	-0.834	0.698
	HQLA	794	0.042	0.055	0.000	0.367
	Net Outflows	794	0.071	0.084	0.000	0.616
	Avail.Stable Fund.	794	0.456	0.245	0.058	0.976
	Requi.Stable Fund.	794	0.300	0.212	0.002	0.964
	Capitalisation	794	0.088	0.078	0.008	0.538
2	△ ln(loans)	793	-0.000	0.208	-0.954	0.669
	Size	793	20.751	0.364	20.105	21.392
	LCR shortfall	793	0.062	0.146	-0.248	0.599
	NSFR shortfall	793	0.024	0.235	-0.539	0.702
	HQLA	793	0.048	0.064	0.000	0.320
	Net Outflows	793	0.110	0.133	0.000	0.617
	Avail.Stable Fund.	793	0.302	0.189	0.008	0.846
	Requi.Stable Fund.	793	0.326	0.233	0.002	0.856
	Capitalisation	793	0.035	0.047	0.000	0.479
3	△ ln(loans)	793	0.005	0.202	-0.856	0.638
	Size	793	22.071	0.407	21.394	22.799
	LCR shortfall	793	0.054	0.116	-0.245	0.590
	NSFR shortfall	793	0.067	0.235	-0.594	0.693
	HQLA	793	0.036	0.041	0.000	0.348
	Net Outflows	793	0.090	0.106	0.002	0.612
	Avail.Stable Fund.	793	0.296	0.192	0.006	0.790
	Requi.Stable Fund.	793	0.363	0.242	0.003	0.931
	Capitalisation	793	0.030	0.051	0.000	0.559
4	△ ln(loans)	793	0.005	0.164	-0.783	0.661
	Size	793	23.518	0.512	22.800	24.671
	LCR shortfall	793	-0.025	0.103	-0.302	0.513
	NSFR shortfall	793	0.146	0.148	-0.323	0.605
	HQLA	793	0.082	0.085	0.000	0.345
	Net Outflows	793	0.056	0.068	0.001	0.590
	Avail.Stable Fund.	793	0.267	0.147	0.014	0.728
	Requi.Stable Fund.	793	0.412	0.204	0.008	0.811
	Capitalisation	793	0.021	0.017	0.001	0.131
Total	△ ln(loans)	3173	0.003	0.193	-0.954	0.669
	Size	3173	21.380	1.683	17.251	24.671
	LCR shortfall	3173	0.030	0.121	-0.302	0.600
	NSFR shortfall	3173	0.020	0.255	-0.834	0.702
	HQLA	3173	0.052	0.066	0.000	0.367
	Net Outflows	3173	0.082	0.103	0.000	0.617
	Avail.Stable Fund.	3173	0.330	0.210	0.006	0.976
	Requi.Stable Fund.	3173	0.350	0.227	0.002	0.964

Capitalisation	3173	0.043	0.059	0.000	0.559

TAB. 2 – Average ratio of loans over total assets by quartiles of bank size.

Quartiles	**Loans to**				
of Size	**Total**	**NFC**	**Retail**	**MFI**	**Other**
1	0.831*	0.064***	0.079	0.662**	0.026***
	(0.212)	(0.131)	(0.158)	(0.268)	(0.072)
2	0.849***	0.083	0.081***	0.637***	0.048***
	(0.187)	(0.130)	(0.167)	(0.253)	(0.085)
3	0.818***	0.090**	0.045***	0.607***	0.076
	(0.231)	(0.150)	(0.097)	(0.262)	(0.095)
4	0.667	0.081	0.025	0.482	0.079
	(0.249)	(0.114)	(0.053)	(0.256)	(0.086)
Total	0.791	0.080	0.057	0.597	0.057
	(0.233)	(0.132)	(0.130)	(0.269)	(0.087)

Standard errors in parenthesis.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

TAB. 3 – Correlation factors between growth rate of loans to the different sectors.

$\Delta ln(loans)_{j,t-1}$	j				
j	Total	NFC	Retail	MFI	Other
Total	1.000				
NFC	0.075	1.000			
	(0.000)				
Retail	0.098	0.020	1.000		
	(0.000)	(0.282)			
MFI	0.693	0.018	0.053	1.000	
	(0.000)	(0.298)	(0.004)		
Others	0.135	0.000	0.037	0.035	1.000
	(0.000)	(0.992)	(0.055)	(0.049)	

p-values in parenthesis.

TAB. 4: Descriptive statistics on simulated data by quartile of total assets.

Quartiles of Size	**Variables**	Statistics				
		N	Mean	St.Dev.	Min	Max
1	∆ ln(loans)	724	-0.0120	0.2183	-1.9083	1.0690
	Size	724	19.5225	0.5386	17.5586	20.1686
	LCR shortfall	724	-0.0529	0.0772	-0.3451	0.0000
	NSFR shortfall	724	-0.0399	0.1279	-0.9565	0.0000
	HQLA	724	0.1120	0.0873	0.0001	0.3536
	Net Outflows	724	0.0591	0.0630	0.0000	0.2936
	Avail.Stable Fund.	724	0.5027	0.1577	0.0913	0.9839
	Requi.Stable Fund.	724	0.4627	0.1822	0.0052	0.9822
	Capitalisation	724	0.4800	0.1787	0.0696	0.9839
2	∆ ln(loans)	723	0.0029	0.2032	-1.1518	0.6366
	Size	723	20.7270	0.3216	20.1711	21.2713
	LCR shortfall	723	-0.1485	0.1125	-0.3390	0.0000
	NSFR shortfall	723	-0.0448	0.1404	-1.3614	0.0000
	HQLA	723	0.1892	0.1054	0.0008	0.3851
	Net Outflows	723	0.0406	0.0558	0.0000	0.2904
	Avail.Stable Fund.	723	0.5491	0.1586	0.0777	1.3768
	Requi.Stable Fund.	723	0.5043	0.2013	0.0089	0.9817
	Capitalisation	723	0.4770	0.2326	0.0600	0.9817
3	∆ ln(loans)	723	0.0051	0.2156	-0.9819	0.6761
	Size	723	21.8694	0.4207	21.2716	22.7208
	LCR shortfall	723	-0.0700	0.1139	-0.3503	0.0000
	NSFR shortfall	723	-0.1336	0.2112	-1.3019	0.0000
	HQLA	723	0.1107	0.1156	0.0014	0.3503
	Net Outflows	723	0.0406	0.0497	0.0000	0.2885
	Avail.Stable Fund.	723	0.4538	0.2092	0.0601	1.3643
	Requi.Stable Fund.	723	0.3202	0.2037	0.0039	0.9824
	Capitalisation	723	0.1840	0.2049	0.0600	0.9824
4	∆ ln(loans)	723	0.0005	0.1634	-0.7467	0.6504
	Size	723	23.5646	0.5236	22.7212	24.7140
	LCR shortfall	723	-0.0781	0.0990	-0.3493	0.0000
	NSFR shortfall	723	-0.0426	0.1136	-0.7990	0.0000
	HQLA	723	0.1131	0.0991	0.0009	0.3798
	Net Outflows	723	0.0350	0.0301	0.0000	0.2720
	Avail.Stable Fund.	723	0.4084	0.1575	0.0657	1.2291
	Requi.Stable Fund.	723	0.3658	0.1743	0.0008	0.7965
	Capitalisation	723	0.0824	0.0830	0.0600	0.5461
Total	∆ ln(loans)	2893	-0.0009	0.2013	-1.9083	1.0690
	Size	2893	21.4202	1.5597	17.5586	24.7140
	LCR shortfall	2893	-0.0874	0.1080	-0.3503	0.0000
	NSFR shortfall	2893	-0.0652	0.1579	-1.3614	0.0000
	HQLA	2893	0.1312	0.1076	0.0001	0.3851
	Net Outflows	2893	0.0438	0.0519	0.0000	0.2936
	Avail.Stable Fund.	2893	0.4785	0.1800	0.0601	1.3768
	Requi.Stable Fund.	2893	0.4133	0.2044	0.0008	0.9824
	Capitalisation	2893	0.3059	0.2545	0.0600	0.9839

C Estimation Results

C.1 Estimations on historical series

TAB. 5: Estimation results of the growth rate of total loans. Banks' characteristics : LCR and NSFR shortfalls

	LCR-short	NSFR-short	LCR/NSFR short.
	(1)	(2)	(3)
Δ ln(loans)$_{t-1}$	-0.141***	-0.136***	-0.140***
	(0.0363)	(0.0379)	(0.0398)
Δi_{t-1}	-0.248	-0.738**	-0.933**
	(0.382)	(0.372)	(0.411)
Output-Gap$_{t-1}$	0.0726	0.282*	0.233
	(0.192)	(0.152)	(0.164)
Size$_{t-1}$	0.0440**	0.00583	0.00189
	(0.0191)	(0.0203)	(0.0174)
Size$_{t-1}$ $\cdot$ Δi_{t-1}	0.0122	0.0355**	0.0439**
	(0.0174)	(0.0171)	(0.0188)
LCR-short.$_{t-1}$	0.0609		0.00898
	(0.0677)		(0.119)
LCR-sh.$_{t-1}$ $\cdot$ Δi_{t-1}	-2.132*		
	(1.226)		
Size$_{t-1}$$\cdot$ LCR-sh.$_{t-1}$ $\cdot$ Δi_{t-1}	0.0981*		
	(0.0556)		
NSFR-short.$_{t-1}$		0.0870**	0.135**
		(0.0426)	(0.0597)
NSFR-sh.$_{t-1}$ $\cdot$ Δi_{t-1}		0.711*	-0.158**
		(0.394)	(0.0802)
Size$_{t-1}$$\cdot$ NSFR-sh.$_{t-1}$ $\cdot$ Δi_{t-1}		-0.0396**	
		(0.0193)	
Size$_{t-1}$$\cdot$ NSFR-sh.$_{t-1}$$\cdot$ LCR-sh.$_{t-1}$ $\cdot$ Δi_{t-1}			0.0273
			(0.0168)
Observations	3173	3173	3173
Hansen test (p-value)	0.505	0.503	0.266
AR(1) test (p-value)	1.28e-10	1.75e-10	1.57e-10
AR(2) test (p-value)	0.729	0.789	0.891
No. of instruments	119	108	91
No. of groups	130	130	130
Chi2 (p-value)	0.000	0.000	0.000

Estimator : System-GMM. Standard errors in parentheses.

Seasonal and crisis dummies : Yes.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

TAB. 6: Estimation results of the growth rate of total loans. Banks' characteristics : LCR and NSFR shortfalls disaggregated

	Liq.As.	Net-Outflow	NSFR-sh.Dis.	LCR-sh.Dis.+RSF
	(4)	(5)	(6)	(7)
Δ ln(loans)$_{t-1}$	-0.139***	-0.132***	-0.130***	-0.129***
	(0.0374)	(0.0408)	(0.0373)	(0.0373)
Δi_{t-1}	-0.488	-0.792**	-0.953**	-0.495*
	(0.336)	(0.356)	(0.385)	(0.252)
Output-Gap$_{t-1}$	0.252	0.137	0.286*	0.303*
	(0.186)	(0.186)	(0.165)	(0.165)
Size$_{t-1}$	0.0131	0.0320	0.0198	0.00836
	(0.0222)	(0.0261)	(0.0255)	(0.0157)
Size$_{t-1}$ $\cdot$ Δi_{t-1}	0.0235	0.0374**	0.0443***	0.0255**
	(0.0156)	(0.0166)	(0.0171)	(0.0116)
Liq.$_{t-1}$	-0.152			
	(0.139)			
Liq.$_{t-1}$ $\cdot$ Δi_{t-1}	6.167**			
	(2.978)			
Size$_{t-1}$$\cdot$ Liq.$_{t-1}$ $\cdot$ Δi_{t-1}	-0.278**			
	(0.135)			
NO$_{t-1}$		-0.260**		
		(0.122)		
NO$_{t-1}$ $\cdot$ Δi_{t-1}		5.416*		
		(3.124)		
Size$_{t-1}$$\cdot$ NO$_{t-1}$ $\cdot$ Δi_{t-1}		-0.252*		
		(0.146)		
Req.Fund.$_{t-1}$			0.173**	0.158**
			(0.0751)	(0.0670)
Req.Fund.$_{t-1}$ $\cdot$ Δi_{t-1}			-0.119*	-0.100**
			(0.0641)	(0.0417)
Av.Fund.$_{t-1}$			0.0896	
			(0.0847)	
Av.Fund.$_{t-1}$ $\cdot$ Δi_{t-1}			0.179*	
			(0.0979)	
Size$_{t-1}$$\cdot$ Req.Fund.$_{t-1}$$\cdot$ Av.Fund.$_{t-1}$ $\cdot$ Δi_{t-1}			-0.0485*	
			(0.0292)	
LCR-short.$_{t-1}$				0.0785
				(0.0749)
LCR-sh.$_{t-1}$ $\cdot$ Δi_{t-1}				-0.169**

				(0.0829)
Size$_{t-1}$· Req.Fund.$_{t-1}$· LCR-sh.$_{t-1}$ · Δi_{t-1}				0.0224*
				(0.0115)
Observations	3173	3173	3173	3173
Hansen test (p-value)	0.343	0.236	0.382	0.599
AR(1) test (p-value)	0.000	0.000	0.000	0.000
AR(2) test (p-value)	0.684	0.716	0.830	0.687
No. of instruments	124	95	130	130
No. of groups	130	130	130	130
Chi2 (p-value)	0.000	0.000	0.000	0.000

Estimator : System-GMM. Standard errors in parentheses.

Seasonal and crisis dummies : Yes.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

TAB. 7 – Average Long-term Marginal Effect of a Monetary Policy shock. Model 3.

Quartiles of NSFR-short	Quartiles of Size 1	2	3	4	Total
1	-0.048	0.011	0.076	0.122	-0.006
	(0.296)	(0.410)	(0.019)	(0.007)	(0.267)
2	-0.086	-0.015	0.038	0.122	0.011
	(0.120)	(0.487)	(0.130)	(0.006)	(0.220)
3	-0.121	-0.038	0.025	0.098	0.022
	(0.082)	(0.334)	(0.294)	(0.015)	(0.160)
4	-0.165	-0.074	-0.009	0.045	-0.020
	(0.070)	(0.181)	(0.424)	(0.191)	(0.239)
Total	-0.079	-0.026	0.029	0.083	0.002
	(0.204)	(0.368)	(0.234)	(0.081)	(0.222)

p-values in parenthesis

TAB. 8 – Average Long-term Marginal Effect of a Monetary Policy shock. Model 4.

Quartiles of HQLA	Quartiles of Size 1	2	3	4	Total
1	-0.036	0.006	0.038	0.070	0.016
	(0.452)	(0.630)	(0.074)	(0.054)	(0.319)
2	-0.023	0.010	0.036	0.066	0.014
	(0.577)	(0.602)	(0.058)	(0.049)	(0.379)
3	-0.001	0.021	0.038	0.058	0.030
	(0.682)	(0.328)	(0.035)	(0.047)	(0.243)
4	0.070	0.077	0.039	0.011	0.040
	(0.197)	(0.086)	(0.083)	(0.313)	(0.211)
Total	-0.003	0.025	0.037	0.040	0.025
	(0.486)	(0.439)	(0.057)	(0.169)	(0.288)

p-values in parenthesis

TAB. 9 – Average Long-term Marginal Effect of a Monetary Policy shock. Model 5.

Quartiles of NO	Quartiles of Size 1	2	3	4	Total
1	-0.092	-0.013	0.041	0.094	0.000
	(0.074)	(0.478)	(0.074)	(0.014)	(0.147)
2	-0.054	-0.007	0.033	0.079	0.019
	(0.133)	(0.540)	(0.104)	(0.012)	(0.184)
3	-0.035	-0.002	0.030	0.066	0.021
	(0.278)	(0.590)	(0.124)	(0.022)	(0.229)
4	0.019	0.035	0.009	0.014	0.021
	(0.423)	(0.358)	(0.426)	(0.288)	(0.386)
Total	-0.043	0.006	0.027	0.071	0.015
	(0.219)	(0.480)	(0.196)	(0.051)	(0.236)

p-values in parenthesis

TAB. 10 – Average Long-term Marginal Effect of a Monetary Policy shock. Model 6. First and fourth quartiles of banks' size.

	Quartiles of RSF									
Quartiles	*Small banks*					*Big banks*				
of ASV	1	2	3	4	Total	1	2	3	4	Total
1	-0.094	-0.148		-0.221	-0.121	0.099	0.051	-0.019	-0.055	0.051
	(0.133)	(0.059	)	(0.033)	(0.097)	(0.024)	(0.225)	(0.474)	(0.301)	(0.192)
2	-0.085	-0.151	-0.232	-0.393	-0.168	0.090	0.034	-0.044	-0.120	-0.031
	(0.132)	(0.063)	(0.042)	(0.030)	(0.082)	(0.055)	(0.384)	(0.454)	(0.244)	(0.353)
3	-0.074	-0.150	-0.274	-0.441	-0.205	-0.141	0.028	-0.103	-0.201	-0.148)
	(0.147)	(0.076)	(0.044)	(0.038)	(0.085)	(0.227)	(0.598)	(0.395)	(0.219)	(0.313)
4	-0.086	-0.191	-0.326	-0.548	-0.280			-0.145	-0.423	-0.340
	(0.190)	(0.104)	(0.077)	(0.066)	(0.108)			(0.369)	(0.159)	(0.222)
Total	-0.084	-0.168	-0.292	-0.498	-0.223	0.096	0.039	-0.071	-0.211	-0.072
	(0.155)	(0.084)	(0.062)	(0.054)	(0.096)	(0.029)	(0.351)	(0.428)	(0.220)	(0.290)

p-values in parenthesis

TAB. 11 – Average Elasticities of the Long-term Marginal Effect of Monetary Policy shock with respect to NSFR and LCR shortfalls (Model 3).

Elasticities with respect to					
NSFR shortfall			**LCR shortfall**		
Quartiles of LCR shortfall	Elasticity	p-value	Quartiles of NSFR shortfall	LCR shortfall	p-value
1	-2.417	0.057	1	-0.501	0.108
2	-12.425	0.057	2	-0.355	0.108
3	-3.354	0.063	3	0.299	0.108
4	-0.802	0.228	4	0.848	0.108
Total	-4.748	0.101	Total	0.073	0.108

C.2 Estimations on adjusted series

TAB. 12: Estimation results of the growth rate of total loans. Banks' characteristics : LCR and NSFR shortfalls disaggregated

	S1	
Δ ln(loans)$_{t-1}$	-0.117***	(0.0415)
Δi_{t-1}	1.693***	(0.618)
Output-Gap$_{t-1}$	0.352	(0.267)
Size$_{t-1}$	-0.0149	(0.0402)
Size$_{t-1}$ $\cdot$ Δi_{t-1}	-0.0619***	(0.0239)
NO$_{t-1}$	0.266	(0.364)
NO$_{t-1}$ $\cdot$ Δi_{t-1}	0.870	(0.801)
Liq.$_{t-1}$	0.0867	(0.187)
Liq.$_{t-1}$ $\cdot$ Δi_{t-1}	0.269*	(0.158)
Size$_{t-1}$$\cdot$ NO$_{t-1}$$\cdot$ Liq.$_{t-1}$ $\cdot$ Δi_{t-1}	-0.240	(0.149)
Req.Fund.$_{t-1}$	0.176	(0.157)
Req.Fund.$_{t-1}$		
Req.Fund.$_{t-1}$ $\cdot$ Δi_{t-1}	-0.767**	(0.307)
Av.Fund.$_{t-1}$	-0.0272	(0.0875)
Av.Fund.$_{t-1}$		
Av.Fund.$_{t-1}$ $\cdot$ Δi_{t-1}	-0.599***	(0.226)
Size$_{t-1}$$\cdot$ Req.Fund.$_{t-1}$$\cdot$ Av.Fund.$_{t-1}$ $\cdot$ Δi_{t-1}	0.0525**	(0.0211)
Observations	2893	
Hansen test (p-value)	0.360	
AR(1) test (p-value)	0.000	
AR(2) test (p-value)	0.340	
No. of instruments	134	
No. of groups	144	
Chi2 (p-value)	0.000	

Estimator : System-GMM. Standard errors in parentheses.

Seasonal and crisis dummies : Yes.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

TAB. 13 – Average Long-term Marginal Effect of Monetary Policy shock. Model S1.

Quartiles of HQLA	Quartiles of Size 1	2	3	4	Total
1	0.113	0.116	0.028	-0.017	0.050
	(0.150)	(0.120)	(0.289)	(0.203)	(0.209)
2	0.155	0.126	0.101	-0.048	0.074
	(0.046)	(0.172)	(0.224)	(0.246)	(0.172)
3	0.160	0.074	0.128	-0.057	0.075
	(0.034)	(0.158)	(0.165)	(0.257)	(0.141)
4	0.118	0.052	0.020	-0.062	0.033
	(0.162)	(0.158)	(0.386)	(0.256)	(0.229)
of NO					
1	0.093	0.070	-0.011	-0.068	0.027
	(0.155)	(0.120)	(0.336)	(0.272)	(0.215)
2	0.122	0.081	0.062	-0.044	0.045
	(0.061)	(0.119)	(0.273)	(0.196)	(0.174)
3	0.149	0.092	0.099	-0.039	0.067
	(0.030)	(0.124)	(0.257)	(0.283)	(0.184)
4	0.178	0.066	0.090	-0.034	0.094
	(0.072)	(0.271)	(0.246)	(0.206)	(0.179)
of ASF					
1	0.264	0.225	0.186	0.011	0.128
	(0.014)	(0.012)	(0.086)	(0.315)	(0.166)
2	0.146	0.117	0.034	-0.091	0.037
	(0.049)	(0.068)	(0.370)	(0.175)	(0.167)
3	0.092	0.055	0.016	-0.107	0.040
	(0.103)	(0.149)	(0.368)	(0.121)	(0.184)
4	0.104	0.053	-0.039	-0.070	0.027
	(0.131)	(0.228)	(0.356)	(0.237)	(0.234)
of RSF					
1	0.271	0.178	0.131	0.050	0.131
	(0.082)	(0.055)	(0.142)	(0.343)	(0.182)
2	0.177	0.106	0.002	-0.076	0.032
	(0.029)	(0.127)	(0.433)	(0.224)	(0.201)
3	0.095	0.062	0.013	-0.116	0.037
	(0.098)	(0.125)	(0.342)	(0.100)	(0.140)
4	0.096	0.052	-0.015	-0.073	0.033
	(0.112)	(0.225)	(0.383)	(0.231)	(0.228)
Total	0.143	0.076	0.058	-0.045	0.058
	(0.078)	(0.153)	(0.280)	(0.240)	(0.188)

p-values in parenthesis

FIG. 1 – Box and whiskers plot of the LCR, 2003q1-2010q4. Full sample and 1th and 4th quartiles of total assets.

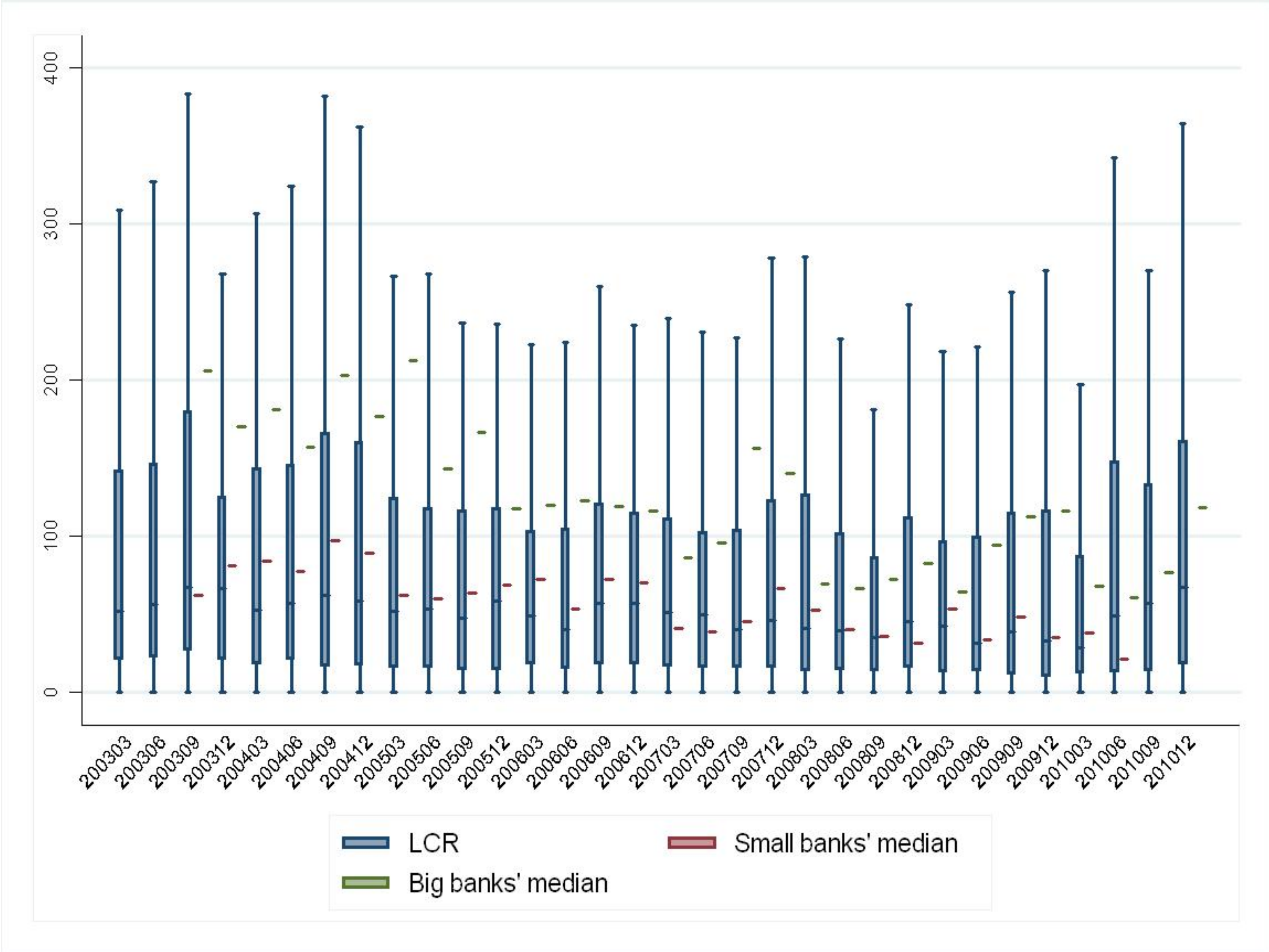
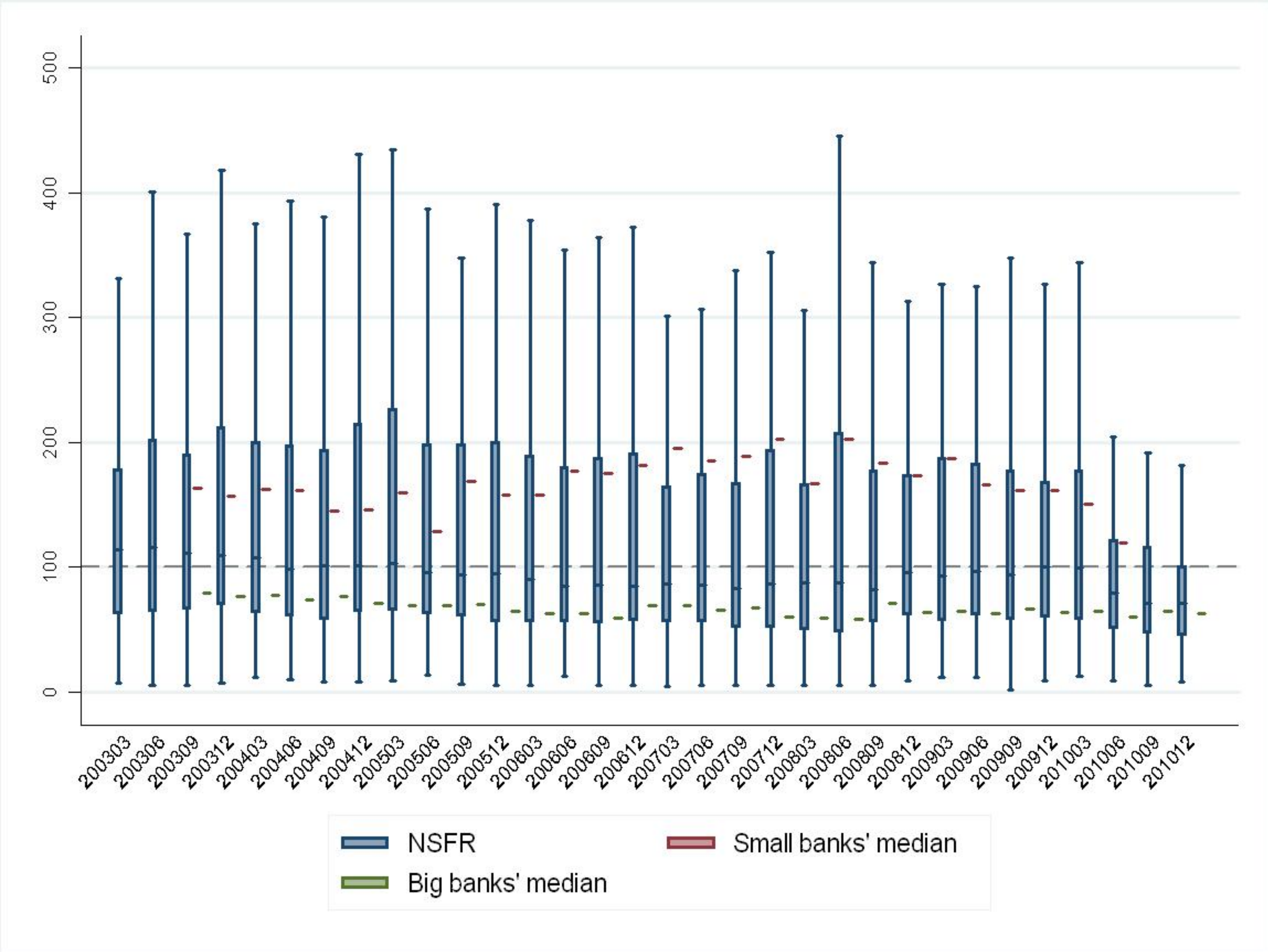


FIG. 2 – Box and whiskers plot of the NSFR, 2003q1-2010q4. Full sample and 1th and 4th quartiles of total assets.



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