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Liquidity Shock and Bank Risk

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Abstract

This paper studies banks' risk-taking behavior in response to negative liquidity shocks on their balance sheets, i.e., unexpected events that leave banks with a liquidity shortfall. Using data for European publicly traded banks from 2005 to 2020, we find that banks decrease their risk-taking when they face a negative liquidity shock. A negative liquidity shock is associated with both lower credit risk and default risk. Further evidence shows that negative liquidity shocks affect large banks and banks operating under regulatory capital pressure to a greater extent. We also investigate how banks react to positive liquidity shocks and find that they do not take more risk when they experience a liquidity surplus. Our findings contribute to the literature on banks' liquidity management and bear several policy implications.

JEL classification: G21, G28

Keywords: Liquidity shock, deposits, bank risk.

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Abstract

This paper studies banks' risk-taking behavior in response to negative liquidity shocks on their balance sheets, i.e., unexpected events that leave banks with a liquidity shortfall. Using data for European publicly traded banks from 2005 to 2020, we find that banks decrease their risk-taking when they face a negative liquidity shock. A negative liquidity shock is associated with both lower credit risk and default risk. Further evidence shows that negative liquidity shocks affect large banks and banks operating under regulatory capital pressure to a greater extent. We also investigate how banks react to positive liquidity shocks and find that they do not take more risk when they experience a liquidity surplus. Our findings contribute to the literature on banks' liquidity management and bear several policy implications.

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1. Introduction

The 2007-2008 global financial crisis (GFC) shed light on the importance of efficient liquidity management for financial institutions. Indeed, liquidity shortages experienced by several banks during the GFC negatively impacted credit supply and the real economy (Ivashina and Scharfstein, 2010; Cornett et al., 2011; Acharya and Mora, 2015). To prevent the reoccurrence of such a scenario and enable banks to better absorb liquidity shocks in the future, regulators have redesigned the existing capital regulatory requirements by making them tighter and have implemented two new minimum liquidity requirements, the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR). The LCR requires banks to hold high-quality liquid assets to sustain short-term stress periods and the NSFR requires banks to hold stable long-term funding. However, various studies show that liquidity regulation might have counterproductive effects by reducing banks' profitability and encourage them to take more risk (King, 2013; Hoerova et al., 2018; Curfman and Kandrak, 2022; Bosshardt et al., 2023).

Several studies investigate changes in bank behavior when they face liquidity problems during financial crises and look at the implications on credit supply and the real economy (Ivashina and Scharfstein, 2010; Cornett et al., 2011; Acharya and Mora, 2015; Becker and Ivashina, 2018; Acharya et al., 2018). All of these studies show that liquidity problems push banks to cut lending. For instance, Ivashina and Scharfstein (2010) find that during the GFC, banks facing difficulties to collect deposits tended to decrease their lending more than other banks. Similarly, Cornett et al. (2011) document that banks that found themselves with higher portions of illiquid assets during the GFC also sharply reduced their lending. In Europe, Acharya et al. (2018) show that at the time of the European sovereign debt crisis of 2010-2012, European banks holding sovereign bonds endured severe losses and lending contraction. A similar impact of the European sovereign debt crisis on bank lending is documented by Becker and Ivashina (2018).

Regarding the impact of liquidity risk on bank risk-taking, Acharya and Naqvi (2012) theoretically show that managers of banks with lower funding liquidity risk may tend to engage in aggressive lending policies to increase their compensation. These predictions are confirmed by the empirical findings of Khan et al. (2017), who find that higher deposit inflows, as a proxy for lower funding liquidity risk, incentivize banks to take more risk. Furthermore, Imbierowicz and Rauch (2014) show that credit and liquidity risks, and their interaction affect banks' default probability. Chen et al. (2021) investigate the impact of liquidity risk on bank performance during the GFC and find that higher liquidity risk decreases banks' survival probability.

In this paper, we investigate how banks react to exogenous liquidity shocks that affect their balance sheet structure. Specifically, we build an approach allowing us to identify banks that experience a negative liquidity shock (i.e., an exogenous and unexpected event that induces a liquidity shortfall) and investigate how such banks react in terms of risk-taking. Our approach is based on the partial adjustment model and enables us to capture negative liquidity shocks at the bank level and quantify their economic magnitude.

Given that liquidity management policies differ from one bank to another and that different internal and external factors determine banks' risk-taking behavior beside their liquidity positions, it is unclear whether banks decrease or increase their risks when they face negative liquidity shocks.

On the one hand, experiencing negative liquidity shocks is likely to make affected banks more vulnerable to future plausible financial shocks, which increases their probability of failure. The fear of failure may incentivize those banks to act prudently and decrease their risk-taking. On the other hand, negative liquidity shocks might increase banks' funding needs and costs, which can decrease their charter value, so banks have less to lose in the future; this, in turn, may encourage such banks to take more risk.

Capturing banks experiencing negative liquidity shocks is not straightforward and poses empirical challenges. Specifically, liquidity positions' management varies from one bank to another and depends on the tradeoff between the costs and benefits of working with a certain level of liquidity. A bank might deliberately choose to operate with a liquidity shortfall for a certain period to meet its objectives. However, negative shocks should be exogenous and involuntary.

To overcome these empirical challenges, we consider the approach used by DeYoung et al. (2018) to identify capital shocks by applying it to liquidity instead. Our empirical investigation is carried out in three stages. First, building on DeYoung and Jang (2016) who show that banks do actually target their liquidity level, we use the partial adjustment model to estimate the internal liquidity ratio target for each bank each year. Second, we assume that a bank is experiencing an involuntary and exogenous negative shock to its liquidity ratio if we observe the following scenario: at a given point in time, a bank is operating with a liquidity level which is below its internal liquidity ratio target, and subsequently, this bank experiences an additional decrease in its liquidity ratio that moves it further below its internal liquidity ratio target. This is because in the absence of a shock the bank should have taken action to move closer to its target but the shock makes it drift further away. Third, we then estimate the impact of negative

shocks on banks' liquidity ratios—total deposits-to-net loans ratios, total deposits-to-total assets ratios, net stable funding ratios—on their returns' volatility, credit risk and default risk.

In order to assess the changes in bank risk, we use accounting-based risk measures—standard deviation of the return on assets, default risk (Z-Score), and credit risk (non-performing loans)—to which we add market-based risk measures (standard deviation of the daily stock returns and market-based Z-Score). We use annual data for publicly traded banks from 16 European countries between 2005 and 2020.

Our results show that banks respond to negative liquidity shocks by reducing their risk-taking. Specifically, we find that both banks' default risk and credit risk decrease when they experience negative shocks to their total deposits-to-net loans ratios. Such banks behave similarly when they face negative shocks on their total deposits-to-total assets ratios or on their net stable funding ratios. This suggests that banks experiencing negative liquidity shocks become more prudent and take less risk to restore their liquidity positions. We also go deeper in our analysis by considering the effect of bank size and regulatory capital pressure on the relationship between negative liquidity shocks and bank risk-taking. We find a larger decrease in bank risk for large banks experiencing negative liquidity shocks and for shocked banks operating under regulatory capital pressure (banks with a tier 1 capital-to-risk weighted assets ratio below 8%).

We further investigate the risk behavior of banks experiencing the opposite scenario, namely positive liquidity shocks that leave banks with excess liquidity. The results indicate that banks do not change their risk-taking behavior when they face positive liquidity shocks. Indeed, while banks reduce their risk-taking when they experience negative liquidity shocks, they do not seem to take advantage of being excessively liquid to increase their risk-taking.

Our findings can be helpful for regulators for a better understanding of bank liquidity management and provide insights on how they can update and improve minimum liquidity standards². Previous literature on the effects of liquidity requirements on bank risk behavior has argued that requiring banks to comply with a stable funding constraint negatively impacts their profitability and incentivizes them to take more risk (e.g., King, 2013; Curfman and Kandrac,

² Our work also adds to the literature investigating the determinants of bank risk. Previous literature uncovers several factors that impact bank risk. For instance, product diversification (Mercieca et al., 2007; Lepetit et al., 2008; DeYoung and Torna, 2013), competition (Craig and Dinger, 2013; Akins et al., 2016), funding (Demirguc-Kunt and Huizinga, 2010; Vazquez and Federico, 2015), governance (Laeven and Levine, 2009; Saghi-Zedek and Tarazi, 2015), deposit insurance (Lambert et al., 2017), and size (Bertay et al., 2013).

2022). Our study reveals that when banks experience negative liquidity shocks that push them far below their target liquidity level, they become more prudent and take less risk. Our findings also suggest that liquidity requirements should consider that the optimal liquidity level varies from one bank to another depending on their characteristics and macroeconomic conditions.

The remainder of the paper is organized as follows. In section 2, we present our key hypotheses. In section 3, we describe our two-stage empirical methodology to identify negative liquidity shocks. In section 4, we present the data and define the variables. In section 5, we discuss our main findings and conduct further investigations. In section 6, we conclude the paper.

2. Hypotheses development

Prior literature has extensively investigated bank liquidity risk and its potential interaction with other risks and implications for bank stability. Imbierowicz and Rauch (2014) find that liquidity risk and credit risk affect banks' probability of default separately and jointly. However, there is no contemporaneous or causal relationship between those risks. Hong et al. (2014) document that systemic liquidity risk is one of the reasons behind banks' failure between 2009 and 2010. Khan et al. (2017) find a negative relationship between funding liquidity risk and bank risk-taking more generally. Banks experiencing negative liquidity shocks face higher liquidity risk, likely leading them to change their risk-taking behavior. Nevertheless, the effects of negative liquidity shocks on bank risk-taking are not straightforward, as they depend on bank managers' risk-taking incentives.

The role of monitoring, the growing fear of failure during distress periods, and the lessons learned from the GFC lead us to expect that negative liquidity shocks will likely incentivize banks to decrease their risk-taking. Acharya and Naqvi (2012) present a theoretical model explaining how banks' liquidity levels affect credit supply and risk-taking moral hazard. They point out that, when managers' compensations depend on the volume of loans granted they tend to lend excessively and take more risk by lowering lending rates and standards. Bank shareholders can conduct an ex-post audits and sanction managers if they detect excessive lending behavior. However, because audits are costly, they are only conducted if the bank experiences large liquidity needs. Deposits inflows incentivize managers to underestimate the downside risk because they improve the bank's liquidity and hence reduce the probability of being audited. Hence, they take more risk by lending excessively. Conversely, monitoring and

market discipline become stronger when banks experience negative liquidity shocks. Hence, managers become more prudent and take less risk.

Several empirical studies analyze how banks dealt with the liquidity problems they experienced during the GFC. Cornett et al. (2011) find that banks responded to liquidity that dried up during such an episode by reducing lending. Consistent with this view, Ivashina and Scharfstein (2010) show that banks decrease their lending to a lesser extent if they have better access to deposit funding and do not depend on short-term debt. Similarly, Acharya and Mora (2015) find that banks with undrawn commitments faced deposit shortfalls during the GFC. Those banks tried to attract deposits to cover this shortfall. However, deposit growth was unsatisfactory, which led them to cut lending.

Experiencing negative liquidity shocks is likely to make affected banks more vulnerable to future plausible financial shocks, which increases their probability of failure. The fear of failure may incentivize those banks to act prudently and decrease their risk-taking. Cont et al. (2020) model the interactions between solvency and liquidity risk and their implication on banks' balance sheets. They argue that banks' solvency shocks trigger endogenous liquidity shocks via margin requirements. Such liquidity shocks amplify banks' default risk through the cost of funding. Vuillemeys (2014) analyzes the evolution of the banks' default probabilities in the euro area from 2004 to 2010 and finds that liquidity risk exacerbates banks' default probabilities during the boom period. In the same line, Vazquez and Federico (2015) find banks with fragile structural liquidity or which were highly leveraged before the GFC were more exposed to failure subsequently.

The cost of attracting stable funding and the effect of charter value offer a different perspective of how banks may react to negative liquidity shocks possibly leading them to take on more risk. Indeed, banks experiencing negative liquidity shocks need to attract stable funding to recover from the shock. However, the cost of attracting funding is likely to be high, which leaves affected banks with greater repayment burdens which could push banks to select more profitable but also riskier assets and by expanding their lending to riskier borrowers. King (2013) shows that banks need to pay higher funding costs to raise long-term funds and maintain a higher net stable funding ratio, which leads to a decrease in profitability encouraging banks to take more risk.

Bankruptcy costs can also affect banks risk appetite. Prior literature shows that banks' charter value significantly affects their risk-taking behavior (e.g., Keeley, 1990; Demsetz et al., 1996; Hellmann et al., 2000; Konishi and Yasuda, 2004; Repullo, 2004; González, 2005). Experiencing negative liquidity shocks might hence increase banks' funding needs and costs,

which can decrease their charter value. In such a situation banks have less to lose which could encourage them to take more risk.

Lastly, a salient literature on bank liquid asset holdings offers a third view regarding the effect of negative liquidity shocks on bank risk-taking. The capacity to absorb and handle negative liquidity shocks depends on the banks' liquid assets holding. Higher liquid assets holdings enable banks to manage and absorb funding shocks (Hanson et al., 2015). Similarly, Ratnovski (2013) shows that banks holding higher portions of liquid assets are better armed to face negative balance sheet shocks. Furthermore, de Bandt et al. (2021) illustrate that higher liquid assets holding decreases the probability that banks experience a run. Negative deposit shocks may hence not change the risk-taking behavior of banks holding higher levels of liquid assets.

Based on insights from the literature, in response to negative liquidity shocks, banks can either take less risk or take more risk or leave their risk-taking unchanged.

3. Methodology

This paper aims to analyze whether banks change their risk-taking behavior in response to negative liquidity shocks. In order to reach this objective, we need first to identify banks that experience plausible negative liquidity shocks i.e. negative changes in liquidity that are plausibly exogenous. Previous studies on funding liquidity shocks have exploited the dry-up of the interbank market, in August 2007 (Iyer et al., 2014; Ippolito et al., 2016) or following the Lehman Brothers collapse (DeJonghe et al., 2020), to identify exogenous shocks to bank funding. Our approach, based on the methodology developed by DeYoung et al. (2018) to identify negative capital shock, enables us to capture negative shocks on banks' liquidity ratios and quantify their economic magnitude.

3.1. Estimating the target liquidity ratios and identifying the liquidity shocks

Following DeYoung and Jang (2016), we use partial adjustment model techniques (Berger et al., 2008; Lepetit et al., 2015; De Jonghe and Öztekin, 2015; DeYoung and Jang, 2016) to estimate liquidity targets for each bank at each time period. Then, we consider that a bank has experienced a negative liquidity shock at time $t-1$ if we observe the following sequence: 1/ the bank is operating below its liquidity ratio target at time $t-2$; 2/ instead of converging toward its target, the banks experiences at time $t-1$ a further decrease in its liquidity ratio that pushes it further below its internal target; such a bank is identified as experiencing a negative liquidity shock at time $t-1$.

3.1.1. Liquidity adjustment model

We start by estimating internal liquidity ratio targets for each bank in each year of our 2005-2020 sample. We assume that each bank sets a target liquidity ratio that can be expressed as a function of bank characteristics and economic conditions:

$$L_{i,t}^* = \beta \cdot X_{i,t-1} \quad (1)$$

where $L_{i,t}^*$ is bank i 's target liquidity ratio at time t , $X_{i,t-1}$ is a vector of bank characteristics and economic conditions that determine the bank's target liquidity ratio. L^* represents the bank's desired level of liquidity. However, unexpected events can push banks away from L^* , and adjusting toward their desired liquidity target depends on a tradeoff between the costs and the benefits of operating below L^* . We assume that in each period, to return toward their liquidity desired level, banks close a constant portion λ of the gap between their actual liquidity ratios L and their target liquidity ratios L^* :

$$L_{i,t} - L_{i,t-1} = \lambda \cdot (L_{i,t}^* - L_{i,t-1}) + \varepsilon_{i,t} \quad (2)$$

where λ is a scalar adjustment speed, $\lambda \in [0; 1]$. A higher value of λ indicates that banks reduce a higher portion of the gap between $L_{i,t-1}$ and $L_{i,t}^*$. Substituting Eqs. (1) into (2) and rearranging yields:

$$L_{i,t} = \lambda \beta \cdot X_{i,t-1} + (1 - \lambda) \cdot L_{i,t-1} + \varepsilon_{i,t} \quad (3)$$

To estimate the target liquidity ratio $L_{i,t}^*$, we start by recovering the estimated adjustment speed $\hat{\lambda}$ from the estimated parameter $(\widehat{1 - \lambda})$, and then we recover $\hat{\beta}$ by dividing the estimated parameter $\widehat{\lambda \beta}$ by $\hat{\lambda}$. After which, we use $\hat{\beta}$ in Eq.(1) to compute $L_{i,t}^*$ for each bank at each period of time.

The estimated adjustment speed $\hat{\lambda}$ is constant across banks. However, each bank follows its own liquidity adjustment process depending on its characteristics and economic conditions. Therefore, we express λ as follows:

$$\lambda_{i,t} = \varphi Z_{i,t-1} \quad (4)$$

where $\lambda_{i,t}$ is the bank-specific, time-varying liquidity adjustment speed, $Z_{i,t-1}$ is a vector of bank characteristics and economic conditions that determine liquidity adjustment speeds, and φ is a vector of coefficients to be estimated. Substituting Eq.(4) to Eq.(2) gives:

$$L_{i,t} - L_{i,t-1} = \varphi Z_{i,t-1} (L_{i,t}^* - L_{i,t-1}) + \varepsilon_{i,t} \quad (5)$$

Rewording $L_{i,t} - L_{i,t-1}$ as $\Delta L_{i,t}$, rewording $L_{i,t}^* - L_{i,t-1}$ as $GAP_{i,t}$, and rearranging gives:

$$\Delta L_{i,t} = \varphi (Z_{i,t-1} \cdot GAP_{i,t}) + \varepsilon_{i,t} \quad (6)$$

Once the estimated coefficients $\hat{\phi}$ are in-hand, we use Eq.(4) to compute the bank-specific, time-varying liquidity adjustment speed $\lambda_{i,t}$. The flexible estimated liquidity adjustment speed $\lambda_{i,t}$ can be used to re-estimate a more-accurate target liquidity ratio. We re-specify and rearrange Eq.(3) as follows:

$$L_{i,t} - L_{i,t-1}(1 - \widehat{\lambda}_{i,t}) = \beta \cdot \widehat{\lambda}_{i,t} X_{i,t-1} + \varepsilon_{i,t} \quad (7)$$

where β is a vector of coefficients to be used in Eq.(1) to re-compute the target liquidity ratios $L_{i,t}^*$ more accurately.

We estimate Eq.(3) using the generalized method of moments techniques (Blundell and Bond, 1998), and Eq.(6) and Eq.(7) using the ordinary least squares model. The three equations are estimated with bank and time fixed effects.

3.1.2. Negative liquidity shocks

Our logic to identify banks plausibly experiencing negative liquidity shocks is consistent in spirit with the method used by DeYoung et al. (2018) to identify banks facing negative capital shocks. A reduction in bank liquidity is not necessarily an exogenous event as it can be a strategic decision of the bank. We consider that a negative liquidity shock occurs when a bank, which was already operating below its liquidity ratio target at the previous period, experiences a liquidity ratio decrease in the current period which pushes it further below its liquidity ratio target. Indeed, if the bank was already operating below its target in the previous period, it should have taken action to move closer to its target. Hence, the fact that the bank is drifting further away from its new target is indicative of an exogenous shock.

Because our main objective is to study banks' risk-taking behavior at time t in response to negative liquidity shocks that occurred in the previous period ($t-1$), we consider negative liquidity shocks occurring at $t-1$. Formally, in our setting a negative liquidity shock is characterized by a decrease in the liquidity ratio ($\Delta L_{i,t-1} < 0$) at a bank which was already operating below its liquidity ratio target ($GAP_{i,t-2} = L_{i,t-2}^* - L_{i,t-2} > 0$) which leads it to move further below its liquidity target ratio ($GAP_{i,t-1} > GAP_{i,t-2}$). This last condition prevents the possibility that the fall in bank liquidity at $t-1$ may be the result of a decrease in the bank's liquidity target itself. By imposing that the decrease in the liquidity ratio needs to be larger than the decrease in the liquidity ratio target ($\Delta L_{i,t-1} > \Delta L_{i,t-1}^*$) we ensure that the fall in liquidity is not due to a discretionary action taken by the bank.

Our negative liquidity ratio shock variable is defined as follows:

$$\begin{aligned} \text{NegativeShock}_{i,t-1} &= 1 \text{ if } L_{i,t-2} < L_{i,t-2}^* \text{ and } \Delta L_{i,t-1} < 0 \text{ and } \Delta \text{GAP}_{i,t-1} > \\ &0 \text{ and } 0 \text{ otherwise} \end{aligned} \quad (8)$$

To seize the economic magnitude of the negative liquidity shock, we define a second negative liquidity shock variable that measures the reduction in the liquidity ratio experienced by banks facing negative liquidity shocks. To facilitate the interpretation of the results, we use the absolute value of the annual change in the liquidity ratio:

$$\text{NegativeShockSize}_{i,t-1} = |\Delta L_{i,t-1}| \text{ if } \text{NegativeShock}_{i,t-1} = 1 \text{ and } 0 \text{ otherwise} \quad (9)$$

Previous studies on bank liquidity management yield conclusions that align with our identification method. DeYoung and Jang (2016) analyze bank liquidity adjustments and find that banks operating below their liquidity targets take immediate action to move closer to their targets. Specifically, they find higher adjustment speeds toward the targets for banks operating below their targets than for banks operating above the targets. Therefore, a decrease in the liquidity ratio of a bank operating below its liquidity target is most likely driven by an unexpected event (i.e., shock) preventing it from converging toward its target by increasing its liquidity ratios. Bank liquidity management could possibly be disrupted by unexpected deposit outflows or an abnormal increase in lending. However, for a bank that operates above its liquidity target, the factors that could explain a decrease in the liquidity ratios are unclear. A fall in liquidity could be the result of a deliberate decision of the managers and hence driven by strategic changes in liquidity management policy.

3.2. The impact of negative liquidity shocks on bank risk

3.2.1. Model specification

To assess the impact of negative liquidity shocks on banks' risk-taking behavior, we use the ordinary least squares model, where we estimate how an event characterized by either deposits outflow and/or an inability to raise funding to converge toward the optimal liquidity level affects the risk-taking behavior of the affected banks. The baseline model is specified as follows:

$$\text{Risk}_{i,t} = \alpha + \beta \cdot \text{NegativeShock}_{i,t-1} + \delta \cdot \text{Below}_{i,t-2} + \gamma \cdot \text{Controls}_{i,t-1} + \mu_i + \tau_t + \varepsilon_{i,t} \quad (10)$$

where i and t denotes bank and times, respectively. $Risk_{i,t}$ refers to bank risk measures. $NegativeShock_{i,t-1}$ is a dummy variable equal to one for banks experiencing negative liquidity shocks and zero otherwise. We alternatively use $NegativeShockSize_{i,t-1}$ that is a continuous variable measuring the decline in a bank's liquidity ratio due to a negative shock. $Below_{i,t-2}$ is a dummy equal to one for banks operating below their liquidity targets and zero otherwise³. $Controls_{i,t-1}$ represents a vector of banks' characteristics and macroeconomic variables considered by prior literature to have an impact on bank risk. Our model includes bank-fixed effects μ_i , and time-fixed effects τ_t .

3.2.2. Bank risk measures

We use the standard deviation of the bank's return on assets over the preceding three years to measure bank risk-taking behavior ($SDROA$). Furthermore, we also use the Z-Score to measure bank default risk. Following the literature (Laeven and Levine, 2009; Houston et al., 2010; Beck et al., 2013; Delis et al., 2014; Khan et al., 2017; Ardekani et al., 2020), we construct our Z-Score measure ($ZScore$) as follows:

$$ZScore = \text{Ln} \left[\frac{ROAa3 + Equity}{SDROA} \right]$$

where $ROAa3$ is the three-year rolling window average of the bank's return on assets. $Equity$ is total equity divided by total assets. A higher value signifies a higher distance from default (i.e., lower default risk).

We also consider a risk-adjusted return measure, $SharpeRatio$, which is equal to the return on equity divided by the standard deviation of return on equity over the preceding three years (Demirguc-Kunt and Huizinga, 2010; Berger et al., 2017)⁴. To capture credit risk, we use the ratio of non-performing loans divided to total assets (NPL) (Shehzad et al., 2010; Abedifar et al., 2018).

³ The *Below* dummy serves to absorb any increase or decrease in risk that are not specifically related to negative liquidity shocks but that could be driven by the fact that the bank is operating below its liquidity target.

⁴ We re-run our risk model using risk variables ($SDROA$, $ZScore$, and $SharpeRatio$) computed on the basis of four-year rolling windows instead of three-year rolling windows. Our main findings remain the same (see Table A.1 in the appendix).

We complement our risk measure with market-based risk measures. Namely, we use the standard deviation of daily stock returns (*SDDSR*) and the market data-based Z-Score⁵ (*MDZscore*) (Lepetit et al., 2008; Saghi-Zedek and Tarazi, 2015).

3.2.3. Control variables

We consider a set of factors likely to impact bank risk-taking behavior. We introduce the natural logarithm of bank total assets (*Size*) in the regressions. Larger banks' capacity to diversify their sources of income enables them to decrease their risk (Demsetz and Strahan, 1997). However, these banks may take more risk due to the too-big-to-fail doctrine (Galloway et al., 1997). We also control for banks' capitalization using the ratio of total equity to total assets (*Equity*). It is more likely that well-capitalized banks face a lower default risk. However, the expected risk-taking behavior of these banks remains ambiguous. On the one hand, the higher cost of failure for well-capitalized banks incentivizes them to take less risk (Keeley, 1990). The fear of a costly failure incentivizes well-capitalized banks' shareholders to take less risk (Jeitschko and Jeung, 2005). On the other hand, higher equity can increase banks' risk-taking capacity. Maintaining higher capital ratios to comply with capital regulation could also encourage banks to increase their asset risk to reach the desired level of shareholders' expected return (Koehn and Santomero, 1980; Kim and Santomero, 1988).

We also consider, the bank's business model measured by the ratio of non-interest income to operating income (*NII*). Prior studies have found that higher dependence on non-interest income activities increases bank risk (e.g., Stiroh, 2004; Lepetit et al., 2008; Demirguc-Kunt and Huizinga, 2010). To control for operational efficiency we include the cost-to-income ratio (*CIR*). Based on prior evidence, we expect operational efficiency to have a positive impact on bank risk (Shehzad et al., 2010; Barry et al., 2011).

Finally, we consider the differences in economic conditions using the real gross domestic product growth rate (*GDPGrowth*). We expect a negative relationship between *GDPGrowth* and bank risk (Beltratti and Stulz, 2012; Distinguin et al., 2013).

Table 1 displays the summary statistics and definitions of all variables used in our study. Pairwise correlations between variables are presented in Table 2.

[Insert Table 1 and Table 2 here]

⁵ MDZscore= $Ln \left[\frac{(\text{mean of daily stock returns}+1)}{\text{standard deviation of daily stock returns}} \right]$

4. Data and variables

4.1. Data

We estimate our regressions using annual financial statement data on publicly traded banks for 16 western European countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom) between 2005 to 2020. The data are collected from the WorldScope database (Refinitiv) and cross-checked with financial statements (balance sheets and income statements) retrieved from Orbis BankFocus (Bureau Van Dijk). We complement our data with financial market and macroeconomic data retrieved from DataStream (Refinitiv) and WorldBank WDI databases, respectively.

We start with a sample of 199 banks. We winsorize bank variables at the top and bottom 2.5 percent level to remove outliers. We ignore banks with no available information on total assets, equity, loans, deposits, and net income. We also only keep banks with information on at least four consecutive years to ensure that we have a sufficiently long history. Following Beltratti and Stulz (2012), we exclude banks with a total deposits-to-total assets ratio and net loans-to-total assets ratio lower than 20% and 10% respectively to restrict our investigation on pure commercial banks. We end up with an unbalanced sample of 149 publicly traded banks. The number of banks per country and the representativeness of our final sample are displayed in Table 3. On average, 88% of banks' total assets in the initial sample are represented in the final sample (see Table 3).

[Insert Table 3 here]

4.2. Liquidity targets and shocks

To capture banks experiencing negative liquidity shocks, we start by estimating liquidity ratio targets L^* for each bank in each year. Using the partial adjustment model approach defined in Eq.(1) to (7), we estimate liquidity targets using two liquidity measures. Total deposits-to-Net loans ($TDNL$) and the net stable funding ratio⁶ ($NSFR$). We also add the total deposits-to-total assets ratio ($TDTA$) to measure bank liquidity funding⁷. $TDNL^*$, $NSFR^*$, and $TDTA^*$ are

⁶ Due to the unavailability of data on the NSFR reported by banks, we compute the NSFR of each bank using the balance sheet data available in WorldScope. We assign a weight to each balance sheet item following (BIS, 2014). See Table A.2 in the appendix for more details.

⁷ Following Khan et al. (2017), we use the total deposits-to-total assets ratio ($TDTA$) to measure bank liquidity funding. Higher TDTA ratio reflects lower funding liquidity risk because banks hold enough funds to immediately meet their obligations.

respectively the bank's *TDNL*, *NSFR*, and *TDTA* ratio target. Following DeYoung and Jang (2016), we designate a vector of liquidity target determinants $X_{i,t-1}$: the natural logarithm of total assets (*Size*), the total equity-to-total assets ratio (*Equity*), the gross domestic product growth (*GDPgrowth*). Factors that are likely to determine bank liquidity adjustment speed $Z_{i,t-1}$ are: *Size*, *Equity*, and *Below* that is a dummy variable equal to one for banks operating below their liquidity targets. Our estimations include bank fixed effects and year fixed effects.

Table 4 displays the three-step partial adjustment estimations. Banks set, on average, a *TDNL** of 81%, a *TDTA** of 61%, and a *NSFR** of 141%. Table 5 shows that the estimated liquidity targets are relatively stable across the 2005-2020 sample period. However, the annual percentage of banks experiencing liquidity negative shocks fluctuates significantly during the entire sample period. Indeed, three years before and during the GFC a higher percentage of banks experienced negative liquidity shocks. Between 2005 and 2008, the annual negative shocks percentage reached levels of 26-39% for *TDNL*, and levels of 33-53% for *TDTA*. The percentage of annual negative *NSFR* shocks reached levels of 35-44% during the same period. On the whole sample period, the magnitude of the negative shocks to *TDNL* reached a yearly average level between 10 and 200 basis points and between 15 and 250 basis points for the negative shocks to *TDTA*. For the regulatory liquidity ratio (*NSFR*), the shocks' magnitude reached a yearly average level between 79 and 119 basis points.

The estimated coefficients of the liquidity target ratios determinants are displayed in Table 4, Steps 1 and 3. As banks increase in size, they set higher liquidity targets. Bank assets twice larger are associated with a 3% increase in *TDNL** ($0.0436 \cdot \ln(2)$), a 2.5% increase in *TDTA** ($0.0364 \cdot \ln(2)$), and a 5.8% increase in *NSFR** ($0.0830 \cdot \ln(2)$). Although large banks could set lower balance sheet liquidity targets because of their capacity to diversify their funding sources our results show the opposite. This could be due to more stringent regulatory pressure and supervision forcing large banks to exhibit higher balance sheet liquidity.

In the second step of our partial adjustment model (Table 4, Step 2), we estimate banks' liquidity adjustment speeds for *TDNL*, *TDTA*, and *NSFR*. Banks close, on average, 17% of the gap between their actual and target liquidity ratio for *TDNL*. The banks in our sample show a lower adjustment speed for *TDTA*; they reduce 14% of the distance between their actual and target ratio. Regarding the regulatory liquidity ratio (*NSFR*), the adjustment speed is roughly similar with banks reducing 15% of the gap. The impact of the determinants of the adjustment speed is displayed in columns 1, 2 and 3 of step 2. The results show that size has a negative impact on the adjustment speed for *TDNL* and *TDTA*. Being a twice larger bank is associated with a 1.5% decrease in *TDNL* adjustment speed ($-0.0217 \cdot \ln(2)$) and a 0.8% decrease in *TDTA*

adjustment speed ($-0.0122 \cdot \ln(2)$). This result shows that despite having a broader access than small banks to market liquidity, which should enable them to quicker converge toward their liquidity target, large banks prefer to adjust slower than small banks. Banks operating below their target *NSFR* show higher adjustment speed than those operating above their target *NSFR* possibly because of the fear of compliance risk and cost of regulatory breach. Such banks are also more closely scrutinized bank supervisors. Higher GDP growth incentivizes banks to adjust slower toward their target *NSFR*. Such a behavior could be explained by the presence of lower default risk and liquidity risk in periods of booming economic conditions. A one standard deviation increase in GDP Growth is associated with an 11.6% decrease in the *NSFR* adjustment speed.

[Insert Table 4 and Table 5 here]

5. Results

5.1. Main results

The results of our baseline model are displayed in Table 6, where liquidity shock variables are based on three different definitions (the total deposits-to-net loans ratio, the total deposits-to-total assets ratio, and the net stable funding ratio). The outcome variables used in the regressions are : return volatility (*SDROA* and *SDDSR*), default risk (*ZScore*, and *MDZscore*), risk-adjusted return (*SharpeRatio*, and credit risk (*NPL*). The results are displayed in three panels (A, B, and C), each panel corresponding to one of the three liquidity definitions we use.

The results regarding the impact of negative shocks to *TDNL* (total deposits-to-net loans ratio) on bank risk indicators are displayed in the Panel A. The coefficient of *NegativeShock* is positive and statistically significant when the outcome variables are *ZScore* and *SharpeRatio*, and negative and statistically significant when the outcome variable is *NPL*. These results indicate that negative liquidity shocks lead affected banks to decrease their default risk and credit risk. Similarly, the results show that an increase in the magnitude of the negative shocks to *TDNL* (*NegativeShockSize*) decreases affected banks' default risk and credit risk (Columns 6 and 8). However, the impact is not significant when considering market-based risk measures (*SDDSR* and *MDZscore*). Operating below the *TDNL* target (*Below*) is associated with higher default risk and credit risk. Such a result shows the importance of introducing such a control variable in our regressions to separate the effect of negative liquidity shocks from the effect of operating below liquidity targets. Although banks take more risk when they operate below their

target liquidity ratio, negative shocks push them to behave more prudently. All in all, the risk-taking behavior of banks experiencing negative liquidity shocks is different from the risk-taking of banks that operate temporarily or purposely below their liquidity targets.

Our results also provide some economically meaningful insights. A negative shock to TDNL is associated with a 0.8% increase in *ZScore*⁸, a 6.8% increase in *SharpeRatio*, and a 5.5% decrease in *NPL*. Furthermore, in the presence of negative shocks to TDNL, a one standard deviation increase in the negative shock size leads to an increase in *SharpeRatio* by 7.1% of its mean and a decrease in *NPL* by 5.8% of its mean. Such results correspond to non-trivial decreases in the affected banks' default risk and credit risk.

Concerning control variables, the coefficients on *Size* (Columns 7 and 8) show a lower credit risk for large banks (lower *NPL*). The specifications in columns 3 and 4 indicate that better-capitalized banks exhibit lower default risk on average. We also find that better diversified banks take less risk (lower *NPL* and *SDDSR*) and are less fragile (higher *MDZscore*). The coefficients on *CIR* in columns 1 to 6 indicate that banks which are less efficient (higher cost-to-income ratio) take more risk (higher *SDROA*) and are more financially vulnerable (lower *ZScore* and *SharpeRatio*). Finally, our results also show that better economic conditions (higher *GDPgrowth*) are negatively associated with risk. Overall, such results are consistent with those of the literature (Jiang et al., 2023; Dinger and te Kaat, 2020).

In Panel B, we run the same regressions using the total deposits-to-total assets ratio (*TDTA*) to measure negative funding liquidity shock. Overall, the results show that in the presence of negative funding liquidity shocks, banks decrease their credit risk and increase their risk-adjusted return. Specifically, a negative shock to *TDTA* is associated with a 5% increase in *SharpeRatio* and a 3% decrease in *NPL*. Overall, the results are consistent with those of Panel A. The results displayed in Panel C indicate that the magnitude of the negative shocks to *NSFR* also decrease affected banks' credit risk and default risk. More precisely, a one standard deviation increase in the negative shock size to *NSFR* is associated with an increase in *ZScore* by 1% of its mean and a decrease in *NPL* by 8.6% of its mean.

[Insert Table 6 here]

As a further investigation of how banks change their risk-taking behavior in response to negative liquidity shocks, we analyze the impact of the breadth of the liquidity gap (distance

⁸ Computed as $(0.1724 \times 0.1905) / 4.1643$

between the liquidity target and the actual liquidity level) and the shock size. *SmallShortfall* is a dummy equal to one if a bank is experiencing a negative liquidity shock ($NegativeShock=1$) and the Gap is smaller than the median value (which is equal to 3%, 2%, and 5% for the TDNL, TDTA, and the NSFR gaps, respectively). *LargeShortfall* is a dummy equal to one if a bank is experiencing a negative liquidity shock and the gap is greater than the median value. To capture the impact of shocks' size, we disaggregate *NegativeShockSize* based on the size of the reduction in liquidity for banks experiencing negative liquidity shocks. *SmallShock* is equal to the absolute value of the annual change in liquidity ($|\Delta L|$) if a bank is experiencing a negative liquidity shock and the extent of the liquidity ratio decline is lower than the median value (which is equal to 3%, 2%, and 4% for $\Delta TDNL$, $\Delta TDTA$, and $\Delta NSFR$, respectively). *LargeShock* is equal to $|\Delta L|$ if a bank is experiencing a negative liquidity shock and the value of the liquidity ratio decline is greater than the median value. Afterward, we re-estimate Eq.(10) using the variables mentioned above.

Panel A of Table 7 displays the results of this analysis using *TDNL* to measure negative liquidity shocks. Regardless of the breadth of the gap or the shock size, a negative liquidity shock decreases banks' credit risk and default risk. However, the coefficients tend to be higher in absolute terms for banks experiencing large shortfalls in *TDNL* when the outcome variables are *ZScore* and *SharpeRatio* than for banks facing small *TDNL* shortfalls. In the estimations using *SharpeRatio* and *NPL* as the outcome variables, the coefficients for banks with large negative shocks in their *TDNL* are lower in absolute terms than for banks experiencing small negative shocks. The different levels of shortfall and shock sizes in bank funding liquidity (Panel B, Table 7) increase risk-adjusted return (Columns 5 and 6). Nevertheless, only large shortfalls in liquidity funding (*TDTA*) decrease bank credit risk (*NPL*). Panel C of Table 7 shows that only large shocks to *NSFR* incentivize banks to decrease their credit risk (*NPL*) and default risk (*ZScore*).

[Insert Table 7 here]

On the whole, the results provided in this section show that negative liquidity shocks incentivize shocked banks to decrease their risk-taking. Indeed, banks react to negative liquidity shocks by decreasing both their credit risk and default risk. These findings are consistent with the conjecture that banks take less risk in response to negative liquidity shocks. Our findings reveal that banks become more prudent when they face problems in managing their liquidity.

However, their sensitivity to negative liquidity shocks may vary depending on their size and their level of capitalization. We study the impact of these factors in the following section.

5.2. Further investigations

So far, we have studied the changes in banks' risk-taking behavior when they face negative liquidity shocks, and have found that negative liquidity shocks incentivize shocked banks to take less risk. In this section, we go further and investigate if the risk-taking behavior of shocked banks differs depending on their size and compliance with regulatory capital requirements (i.e. if they are operating under regulatory capital pressure). Furthermore, we examine banks' risk-taking behavior when they face the opposite situation, namely a positive liquidity shock that generates exogenous and unexpected liquidity inflows.

5.2.1. Large banks

Because they are considered too big to fail larger banks are expected to take more risk than smaller ones (Galloway et al., 1997). However, such banks could also exhibit lower risk because they are able to diversify their activities to a greater extent (Demsetz and Strahan, 1997). The risk-taking behavior of banks experiencing negative liquidity shocks may hence differ depending on their size. Large banks have a strong ability to raise funds and diversify their funding sources. Consequently, large shocked banks can more easily raise the necessary funds to manage a negative liquidity shock and rapidly converge to their target liquidity ratio without strongly altering their balance sheet composition. Their easier access to market liquidity could also lead to a decrease in risk if such liquidity is _ at least initially _ kept in safe assets. More generally, because their charter value is less likely to be negatively affected by a liquidity shock than small banks, we expect larger banks to have lower incentives than small banks to take higher risk when they face negative liquidity shocks. Large banks are also more likely to reduce their risk-taking to restore confidence in their resilience unless they are severely hit by the negative liquidity shock.

To test this hypothesis, we use the European central bank definition of systemically important financial institutions and create a dummy variable *LargeBanks* equal to one for banks with total assets exceeding 30 billion euros⁹ and zero otherwise (Bakkar and Nyola, 2021). Panel A of Table 8 shows that large banks decrease their default risk ($\alpha_1 + \alpha_2$ significantly different from 0 for *ZScore*), increase their risk-adjusted return ($\alpha_1 + \alpha_2$ significantly different

⁹ 63 banks are classified as large banks in our sample.

from 0 for *SharpeRatio*) and decrease their credit risk ($\alpha_1 + \alpha_2$ significantly different from 0 for *NPL*) when they face negative shocks to *TDNL*. Consistently, the results displayed in Panel B shows that larger banks respond to negative shocks to *TDTA* by increasing their risk-adjusted return ($\alpha_1 + \alpha_2$ and $\alpha'_1 + \alpha'_2$ significant for *SharpeRatio*). Similarly, such banks become less financially fragile when they face larger negative shocks to the NSFR ($\alpha'_1 + \alpha'_2$ significant for *ZScore*). By contrast, small banks do not reduce their credit risk when they face negative liquidity shocks to *TDNL*, *TDTA* or *NSFR*. Overall, these results indicate that only large banks respond to negative liquidity shocks by decreasing their risk-taking.

[Insert Table 8 here]

5.2.2. Regulatory capital pressure

At the aftermath of the GFC, regulators redesigned bank regulatory capital requirements by making them tighter. These requirements put poorly capitalized banks under strong regulatory pressure. Regulatory capital pressure forces poorly capitalized banks to promptly change their risk-taking behavior. Konishi and Yasuda (2004) find that commercial banks have effectively reduced their risk-taking after the implementation of capital adequacy requirements. Similarly, Hyun and Rhee (2011) present a dynamic banking model in which they show that to meet higher capital ratios, banks tend to decrease their holdings of high-risk assets instead of issuing new equity. We expect that banks under regulatory capital pressure will decrease their risk-taking to a larger extent than well capitalized banks when they face negative liquidity shocks.

To capture the impact of regulatory capital pressure, we create a dummy variable *RegulatoryPressure* equal to one for banks with a tier one capital ratio lower than 8% and zero otherwise. The results are displayed in Table 9. Panel A of Table 9 shows that banks operating under regulatory capital pressure reduce their risk-taking ($\beta_1 + \beta_2$ significantly different from 0 for *SDROA*), stock returns volatility ($\beta'_1 + \beta'_2$ significantly different from 0 for *SDDSR*), default risk ($\beta_1 + \beta_2$ significantly different from 0 for *ZScore* and $\beta'_1 + \beta'_2$ significantly different from 0 for *MDZscore*) credit risk ($\beta_1 + \beta_2$ significantly different from 0 for *NPL*) and increase their risk-adjusted return ($\beta_1 + \beta_2$ significantly different from 0 for *SharpeRatio*) when they experience *TDNL* negative shocks. Furthermore, those banks reduce their credit risk and default risk to a larger extent than well capitalized banks facing a negative shock to *TDNL*. In Panel B and C, we re-run our regressions using *TDTA* and *NSFR* to measure negative liquidity shocks. The coefficients capturing the effect of regulatory pressure on the risk behavior of banks

experiencing negative shocks are not significant in all of the regressions. The effect of regulatory capital pressure disappears when we use *TDTA* and *NSFR* as negative shock variables. On the whole, these findings show that the impact of negative liquidity shocks on bank risk-taking becomes stronger when affected banks work under regulatory capital pressure.

[Insert Table 9 here]

5.2.3. Positive liquidity shocks

For deeper insights into the impact of liquidity positions on bank risk-taking behavior, we investigate changes in risk when banks face the opposite scenario (positive liquidity shocks). A few studies have theoretically analyzed the reaction of banks to unexpected liquidity inflows. Acharya and Naqvi (2012) show that deposit inflows incentivize beneficiary banks' managers to take more risk by increasing loan volume excessively. In a related vein, Wagner (2007) argues that by making crises less costly for them, higher asset liquidity incentivizes banks to take more risk thereby threatening overall banking system stability. Empirical findings support such theoretical predictions. Khan et al. (2017) note that lower funding liquidity risk encourages banks to take more risk. We hence expect that banks take more risk when they are awash with liquidity, i.e., when they experience positive liquidity shocks. To test our hypothesis, we estimate the following model:

$$Risk_{i,t} = \alpha + \beta.PositveShock_{i,t-1} + \delta.Above_{i,t-2} + \gamma.Controls_{i,t-1} + \mu_i + \tau_t + \varepsilon_{i,t} \quad (11)$$

where i and t denote bank and time, respectively. $Risk_{i,t}$ refers to our bank risk measures (*SDROA*, *ZScore*, *SharpeRatio*, *NPL*, *SDDSR*, and *MDZscore*). $PositveShock_{i,t-1}$ is a dummy variable equal to one if there is an increase in the liquidity ratio ($\Delta L_{i,t-1} > 0$) at a bank that is already working above its liquidity ratio target ($GAP_{i,t-2} = L_{i,t-2}^* - L_{i,t-2} < 0$) that leads it to the point of moving further away from its liquidity target ratio ($GAP_{i,t-1} < GAP_{i,t-2}$) and zero otherwise. $Above_{i,t-2}$ is a dummy equal to one for banks operating above their liquidity targets and zero otherwise¹⁰. $Controls_{i,t-1}$ represents a vector of bank characteristics and macroeconomic variables (*Size*, *Equity*, *NII*, *CIR*, and *GDPGrowth*). Our model includes bank fixed-effects μ_i , and time-fixed effects τ_t .

¹⁰ The *above* dummy serves to absorb any increase or decrease in risk of above-liquidity target banks that are not related to positive liquidity shocks.

The effect of positive liquidity shocks on bank risk is reported in Table 10. Panel A in Table 10 shows that banks respond to positive shocks on their *TDNL* (*PositiveShock*) by increasing their credit risk (*NPL*). However, an increase in the size of positive *TDNL* shocks (*PositiveShockSize*) is associated with a decrease in returns volatility (*SDROA*) and default risk (*ZScore*). In Panel B and C in Table 10, we repeat our tests using *TDTA* and *NSFR*, respectively, to measure positive liquidity shocks. We find that banks experiencing positive *NSFR* shocks reduce their credit risk (*NPL*). In Panel B, the coefficients of positive *TDTA* shocks are not significant in all of the estimations reflecting that banks do not significantly change their risk-taking behavior when they face positive funding liquidity shocks.

From these results, we can conclude that banks decrease their default risk but increase their credit risk when they face positive *TDNL* shocks. However, banks respond to positive shocks in their stable funding ratio (*NSFR*) by taking less credit risk. Such a difference in terms of responses depending on which liquidity ratio is considered (regulatory or non-regulatory) could be due to the fact that the *NSFR*, in addition to deposits, includes other stable funding such as equity. Our findings are counterintuitive and inconsistent with the risk-increasing view (Acharya and Naqvi, 2012; Khan et al., 2017). Indeed, the aforementioned studies have analyzed the effect of deposit inflows but did not consider other aspects of bank liquidity management (i.e., the volume of loans funded by deposits and other sources of stable funding). Our findings show that banks react differently to positive liquidity and funding shocks.

[Insert Table 10 here]

6 Conclusion

The GFC and the European sovereign debt crisis of 2010-2012 have shown how a lack of efficiency in managing bank liquidity can destabilize the financial system. Such episodes have revealed the importance for banks to hold enough liquidity to face possible future financial shocks. Within the framework of the Basel III accords, regulators have implemented two new liquidity requirements, the LCR and the *NSFR*. Many papers have studied the impact of the introduction of these new liquidity requirements on banks' behavior. However, so far, the literature is not clear on how liquidity shortfalls affect the behavior of banks in terms of risk-taking. In this paper, we fill this gap and contribute to the literature by analyzing the risk behavior of European publicly traded banks that experienced negative liquidity shocks between 2005 and 2020.

We address this question by using a three-step partial adjustment model approach. This setting enables us to define a liquidity target for each bank, each year, using bank financial statement data. With the estimated liquidity target ratios in hand, we assume that a bank experiences plausible involuntary negative shocks to its liquidity ratio if it drifts further away from its target liquidity ratio while already operating below this level for a given period of time. Indeed, our conjecture is that, in the absence of a shock, such a bank would have taken action to move closer to its target. Our findings show that banks respond to negative liquidity shocks by taking less risk and specifically by decreasing both their credit and default risk. Furthermore, this effect is more accentuated in large banks and banks operating under regulatory capital pressure. Further analyses show that, conversely, banks do not significantly change their risk-taking behavior when they face positive liquidity shocks, i.e., when they suddenly become excessively liquid.

On the whole, the findings of this paper provide insights on the impact of exogenous liquidity shocks on bank risk-taking behavior. Specifically, the results indicate that banks become more prudent by decreasing their risk when they face negative liquidity shocks. Shocked banks do not take more risk when they involuntarily move far below their internal liquidity targets. On the contrary, they become more disciplined. Moreover, our results show that even banks that operate under regulatory capital pressure, and hence with a lower charter value, reduce their risk when they face negative liquidity shocks. Our findings do not support the view that banks take more risk when they face liquidity problems. Also, our findings suggest that requiring banks to comply with stricter liquidity rules would not push them to take more risk.

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Table 1

Summary statistics

Unbalanced panel of European publicly traded banks between 2005 and 2020.

Variable	Definition	Source	N	Mean	SD	Min	Median	Max
TDNL	Total deposits/net loans	WorldScope	1,753	0.7912	0.3127	0.2351	0.7589	2.1334
TDTA	Total deposits/total assets	WorldScope	1,753	0.5321	0.1683	0.2030	0.5439	0.8519
NSFR	Net Stable Funding Ratio (Appendix A.2)	WorldScope	1,753	1.3410	1.3828	0.3258	0.9414	6.3610
ΔTDNL	Annual change in TDNL	WorldScope	1,753	0.0112	0.0771	-0.3512	0.0094	0.3323
ΔTDTA	Annual change in TDTA	WorldScope	1,753	0.0030	0.0372	-0.1233	0.0029	0.1284
ΔNSFR	Annual change in NSFR	WorldScope	1,753	0.0128	0.2295	-0.7355	0.0037	0.7087
TargetTDNL	TDNL estimated target	WorldScope	1,753	0.8128	0.0983	0.5766	0.8036	1.0916
TargetTDTA	TDTA estimated target	WorldScope	1,753	0.6121	0.0795	0.4326	0.6017	0.7667
TargetNSFR	NSFR estimated target	WorldScope	1,753	1.4072	0.1859	0.9227	1.3868	1.7660
SDROA	Standard deviation of ROA over the preceding 3 years	WorldScope	1,753	0.0024	0.0037	0.0001	0.0011	0.0192
ZScore	$\ln[(ROA_{a3} + \text{Equity}) / \text{SDROA}]$ where ROA_{a3} is the 3-year rolling window average ROA	WorldScope	1,753	4.1643	1.1729	1.5918	4.2662	6.3593
SharpeRatio	ROE / SDROE where SDROE is the standard deviation of ROE over the preceding 3 years	WorldScope	1,753	9.0260	11.7525	-1.6665	5.0606	52.5451
NPL	Non-performing loans/total assets	WorldScope	1,486	0.0296	0.0470	0.0003	0.0125	0.2227
SDDSR	Standard deviation of daily stock returns	DataStream	1,753	0.0195	0.0125	0.0003	0.0164	0.1067
MDZscore	Market data based Zscore = $\ln[(\text{mean of daily stock returns} + 1) / \text{standard deviation of daily stock returns}]$	DataStream	1,753	4.1145	0.6231	2.2188	4.1149	8.0868
Size	Natural logarithm of total assets	WorldScope	1,753	17.0726	2.1714	12.3575	16.8056	21.1244
Equity	Equity/total assets	WorldScope	1,753	0.0767	0.0348	0.0246	0.0676	0.2092
NII	Non-interest income/Operating income	WorldScope	1,753	0.3066	0.1437	0.0455	0.2870	0.7913
CIR	Cost to income ratio	WorldScope	1,753	0.4559	0.1508	0.1435	0.4355	0.8138

GDPGrowth	Real Gross Domestic Product growth	WDI	1,753	0.0092	0.0289	-0.1082	0.0162	0.2518
LargeBanks	Dummy equal to one if banks total assets exceed 30 billion euros and zero otherwise	WorldScope	1,753	0.4187	0.4935	0	0	1
RegulatoryPressure	Dummy equal to one if banks Tier 1 capital to RWA ratio below 8% and zero otherwise	WorldScope	1,424	0.1046	0.3062	0	0	1
BelowTDNL	equal to one if TDNL<TargetTDNL and zero otherwise	WorldScope	1,753	0.5648	0.4959	0	1	1
BelowTDTA	equal to one if TDTA<TargetTDTA and zero otherwise	WorldScope	1,753	0.6098	0.4879	0	1	1
BelowNSFR	equal to one if NSFR<TargetNSFR and zero otherwise	WorldScope	1,753	0.8220	0.3826	0	1	1
AboveTDNL	equal to one if TDNL>TargetTDNL and zero otherwise	WorldScope	1,753	0.4353	0.4959	0	0	1
AboveTDTA	equal to one if TDTA>TargetTDTA and zero otherwise	WorldScope	1,753	0.3902	0.4879	0	0	1
AboveNSFR	equal to one if NSFR>TargetNSFR and zero otherwise	WorldScope	1,753	0.1780	0.3826	0	0	1
NegativeShockTDNL	equal to one if $\Delta TDNL_{i,t} < 0$ and TargetTDNL _{i,t-1} > TDNL _{i,t-1} and GapTDNL _{i,t} > GapTDNL _{i,t-1} and 0 otherwise	WorldScope	1,753	0.1905	0.3928	0	0	1
NegativeShockTDTA	equal to one if $\Delta TDTA_{i,t} < 0$ and TargetTDTA _{i,t-1} > TDTA _{i,t-1} and GapTDTA _{i,t} > GapTDTA _{i,t-1} and 0 otherwise	WorldScope	1,753	0.2470	0.4314	0	0	1
NegativeShockNSFR	equal to one if $\Delta NSFR_{i,t} < 0$ and TargetNSFR _{i,t-1} > NSFR _{i,t-1} and GapNSFR _{i,t} > GapNSFR _{i,t-1} and 0 otherwise	WorldScope	1,753	0.2818	0.4500	0	0	1
PositiveShockTDNL	Equal to one if $\Delta TDNL_{i,t} > 0$ and TargetTDNL _{i,t-1} < TDNL _{i,t-1} and GapTDNL _{i,t} < GapTDNL _{i,t-1} and 0 otherwise	WorldScope	1,753	0.2054	0.4041	0	0	1
PositiveShockTDTA	Equal to one if $\Delta TDTA_{i,t} > 0$ and TargetTDTA _{i,t-1} < TDTA _{i,t-1} and GapTDTA _{i,t} < GapTDTA _{i,t-1} and 0 otherwise	WorldScope	1,753	0.1780	0.3826	0	0	1
PositiveShockNSFR	Equal to one if $\Delta NSFR_{i,t} > 0$ and TargetNSFR _{i,t-1} < NSFR _{i,t-1} and GapNSFR _{i,t} < GapNSFR _{i,t-1} and 0 otherwise	WorldScope	1,753	0.0628	0.2426	0	0	1
NegativeShockSizeTDNL	equal to $ \Delta TDNL $ if NegativeShock==1 and 0 otherwise	WorldScope	1,753	0.0075	0.0238	0	0	0.3512
NegativeShockSizeTDTA	equal to $ \Delta TDTA $ if NegativeShock==1 and 0 otherwise	WorldScope	1,753	0.0069	0.0188	0	0	0.1233
NegativeShockSizeNSFR	equal to $ \Delta NSFR $ if NegativeShock==1 and 0 otherwise	WorldScope	1,753	0.0273	0.0832	0	0	0.7355
PositiveShockSizeTDNL	equal to $ \Delta TDNL $ if PositiveShock==1 and 0 otherwise	WorldScope	1,753	0.0150	0.0440	0	0	0.3323
PositiveShockSizeTDTA	equal to $ \Delta TDTA $ if PositiveShock==1 and 0 otherwise	WorldScope	1,753	0.0044	0.0139	0	0	0.1284
PositiveShockSizeNSFR	equal to $ \Delta NSFR $ if PositiveShock==1 and 0 otherwise	WorldScope	1,753	0.0172	0.0909	0	0	0.7087

SmallShortfallTDNL	Dummy variable equal to one if NegativeShockTDNL=1 and $\Delta\text{gap}<\text{median}$	WorldScope	1,753	0.0890	0.2848	0	0	1
SmallShortfallTDTA	Dummy variable equal to one if NegativeShockTDTA=1 and $\Delta\text{gap}<\text{median}$	WorldScope	1,753	0.1221	0.3275	0	0	1
SmallShortfallNSFR	Dummy variable equal to one if NegativeShockNSFR=1 and $\Delta\text{gap}<\text{median}$	WorldScope	1,753	0.1392	0.3462	0	0	1
LargeShortfallTDNL	Dummy variable equal to one if NegativeShockTDNL=1 and $\Delta\text{gap}>\text{median}$	WorldScope	1,753	0.1015	0.3021	0	0	1
LargeShortfallTDTA	Dummy variable equal to one if NegativeShockTDTA=1 and $\Delta\text{gap}>\text{median}$	WorldScope	1,753	0.1249	0.3307	0	0	1
LargeShortfallNSFR	Dummy variable equal to one if NegativeShockNSFR=1 and $\Delta\text{gap}>\text{median}$	WorldScope	1,753	0.1426	0.3498	0	0	1
SmallNegativeShockTDNL	Dummy variable equal to $ \Delta\text{TDNL} $ if NegativeShockTDNL=1 and $\Delta\text{TDNL}<\text{median}$	WorldScope	1,753	0.0012	0.0045	0	0	0.0279
SmallNegativeShockTDTA	Dummy variable equal to $ \Delta\text{TDTA} $ if NegativeShockTDTA=1 and $\Delta\text{TDTA}<\text{median}$	WorldScope	1,753	0.0011	0.0033	0	0	0.0176
SmallNegativeShockNSFR	Dummy variable equal to $ \Delta\text{NSFR} $ if NegativeShockTDTA=1 and $\Delta\text{NSFR}<\text{median}$	WorldScope	1,753	0.0027	0.0079	0	0	0.0420
LargeNegativeShockTDNL	Dummy variable equal to $ \Delta\text{TDNL} $ if NegativeShockTDNL=1 and $\Delta\text{TDNL}>\text{median}$	WorldScope	1,753	0.0063	0.0237	0	0	0.3512
LargeNegativeShockTDTA	Dummy variable equal to $ \Delta\text{TDTA} $ if NegativeShockTDTA=1 and $\Delta\text{TDTA}>\text{median}$	WorldScope	1,753	0.0058	0.0189	0	0	0.1233
LargeNegativeShockNSFR	Dummy variable equal to $ \Delta\text{NSFR} $ if NegativeShockTDTA=1 and $\Delta\text{NSFR}>\text{median}$	WorldScope	1,753	0.0246	0.0836	0	0	0.7355

Table 2
Pairwise correlation matrix

	1	2	3	4	5	6	7	8	9	10	11
1 SDROA	1										
2 ZScore	-0.734	1									
3 SharpeRatio	-0.327	0.595	1								
4 NPL	0.618	-0.410	-0.229	1							
5 SDDSR	0.564	-0.547	-0.340	0.513	1						
6 MDZscore	-0.434	0.503	0.370	-0.405	-0.879	1					
7 Size	0.001	-0.229	-0.116	0.071	0.205	-0.230	1				
8 Equity	0.080	0.113	-0.091	0.150	-0.035	0.039	0.043	1			
9 NII	-0.047	-0.058	-0.087	-0.087	-0.079	0.013	0.239	0.122	1		
10 CIR	0.292	-0.204	-0.117	0.322	0.139	-0.100	-0.033	-0.059	0.069	1	
11 GDPGrowth	-0.180	0.204	0.137	-0.127	-0.370	0.326	-0.056	-0.012	-0.019	-0.079	1

Table 3

European publicly traded banks distribution by country from 2005 to 2020

Country	Number of listed commercial banks in the sample	Total assets of sample banks divided by total assets of banks in Datastream (%)
Austria	8	1
Belgium	1	0.5141
Denmark	17	0.9957
Finland	3	0.9901
France	17	1
Germany	13	0.9427
Greece	5	0.4550
Ireland	3	1
Italy	11	0.9826
Netherlands	3	1
Norway	24	0.9169
Portugal	2	0.9979
Spain	6	0.9793
Sweden	3	0.9731
Switzerland	20	0.3337
United Kingdom	13	0.9944
Total or Mean	149	0.8797

Table 4**Partial adjustment Model for TDNL, TDTA, and NSFR.**

Parameters for the three-step partial adjustment model, estimated for an unbalanced panel of 149 European publicly traded banks from 2005 to 2020 for total deposits/net loans (TDNL), total deposits/total assets (TDTA), and net stable funding ratio (NSFR). Step 1 estimated using GMM (Blundell and Bond, 1988) with fixed bank effects and fixed year effects. Step 2 and Step 3 estimated using OLS with fixed bank effects and fixed year effects. P-values based on robust standard errors are shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	Step 1				Step 2				Step 3		
	(1) TDNL	(2) TDTA	(3) NSFR		(1) Δ TDNL	(2) Δ TDTA	(3) Δ NSFR		(1) TDNL _{i,t} - TDNL _{i,t-1} (1- TDNL _{i,t})	(2) TDTA _{i,t} - TDTA _{i,t-1} (1- TDTA _{i,t})	NSFR _{i,t} - NSFR _{i,t-1} (1- NSFR _{i,t})
Lagged dependent variable	0.8865*** (0.0564)	0.7228*** (0.1026)	0.8876*** (0.0276)	Gap_iSize_{t-1}	-0.0217** (0.0091)	-0.0122** (0.0051)	-0.0044 (0.0041)	Speed_iSize_{t-1}	0.0436*** (0.0068)	0.0364** (0.0160)	0.0830*** (0.0104)
Size_{t-1}	0.0008 (0.0018)	-0.0106** (0.0044)	-0.0074 (0.0095)	Gap_iBelow_{t-1}	0.0585 (0.0453)	0.0097 (0.0370)	0.1413*** (0.0403)	Speed_iEquity_{t-1}	0.0138 (0.0284)	-0.0031 (0.0166)	-0.0416 (0.0720)
Equity_{t-1}	-0.0025 (0.0057)	-0.0150** (0.0068)	-0.0157 (0.0279)	Gap_iGDPgrowth_{t-1}	-0.3140 (0.3300)	-0.2780* (0.1657)	-0.9196** (0.4034)	Speed_iGDPgrowth_{t-1}	0.8184 (0.7301)	0.1251 (0.8545)	1.7749 (2.1559)
GDPgrowth_{t-1}	0.2264 (0.1921)	0.8272** (0.4182)	-0.0605 (3.3396)	Gap_t	0.5052*** (0.1806)	0.3479*** (0.1007)	0.1277* (0.0653)	Constant	0.0596*** (0.0196)	-0.0093 (0.0379)	-0.0294 (0.0378)
Constant	0.0831 (0.0562)	0.3247** (0.1293)	0.2920 (0.1946)	Constant	0.0397*** (0.0065)	0.0026 (0.0034)	-0.0314 (0.0270)				
Observations	1,753	1,753	1,753	R-squared	0.1511	0.1454	0.1226	R-squared	0.1174	0.0783	0.0920
Banks	149	149	149	Observation	1,753	1,753	1,753	Observation	1,753	1,753	1,753
Hansen test (p-value)	0.917	0.150	0.114	Bank	149	149	149	Bank	149	149	149
AR2 test (p-value)	0.647	0.128	0.166	Year FE	YES	YES	YES	Year FE	YES	YES	YES
Year FE	YES	YES	YES	Bank FE	YES	YES	YES	Bank FE	YES	YES	YES
Bank FE	YES	YES	YES	Adjustment speed λ	0.1725	0.1423	0.1538	Estimated target L^*	0.8128	0.6121	1.4072
Adjustment speed λ	0.1135	0.2772	0.1124								
Estimated target L^*	0.8829	0.5637	1.4656								

Table 5

Annual means for estimated targets, banks experiencing negative shocks (*NegativeShock*) and negative shocks size (*NegativeShockSize*) each year. Unbalanced panel of 149 European publicly traded banks from 2005 to 2020.

Panel A: TDNL (total deposits-to-net loans)			Panel B: TDTA (total deposits-to-total assets)			Panel C: NSFR (net stable funding ratio)					
Mean Target	Banks experiencing NegativeShock	NegativeShockSize	Mean Target	Banks experiencing NegativeShock	NegativeShockSize	Mean Target	Banks experiencing NegativeShock	NegativeShockSize			
2005	0.8047	0.3571	0.0209	2005	0.6032	0.5306	0.0250	2005	1.4219	0.3878	0.0672
2006	0.8087	0.3939	0.0154	2006	0.6080	0.3838	0.0083	2006	1.4160	0.3535	0.0193
2007	0.8247	0.3333	0.0130	2007	0.6140	0.3636	0.0124	2007	1.4450	0.4444	0.0364
2008	0.8215	0.2653	0.0103	2008	0.6137	0.3265	0.0091	2008	1.4379	0.3878	0.0333
2009	0.8000	0.0600	0.0034	2009	0.6120	0.1700	0.0035	2009	1.4055	0.4100	0.0281
2010	0.7639	0.1539	0.0106	2010	0.6028	0.2308	0.0112	2010	1.3156	0.1250	0.0197
2011	0.8094	0.1793	0.0083	2011	0.6089	0.2830	0.0077	2011	1.4107	0.3208	0.0157
2012	0.8111	0.0818	0.0010	2012	0.6146	0.1182	0.0015	2012	1.4135	0.2818	0.0133
2013	0.8155	0.1650	0.0110	2013	0.6245	0.1959	0.0079	2013	1.4138	0.4330	0.1191
2014	0.8030	0.2035	0.0068	2014	0.6097	0.3274	0.0087	2014	1.3878	0.1770	0.0114
2015	0.8236	0.1712	0.0071	2015	0.6192	0.1712	0.0062	2015	1.4259	0.3063	0.0403
2016	0.8267	0.1525	0.0041	2016	0.6167	0.1949	0.0027	2016	1.4230	0.1864	0.0099
2017	0.8218	0.1570	0.0039	2017	0.6136	0.1570	0.0022	2017	1.4066	0.2314	0.0140
2018	0.8261	0.2645	0.0064	2018	0.6130	0.2149	0.0030	2018	1.4117	0.2562	0.0132
2019	0.8194	0.1349	0.0034	2019	0.6099	0.1984	0.0030	2019	1.3993	0.1746	0.0132
2020	0.8174	0.0530	0.0010	2020	0.6103	0.1742	0.0030	2020	1.3905	0.1591	0.0079

Table 6**Negative Liquidity Shocks and Bank Risk**

This table displays the relationship between shock of liquidity and bank risk using a sample of European publicly traded banks during 2005-2020. SDROA is the standard deviation of ROA over the preceding 3 years. ZScore measures bank risk of default = $\ln[(ROA+Equity)/SDROA]$. SharpeRatio = $ROE/SDROE$. NPL = Non-performing loans/total assets. SDDSR is the standard deviation of daily stock returns. MDZscore is the market based zscore = $\ln[(\text{daily stock returns}+1)/SDDSR]$. NegativeShock equal to one if $\Delta LiquidityRatio_{i,t} < 0$ and $Target_{i,t-1} > LiquidityRatio_{i,t-1}$ and $gap_{i,t} > gap_{i,t-1}$ and 0 otherwise. NegativeShockSize equal to $|\Delta LiquidityRatio|$ if NegativeShock = 1 and zero otherwise. Below equal to one if $LiquidityRatio < Target$ and zero otherwise. Size is the natural logarithm of total assets. Equity = equity/Total assets. NII = Non-interest income/operating income. CIR is the cost income ratio. GDPGrowth is the real Gross Domestic Product growth. OLS with bank fixed effects and year fixed effects. P-values based on robust standard errors are shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Panel A: total deposits-to-net loans negative shock

	SDROA		ZScore		SharpeRatio		NPL		SDDSR		MDZscore	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
NegativeShock_{t-1}	-0.0003 (0.0002)		0.1794*** (0.0550)		3.2285*** (0.7193)		-0.0085*** (0.0023)		0.0001 (0.0005)		0.0154 (0.0267)	
NegativeShockSize_{t-1}		-0.0013 (0.0031)		1.1986 (0.8823)		26.9235*** (9.4682)		-0.0716** (0.0340)		0.0124 (0.0121)		0.0013 (0.4028)
Below_{t-2}	0.0004* (0.0002)	0.0003 (0.0002)	-0.2208*** (0.0836)	-0.1897** (0.0861)	-3.1494*** (0.9339)	-2.6494*** (0.9713)	0.0134*** (0.0040)	0.0122*** (0.0040)	-0.0003 (0.0009)	-0.0004 (0.0008)	0.0200 (0.0401)	0.0238 (0.0395)
Size_{t-1}	-0.0005 (0.0006)	-0.0005 (0.0006)	0.1402 (0.1421)	0.1538 (0.1440)	1.7347 (1.3265)	1.9380 (1.3494)	-0.0206** (0.0093)	-0.0212** (0.0094)	0.0013 (0.0020)	0.0012 (0.0020)	-0.0610 (0.0739)	-0.0591 (0.0744)
Equity_{t-1}	-0.0002 (0.0003)	-0.0002 (0.0003)	0.2910*** (0.0771)	0.2906*** (0.0779)	0.7570 (0.5717)	0.7653 (0.5911)	0.0031 (0.0050)	0.0031 (0.0051)	-0.0015* (0.0009)	-0.0015* (0.0009)	0.0607 (0.0424)	0.0604 (0.0424)
NII_{t-1}	-0.0017 (0.0016)	-0.0017 (0.0016)	0.0018 (0.5089)	0.0087 (0.5066)	-0.8366 (4.2563)	-0.8436 (4.2193)	-0.0821*** (0.0260)	-0.0815*** (0.0262)	-0.0146*** (0.0047)	-0.0149*** (0.0047)	0.4256** (0.1855)	0.4287** (0.1859)
CIR_{t-1}	0.0006*** (0.0002)	0.0006*** (0.0002)	-0.1751*** (0.0516)	-0.1755*** (0.0518)	-1.6249*** (0.4948)	-1.6385*** (0.4919)	-0.0018 (0.0033)	-0.0017 (0.0033)	0.0004 (0.0005)	0.0004 (0.0005)	-0.0362 (0.0240)	-0.0361 (0.0240)
GDPGrowth_{t-1}	-0.0532*** (0.0123)	-0.0532*** (0.0122)	7.2886*** (1.7557)	7.2706*** (1.7320)	-7.5765 (17.4288)	-7.5111 (17.5190)	-0.3098*** (0.1165)	-0.3088*** (0.1161)	-0.1015*** (0.0243)	-0.1006*** (0.0238)	1.9855*** (0.7023)	1.9766*** (0.6932)
Constant	0.0108 (0.0096)	0.0112 (0.0097)	1.8585 (2.3423)	1.6633 (2.3683)	-17.9216 (21.9258)	-20.7312 (22.3181)	0.3840** (0.1568)	0.3924** (0.1589)	-0.0028 (0.0324)	-0.0013 (0.0328)	5.4022*** (1.2199)	5.3721*** (1.2295)
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,753	1,753	1,753	1,753	1,753	1,753	1,486	1,486	1,753	1,753	1,753	1,753
R-squared	0.1682	0.1670	0.1801	0.1758	0.0748	0.0646	0.2442	0.2371	0.3802	0.3811	0.4136	0.4134
Banks	149	149	149	149	149	149	141	141	149	149	149	149

[Table continued on next page]

Panel B: total deposits-to-total assets negative shock												
	SDROA		ZScore		SharpeRatio		NPL		SDDSR		MDZscore	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
NegativeShock_{t-1}	0.0001 (0.0001)		0.0259 (0.0492)		1.8220*** (0.5318)		-0.0035** (0.0016)		0.0003 (0.0005)		0.0021 (0.0193)	
NegativeShockSize_{t-1}		0.0056 (0.0040)		-0.1024 (1.0688)		27.6572*** (8.7714)		-0.0213 (0.0489)		0.0226 (0.0158)		-0.1367 (0.4723)
Below_{t-2}	0.0015** (0.0006)	0.0015** (0.0006)	-0.3858** (0.1665)	-0.3762** (0.1671)	-2.2439* (1.2983)	-1.9108 (1.3248)	0.0156* (0.0082)	0.0148* (0.0082)	0.0016 (0.0012)	0.0015 (0.0012)	0.0142 (0.0716)	0.0162 (0.0715)
Size_{t-1}	-0.0006 (0.0006)	-0.0006 (0.0006)	0.1646 (0.1478)	0.1690 (0.1478)	1.7221 (1.3351)	1.7231 (1.3217)	-0.0213** (0.0097)	-0.0216** (0.0098)	0.0011 (0.0020)	0.0009 (0.0020)	-0.0574 (0.0738)	-0.0559 (0.0746)
Equity_{t-1}	-0.0001 (0.0003)	-0.0001 (0.0003)	0.2781*** (0.0786)	0.2775*** (0.0789)	0.7108 (0.6093)	0.7348 (0.6196)	0.0034 (0.0051)	0.0035 (0.0051)	-0.0015* (0.0009)	-0.0014* (0.0008)	0.0604 (0.0424)	0.0601 (0.0423)
NII_{t-1}	-0.0018 (0.0016)	-0.0019 (0.0016)	0.0599 (0.5090)	0.0636 (0.5072)	0.0162 (4.2970)	-0.2560 (4.3155)	-0.0867*** (0.0267)	-0.0866*** (0.0269)	-0.0145*** (0.0047)	-0.0149*** (0.0047)	0.4250** (0.1856)	0.4273** (0.1858)
CIR_{t-1}	0.0006*** (0.0002)	0.0006*** (0.0002)	-0.1620*** (0.0513)	-0.1622*** (0.0515)	-1.4900*** (0.4877)	-1.5535*** (0.4905)	-0.0027 (0.0032)	-0.0026 (0.0032)	0.0004 (0.0005)	0.0004 (0.0005)	-0.0371 (0.0243)	-0.0369 (0.0242)
GDPGrowth_{t-1}	-0.0520*** (0.0114)	-0.0518*** (0.0113)	7.1159*** (1.6109)	7.0704*** (1.6066)	-5.0845 (17.5826)	-6.0905 (17.7161)	-0.3118*** (0.1070)	-0.3077*** (0.1058)	-0.0991*** (0.0233)	-0.0982*** (0.0228)	1.9615*** (0.6916)	1.9498*** (0.6866)
Constant	0.0120 (0.0099)	0.0126 (0.0099)	1.6037 (2.4188)	1.5347 (2.4180)	-18.1100 (22.1937)	-17.7736 (21.9761)	0.3935** (0.1620)	0.3981** (0.1642)	-0.0009 (0.0323)	0.0018 (0.0328)	5.3512*** (1.2169)	5.3265*** (1.2318)
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,753	1,753	1,753	1,753	1,753	1,753	1,486	1,486	1,753	1,753	1,753	1,753
R-squared	0.1789	0.1797	0.1796	0.1795	0.0618	0.0591	0.2344	0.2326	0.3817	0.3831	0.4132	0.4132
Bank	149	149	149	149	149	149	141	141	149	149	149	149

[Table continued on next page]

Panel C: net stable funding ratio negative shock												
	SDROA		ZScore		SharpeRatio		NPL		SDDSR		MDZscore	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
NegativeShock_{t-1}	0.0001 (0.0002)		0.0331 (0.0491)		0.4597 (0.6630)		-0.0006 (0.0016)		-0.0002 (0.0004)		0.0288 (0.0186)	
NegativeShockSize_{t-1}		-0.0013 (0.0008)		0.4461** (0.2232)		5.1181* (3.0752)		-0.0307** (0.0122)		-0.0017 (0.0027)		0.1761* (0.0974)
Below_{t-2}	-0.0006* (0.0003)	-0.0005 (0.0003)	0.2017** (0.0962)	0.2038** (0.0960)	0.2796 (0.8184)	0.3258 (0.7805)	-0.0041 (0.0030)	-0.0039 (0.0031)	-0.0017** (0.0008)	-0.0017** (0.0008)	0.0577 (0.0356)	0.0628* (0.0352)
Size_{t-1}	-0.0004 (0.0006)	-0.0004 (0.0006)	0.1140 (0.1429)	0.1057 (0.1423)	1.8105 (1.3221)	1.7129 (1.2856)	-0.0202** (0.0094)	-0.0194** (0.0093)	0.0014 (0.0019)	0.0015 (0.0019)	-0.0639 (0.0715)	-0.0676 (0.0711)
Equity_{t-1}	-0.0002 (0.0003)	-0.0002 (0.0003)	0.2940*** (0.0809)	0.2925*** (0.0811)	0.7540 (0.6183)	0.7354 (0.6151)	0.0029 (0.0052)	0.0030 (0.0052)	-0.0016* (0.0009)	-0.0016* (0.0009)	0.0611 (0.0418)	0.0602 (0.0419)
NII_{t-1}	-0.0019 (0.0016)	-0.0020 (0.0016)	0.1082 (0.5125)	0.1264 (0.5115)	0.3782 (4.2722)	0.5642 (4.2623)	-0.0871*** (0.0270)	-0.0887*** (0.0273)	-0.0148*** (0.0047)	-0.0149*** (0.0048)	0.4439** (0.1874)	0.4465** (0.1889)
CIR_{t-1}	0.0006*** (0.0002)	0.0006*** (0.0002)	-0.1787*** (0.0510)	-0.1805*** (0.0507)	-1.5526*** (0.4826)	-1.5750*** (0.4836)	-0.0020 (0.0033)	-0.0020 (0.0032)	0.0005 (0.0005)	0.0005 (0.0005)	-0.0393* (0.0235)	-0.0404* (0.0234)
GDPGrowth_{t-1}	-0.0535*** (0.0123)	-0.0536*** (0.0124)	7.4250*** (1.7252)	7.4529*** (1.7261)	-6.1498 (17.3838)	-5.8675 (17.5509)	-0.3194*** (0.1176)	-0.3215*** (0.1157)	-0.1011*** (0.0243)	-0.1012*** (0.0242)	1.9559*** (0.7035)	1.9595*** (0.6957)
Constant	0.0102 (0.0096)	0.0099 (0.0095)	1.9842 (2.3657)	2.1146 (2.3560)	-20.8198 (22.1657)	-19.2748 (21.5704)	0.3898** (0.1586)	0.3768** (0.1566)	-0.0045 (0.0314)	-0.0050 (0.0312)	5.4006*** (1.1898)	5.4617*** (1.1843)
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,753	1,753	1,753	1,753	1,753	1,753	1,486	1,486	1,753	1,753	1,753	1,753
R-squared	0.1688	0.1702	0.1761	0.1776	0.0560	0.0575	0.2239	0.2306	0.3826	0.3827	0.4159	0.4163
Bank	149	149	149	149	149	149	141	141	149	149	149	149

Table 7**Negative Liquidity Shocks and Bank Risk: effect of gap breadth and shock size**

This table displays the impact of gap breadth and shock size on the relationship between shock of liquidity and bank risk using a sample of European publicly traded banks during 2005-2020. SDROA is the standard deviation of ROA over the preceding 3 years. ZScore measures bank risk of default = $\ln[(ROA+Equity)/SDROA]$. SharpeRatio = ROE/SDROE. NPL= Non-performing loans/total assets. SDDSR is the standard deviation of daily stock returns. MDZscore is the market based zscore= $\ln[(\text{daily stock returns}+1)/SDDSR]$. NegativeShock equal to one if $\Delta LiquidityRatio_{i,t} < 0$ and $Target_{i,t} > LiquidityRatio_{i,t-1}$ and $gap_{i,t} > gap_{i,t-1}$ and 0 otherwise. NegativeShockSize equal to $|\Delta LiquidityRatio|$ if NegativeShock=1 and zero otherwise. SmallShortfall equal to one if NegativeShock=1 and $\Delta gap < median$ and zero otherwise. LargeShortfall equal to one if NegativeShock=1 and $\Delta gap > median$ and zero otherwise. SmallNegativeShock equal to $|\Delta LiquidityRatio|$ if NegativeShock=1 and $\Delta LiquidityRatio < median$ and zero otherwise. LargeNegativeShock equal to $|\Delta LiquidityRatio|$ if NegativeShock=1 and $\Delta LiquidityRatio > median$ and zero otherwise. Below equal to one if $LiquidityRatio < Target$ and zero otherwise. Controls are Size is the natural logarithm of total assets. Equity=equity/Total assets. NII= Non-interest income/operating income. CIR is the cost income ratio. GDPGrowth is the real Gross Domestic Product growth. OLS with bank fixed effects and year fixed effects. P-values based on robust standard errors are shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Panel A: total deposits-to-net loans negative shock

	SDROA		ZScore		SharpeRatio		NPL		SDDSR		MDZscore	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
SmallShortfall_{t-1}	-0.0001 (0.0002)		0.1204* (0.0654)		3.0774*** (0.9511)		-0.0095*** (0.0030)		-0.0004 (0.0006)		0.0447 (0.0295)	
LargeShortfall_{t-1}	-0.0005** (0.0002)		0.2350*** (0.0667)		3.3708*** (0.8067)		-0.0077*** (0.0023)		0.0005 (0.0007)		-0.0123 (0.0348)	
SmallNegativeShock_{t-1}		-0.0177* (0.0098)		9.5738** (4.1324)		144.3599*** (55.2625)		-0.3423** (0.1496)		-0.0133 (0.0350)		1.4968 (1.6999)
LargeNegativeShock_{t-1}		-0.0011 (0.0031)		1.1172 (0.8900)		25.7811*** (9.3604)		-0.0693** (0.0338)		0.0126 (0.0122)		-0.0133 (0.4042)
Below_{t-2}	0.0004* (0.0002)	0.0004 (0.0002)	-0.2242*** (0.0837)	-0.2008** (0.0848)	-3.1580*** (0.9438)	-2.8044*** (0.9613)	0.0134*** (0.0040)	0.0125*** (0.0039)	-0.0004 (0.0009)	-0.0004 (0.0008)	0.0216 (0.0400)	0.0218 (0.0395)
Constant	0.0103 (0.0097)	0.0114 (0.0097)	2.0090 (2.3537)	1.5917 (2.3680)	-17.5364 (21.9060)	-21.7349 (22.1969)	0.3867** (0.1575)	0.3952** (0.1586)	-0.0016 (0.0326)	-0.0011 (0.0328)	5.3274*** (1.2166)	5.3593*** (1.2304)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,753	1,753	1,753	1,753	1,753	1,753	1,486	1,486	1,753	1,753	1,753	1,753
R-squared	0.1693	0.1677	0.1810	0.1776	0.0749	0.0676	0.2444	0.2387	0.3807	0.3812	0.4145	0.4137
Bank	149	149	149	149	149	149	141	141	149	149	149	149

[Table continued on next page]

Panel B: total deposits-to-total assets negative shock												
	SDROA		ZScore		SharpeRatio		NPL		SDDSR		MDZscore	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
SmallShortfall _{t-1}	0.0002 (0.0002)		-0.0156 (0.0631)		1.6403** (0.7037)		-0.0021 (0.0018)		0.0002 (0.0005)		0.0122 (0.0212)	
LargeShortfall _{t-1}	0.0001 (0.0002)		0.0702 (0.0683)		2.0163*** (0.6156)		-0.0050** (0.0023)		0.0005 (0.0008)		-0.0088 (0.0279)	
SmallNegativeShock _{t-1}		0.0080 (0.0180)		0.3000 (6.1378)		169.9365** (72.1240)		-0.4408* (0.2349)		-0.0059 (0.0494)		0.4091 (1.9306)
LargeNegativeShock _{t-1}		0.0056 (0.0039)		-0.1030 (1.0692)		27.4400*** (8.6724)		-0.0203 (0.0488)		0.0226 (0.0158)		-0.1376 (0.4732)
Below _{t-2}	0.0015** (0.0006)	0.0014** (0.0006)	-0.3889** (0.1659)	-0.3768** (0.1664)	-2.2576* (1.3038)	-2.0969 (1.2939)	0.0157* (0.0082)	0.0153* (0.0081)	0.0016 (0.0012)	0.0015 (0.0012)	0.0150 (0.0717)	0.0155 (0.0717)
Constant	0.0119 (0.0099)	0.0126 (0.0099)	1.7354 (2.4253)	1.5333 (2.4216)	-17.5331 (21.8448)	-18.2609 (21.8980)	0.3893** (0.1626)	0.3988** (0.1634)	-0.0005 (0.0328)	0.0018 (0.0328)	5.3188*** (1.2214)	5.3247*** (1.2324)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,753	1,753	1,753	1,753	1,753	1,753	1,486	1,486	1,753	1,753	1,753	1,753
R-squared	0.1790	0.1798	0.1802	0.1795	0.0619	0.0614	0.2350	0.2345	0.3817	0.3832	0.4134	0.4133
Bank	149	149	149	149	149	149	141	141	149	149	149	149

Panel C: net stable funding ratio negative shock												
	SDROA		ZScore		SharpeRatio		NPL		SDDSR		MDZscore	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
SmallShortfall _{t-1}	0.0003 (0.0002)		-0.0162 (0.0608)		0.4373 (0.8226)		0.0019 (0.0022)		-0.0005 (0.0006)		0.0401 (0.0254)	
LargeShortfall _{t-1}	-0.0001 (0.0002)		0.0827 (0.0588)		0.4822 (0.7603)		-0.0030 (0.0020)		0.0001 (0.0006)		0.0174 (0.0225)	
SmallNegativeShock _{t-1}		0.0097 (0.0066)		-1.1302 (2.4015)		-2.3603 (26.7547)		-0.0069 (0.0776)		-0.0207 (0.0189)		1.3499 (0.8938)
LargeNegativeShock _{t-1}		-0.0013 (0.0008)		0.4472** (0.2235)		5.1236* (3.0756)		-0.0308** (0.0122)		-0.0017 (0.0027)		0.1752* (0.0974)
Below _{t-2}	-0.0006* (0.0003)	-0.0006* (0.0003)	0.2046** (0.0961)	0.2091** (0.0973)	0.2809 (0.8204)	0.3509 (0.8065)	-0.0043 (0.0030)	-0.0040 (0.0031)	-0.0016* (0.0008)	-0.0016* (0.0008)	0.0570 (0.0356)	0.0588 (0.0357)
Constant	0.0098 (0.0096)	0.0095 (0.0096)	2.0772 (2.3582)	2.1818 (2.3622)	-20.7776 (22.0074)	-18.9556 (21.6693)	0.3821** (0.1575)	0.3757** (0.1565)	-0.0039 (0.0313)	-0.0042 (0.0311)	5.3793*** (1.1830)	5.4116*** (1.1787)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,753	1,753	1,753	1,753	1,753	1,753	1,486	1,486	1,753	1,753	1,753	1,753
R-squared	0.1702	0.1712	0.1769	0.1778	0.0560	0.0576	0.2255	0.2306	0.3829	0.3830	0.4161	0.4168
Bank	149	149	149	149	149	149	141	141	149	149	149	149

Table 8**Negative liquidity shock and bank risk: effect of bank size**

This table displays the impact of bank size on the relationship between shock of liquidity and bank risk using a sample of European publicly traded banks during 2005-2020. SDROA is the standard deviation of ROA over the preceding 3 years. ZScore measures bank risk of default = $\ln[(ROA+Equity)/SDROA]$. SharpeRatio = ROE/SDROE. NPL= Non-performing loans/total assets. SDDSR is the standard deviation of daily stock returns. MDZscore is the market based zscore= $\ln[(\text{daily stock returns}+1)/SDDSR]$. NegativeShock equal to one if $\Delta\text{LiquidityRatio}_{i,t}<0$ and $\text{Target}_{i,t}>\text{LiquidityRatio}_{i,t-1}$ and $\text{gap}_{i,t}>\text{gap}_{i,t-1}$ and 0 otherwise. NegativeShockSize equal to $|\Delta\text{LiquidityRatio}|$ if NegativeShock=1 and zero otherwise. LargeBank equal to one if banks total assets exceeds 30 billions euros and zero otherwise. Below equal to one if $\text{LiquidityRatio}<\text{Target}$ and zero otherwise. Controls are Size is the natural logarithm of total assets. Equity=equity/Total assets. NII= Non-interest income/operating income. CIR is the cost income ratio. GDPGrowth is the real Gross Domestic Product growth. OLS with bank fixed effects and year fixed effects. P-values based on robust standard errors are shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Panel A: total deposits-to-net loans negative shock

	SDROA		ZScore		SharpeRatio		NPL		SDDSR		MDZscore	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
NegativeShock_{i,t}(α1)	-0.0001 (0.0002)		0.0994 (0.0706)		1.6222* (0.9528)		-0.0027 (0.0026)		0.0011* (0.0007)		-0.0333 (0.0391)	
NegativeShock_{i,t}xLargeBanks_{i,t}(α2)	-0.0004 (0.0003)		0.1625 (0.1095)		3.2611** (1.2740)		-0.0112** (0.0049)		-0.0020* (0.0011)		0.0990* (0.0514)	
NegativeShockSize_{i,t}(α'1)		-0.0058 (0.0044)		2.1624 (2.0792)		26.7881* (14.8065)		-0.1230** (0.0608)		0.0128 (0.0134)		-0.9162 (0.8452)
NegativeShockSize_{i,t}xLargeBanks_{i,t}(α'2)		0.0061 (0.0050)		-1.2836 (2.2897)		0.2247 (18.3591)		0.0676 (0.0735)		-0.0006 (0.0205)		1.2236 (0.9478)
Below_{i,t}	0.0004* (0.0002)	0.0004 (0.0002)	-0.2165** (0.0837)	-0.1928** (0.0860)	-3.0572*** (0.9372)	-2.6280*** (0.9814)	0.0131*** (0.0040)	0.0123*** (0.0039)	-0.0004 (0.0009)	-0.0005 (0.0008)	0.0221 (0.0401)	0.0274 (0.0397)
LargeBanks_{i,t}	-0.0003 (0.0008)	-0.0004 (0.0007)	0.0551 (0.1986)	0.1089 (0.1940)	1.5583 (2.2693)	2.3771 (2.4597)	0.0007 (0.0107)	-0.0021 (0.0107)	-0.0008 (0.0019)	-0.0013 (0.0019)	-0.0256 (0.1134)	-0.0137 (0.1119)
Constant	0.0098 (0.0097)	0.0105 (0.0099)	2.1894 (2.3965)	1.8645 (2.4441)	-10.2912 (22.2154)	-15.5037 (22.8972)	0.3696** (0.1590)	0.3886** (0.1612)	-0.0072 (0.0310)	-0.0042 (0.0313)	5.4740*** (1.1975)	5.3782*** (1.2121)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,753	1,753	1,753	1,753	1,753	1,753	1,486	1,486	1,753	1,753	1,753	1,753
R-squared	0.1692	0.1678	0.1816	0.1763	0.0802	0.0660	0.2490	0.2377	0.3822	0.3815	0.4156	0.4143
Bank	149	149	149	149	149	149	141	141	149	149	149	149
Wald tests												
α1+α2	-0.0005		0.2619***		4.8832***		-0.0139***		-0.0009		0.0657*	
α'1+α'2		0.0002		0.8788		27.0128**		-0.0554		0.0122		0.3074

[Table continued on next page]

Panel B: total deposits-to-total assets negative shock												
	SDROA		ZScore		SharpeRatio		NPL		SDDSR		MDZscore	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
NegativeShock_{t-1}(α1)	0.0000 (0.0002)		0.0391 (0.0857)		1.3127 (0.8741)		-0.0026 (0.0030)		0.0007 (0.0006)		0.0005 (0.0323)	
NegativeShock_{t-1}xLargeBanks_{t-1}(α2)	0.0002 (0.0003)		-0.0221 (0.1115)		0.8240 (1.0875)		-0.0015 (0.0046)		-0.0007 (0.0011)		0.0025 (0.0466)	
NegativeShockSize_{t-1}(α'1)		-0.0028 (0.0053)		0.5437 (2.4019)		19.4927 (14.7836)		-0.0991 (0.0872)		0.0070 (0.0145)		-0.4559 (0.7171)
NegativeShockSize_{t-1}xLargeBanks_{t-1}(α'2)		0.0119* (0.0071)		-0.9037 (2.7466)		11.8361 (17.5617)		0.1079 (0.1134)		0.0219 (0.0251)		0.4511 (0.9369)
Below_{t-2}	0.0015** (0.0006)	0.0015** (0.0006)	-0.3862** (0.1636)	-0.3772** (0.1647)	-2.0816 (1.2581)	-1.8092 (1.2905)	0.0154* (0.0083)	0.0150* (0.0081)	0.0015 (0.0012)	0.0015 (0.0012)	0.0145 (0.0707)	0.0177 (0.0712)
LargeBanks_{t-1}	-0.0003 (0.0007)	-0.0004 (0.0007)	0.0889 (0.1930)	0.0922 (0.1913)	2.0885 (2.5263)	2.2710 (2.4979)	-0.0008 (0.0110)	-0.0024 (0.0112)	-0.0010 (0.0019)	-0.0014 (0.0019)	-0.0023 (0.1092)	-0.0065 (0.1124)
Constant	0.0115 (0.0100)	0.0121 (0.0100)	1.7722 (2.4967)	1.7047 (2.4988)	-12.5529 (22.7125)	-12.3168 (22.5633)	0.3891** (0.1658)	0.3967** (0.1679)	-0.0040 (0.0310)	-0.0006 (0.0314)	5.3491*** (1.2040)	5.3290*** (1.2201)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,753	1,753	1,753	1,753	1,753	1,753	1,486	1,486	1,753	1,753	1,753	1,753
R-squared	0.1793	0.1812	0.1798	0.1797	0.0635	0.0607	0.2345	0.2335	0.3822	0.3838	0.4132	0.4133
Bank	149	149	149	149	149	149	141	141	149	149	149	149
Wald tests												
α1+α2	0.0002		0.0171		2.1366***		-0.0040		0.0001		0.0030	
α'1+α'2		0.0091*		-0.3600		31.3288***		0.0089		0.0289		-0.0048

[Table continued on next page]

Panel C: net stable funding ratio negative shock												
	SDROA		ZScore		SharpeRatio		NPL		SDDSR		MDZscore	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
NegativeShock_{t-1}(α'1)	0.0001 (0.0002)		0.0165 (0.0720)		0.7541 (0.9992)		0.0020 (0.0020)		-0.0002 (0.0005)		0.0287 (0.0278)	
NegativeShock_{t-1}xLargeBanks_{t-1}(α'2)	-0.0000 (0.0003)		0.0375 (0.1010)		-0.6255 (1.2168)		-0.0054* (0.0029)		0.0001 (0.0010)		0.0001 (0.0429)	
NegativeShockSize_{t-1}(α'1)		-0.0005 (0.0008)		0.0356 (0.2670)		8.0874* (4.4460)		-0.0236** (0.0110)		-0.0007 (0.0023)		0.1538 (0.1334)
NegativeShockSize_{t-1}xLargeBanks_{t-1}(α'2)		-0.0016 (0.0014)		0.8586* (0.4363)		-6.1185 (5.5973)		-0.0135 (0.0202)		-0.0021 (0.0061)		0.0464 (0.1978)
Below_{t-2}	-0.0006* (0.0003)	-0.0006 (0.0003)	0.2049** (0.0963)	0.2065** (0.0958)	0.3221 (0.8262)	0.3821 (0.7869)	-0.0043 (0.0030)	-0.0039 (0.0031)	-0.0017** (0.0008)	-0.0017** (0.0008)	0.0578 (0.0361)	0.0628* (0.0356)
LargeBanks_{t-1}	-0.0004 (0.0007)	-0.0003 (0.0007)	0.1042 (0.2177)	0.0899 (0.2074)	2.7333 (2.5300)	2.7082 (2.4908)	-0.0007 (0.0113)	-0.0023 (0.0111)	-0.0015 (0.0017)	-0.0014 (0.0017)	0.0035 (0.1080)	0.0017 (0.1074)
Constant	0.0094 (0.0097)	0.0092 (0.0097)	2.2411 (2.4429)	2.3131 (2.4281)	-15.2380 (22.7072)	-13.2794 (22.0576)	0.3845** (0.1608)	0.3711** (0.1601)	-0.0077 (0.0298)	-0.0080 (0.0298)	5.4084*** (1.1735)	5.4654*** (1.1687)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,753	1,753	1,753	1,753	1,753	1,753	1,486	1,486	1,753	1,753	1,753	1,753
R-squared	0.1693	0.1713	0.1766	0.1797	0.0578	0.0598	0.2256	0.2311	0.3831	0.3834	0.4159	0.4163
Bank	149	149	149	149	149	149	141	141	149	149	149	149
Wald tests												
α'1+α'2	0.0000		0.0541		0.1286		-0.0034		-0.0002		0.0289	
α'1+α'2		-0.0021*		0.8942***		1.9689		-0.0371*		-0.0028		0.2003

Table 9**Negative liquidity shock and bank risk: effect of capital regulatory pressure**

This table displays the impact of capital regulatory pressure on the relationship between shock of liquidity and bank risk using a sample of European publicly traded banks during 2005-2020. SDROA is the standard deviation of ROA over the preceding 3 years. ZScore measures bank risk of default = $\ln[(ROA+Equity)/SDROA]$. SharpeRatio = ROE/SDROE. NPL= Non-performing loans/total assets. SDDSR is the standard deviation of daily stock returns. MDZscore is the market based zscore= $\ln[(\text{daily stock returns}+1)/SDDSR]$. NegativeShock equal to one if $\Delta LiquidityRatio_{i,t} < 0$ and $Target_{i,t-1} > LiquidityRatio_{i,t-1}$ and $gap_{i,t} > gap_{i,t-1}$ and 0 otherwise. NegativeShockSize equal to $|\Delta LiquidityRatio|$ if NegativeShock=1 and zero otherwise. RegulatoryPressure equal to one if bank tier 1 capital to RWA ratio below 8% and zero otherwise. Below equal to one if $LiquidityRatio < Target$ and zero otherwise. Controls are Size is the natural logarithm of total assets. Equity=equity/Total assets. NII= Non-interest income/operating income. CIR is the cost income ratio. GDPGrowth is the real Gross Domestic Product growth. OLS with bank fixed effects and year fixed effects. P-values based on robust standard errors are shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	SDROA		ZScore		SharpeRatio		NPL		SDDSR		MDZscore	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
NegativeShock_{t-1}(β1)	-0.0001 (0.0002)		0.1222* (0.0676)		2.4915*** (0.9058)		-0.0064** (0.0025)		0.0010 (0.0007)		0.0035 (0.0251)	
NegativeShock_{t-1} × RegulatoryPressure_{t-1}(β2)	-0.0012** (0.0006)		0.1739 (0.1490)		0.7081 (1.7409)		-0.0078 (0.0065)		-0.0036* (0.0021)		0.1261 (0.0939)	
NegativeShockSize_{t-1}(β'1)		0.0009 (0.0035)		0.7689 (1.0273)		14.3785 (9.9730)		-0.0602 (0.0461)		0.0295 (0.0202)		-0.4948 (0.5467)
NegativeShockSize_{t-1} × RegulatoryPressure_{t-1}(β'2)		-0.0111 (0.0078)		2.0808 (2.1274)		10.0430 (21.3035)		-0.0640 (0.0955)		-0.0561** (0.0266)		2.2465** (0.9417)
Below_{t-2}	0.0003 (0.0003)	0.0003 (0.0003)	-0.1839* (0.0934)	-0.1593* (0.0954)	-1.9266** (0.9564)	-1.4176 (1.0315)	0.0109** (0.0046)	0.0099** (0.0046)	-0.0010 (0.0010)	-0.0011 (0.0009)	0.0301 (0.0423)	0.0368 (0.0420)
RegulatoryPressure_{t-1}	-0.0004 (0.0005)	-0.0007 (0.0005)	0.3149** (0.1299)	0.3606*** (0.1328)	1.3442 (1.5929)	1.7549 (1.4366)	-0.0055 (0.0060)	-0.0084 (0.0061)	-0.0010 (0.0016)	-0.0014 (0.0014)	0.0422 (0.0789)	0.0527 (0.0668)
Constant	0.0037 (0.0113)	0.0041 (0.0115)	4.3081 (2.7843)	4.2371 (2.8131)	14.0442 (25.2095)	12.3894 (25.6532)	0.2547* (0.1445)	0.2574* (0.1453)	0.0049 (0.0352)	0.0055 (0.0354)	4.9390*** (1.2645)	4.9464*** (1.2721)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,392	1,392	1,392	1,392	1,392	1,392	1,223	1,223	1,392	1,392	1,392	1,392
R-squared	0.1452	0.1411	0.1999	0.1973	0.0973	0.0892	0.2619	0.2556	0.4364	0.4381	0.4653	0.4664
Bank	142	142	142	142	142	142	135	135	142	142	142	142
Wald tests												
β1+β2	-0.0013**		0.2961**		3.1996**		-0.0142**		-0.0026		0.1296	
β'1+β'2		-0.0103		2.8497		24.4216		-0.1242*		-0.0267**		1.7517***

[Table continued on next page]

Panel B: total deposits-to-total assets negative shock												
	SDROA		ZScore		SharpeRatio		NPL		SDDSR		MDZscore	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
NegativeShock _{t-1} (β1)	0.0002		0.0128		1.0042*		-0.0030*		0.0005		-0.0054	
	(0.0002)		(0.0620)		(0.5641)		(0.0017)		(0.0006)		(0.0208)	
NegativeShock _{t-1} ×RegulatoryPressure _{t-1} (β2)	0.0002		-0.1120		-0.6356		0.0062		-0.0002		0.0317	
	(0.0004)		(0.1408)		(1.7431)		(0.0046)		(0.0016)		(0.0910)	
NegativeShockSize _{t-1} (β'1)		0.0050		-0.4743		20.5657		-0.0456		0.0378		-0.7013
		(0.0048)		(1.2406)		(13.0906)		(0.0563)		(0.0244)		(0.6894)
NegativeShockSize _{t-1} ×RegulatoryPressure _{t-1} (β'2)		-0.0018		2.4117		-8.8801		0.0174		-0.0352		1.9211
		(0.0091)		(2.5479)		(23.9766)		(0.1138)		(0.0299)		(1.2273)
Below _{t-2}	0.0009*	0.0010*	-0.2791	-0.2699	-1.6423	-1.4767	0.0105	0.0100	0.0003	0.0001	0.0224	0.0276
	(0.0005)	(0.0005)	(0.1724)	(0.1726)	(1.6266)	(1.6391)	(0.0080)	(0.0080)	(0.0013)	(0.0013)	(0.0743)	(0.0747)
RegulatoryPressure _{t-1}	-0.0010*	-0.0009*	0.4588***	0.3679***	2.2554	2.0939	-0.0132*	-0.0103	-0.0023	-0.0020	0.0841	0.0699
	(0.0006)	(0.0005)	(0.1561)	(0.1394)	(1.7673)	(1.5259)	(0.0069)	(0.0065)	(0.0018)	(0.0015)	(0.0908)	(0.0705)
Constant	0.0055	0.0055	4.0105	4.2376	12.5442	14.0735	0.2594*	0.2539*	0.0090	0.0114	4.7996***	4.8069***
	(0.0118)	(0.0118)	(2.8730)	(2.8593)	(25.5929)	(25.1989)	(0.1490)	(0.1505)	(0.0355)	(0.0358)	(1.2675)	(1.2860)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,392	1,392	1,392	1,392	1,392	1,392	1,223	1,223	1,392	1,392	1,392	1,392
R-squared	0.1450	0.1448	0.1975	0.1977	0.0879	0.0875	0.2493	0.2482	0.4330	0.4357	0.4621	0.4635
Bank	142	142	142	142	142	142	135	135	142	142	142	142
Wald tests												
β1+β2	0.0004		-0.0993		0.3686		0.0032		0.0003		0.0263	
β'1+β'2		0.0032		1.9373		11.6856		-0.0283		0.0025		1.2198

[Table continued on next page]

Panel C: net stable funding ratio negative shock												
	SDROA		ZScore		SharpeRatio		NPL		SDDSR		MDZscore	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
NegativeShock _{t-1} (β1)	-0.0000		0.0326		0.2506		-0.0028*		0.0000		0.0163	
	(0.0002)		(0.0604)		(0.6404)		(0.0017)		(0.0004)		(0.0198)	
NegativeShock _{t-1} × RegulatoryPressure _{t-1} (β2)	0.0003		-0.0481		0.1347		0.0040		0.0000		0.0254	
	(0.0003)		(0.1221)		(1.2616)		(0.0054)		(0.0014)		(0.0629)	
NegativeShockSize _{t-1} (β'1)		-0.0011		0.4067		2.0681		-0.0248**		-0.0001		0.1170
		(0.0007)		(0.2468)		(3.2625)		(0.0109)		(0.0027)		(0.0899)
NegativeShockSize _{t-1} × RegulatoryPressure _{t-1} (β'2)		0.0011		-0.2831		1.8274		-0.0070		0.0016		-0.0568
		(0.0022)		(0.5325)		(7.2056)		(0.0195)		(0.0099)		(0.4125)
Below _{t-2}	-0.0008**	-0.0008**	0.2152**	0.2195**	-0.3542	-0.3095	-0.0065**	-0.0070**	-0.0013	-0.0012	0.0251	0.0286
	(0.0004)	(0.0004)	(0.0998)	(0.0993)	(1.0194)	(0.9709)	(0.0029)	(0.0029)	(0.0010)	(0.0010)	(0.0396)	(0.0395)
RegulatoryPressure _{t-1}	-0.0010*	-0.0009*	0.4275***	0.4180***	2.0804	2.0412	-0.0114*	-0.0093	-0.0024	-0.0024	0.0872	0.0983
	(0.0005)	(0.0005)	(0.1516)	(0.1358)	(1.4622)	(1.3227)	(0.0068)	(0.0059)	(0.0015)	(0.0016)	(0.0577)	(0.0599)
Constant	0.0041	0.0041	4.3220	4.3802	12.1251	12.8372	0.2522*	0.2434*	0.0079	0.0081	4.7373***	4.7776***
	(0.0115)	(0.0114)	(2.8642)	(2.8493)	(25.6443)	(25.4009)	(0.1454)	(0.1451)	(0.0346)	(0.0343)	(1.2448)	(1.2436)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,392	1,392	1,392	1,392	1,392	1,392	1,223	1,223	1,392	1,392	1,392	1,392
R-squared	0.1453	0.1462	0.1979	0.1990	0.0857	0.0861	0.2488	0.2530	0.4338	0.4339	0.4628	0.4628
Bank	142	142	142	142	142	142	135	135	142	142	142	142
Wald tests												
β1+β2	0.0002		-0.0156		0.3853		0.0013		0.0001		0.0417	
β'1+β'2		-0.0000		0.1236		3.8955		-0.0318		0.0015		0.0602

Table 10**Positive liquidity shock and bank risk**

This table displays the relationship between positive shock of liquidity and bank risk using a sample of European publicly traded banks during 2005-2020. SDROA is the standard deviation of ROA over the preceding 3 years. ZScore measures bank risk of default = $\ln[(ROA+Equity)/SDROA]$. SharpeRatio = $ROE/SDROE$. NPL = Non-performing loans/total assets. SDDSR is the standard deviation of daily stock returns. MDZscore is the market based zscore = $\ln[(\text{daily stock returns}+1)/SDDSR]$. PositiveShock equal to one if $\Delta LiquidityRatio_{i,t} > 0$ and $Target_{i,t-1} < LiquidityRatio_{i,t-1}$ and $gap_{i,t} < gap_{i,t-1}$ and 0 otherwise. PositiveShockSize equal to $|\Delta LiquidityRatio|$ if PositiveShock=1 and zero otherwise. Below equal to one if $LiquidityRatio > Target$ and zero otherwise. controls are: Size is the natural logarithm of total assets. Equity=equity/Total assets. NII= Non-interest income/operating income. CIR is the cost income ratio. GDPGrowth is the real Gross Domestic Product growth. OLS with bank fixed effects and year fixed effects. P-values based on robust standard errors are shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	SDROA		ZScore		SharpeRatio		NPL		SDDSR		MDZscore	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
PositiveShock_{t-1}	-0.0001 (0.0002)		0.0918 (0.0668)		-0.2161 (0.8521)		0.0063** (0.0028)		0.0002 (0.0006)		-0.0142 (0.0262)	
PositiveShockSize_{t-1}		-0.0038** (0.0018)		1.5026*** (0.4925)		1.9045 (5.5901)		0.0655 (0.0403)		-0.0014 (0.0040)		-0.0420 (0.1543)
Above_{t-2}	-0.0003 (0.0003)	-0.0002 (0.0002)	0.1363 (0.0919)	0.1428 (0.0872)	2.4412** (1.0743)	2.3046** (0.9894)	-0.0142*** (0.0038)	-0.0128*** (0.0039)	0.0002 (0.0009)	0.0003 (0.0008)	-0.0176 (0.0396)	-0.0228 (0.0391)
Constant	0.0118 (0.0098)	0.0125 (0.0099)	1.2698 (2.4079)	1.0155 (2.4308)	-26.4834 (22.5003)	-27.0210 (22.5018)	0.4022** (0.1577)	0.3940** (0.1556)	-0.0034 (0.0324)	-0.0030 (0.0325)	5.4049*** (1.2312)	5.4045*** (1.2310)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,753	1,753	1,753	1,753	1,753	1,753	1,486	1,486	1,753	1,753	1,753	1,753
R-squared	0.1669	0.1696	0.1759	0.1791	0.0605	0.0605	0.2377	0.2390	0.3803	0.3803	0.4135	0.4134
Bank	149	149	149	149	149	149	141	141	149	149	149	149

[Table continued on next page]

Panel B: total deposits-to-total assets positive shock												
	SDROA		ZScore		SharpeRatio		NPL		SDDSR		MDZscore	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
PositiveShock_{t-1}	0.0002 (0.0002)		-0.0504 (0.0667)		-1.1022 (1.0832)		0.0039 (0.0033)		0.0004 (0.0005)		0.0044 (0.0254)	
PositiveShockSize_{t-1}		-0.0019 (0.0048)		-0.7754 (1.5497)		-19.4006 (12.7802)		0.1881* (0.1036)		-0.0121 (0.0125)		0.3391 (0.5839)
Above_{t-2}	-0.0016** (0.0007)	-0.0015** (0.0006)	0.4017** (0.1715)	0.3890** (0.1697)	2.1759* (1.2940)	1.9356 (1.3590)	-0.0165* (0.0086)	-0.0174** (0.0084)	-0.0019 (0.0012)	-0.0015 (0.0012)	-0.0170 (0.0693)	-0.0201 (0.0715)
Constant	0.0128 (0.0097)	0.0135 (0.0097)	1.2946 (2.4459)	1.2570 (2.4595)	-20.8730 (21.4901)	-21.4276 (22.0685)	0.4040** (0.1626)	0.3912** (0.1619)	-0.0008 (0.0321)	0.0014 (0.0322)	5.3512*** (1.2272)	5.3250*** (1.2279)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,753	1,753	1,753	1,753	1,753	1,753	1,486	1,486	1,753	1,753	1,753	1,753
R-squared	0.1789	0.1786	0.1798	0.1796	0.0580	0.0574	0.2338	0.2373	0.3817	0.3818	0.4132	0.4133
Bank	149	149	149	149	149	149	141	141	149	149	149	149
Panel C: net stable funding ratio positive shock												
	SDROA		ZScore		SharpeRatio		NPL		SDDSR		MDZscore	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
PositiveShock_{t-1}	-0.0001 (0.0004)		-0.0258 (0.0979)		-0.3537 (0.7352)		-0.0113*** (0.0038)		-0.0009 (0.0006)		0.0550* (0.0324)	
PositiveShockSize_{t-1}		-0.0001 (0.0010)		-0.1019 (0.2650)		-1.7457 (1.8308)		-0.0284** (0.0111)		-0.0020 (0.0015)		0.0628 (0.0654)
Above_{t-2}	0.0006* (0.0003)	0.0006 (0.0003)	-0.2028** (0.0983)	-0.2018** (0.0968)	-0.2963 (0.8869)	-0.2529 (0.8239)	0.0078** (0.0037)	0.0069* (0.0037)	0.0020** (0.0009)	0.0019** (0.0008)	-0.0820** (0.0368)	-0.0708** (0.0356)
Constant	0.0098 (0.0094)	0.0097 (0.0096)	2.2374 (2.3625)	2.2081 (2.3710)	-19.8280 (22.1098)	-20.2539 (22.0247)	0.3899** (0.1589)	0.3830** (0.1594)	-0.0055 (0.0313)	-0.0064 (0.0313)	5.4357*** (1.1862)	5.4878*** (1.1894)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,753	1,753	1,753	1,753	1,753	1,753	1,486	1,486	1,753	1,753	1,753	1,753
R-squared	0.1688	0.1688	0.1758	0.1759	0.0557	0.0558	0.2280	0.2284	0.3829	0.3828	0.4156	0.4152
Bank	149	149	149	149	149	149	141	141	149	149	149	149

Appendix

Table A.1

Negative liquidity Shock and Bank Risk (risk measures computed using four-years rolling windows)

This table display the relationship between shock of liquidity and bank risk using a sample of European publicly traded banks during 2005-2020. SDROA4 is the standard deviation of ROA over the preceding 4 years. ZScore4 measures bank risk of default = $\ln[(ROA+Equity)/SDROA4]$. SharpeRatio = $ROE/SDROE4$. NegativeShock equal to one if $\Delta LiquidityRatio_{i,t} < 0$ and $Target_{i,t-1} > LiquidityRatio_{i,t-1}$ and $gap_{i,t} > gap_{i,t-1}$ and 0 otherwise. NegativeShockSize equal to $|\Delta LiquidityRatio|$ if NegativeShock=1 and zero otherwise. Below equal to one if $LiquidityRatio < Target$ and zero otherwise. Controls are: Size is the natural logarithm of total assets. Equity=equity/Total assets. NII= Non-interest income/operating income. CIR is the cost income ratio. GDPGrowth is the real Gross Domestic Product growth. OLS with bank fixed effects and year fixed effects. P-values based on robust standard errors are shown in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Panel A: total deposits-to-net loans negative shock

	SDROA4		ZScore4		SharpeRatio4	
	(1)	(2)	(3)	(4)	(5)	(6)
NegativeShock _{t-1}	-0.0002 (0.0002)		0.1388** (0.0553)		1.6922*** (0.4630)	
NegativeShockSize _{t-1}		0.0018 (0.0041)		0.7256 (0.8105)		13.3326** (5.8459)
Below _{t-2}	0.0006** (0.0003)	0.0005* (0.0003)	-0.2577*** (0.0814)	-0.2313*** (0.0814)	-2.4511*** (0.6098)	-2.1802*** (0.6117)
Constant	0.0162 (0.0127)	0.0169 (0.0129)	0.6606 (2.4689)	0.4828 (2.4894)	-19.6088 (14.2775)	-21.1841 (14.6327)
Controls	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES
Observations	1,753	1,753	1,753	1,753	1,753	1,753
R-squared	0.1632	0.1627	0.1886	0.1849	0.1015	0.0932
Bank	149	149	149	149	149	149

Panel B: total deposits-to-total assets negative shock

	SDROA4		ZScore4		SharpeRatio4	
	(1)	(2)	(3)	(4)	(5)	(6)
NegativeShock _{t-1}	0.0001 (0.0002)		0.0422 (0.0425)		0.9459*** (0.3235)	
NegativeShockSize _{t-1}		0.0096* (0.0049)		0.4512 (1.0491)		15.9520*** (6.0919)
Below _{t-2}	0.0019*** (0.0007)	0.0018** (0.0007)	-0.3889*** (0.1441)	-0.3793*** (0.1444)	-1.7698** (0.7766)	-1.6124** (0.7923)
Constant	0.0171 (0.0129)	0.0183 (0.0130)	0.5856 (2.5356)	0.5652 (2.5460)	-18.9340 (14.5010)	-18.5219 (14.4413)
Controls	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES
Observations	1,753	1,753	1,753	1,753	1,753	1,753
R-squared	0.1764	0.1791	0.1881	0.1878	0.0866	0.0850
Bank	149	149	149	149	149	149

[Table continued on next page]

Panel C: net stable funding ratio negative shock						
	SDROA4		ZScore4		SharpeRatio4	
	(1)	(2)	(3)	(4)	(5)	(6)
NegativeShock_{t-1}	0.0001 (0.0002)		0.0529 (0.0396)		0.4121 (0.3180)	
NegativeShockSize_{t-1}		-0.0016* (0.0009)		0.6497*** (0.1927)		2.4248 (1.5655)
Below_{t-2}	-0.0006* (0.0004)	-0.0006 (0.0004)	0.1708* (0.0930)	0.1752* (0.0927)	0.4434 (0.4950)	0.5174 (0.4909)
Constant	0.0151 (0.0127)	0.0148 (0.0127)	0.8879 (2.4901)	1.0807 (2.4649)	-19.7095 (14.4976)	-18.8588 (14.3033)
Controls	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES
Observations	1,753	1,753	1,753	1,753	1,753	1,753
R-squared	0.1631	0.1647	0.1826	0.1866	0.0816	0.0819
Bank	149	149	149	149	149	149

Table A.2

Bank balance sheet weighting used to compute net stable funding ratio

Assets	Weights	Liabilities	Weights
<i>Required stable funding</i>		<i>Available stable funding</i>	
1 Cash & due from banks	0	1 Total deposits	
2 Total investments	0.5	1.1 Demand deposits	0.9
3 Net Loans		1.2 Savings/other time deposits	0.95
3.1 Total Loans		1.3 Unspecified deposits	0
3.1.1 Interbank Loans	0.15	2 Total debt	
3.1.3 Commercial & industrial loans	0.5	2.1 Short term debt & current portion of long-term debt	0
3.1.4 Consumer & installment loans	1	2.2 Long-term debt	1
3.1.2 Other loans	1	3 Provisions for risks and charges	1
3.2 Unearned income	1	4 Deferred income	1
3.3 Reserves for loans losses	1	5 Deferred taxes	1
4 Investment in associated companies	1	6 Deferred tax liability in untaxed reserves	1
5 Customer liabilities on acceptances (Assets)	1	7 Other liabilities	1
6 Real estate assets	1	8 Non-equity reserves	1
7 Net property, plant & equipment	1	9 Minority interest	1
8 Other assets	1	10 Preferred stock	1
		11 Common equity	1