Bank Supervision and Liquidity Creation[☆]

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Abstract

This paper examines whether different supervisory practices affect banks' liquidity creation. Using a sample of commercial banks in the 27 European countries over 1996-2013, I document a negative association between regulators' supervisory power and bank liquidity creation. However, the level of liquidity creation is unaffected by market-based monitoring. Further analysis reveals that the quality of the institutional environment and market incentives play a crucial role in explaining the cross-country variation in bank liquidity creation. The results of additional analyses suggest that supervisory power and private monitoring affect bank liquidity creation by mitigating liquidity risk, and these two supervisory practices are complementary mechanisms in reducing liquidity risks. Overall, the results provide new insights into the design of regulatory and supervisory practices of financial institutions.

JEL classification: G20, G21, G28
Keywords: liquidity; governance; bank regulation; supervision

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1. Introduction

Financial regulation and supervision schemes have been a highly controversial issue among policymakers and scholars in the past few decades. Despite the growing literature on the role of bank regulatory and supervisory frameworks for bank stability (see e.g. Barth et al., 2004; Barth et al., 2006; Beck et al., 2006; Chortareas et al., 2012; Barth et al., 2013; Chen et al., 2020), our understanding of how bank regulation and supervision affect banks' ability to create liquidity is very scant. The existing literature on the relationship between bank liquidity creation and bank regulatory and supervisory policies is rather limited to bank regulatory capital (see e.g. Berger and Bouwman, 2009; Distinguin et al., 2013; Fungáčová et al., 2017). What are the real consequences of empowering official supervisory authorities, and private sector monitoring to financial regulators? Despite the importance, this question is understudied in the literature. The purpose of this paper is to examine how these two supervisory policies affect bank liquidity creation.

In general, there are conflicting and inconclusive views on the impact of official supervisory power and private monitoring from an empirical perspective. On the one hand, prior studies have acknowledged that strengthening official supervisory power enhances bank competition, corruption, and loan spreads (see e.g. Beck et al., 2006; Li, 2019; He et al., 2021), but it is not related to bank development, efficiency, and performance (see e.g. Barth et al., 2004; and Barth et al., 2013). On the other hand, the empirical findings of Chortareas et al. (2012) and Hoque et al. (2015) suggest that greater supervisory power is associated with higher bank efficiency and bank-level risk.

Considering the impact of private sector monitoring, previous studies show that market-based monitoring of banks in terms of fostering information disclosure is positively linked to bank

development, performance, and efficiency (see e.g. Barth et al., 2004; Barth et al., 2013). In contrast, empirical evidence also shows that greater private sector monitoring can result in higher bank inefficiency, lower risk, and less intensive competition (Chortareas et al., 2012; Hoque et al., 2015; Li, 2019). Given that there are two views that provide contrasting predictions, as discussed by Barth et al. (2006, 2004), the predictions about the effect of these two supervisory practices on bank liquidity creation are not clear ex-ante.[1] Due to these opposing views on supervisory power and market-based monitoring, it is of interest to examine the linkage between bank supervision and regulation and liquidity creation empirically.

My analysis is motivated by previous theoretical and empirical work. From a theoretical perspective, Mailath and Mester (1994) show that the regulator's policy influences the risk-taking behavior of banks. In the absence of effective and sound supervision, the likelihood of bank distress and bank runs increases when illiquid assets are financed with liquid liabilities (see e.g. Diamond and Dybvig, 1983; Allen and Gale, 2004). From an empirical perspective, a recent study by Berger et. al (2016) finds that regulatory interventions reduce bank liquidity creation using a supervisory German dataset.[2] Using a sample of commercial banks in the 27 European countries, I advance this line of inquiry by focusing on the role of two supervisory systems (i.e. official supervisory power and private sector monitoring) in enhancing or impeding the ability of banks to create liquidity.

[1] More discussion can be found in the relevant literature review and the hypothesis development in Section 2.
[2] Berger et al. (2016) focuses on all the actions taken by authorities in Germany which are more related to restrictions on banking activities and disciplinary actions such as restrictions and prohibitions of lending, deposit taking activities, and profit distributions, instructions to the bank's management, limitations on the scope of managerial decisions, appointment of a trustee, hearing about dismissal of executives, actual dismissal of executives, official disapprovals, fines for the institutions and executives, warnings of executives and threats of measures according to the Banking Act. It does not consider the dynamics between bank supervision, private monitoring, quality of cross-country governance and the ability of banks to create liquidity.

An answer to the question raised in this paper is an important aspect of a well-functioning financial system and helps policymakers not only to understand the determinants of bank liquidity creation, but also to make informed decisions about the regulation and supervision of the banking system. In this study, bank supervision, and private monitoring are quantified based on surveys conducted by Barth et al. (2004, 2006, 2008, 2013) under the auspices of the World Bank. Overall, the four surveys provide a detailed and comprehensive picture of differences in bank regulation and supervision across various countries. Therefore, the data provide an excellent opportunity to examine the impact of a bank's supervisory environment on bank liquidity creation.

Banks traditionally provide liquidity by funding long-term illiquid assets with short-term liquid liabilities. However, the process of liquidity creation reduces the liquidity of banks and exposes them to different types of risks, such as liquidity risks, and bank runs (Diamond and Dybvig, 1983; Kashyap et al., 2002; Allen and Gale, 2004). [3] In this paper, to measure liquidity provision by banks, I use the three-step procedure of Berger and Bouwman (2009). Each component of liquidity creation such as bank loans and transaction deposits has different theoretically-driven weights based on ease, cost, and time for customers to obtain liquid funds from the bank.

Using data on 220 publicly traded commercial banks in Europe over the period 1996-2013, I obtain the following results. First, a traditional approach to bank supervision that entails strengthening official supervisory authorities tends to decrease bank liquidity creation. This finding is consistent with the "supervisory power view", suggesting that powerful supervisors help prevent banks from engraining in taking excessive risks. The result is also broadly consistent with

[3] In the aftermath of global financial crisis, the Basel Committee on Banking Supervision documented "that many banks had failed to take account of a number of basic principles of liquidity risk management when liquidity was plentiful" (Bank for International Settlements, 2008).

the finding of Agoraki et al. (2011), who document that official supervisory authorities reduce bank risk-taking behavior. In addition, a supervisory strategy that empowers private monitoring of banks by disclosing accurate information to the private sector does not tend to be related to bank liquidity creation. These results are robust when I perform a two-stage least squares (2SLS) analysis using ethnic fractionalization as the instrumental variable.

To identify the underlying economic channel, I investigate how the impact of official supervisory power and private sector monitoring varies across the institutional quality characteristics of individual countries. I find that the observed negative impact of regulators' supervisory power on liquidity creation weakens at higher levels of regulatory quality, the overall quality of country-level governance, and control of corruption. The empirical results also suggest that the effect of private sector monitoring on liquidity creation strengthens at higher levels of regulatory quality, the overall quality of nation-wide governance, and control of corruption. Overall, the analysis shows that the empirical findings depend on the type of institutional quality environments. As such, it is important to identify differences in the stringency of law enforcement and institutional quality attributes that can enhance or impede regulatory and supervisory implementation capacity. I then provide further evidence that the effect of private sector monitoring on liquidity creation is more pronounced when there are weaker incentives for the private sector to monitor banks.

The analysis is validated by examining the direct impact of regulators' supervisory power, and private monitoring, on bank liquidity risk management, as measured by the inverse of the net stable funding ratio, and liquidity transformation gap ratio. I find that the traditional approach to bank supervision that empowers official supervisory authorities tends to decrease bank liquidity risk. Moreover, a supervisory strategy that strengthens private monitoring of banks lowers bank

illiquidity. Overall, I find that banks operating in environments with more stringent private sector monitoring and supervisory measures are less exposed to liquidity risk.

In addition to exploring the direct impact of the effectiveness of the two supervisory practices on liquidity risk, I attempt to provide an assessment of the impact that interplay between supervisory power and private monitoring has upon bank liquidity requirements. In particular, I investigate whether and to what extent the effectiveness of the combined effect of supervisory power and private monitoring has a bearing on bank illiquidity. The results suggest that there is an amplifying combined impact of the two supervisory practices on bank illiquidity. Collectively, the empirical findings indicate that policymakers and authorities may need to pay closer attention to the interplay effect of different bank regulatory and supervisory policies, rather than attempting to identify the separate impacts of regulatory and supervisory practices.

This paper contributes to the literature in many ways. First, this paper examines first and foremost whether regulators' supervisory power and private sector monitoring affect bank liquidity creation. In this regard, this study contributes to the recent bank liquidity creation literature. Specifically, I complement and extend the recent findings of Berger et al. (2016) by focusing on the role of the traditional approach to bank supervision, which entails strengthening official supervisory authorities, and a supervisory strategy that empowers private monitoring of banks. Broadly consistent with the negative relation between regulatory interventions and bank liquidity creation documented by Berger et al. (2016), the findings in this paper indicate that banks operating in environments with stringent supervisory practices create lower levels of bank liquidity. Second, I show that the quality of the institutional environment plays a crucial role in explaining the cross-country variation in bank liquidity creation. Therefore, this study enriches our understanding of the role of different institutional quality characteristics on the linkage between supervisory

enforcement and the ability of banks to create liquidity. This paper also provides an insight into the design of bank supervision schemes with different implementations capacity in terms of the institutional quality environment. Third, I show that market incentives have an important role in monitoring banks. Disclosing information about banks does not necessarily imply greater private sector monitoring unless market participants have incentives to use the published information to monitor banks. The prevalence of deposit insurance and government interventions in the banking sector may undermine the incentives of market participants to monitor banks. Taken together, a lack of incentives of market participants may diminish the beneficial effect of supervisory monitoring. Thus, bank supervisors and policymakers may need to further improve private incentives to monitor banks. Finally, by examining the conditioning effects of institutional quality and market incentives, I contribute to the wider banking literature that investigates such effects on the association between bank regulatory and supervisory policies and bank stability (see e.g. Chortareas et al, 2012; Cihak et al, 2013; Bermpei et al., 2018).

The rest of the paper is organized as follows. Section 2 presents the relevant literature discussion and hypothesis development. Section 3 discusses the data, measures of bank liquidity creation, and bank supervision. Section 4 presents the methodology and the empirical results. Section 6 provides additional analysis, and Section 6 concludes the paper.

2. Related literature and the hypothesis development

Relatively little is known on the relationship between supervisory power and market-based monitoring and bank liquidity creation. The theoretical study by Mailath and Mester (1994) shows that the regulator's policy influences the risk-taking behavior of banks. Nevertheless, the existing

empirical studies are inconclusive and provide conflicting views on the role of official supervisory power on banking system stability. On the one hand, an empirical study by Agoraki et al. (2011) finds that official supervisory power reduces bank risk-taking behavior. Using a dummy variable for one or more interventions by regulators in Germany, such as activity restrictions, pay fines, dismissal of executives, and change process, Berger et al. (2016) recently found that regulatory interventions reduce bank liquidity creation. Empirical evidence by Chortareas et al. (2012) also suggests that official supervisory power can improve bank efficiency. On the other hand, Fernández and González (2005) document that official supervisory power exerts a particularly beneficial effect on reducing bank risk-taking only when auditing and accounting requirements are not implemented. Hoque et al. (2015) also show that empowering official supervisory agencies leads to higher systematic risk and bank risk-taking. Previous studies by Barth et al. (2004, 2013) document that there is no strong association between supervisory power and bank performance, stability, and efficiency.

As discussed in Barth et al. (2004, 2006), according to the "supervisory power view", powerful supervisory authorities can act in the best interests of society and maximize society's welfare. In such a situation, they directly discipline and monitor non-compliant banks and can reduce market failure and overcome market imperfections. Thus, a supervisor with ample powers can help prevent banks from engraining in excessive risk-taking behavior, and thereby bank liquidity creation may decline as well, leading to a reduction in bank illiquidity, and their exposure to liquidity risk. In this regard, I conjecture a negative association between supervisory power and bank liquidity creation. In contrast, according to the "regulatory capture view", powerful supervisory authorities may abuse their power and exert their own private benefits rather than social welfare maximization (Shleifer and Vishny, 1998; Djankov, et. al., 2002; Barth et al., 2004;

Barth et al., 2006). Beck et al. (2006) find that official supervisors with ample powers may reduce bank lending integrity which may have an adverse impact on the efficiency of credit allocation. In such a situation, powerful supervisory authorities may force banks to allocate credits to exert political or private benefits. Hence, official supervisory power may have a positive effect on bank liquidity creation.

Apart from the traditional approach to bank supervision, shareholders and other creditors can also monitor and discipline banks through investors' monitoring ability. However, no consensus exists on whether official supervision has an advantage over the private sector in monitoring banks. According to the "private empowerment view", supervisory authorities may not have an incentive to ease market failure because regulators and supervisors do not have an ownership stake in the banks, and thereby, they have different incentives than private creditors for monitoring and disciplining banks. Therefore, facilitating and encouraging private monitoring and market discipline may promote a better functioning banking system. Previous studies have acknowledged that private monitoring of banks can increase bank performance, development, and banks' soundness by reducing moral hazard, which is made by information asymmetries (see e.g. Barth et al., 2004; Fernández and González, 2005; and Hoque et al., 2015). These studies suggest that countries benefit from facilitating private monitoring rather than empowering official authorities. Given that the private sector monitoring can promote better functioning banking systems by lowering banks' riskiness and increasing banks' soundness, I expect a negative association between private monitoring and bank liquidity creation. However, private monitoring might be difficult in a complex and opaque banking sector. For example, Chortareas et al. (2012) find that private sector monitoring can lead to higher bank inefficiency. From this perspective, I expect that private monitoring has a positive impact on bank liquidity creation.

3. Data

The data used in this study are obtained from several sources. To measure bank supervisory power and private sector monitoring, I use the Private Monitoring Index (*PMI*), and the Official Supervisory Power Index (*OSPI*) from the World Bank's Bank Regulation and Supervision Survey, which was conducted in 1999, 2003, 2007, and 2011. Since these surveys are available at only four points in time, I use the previously available survey data until the new one becomes available. In particular, I use the survey data of 1999 during the period 1996-2002, the survey data of 2003 for the years 2003-2006, survey data of 2007 for the years 2007-2010, and survey data of 2011 for years 2011-2013.

The data on the balance sheet of banks are obtained from the Bloomberg database. This database provides a standardized and detailed balance sheet and income statement data. The standardized datasets ensure the accurate representativeness of the banks' sample in each country and extensively and frequently report the detailed balance sheet information for listed banks. Due to unavailable information on private or unlisted banks, I only include listed banks in this study. To compute the liquidity creation measures, I only include banks for which the breakdown of loans based on loan category and the breakdown of deposits based on their maturity are available in Bloomberg. From 1996 to 2013, I identify 220 listed commercial banks in 27 European countries. Table 1 reports the distribution of banks by country.

[Insert Table 1 here]

In addition to the datasets mentioned above, I rely on other data sources in this study. In particular, I use the World Development Indicator (*WDI*) database to obtain economic development variables. To obtain the cross-country private credit, I use the Financial Structure Dataset (Beck et al., 2010). In addition, to compute bank-specific variables, I collect all necessary data on either balance sheets or income statements from the Bloomberg database. Table 2 provides a brief description of all the variables and data sources used in this study. My final sample consists of 2,676 bank-year observations.

[Insert Table 2 here]

3.1. Bank liquidity creation

In this study, I use Berger and Bouwman's (2009) measure of bank liquidity creation. I only measure on-balance sheet liquidity created by banks or their exposure to liquidity risk because there is no detailed breakdown of off-balance sheet data for publically listed European banks in Bloomberg. Specifically, I use the measure of liquidity creation which incorporates all bank on-balance sheet information.

To compute the liquidity creation measure, all assets, liabilities, and equity are classified as liquid, illiquid, and semiliquid following Berger and Bouwman (2009). In the second step, different theoretically-driven weights are assigned to each item. To summarize briefly, positive weights are given to illiquid assets, and liquid liabilities and negative weights are given to liquid assets, illiquid liabilities, and equity. Positive weights are consistent with the theoretical notion that by creating liquidity banks actually take something illiquid from the public and in turn give

the public something liquid. Negative weights are also in line with the theoretical notion that banks can destroy liquidity by financing liquid assets with illiquid liabilities or equity. In the third step, the weighted sum of all on-balance sheet items is calculated. Table 3 shows the balance sheet items and the corresponding weights for calculating bank liquidity creation based on Distinguin et al. (2013).[4] Following Berger and Bouwman (2009), the measure of liquidity creation is normalized by total assets to improve comparability to avoid giving unnecessary weights to the largest banks.

[Insert Table 3 here]

All else being equal, banks can destroy liquidity by financing liquid assets with illiquid liabilities or equity, and banks can create liquidity on their balance sheets by financing relatively illiquid assets such as long-term loans with relatively liquid liabilities such as demand deposits (Bryant, 1980; and Diamond and Dybvig, 1983). Therefore, higher values of liquidity creation show higher bank illiquidity, because banks get more exposed to maturity transformation risk.

3.2. Bank regulation and supervision

I consider the following two bank regulation and supervision variables in this study. First, I use the Official Supervisory Power Index (*OSPI*) which is a measure of the strength of bank supervision, indicating whether the supervisory authorities have the authority to take specific actions to overcome market failures and prevent and correct problems. This index ranges from 0 to 14, with a higher value indicating the higher power of supervisory authorities. Second, I use the

[4] Distinguin et al. (2013) also use the on-balance sheet information in Bloomberg to compute bank liquidity creation.

Private Monitoring Index (*PMI*) to measure the degree to which regulatory and supervisory practices require accurate and reliable information disclosure. *PMI* focuses on strengthening the incentive and ability of private investors to exert effective monitoring and governance over banks and it ranges from 0 to 12, with higher values indicating greater private monitoring.

3.5. Control variables

I include three key bank-specific variables: bank riskiness, measured by the ratio of loan loss provisions to total loans (*LLP_TL*); size, measured as a natural logarithm of bank's total assets (*LnTA*); and bank profitability, measured by the ratio of net income to total equity (*ROE*).

Bank market power influences the availability of funds in the banks and it also affects the distribution of the bank's loan portfolios (see e.g. Petersen and Rajan, 1995; Berger et al., 2005). Hence, banks with ample market power are able to increase their transformation activities by attracting more funds and making more loans. Therefore, I include a control for bank *Market Power* measured by the ratio of total assets of bank *i* in country *j* to the total assets of the banking sector in that country.

I also control for various macroeconomic variables. First, I control for the macroeconomic environment by including the natural logarithm of GDP (*LnGDP*) to measure the country's economic development. Second, the ratio of imports plus exports of goods and services to GDP (Karolyi et al., 2012) is included in the regression to control for *Global Integration*. Third, the ratio of private credit to GDP is included in the regression to control for *Banking Development* (Beck et al., 2010).

Table 4 reports the summary statistics of all variables used in this study. As can be noted from the table, the mean value of supervisory power and private monitoring is 9.89 and 7.79 respectively, suggesting heterogeneity in regulators' supervisory power and market-based monitoring across countries. In addition, bank liquidity creation ranges from a minimum of -0.401 to a maximum of 0.841 with a mean value of 0.192. Overall, the table shows significant heterogeneity in terms of liquidity creation, supervisory policies, bank-level characteristics, and macroeconomic data.

[Insert Table 4 here]

4. Empirical results

4.1. Main results

To assess the relationship between bank supervision policies and bank liquidity creation, I estimate the following model:

$$LC_{ijt}=\alpha+\beta_1 RSP_{jt}+\beta_2 Bank\ Controls_{ijt}+\beta_3 Macro\text{-}Economic\ Variables_{jt}+\theta_j+\gamma_t+\varepsilon_{ijt} \quad (1)$$

where *i* refers to bank *i*, *j* indexes country *j*, *t* denotes period. The dependent variable is bank liquidity creation scaled by total assets at bank *i* in country *j* in year *t* (*LC*). RSP_{jt} is one of the following: official supervisory power (*OSPI*), or private monitoring (*PMI*). Bank-level control variables are bank profitability (*ROE*), bank size (*LnTA*), *Market Power*, and riskiness of bank

assets (*LLP_TL*). Macroeconomic variables include the country's economic development (*LnGDP*), *Global Integration*, and *Banking Development*. θ_j is country fixed effects and γ_t is the time fixed effects to control for time-invariant country characteristics and business cycles.

[Insert Table 5 here]

To ensure that the results are not driven by spurious correlation between the various independent variables, columns 1 and 3 of Table 5 include regulators' supervisory power or private sector monitoring while only controlling for both observed and unobserved heterogeneity across countries. The results indicate that supervisory power is negatively associated with bank liquidity creation, while liquidity creation is mainly unaffected by market-based monitoring. Columns 2 and 4 of Table 5 report the results of the baseline regression. The coefficient estimate of supervisory power is negative and statistically significant, suggesting that strengthening supervisory power is negatively associated with bank liquidity creation. The coefficient estimate in column 1 implies that a one-standard deviation (2.31) increase in supervisory power reduces bank liquidity creation by 1.62% (= 0.007 × 2.31). Given that the mean value of liquidity creation in dollars is $1.34 billion in my sample, this would translate into a $22.7 million decrease in liquidity creation. This result is broadly consistent with the finding of Agoraki et al. (2011), documenting that official supervisory authorities reduce bank risk-taking behavior. Intriguingly, I find that private sector monitoring is not associated with bank liquidity creation.

As for the control variables, I find that the loan loss provision to total assets (*LLP_TA*) and the return on equity (*ROE*) exert significant effects on liquidity creation, which are negative and positive respectively. These results are consistent with the literature on bank stability (see e.g.

Bermpei et al., 2018). I also find that *Global Integration* has a positive and significant association with liquidity creation. This finding is in line with Baradwaj et al. (2016), who find that liberalization of capital control is positively associated with liquidity creation due to the increased mobility of capital flows as a result of financial integration.

4.2. Endogeneity

To deal with the causal effect between supervisory actions and bank liquidity creation, I use an instrumental variable (IV) analysis. A potential endogeneity problem could exist due to reverse causality. For example, being high liquidity creators may expose banks to higher liquidity risk as they are more illiquid compared to those banks that create the least liquidity creation in the economy. Thus, bank liquidity creation may influence the regulatory and supervisory framework in the direction of being more resilient and accommodative to liquidity management. Therefore, regulatory policies might be endogenous to the structure of the banking sector.

I select the instrumental variables for supervisory actions based on law and finance literature. According to the existing literature on law and finance, ethnic fractionalization plays a crucial role in shaping policies and regulations to promote financial developments (Beck et al. 2003a; Beck et al., 2003b; La Porta et al. 1999; Easterly and Levine, 1997). It is the probability that two randomly chosen persons from the country are from two different ethnic groups. A highly ethnically diverse economy may provide adaptation of policies and regulations that may restrict open and competitive financial system. Hence, I believe that it is highly unlikely that this factor would have a direct impact on bank liquidity creation. However, this variable may influence bank liquidity creation

through its impact on bank regulation and supervision. Therefore, the instrument is likely to satisfy the exclusion restriction assumption.

[Insert Table 6 here]

To mitigate potential causality problems, I require a valid instrument that is correlated with my supervisory policies but uncorrelated with the error term. Following the literature, I conduct the standard first stage F-test of excluded instruments to see whether the instrument is relevant. First-stage estimates are obtained by regressing supervisory power or private monitoring on the instrumental variable and other explanatory variables. In the second stage, I regress my liquidity creation measure on the fitted values of the potentially endogenous variables, other controls, and year dummies. I cannot include country fixed effects due to the time-invariant nature of the instrumental variables. The results of the first and second stages are reported in Table 6. As can be noted from Columns 1 and 2 of Table 6, the results of the F-test indicate that the instrumental variable is valid in my first stage estimations. Consistent with the results in Table 5, the second-stage regression estimates indicate that the effect of regulators' supervisory power on bank liquidity creation is negative and statistically significant, while the coefficient estimate on private monitoring is insignificant. Overall, the main empirical findings hold when using instrumental variable regression analyses.

5. Other additional analysis

5.1. The role of bank size

The size of financial institutions can determine the suitable regulation and supervision by both official supervisory authorities and the private sector. Given that bank size influences the level of liquidity creation (Berger and Bouwman, 2009), as well as monitoring stringency, bank business models, the regulatory and supervisory practices, it is of interest to investigate the effect of strengthening supervisory power and private sector monitoring on bank liquidity creation by bank size class.

[Insert Table 7 here]

Table 6 shows the results for the impact of bank size on the relationship between regulatory and supervisory policies and bank liquidity creation. Using a cutoff point of $1 billion in total assets, large and small banks are identified. Specifically, banks with total assets exceeding $1 billion are considered as large banks, and banks with total assets of up to $1 billion are considered small banks. The results in Table 7 show that powerful official oversight of banks decreases bank liquidity creation only for large banks. However, private sector minoring of banks reduces bank liquidity creation only for small banks. These results may indicate that a combination of the two supervisory systems may complement one another. Since large banks are complex and difficult to monitor, official supervisory agencies have a beneficial effect on banks' exposure to liquidity risk in such large and complex institutions. In contrast, encouraging private sector monitoring might limit small banks' exposure to liquidity risk.

5.2. Controlling for a country's culture, market conditions, and systematically important financial institutions

Prior studies use Hofstede's classifications of culture to assess the effect of cultural dimensions on the financial system (Kwok and Tadesse, 2006), bank risk-taking (Osei-Tutu and Weil, 2020), and corporate saving behavior (Chen et al., 2017). Following previous studies, I capture aggregate value-based measures of cultural characteristics of a country by including *Uncertainty Avoidance* and *Long-Term Orientation* (Hofstede, 1980). *Uncertainty Avoidance* is an index that measures the degree to which a society deals with uncertainty and ambiguity for the future. *Long-Term Orientation* is an index that measures the degree to which a society deals with the long-term orientation of the society. These two indexes are collected from Hofstede's website.

To control for a country's cultural environment, I drop country fixed effects and instead include *Uncertainty Avoidance* and *Long-Term Orientation*. The estimates of the regressions that control for two dimensions of national culture are presented in Columns 1 and 2 of Table 8. Specifically, I observe that the coefficient on supervisory power remains significantly negative, while being insignificant for the private sector monitoring.[5]

Moreover, interbank markets play a crucial role in the liquidity management of banks. During market turmoil, the interbank markets may dry up as banks tend to hold cash instead of lending it to other banks even at short maturities. One of the important lessons that the recent financial crisis taught us was the failure of the most liquid markets in the financial sector (i.e. interbank markets). Stress on the interbank market may make it hard for banks to raise external sources of funds, and thus higher pressure on the interbank market may increase bank illiquidity.

[5] Controlling for a country's legal origin and a religion dose not influence the main results.

Thereby, it might be important to control for the effect of liquidity pressure on the interbank market. To capture the liquidity pressure on the interbank market, I utilize the difference between the one-month interbank rate and the central bank policy rate, with higher values of the spread indicating higher pressure on the interbank market. In addition, a recent study by Berger and Bouwman (2017) documents that monetary policy influences bank liquidity. Hence, to ensure that the findings are not influenced by the macroeconomic environment, market conditions, and the aggregate banking environment, I drop time fixed effects and instead include the central bank's policy rates, and the difference between the one-month interbank rate and the policy rate of the central bank. The results are reported in Columns 3 and 4 of Table 8, and I find that the estimates of the regressions are similar to the main findings.

[Insert Table 8 here]

Finally, in the aftermath of the global financial crisis, bank supervision authorities, regulators, and policymakers have devoted considerable attention to policy measures to address systematically important financial institutions (SIFIs). Given that such large and complex financial institutions can expose higher risks to the financial system, I control for these institutions by including a dummy variable that takes the value of one if the bank is considered to be systemically important in Europe and zero otherwise based on the information provided by Financial Stability Board. The results are reported in Columns 5 and 6 of Table 8. As can be noted, in general, these results are consistent with previous findings.

5.3. Role of institutional quality and market incentive

In general, the bare existence of regulatory or supervisory practices does not necessarily mean their application in practice. Given that institutional quality can enhance or impede the implementation of supervisory practices, it is of interest to examine whether the association between bank supervision and liquidity creation is influenced by the quality of the institutional environment. For this purpose, I utilize the World Governance Indicator (*WGI*) complied by Kaufmann et al. (2006) to obtain the quality of the institutional environment in terms of control of corruption, regulatory quality, and the overall institutional quality. Control of corruption is an indicator of the degree to which public power is exercised for private gain. This index ranges from -2.5 to +2.5, with higher values indicating better control of corruption. Regulatory quality measures the extent to which the government is able to implement sound regulations and policies that promote private sector development. The value of this index ranges from -2.5 to +2.5, with higher values implying better regulatory quality. Finally, the overall governance indicator is calculated as the first principle components indicator of six dimensions of governance, with higher values indicating a higher quality of governance.[6]

Columns 1-6 of Table 9 provide the results which examine the role of the institutional environment on the relationship between regulatory policies and bank liquidity creation. In particular, Columns 1-3 of Table 9 provide the findings of the interaction terms between supervisory power and the characteristics of the institutional quality, while Columns 4-6 report the results of the interaction terms between private sector monitoring and the quality of the institutional environment.

[6] The six different dimensions of governance are Voice and Accountability, Government Effectiveness, Regulatory Quality, Political Stability, Rule of Law, and Control of Corruption. The indexes are covered for more than 200 countries constructed from 35 data sources provided by more than 30 different organizations.

Overall, I find that the interaction between official supervisory power, control of corruption, regulatory quality, and the overall governance indicator is positive and statistically significant either at the 10 percent level or at the 5 percent level. These findings provide some evidence that the observed negative effect of supervisory power on liquidity creation weakens at higher levels of regulatory quality, the overall nation-wide governance, and control of corruption. These results are broadly consistent with Fernández and González (2005), who find that official supervisors with ample power in countries with low accounting and auditing requirements may reduce bank risk-taking behavior. In addition, the results in Columns 4-6 of Table 9 show that the interaction term between private monitoring, control of corruption, regulatory quality, and the overall governance indicator is negative and statistically significant either at 5 percent level or 1 percent level. These results suggest that the effect of private sector monitoring on liquidity creation strengthens at higher levels of regulatory quality, the overall nation-wide governance, and control of corruption. The findings indicate that in countries with a higher quality of nationwide governance private monitoring of banks might discourage banks from engaging in risky banking activities. Thus, consistent with previous studies private sector monitoring could have a beneficial effect by the disclosure of accurate information and encouraging private agents to monitor banks.

Overall, these findings suggest that putting all banks under a common regulatory and supervisory umbrella is difficult, as banks in certain environments may expose themselves to higher risks. Therefore, it is important to identify sources of heterogeneity when looking into different regulatory and supervisory policies.

[Insert Table 9 here]

In addition to the quality of the institutional environments, market incentives play an important role in monitoring banks. Disclosing more information about banks does not necessarily imply greater market-based monitoring if the private sector does not have incentives to use this information to monitor banks. Given that the presence of a deposit insurance scheme and greater power and responsibility for the deposit insurer to intervene in the banking sector to rescue ailing banks can undermine incentives of market participants to monitor banks, I construct a new index combining the explicit deposit insurance scheme and the deposit insurer power based on the World Bank's Bank Regulation and Supervision Survey. The constructed market incentive index ranges from 0 to 5, with higher values indicating weaker market incentives for monitoring banks. Specifically, this index measures whether there is an explicit deposit insurance scheme, whether depositors were fully compensated the last time a bank failed, whether the deposit insurance authority has the authority to decide to intervene in a bank, take legal action against bank directors or officials, and has ever taken any legal action against bank directors or officers. A prior study by Cihak et al. (2013) shows that countries that have weaker market incentives for private sectors to monitor banks had a lower crisis probability. Hence, if weaker incentives for the private investor have a lower crisis probability, I expect that the effect of private monitoring on liquidity creation is more pronounced when market incentives are weaker due to the prevalence of the deposit insurance scheme and greater deposit insurer power.

To examine whether the linkage between private sector monitoring and liquidity creation is influenced by the market incentives to monitor and discipline banks, I include an interaction term between private sector monitoring and market incentive index, and re-estimate the baseline model. The result is reported in Column 7 of Table 9. I find that the coefficient estimate of the interaction term between private monitoring and market incentives is negative and statistically significant,

indicating that the effect of private sector monitoring on liquidity creation is more pronounced when there are weaker incentives for the private sector to monitor banks. Overall, this finding acknowledges the important role of market incentives for the private sector to monitor and discipline banks. Strengthening the deposit insurance scheme and the deposit insurer's power to intervene in banks may lower the incentives for private investors to monitor banks. Thus, policymakers and supervisors may need to pay special attention to improve market incentives and increase the pool of market participants that have an interest in disciplining banks.

5.4. The effect of bank supervisory policies on bank liquidity risk

Prior studies argue that liquidity creation increases banks' exposure to liquidity risk (e.g. Allen and Santomero, 1998; Allen and Gale, 2004). Given that higher values of liquidity creation show higher bank illiquidity, I use two proxies for bank illiquidity. First, I utilize the net stable funding ratio (*NSFR*) which is the ratio of the available amount of stable funding to the required amount of stable funding proposed by the Basel Committee on Banking Regulation and Supervision (BIS, 2009). The global financial crisis that began in 2007 showed how fast and severely illiquidity can crystallize and some particular sources of funding can evaporate (BIS, 2009). In recognition for banks to address their liquidity management deficiencies, the Basel Committee on Banking Supervision introduced a global framework to strengthen liquidity risk management (BIS, 2009). Among other regulatory standards for elevating the resilience of the financial system, the Basel III accords issued a proposal for the implementation of the net stable funding ratio. Specifically, this ratio is proposed to promote the long-term resilience of banks by requiring banks to fund their activities with more stable funding sources. For consistency with my

liquidity creation measure, the inverse of this regulatory ratio (*I_NSFR*) is calculated, with higher values corresponding to higher illiquidity. The *I_NSFR* is the ratio of the required amount of stable funding to the available amount of stable funding. The compositions of assets and liabilities to calculate *I_NSFR* according to Basel III accords (BIS, 2009) are outlined in Table A.1 (*Appendix A*). Second, I calculate the liquidity transformation ratio (*LTR*) which is defined as the ratio of illiquid assets to illiquid liabilities following Deep and Schaefer (2004).[7]

[Insert Table 10 here]

I end my analysis by validating the association between bank supervisory policies and bank illiquidity. For this purpose, I first explore the direct impact of the effectiveness of two supervisory practices on bank liquidity requirements as measured by the inverse of the net stable funding ratio and the liquidity transformation ratio. Columns 1-4 of Table 10 present the results when two liquidity proxies are replaced with the liquidity creation measure. As can be seen from Table 10, I observe a negative association between regulators' supervisory power and market-based monitoring on bank illiquidity, implying the effectiveness of these two supervisory practices on bank liquidity requirements. Overall, these findings indicate that supervisory power and private monitoring affect bank liquidity creation by mitigating liquidity risk.

Besides exploring the direct effect of supervisory policies on bank liquidity risk, this study tries to provide an integrated approach of the Basel II and Basel III ingredients by examining whether and to what extent the effective supervisory framework and market discipline have a complementary effect on bank liquidity requirements. In this context, Delis and Staikouras (2011)

[7] Illiquid assets are defined as total assets, long-term marketable assets, other assets, and net fixed assets, and illiquid liabilities are defined as time deposits, long-term market funding and equity.

document that effective supervision and market discipline are complementary mechanisms in reducing bank risk. The results in Columns 5 and 6 of Table 10 show that the interaction terms between supervisory power and private monitoring are negative and statistically significant, implying that there is a complementary and amplifying combined effect of these variables on bank illiquidity. Therefore, regulatory authorities need to pay closer attention to the interplay effect between bank supervisory policies, rather than trying to determine separate effects of different types of supervisory practices on bank illiquidity.

6. Conclusions

There is a lack of cross-country evidence on the role of strengthening official supervisory power and private sector monitoring in bank liquidity. In this study, I investigate the linkage between these two supervisory policies and bank liquidity creation. I provide evidence that the traditional approach to bank supervision that entails strengthening official supervisory authorities tends to decrease bank liquidity creation, and bank illiquidity as a whole. In addition, a supervisory strategy that empowers private monitoring of banks by disclosing accurate information to the private sector does not tend to be related to bank liquidity creation. However, such supervisory strategies could lower bank illiquidity, as measured by the inverse of the net stable funding ratio, and liquidity transformation gap ratio.

The empirical findings also show that the quality of the institutional environment and market incentives influences the association between bank supervision and liquidity creation. Given that institutional quality and market incentives condition the relationship between bank supervision and liquidity creation, it is important to identify sources of heterogeneity in the relationship

between bank supervisory policies and liquidity creation. Putting all banks under common regulatory and supervisory practices is difficult, as banks operating in certain environments may expose to higher risks.

This paper also explores the direct and combined impact of the effectiveness of the regulators' supervisory power and private sector monitoring on bank liquidity management. I obtain evidence of a negative relationship between regulators' supervisory power, private monitoring, and bank illiquidity. Considering the combined effect of bank supervisory policies on bank illiquidity, I find that regulators' supervisory power and market-based monitoring are complementary mechanisms in reducing bank liquidity risk. Therefore, policymakers and supervisory authorities may need to pay closer attention to the interplay between various regulatory and supervisory policies, rather than attempting to identify the separate impact of different supervisory frameworks on bank liquidity. Overall, the empirical findings provide support for Basel II and Basel III ingredients.

References

Agoraki, M. E. K., Delis, M. D., & Pasiouras, F. (2011). Regulations, competition and bank risk-taking in transition countries. *Journal of Financial Stability*, 7(1), 38–48.

Allen, F., Santomero, A. (1998). The theory of financial intermediation. *Journal of Banking & Financ*e, 21, 1461–1485.

Allen, F., & Gale, D. (2004). Financial intermediaries and markets. *Econometrica,* 72, 1023–1061.

Bank for International Settlements. (2009). International Framework for Liquidity Risk, Measurement, Standards and Monitoring. Consultative Document.

Bank for International Settlements. (2008). Principles for Sound Liquidity Risk Management and Supervision.

Baradwaj, B. G., Shao, Y., & Dewally, M. (2016). Institutions, capital control, and liquidity creation. *Journal of Financial Economic Policy*, 8 (3), 396–422.

Barth, J.R., Caprio, G., Levine, R. (2004). Bank regulation and supervision: what works best? *Journal of Financial Intermediation,* 13 (2), 205–248.

Barth, J.R., Caprio, G., & Levine, R. (2006). Rethinking Bank Regulation: Till Angels Govern. *Cambridge University Press, Cambridge, UK.*

Barth, J.R., Caprio, G., & Levine, R. (2008). Bank regulations are changing: for better or worse? *Comparative Economic Studies*, 50, 537–563.

Barth, J. R., Caprio Jr, G., & Levine, R. (2013). Bank regulation and supervision in 180 countries from 1999 to 2011. *Journal of Financial Economic Policy*, 5(2), 111–219.

Barth, J. R., Lin, C., Ma, Y., Seade, J., & Song, F. M. (2013). Do bank regulation, supervision and monitoring enhance or impede bank efficiency?. *Journal of Banking & Finance*, 37(8), 2879-2892.

Beck, T., Demirguc-Kunt, A., & Levine, R. (2003a). Law, endowment, and finance. *Journal of Financial Economics,* 70, 137–181.

Beck, T., Demirguc-Kunt, A., & Levine, R. (2003b). Law and finance: Why does legal origin matter?. *Journal of Comparative Economics*, 31(4), 653–676.

Beck, T., Demirgüç-Kunt, A., & Levine, R. (2006). Bank supervision and corruption in lending. *Journal of Monetary Economics*, 53(8), 2131–2163.

Beck, T., Demirgüç-Kunt, A., & Levine, R. (2010). Financial institutions and markets across countries and over time: The updated financial development and structure database. *World Bank Economic Review*, 24(1), 77–92.

Berger, A. N., Miller, N. H., Petersen, M. A., Rajan, R. G., & Stein, J. C. (2005). Does function follow organizational form? Evidence from the lending practices of large and small banks. *Journal of Financial Economics*, 76(2), 237–269.

Berger, A. N., & Bouwman, C. H. (2009). Bank liquidity creation. *Review of Financial Studies*, 22(9), 3779–3837.

Berger, A. N., Bouwman, C. H., Kick, T., & Schaeck, K. (2016). Bank liquidity creation following regulatory interventions and capital support. *Journal of Financial Intermediation*, 26, 115–141.

Berger, A. & Bouwman, C. H. (2017). Bank liquidity creation, monetary policy, and financial crises. *Journal of Financial Stability*, 30, 139–155.

Bermpei, T., Kalyvas, A., & Nguyen, T. C. (2018). Does institutional quality condition the effect of bank regulations and supervision on bank stability? Evidence from emerging and developing economies. *International Review of Financial Analysis*, 59, 255–275.

Bryant, J. (1980). A model of reserves, bank runs, and deposit insurance. *Journal of Banking & Finance*, 4(4), 335–344.

Chen, S., Cronqvist, H., Ni, S., & Zhang, F. (2017). Languages and corporate savings behavior. *Journal of Corporate Finance*, 46, 320–341.

Chen, L., Li, H., Liu, F. H., & Zhou, Y. (2020). Bank regulation and systemic risk: Cross country evidence. *Review of Quantitative Finance and Accounting*, 1–35.

Cihak, M., Demirgüç-Kunt, A., Peria, M. S. M., & Mohseni-Cheraghlou, A. (2013). Bank regulation and supervision in the context of the global crisis. *Journal of Financial Stability*, 9(4), 733–746.

Chortareas, G. E., Girardone, C., & Ventouri, A. (2012). Bank supervision, regulation, and efficiency: Evidence from the European Union. *Journal of Financial Stability*, 8(4), 292–302.

Deep, A., & Schaefer, G. K. (2004). Are banks liquidity transformers?. Harvard University Faculty Research, Working Paper.

Delis, M. D., & Staikouras, P. K. (2011). Supervisory effectiveness and bank risk. *Review of Finance*, 15(3), 511–543.

Diamond, D. W., & Dybvig, P. H. (1983). Bank runs, deposit insurance, and liquidity. *Journal of Political Economy*, 91(3), 401–419.

Distinguin, I., Roulet, C., & Tarazi, A. (2013). Bank regulatory capital and liquidity: Evidence from US and European publicly traded banks. *Journal of Banking & Finance*, 37(9), 3295–3317.

Djankov, S., La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (2002). The regulation of entry. *Quarterly Journal of Economics*, 117(1), 1–37.

Easterly, W., & Levine, R. (1997). Africa's growth tragedy: policies and ethnic divisions. *Quarterly Journal of Economics*, 112, 1203–1250.

Fernández, A. I., & Gonzalez, F. (2005). How accounting and auditing systems can counteract risk-shifting of safety-nets in banking: Some international evidence. *Journal of Financial Stability*, 1(4), 466–500.

Fungáčová, Z., Weill, L., & Zhou, M. (2017). Bank capital, liquidity creation and deposit insurance. *Journal of Financial Services Research*, 51(1), 97–123.

He, Z., Qiao, G., Zhang, L., & Zhang, W. (2021). Regulator supervisory power and bank loan contracting. *Journal of Banking & Finance*, Forthcoming.

Hofstede, G. (1980). Culture's Consequences: International Differences in Work-Related Values. Sage Publications, New York.

Holmström, B., & Tirole, J. (1998). Private and public supply of liquidity. *Journal of Political Economy*, 106(1), 1–40.

Hoque, H., Andriosopoulos, D., Andriosopoulos, K., & Douady, R. (2015). Bank regulation, risk and return: Evidence from the credit and sovereign debt crises. *Journal of Banking & Finance*, 50, 455–474.

Kashyap, A. K., Rajan, R., & Stein, J. C. (2002). Banks as liquidity providers: An explanation for the coexistence of lending and deposit-taking. *Journal of Finance*, 57(1), 33–73.

Kaufmann, D., Kraay, A., & Mastruzzi, M. (2006). Governance Matters V: Worldwide Governance Indicators, 1996–2005. World Bank.

Karolyi, G. A., Lee, K. H., & Van Dijk, M. A. (2012). Understanding commonality in liquidity around the world. *Journal of Financial Economics*, 105(1), 82–112.

Kwok, C. C., & Tadesse, S. (2006). National culture and financial systems. *Journal of International Business Studies*, 37(2), 227–247.

La Porta, R., Lopez de Silanes, F., Shleifer, A., & Vishny, R. (1999). The quality of government. *Journal of Law, Economics, and Organization*, 15, 222–279.

Li, S. (2019). The impact of bank regulation and supervision on competition: evidence from emerging economies. *Emerging Markets Finance and Trade*, 55(10), 2334–2364.

Mailath, G. J., & Mester, L. J. (1994). A positive analysis of bank closure. *Journal of Financial Intermediation*, 3(3), 272–299.

Osei-Tutu, F., & Weill, L. (2019). How language shapes bank risk taking. *Journal of Financial Services Research*, 1–22.

Petersen, M.A., & Rajan, R.G. (1995). The effect of credit market competition on lending relationships. *Quarterly Journal of Economics*, 110, 407–443.

Shleifer, A. & R. Vishny (1998). *The Grabbing Hand*: Government Pathologies and their Cures, Cambridge, MA: Harvard University Press.

Table 1. Distribution of banks.

Country	Banks available in Bloomberg	Banks included in the final sample	Total assets of banks in the final sample/total assets of the entire banking sector in the sample (%)
Austria	7	7	1.463
Belgium	6	6	6.497
Bulgaria	5	5	0.017
Croatia	12	7	0.046
Cyprus	4	4	0.163
Czech Republic	1	1	0.116
Denmark	23	22	2.025
Finland	2	2	0.044
France	18	18	20.681
Germany	8	7	11.484
Greece	11	11	1.630
Hungary	1	1	0.122
Ireland	2	2	1.317
Italy	25	15	7.961
Lithuania	1	1	0.002
Luxembourg	1	1	0.436
Malta	4	4	0.047
Netherlands	2	1	0.084
Norway	24	23	1.106
Poland	15	14	0.667
Portugal	4	4	0.927
Romania	3	3	0.050
Slovakia	4	4	0.094
Spain	10	8	8.119
Sweden	4	4	4.860
Switzerland	46	39	5.785
UK	8	6	24.257

This Table reports the distribution of European publicly traded commercial banks by country.

Table 2. Variable definition and sources.

Variables	Definition	Source
LnGDP	Natural logarithm of gross domestic product.	World Development Indicator (WDI)
LnTA	Natural logarithm of bank total assets.	Bloomberg
ROE	Bank's net income divided by total equity.	Bloomberg
LLP_TL	Bank's loan loss provisions divided by total loans.	Bloomberg
Global Integration	Imports plus exports divided by GDP	World Development Indicator (WDI)
Market Power	Bank *i* total assets in country *j* divided by total assets of the banking sector in country *j*.	Bloomberg
Banking Development	Private credit divided by GDP	Financial Structure Dataset (Beck et al., 2010)
Supervisory Power	The index ranges from zero to fourteen, with higher values indicating greater power. The index is built on fourteen questions. A value of one is added to the index for each answer that is "Yes". 1) Can supervisors meet external auditors to discuss reports without bank approval? 2) Are auditors legally required to report misconduct by managers/directors to a supervisory agency? 3) Can legal action against external auditors be taken by the supervisor for negligence? 4) Can supervisors force banks to change the internal organizational structure? 5) Are off-balance sheet items disclosed to supervisors? 6) Can the supervisory agency order directors/management to constitute provisions to cover actual/potential losses? 7) Can the supervisory agency suspend the director's decision to distribute: 7.1. dividends. 7.2. bonuses. 7.3. management fees. 8) Can the supervisory agency supersede bank shareholder rights and declare the bank insolvent? 9)Does banking law allow a supervisory agency to suspend some or all ownership rights of a problem bank? 10) Regarding bank restructuring & reorganization, can supervisory agency or any other govt. agency do the following: 10.1. supersede shareholder rights. 10.2. remove and replace management. 10.3. remove and replace directors.	Barth et al. (2004, 2006, 2008, 2013)
Private Monitoring	The index ranges from zero to twelve, with higher values indicating more private oversight. The index is composed of the following information: Whether subordinated debt is allowable as part of capital? Are off-balance sheet items disclosed to the public?; Whether bank directors and officials are legally liable for the accuracy of the information disclosed to the public; Whether banks must publish consolidated accounts; Whether banks must be audited by certified international auditors; Whether 100 percent of the largest ten banks are rated by international rating agencies; Whether off-balance sheet items are disclosed to the public; Whether banks must disclose their risk management procedures to the public; Whether accrued, though unpaid interest/principal, enter the income statement while the loan is still non-performing; Whether there is no explicit deposit insurance system and insurance was paid the last time a bank failed.	Barth et al. (2004, 2006, 2008, 2013)
LC	Bank liquidity creation normalized by total assets	Berger and Bouwman (2009)

This table presents definitions and sources of all variables used in this paper.

Table 3. Construction of liquidity creation measure.

Assets	**Liquidity Level**	**Weights**
Cash & Near Cash Items	Liquidity Level	-0.5
Interbank Assets	Semiliquid	0
Short-Term Investments	Liquid	-0.5
Commercial Loans	Illiquid	0.5
Consumer Loans	Semiliquid	0
Other Loans	Semiliquid	0
Long-Term Investments	Semiliquid	0
Fixed Assets	Illiquid	0.5
Other Assets	Illiquid	0.5
Customers' Acceptance Liability	Semiliquid	0

Liabilities	**Liquidity Level**	**Weights**
Demand Deposits	Liquid	0.5
Saving Deposits	Liquid	0.5
Time Deposits	Semiliquid	0
Other Deposits	Semiliquid	0
Short-Term Borrowings & Repos	Liquid	0.5
Other Short-Term Liabilities	Liquid	0.5
Long-Term Borrowings	Semiliquid	0
Other Long-Term Liabilities	Semiliquid	0
Total Preferred Equity	Illiquid	-0.5
Minority Interest	Illiquid	-0.5
Shareholder Common Capital	Illiquid	-0.5
Retained Earnings & Other Equity	Illiquid	-0.5

This table shows the construction of the liquidity creation measure following Berger and Bouwman (2009) and the weights used to calculate the measure.

Table 4. Descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
LC	2,676	0.192	0.155	-0.401	0.841
Supervisory Power	2,546	9.888	2.305	6	14
Private Monitoring	2,559	7.787	1.214	5	11
LnTA	2,676	16.055	2.414	9.606	21.643
ROE	2,676	0.103	1.209	-6.601	48.787
LLP_TL	2,676	0.025	0.687	-0.586	34.606
Market Power	2,676	0.148	0.243	0.000	1
Global Integration	2,676	0.817	0.373	0.375	3.492
Banking Development	2,676	0.982	0.463	0.064	2.607
lnGDP	2,676	27.341	1.277	22.306	31.040

This table reports the summary statistics of the main regression variables. The sample consists of 220 publicly traded commercial banks from 27 European countries over the period 1996-2010. The definition of the main variables is reported in Table 2.

Table 5. Baseline results.

VARIABLES		LC		LC
Supervisory Power	-0.009***	-0.007**		
	(0.003)	(0.003)		
Private Monitoring			-0.008	-0.004
			(0.006)	(0.005)
LnTA		0.002		0.001
		(0.006)		(0.006)
ROE		0.007***		0.007***
		(0.002)		(0.002)
LLP_TL		-0.020***		-0.019***
		(0.001)		(0.001)
Market Power		0.039		0.038
		(0.045)		(0.047)
Global Integeration		0.203***		0.209***
		(0.058)		(0.058)
Banking Development		0.023		0.016
		(0.017)		(0.016)
lnGDP		0.007		0.015
		(0.040)		(0.044)
Constant		0.059		-0.213
		(1.012)		(1.104)
Observations	2,546	2,546	2,559	2,559
Adjusted R-squared		0.331		0.328
Year FE	No	Yes	No	Yes
Country FE	Yes	Yes	Yes	Yes

The table presents the panel regression results examining the impact of bank supervision on liquidity creation. The standard errors for the regressions are estimated as heteroskedasticity-robust standard errors clustered by banks are presented in parentheses. *, **, *** indicate significance at the 10%, 5% and 1% levels, respectively. The definition of the main variables is reported in Table 2.

Table 6. Instrumental variable analysis.

	First stage Supervisory Power	First stage Private Monitoring	Second stage LC	Second stage LC
Ethnic fractionalization	5.083***	-1.433**		
	(1.307)	(0.679)		
Supervisory Power			-0.022*	
			(0.013)	
Private Monitoring				0.073
				(0.060)
LnTA	-0.046	-0.020	0.023***	0.026***
	(0.036)	(0.025)	(0.003)	(0.004)
ROE	-0.014	0.008	0.006***	0.006***
	(0.013)	(0.009)	(0.001)	(0.002)
LLP_TL	-0.055**	-0.018*	-0.015***	-0.012***
	(0.22)	(0.010)	(0.003)	(0.003)
Market Power	-0.103	0.343**	-0.119***	-0.142***
	(0.385)	(0.166)	(0.019)	(0.032)
Global Integeration	0.756***	0.395**	0.057***	0.013
	(0.274)	(0.155)	(0.019)	(0.027)
Banking Development	0.743***	0.883***	0.049***	-0.033
	(0.215)	(0.154)	(0.015)	(0.051)
lnGDP	-0.606***	0.161***	-0.020*	-0.018
	(0.100)	(0.051)	(0.011)	(0.013)
Constant	25.118***	2.579*	0.581	-0.169
	(2.782)	(1.432)	(0.391)	(0.200)
Observations	2,439	2,457	2,439	2,457
First-stage F-test of excluded instruments	0.000	0.035		
Year FE	Yes	Yes	Yes	Yes
Country FE	No	No	No	No

The table shows the two-stage least squares regression results. The instrumental variable is ethnic fractionalization. In the first stage regression, bank supervision variables are regressed on the instrumental variable and other controls. In the second stage, the predicted values of bank supervision variables from the first stage are used as the independent variable. The potential endogenous explanatory variables are supervisory power and private monitoring. The standard errors for the regressions are estimated as heteroskedasticity-robust standard errors clustered by banks are presented in parentheses. *, **, *** indicate significance at the 10%, 5% and 1% levels, respectively. The definition of the main variables is reported in Table 2.

Table 7. The role of bank size.

	LC Large	LC Small	LC Large	LC Small
Supervisory Power	-0.007**	-0.007		
	(0.003)	(0.005)		
Private Monitoring			-0.005	-0.028**
			(0.005)	(0.011)
LnTA	-0.003	0.026*	-0.003	0.027*
	(0.008)	(0.014)	(0.008)	(0.014)
ROE	0.007***	0.063	0.007***	0.068
	(0.002)	(0.051)	(0.002)	(0.051)
LLP_TL	-0.022***	-0.017***	-0.022***	-0.017***
	(0.004)	(0.001)	(0.004)	(0.001)
Market Power	0.023	-0.060	0.025	-0.048
	(0.056)	(0.081)	(0.057)	(0.077)
Global Integeration	0.216***	0.092	0.225***	0.045
	(0.071)	(0.073)	(0.072)	(0.083)
Banking Development	0.003	0.044	0.001	0.028
	(0.031)	(0.028)	(0.032)	(0.021)
lnGDP	0.071*	-0.197***	0.084*	-0.201***
	(0.043)	(0.057)	(0.046)	(0.051)
Constant	-1.509	5.019***	-1.902*	5.225***
	(1.077)	(1.405)	(1.129)	(1.270)
Observations	2,074	472	2,087	472
Adjusted R-squared	0.289	0.515	0.286	0.520
Year FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes

This table reports the panel regression results which examine the effect of regulatory policies on liquidity creation by bank size class. Large banks are defined as banks whose total assets exceeding $1 billion, and small banks are defined as banks with total assets of up to $1 billion. The standard errors for the regressions are estimated as heteroskedasticity-robust standard errors clustered by banks are presented in parentheses. *, **, *** indicate significance at the 10%, 5% and 1% levels, respectively. The definition of the main variables is reported in Table 2.

Table 8. Controlling for a country's culture, market conditions, and systematically important financial institutions.

	LC	LC	LC	LC	LC	LC
Supervisory Power	-0.008**		-0.007***		-0.007**	
	(0.003)		(0.003)		(0.003)	
Private Monitoring		-0.001		-0.004		-0.004
		(0.005)		(0.005)		(0.005)
LnTA	0.019***	0.020***	0.001	0.001	0.003	0.002
	(0.004)	(0.004)	(0.006)	(0.006)	(0.006)	(0.006)
ROE	0.006***	0.006***	0.007***	0.007***	0.007***	0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
LLP_TL	-0.016***	-0.015***	-0.020***	-0.019***	-0.020***	-0.019***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Market Power	-0.063**	-0.071**	0.041	0.039	0.047	0.046
	(0.031)	(0.032)	(0.047)	(0.048)	(0.045)	(0.046)
Global Integeration	-0.005	-0.013	0.171***	0.173***	0.204***	0.209***
	(0.026)	(0.025)	(0.048)	(0.048)	(0.058)	(0.057)
Banking Development	0.034**	0.018	0.000	-0.006	0.022	0.015
	(0.015)	(0.015)	(0.021)	(0.020)	(0.017)	(0.017)
lnGDP	-0.032***	-0.027***	-0.058	-0.043	0.007	0.015
	(0.007)	(0.007)	(0.038)	(0.041)	(0.039)	(0.043)
Uncertainty Avoidance	-0.001**	-0.001***				
	(0.000)	(0.000)				
Long-term Orientation	0.001***	0.001**				
	(0.000)	(0.000)				
Spread			0.006	0.006*		
			(0.004)	(0.004)		
Policy Interest Rate			0.001	0.002		
			(0.002)	(0.002)		
SIFIs					-0.033	-0.032

					(0.022)	(0.022)
Constant	0.856***	0.678***	1.721*	1.286	0.041	-0.227
	(0.208)	(0.212)	(0.972)	(1.019)	(1.004)	(1.095)
Observations	2,497	2,510	2,237	2,245	2,546	2,559
Adjusted R-squared	0.174	0.167	0.306	0.304	0.332	0.330
Year FE	Yes	Yes	No	No	Yes	Yes
Country FE	No	No	Yes	Yes	Yes	Yes

This table shows the panel regression results examining the effect of official supervisory power and private monitoring on bank liquidity creation. Uncertainty Avoidance and Long-term Orientation are used as a proxy for a county's culture. Uncertainty Avoidance is an index that measures the degree to which a society deals with uncertainty and ambiguity for the future. Long-Term Orientation is an index that measures the degree to which a society deals with the long-term orientation of the society. Spread is the difference between the one-month interbank rate and the central bank policy rate. The policy interest rate is the central bank's policy rate. SIFIs is a dummy variable that takes the value of one if the bank is considered to be systemically important in Europe and zero otherwise. The standard errors for the regressions are estimated as heteroskedasticity-robust standard errors clustered by banks are presented in parentheses. *, **, *** indicate significance at the 10%, 5% and 1% levels, respectively. The definition of the main variables is reported in Table 2.

Table 9. Role of institutional quality and market incentive.

	LC	LC	LC	LC	LC	LC	LC
Supervisory Power	-0.013***	-0.026***	-0.005				
	(0.004)	(0.009)	(0.003)				
Private Monitoring				0.028**	0.040*	-0.008*	0.013
				(0.012)	(0.022)	(0.004)	(0.010)
Control of Corruption	-0.180***			0.106*			
	(0.064)			(0.054)			
Regulatory Quality		-0.271***			0.171		
		(0.083)			(0.115)		
Quality of Governance			-0.051**			0.059***	
			(0.022)			(0.021)	
Supervisory Power × Control of Corruption	0.006*						
	(0.004)						
Supervisory Power × Regulatory Quality		0.016**					
		(0.007)					
Supervisory Power × Quality of Governance			0.002*				
			(0.001)				
Private Monitoring × Control of Corruption				-0.025***			
				(0.007)			
Private Monitoring × Regulatory Quality					-0.036**		
					(0.016)		
Private Monitoring × Quality of Governance						-0.010***	
						(0.003)	
Private Incentive							0.061**
							(0.028)
Private Monitoring × Private Incentive							-0.010**
							(0.004)
LnTA	0.001	0.002	0.001	0.001	0.001	0.001	0.001

	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
ROE	0.007***	0.007***	0.007***	0.007***	0.007***	0.007***	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
LLP_TL	-0.019***	-0.019***	-0.019***	-0.019***	-0.019***	-0.019***	-0.019***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Market Power	0.038	0.040	0.040	0.040	0.041	0.042	0.039
	(0.046)	(0.047)	(0.047)	(0.047)	(0.048)	(0.048)	(0.047)
Global Integeration	0.221***	0.182***	0.217***	0.234***	0.230***	0.230***	0.228***
	(0.060)	(0.058)	(0.061)	(0.060)	(0.058)	(0.062)	(0.057)
Banking Development	0.025	0.008	0.018	0.034*	0.025	0.026	0.022
	(0.020)	(0.019)	(0.019)	(0.020)	(0.020)	(0.019)	(0.017)
lnGDP	0.042	0.054	0.053	0.015	0.044	0.016	-0.006
	(0.036)	(0.042)	(0.043)	(0.038)	(0.048)	(0.043)	(0.041)
Constant	-0.624	-0.807	-1.123	-0.335	-1.172	-0.218	0.206
	(0.890)	(1.048)	(1.090)	(0.938)	(1.169)	(1.080)	(1.022)
Observations	2,175	2,175	2,175	2,181	2,181	2,181	2,559
Adjusted R-squared	0.322	0.321	0.318	0.327	0.321	0.323	0.333
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table reports the panel regression results which examine the role of institutional quality environments and market incentives on liquidity creation. The quality of institutional characteristics is obtained from Kaufmann et al. (2006). Control of corruption is an indicator of the degree to which public power is exercised for private gain, with higher values indicating better control of corruption. Regulatory quality measures the extent to which the government is able to implement sound regulations and policies that promote private sector development, with higher values indicating better regulatory quality. The overall quality of governance is calculated as the first principle components indicator of six dimensions of governance, with higher values indicating a higher quality of governance. The market incentive is an index that combines of the explicit deposit insurance scheme and the deposit insurer power based on the World Bank's Bank Regulation and Supervision Survey. The standard errors for the regressions are estimated as heteroskedasticity-robust standard errors clustered by banks are presented in parentheses. *, **, *** indicate significance at the 10%, 5% and 1% levels, respectively. The definition of the main variables is reported in Table 2.

Table 10. The effect of bank supervisory policies on bank liquidity risk.

	I_NSFR	LTR	I_NSFR	LTR	I_NSFR	LTR
Supervisory Power	-0.032*	-0.102***			0.252*	0.605***
	(0.017)	(0.039)			(0.130)	(0.192)
Private Monitoring			-0.096**	-0.224***	0.267**	0.662***
			(0.044)	(0.066)	(0.134)	(0.223)
Supervisory Power × Private Monitoring					-0.037**	-0.092***
					(0.017)	(0.025)
LnTA	0.071***	-0.153**	0.068***	-0.169***	0.071***	-0.161***
	(0.024)	(0.060)	(0.024)	(0.060)	(0.023)	(0.059)
ROE	0.007	0.246*	0.008	0.249*	0.008	0.248*
	(0.007)	(0.136)	(0.006)	(0.137)	(0.006)	(0.135)
LLP_TL	-0.026***	-0.121***	-0.024***	-0.117***	-0.026***	-0.123***
	(0.005)	(0.017)	(0.004)	(0.017)	(0.005)	(0.017)
Market Power	-0.303	-0.198	-0.297	-0.019	-0.316	-0.082
	(0.208)	(0.421)	(0.209)	(0.414)	(0.212)	(0.412)
Global Integration	0.581**	2.317***	0.409*	1.995**	0.474*	2.021**
	(0.281)	(0.835)	(0.229)	(0.803)	(0.253)	(0.845)
Banking Development	-0.181	-0.255	-0.232*	-0.395	-0.121	-0.104
	(0.128)	(0.264)	(0.128)	(0.253)	(0.124)	(0.270)
lnGDP	0.123	-0.521	0.164	-0.403	0.226	-0.287
	(0.211)	(0.553)	(0.225)	(0.505)	(0.236)	(0.488)
Constant	-3.636	18.541	-4.299	16.144	-8.544	6.985
	(5.577)	(14.609)	(5.842)	(13.256)	(6.439)	(13.424)
Observations	2,546	2,546	2,559	2,559	2,541	2,541
Adjusted R-squared	0.150	0.216	0.153	0.220	0.155	0.228
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes

This table shows the results of the panel regressions using liquidity risk measures as a dependant variable. The I_NSFR is the inverse of the net stable funding ratio (BIS, 2009) and LTR is the liquidity transformation gap ratio (Deep and Schaefer, 2004). The I_NSFR and LTR are used as liquidity risk proxies. The last two columns of this table report the estimation results on the combined effect of supervisory power and private monitoring on bank illiquidity. The standard errors for the regressions are estimated as heteroskedasticity-robust standard errors clustered by banks are presented in parentheses. *, **, *** indicate significance at the 10%, 5% and 1% levels, respectively. The definition of the main variables is reported in Table 2.

Appendix A

Table A.1. Calculation of the net stable funding ratio.

Assets	Corresponding definition of BIS	Weights
Required amount of stable funding		
Cash and near cash items	Cash	0
Interbank assets	Loans to financial entities having effective maturities of less than one year	0
Marketable securities and other short-term investments	Securities with effective remaining maturities of less than one year	0
Commercial loans	All other assets	1
Consumer loans	Loans to retail clients having residual maturity of less than one year.	0.85
Other loans	All other assets	1
Long-term investments	Unencumbered listed equity securities or unencumbered corporate bonds rated at least A- with an effective maturity of greater than 1 year)	0.5
Fixed assets	All other assets	1
Other assets	All other assets	1
Customer acceptances	Unencumbered listed equity or nonfinancial senior unsecured corporate bonds rated at least A- (with remaining maturity > 1 yr)	0.5
Liabilities	**Corresponding definition of BIS**	**Weights**
Available amount of stable funding		
Demand deposits	Retail deposits and/or term retail deposits with residual maturities of less than one year	0.7
Saving deposits		0.7
Time deposits	Other liabilities with effective maturities of one year or greater	1
Other term deposits	Other liabilities with effective maturities of one year or greater	1
Short-term borrowings	All other liabilities and equity categories not included in the above categories	0
Other short-term liabilities	All other liabilities and equity categories not included in the above categories	0
Long-term borrowings	Other liabilities with effective maturities of one year or greater	1
Other long-term liabilities	Other liabilities with effective maturities of one year or greater	1

Subordinated debentures	Total amount of capital, including both Tier 1 and Tier 2, and total amount of any preferred stock not included in Tier 2 that has an effective maturity of one year or greater	1
Preferred equity		1
Minority interests		1
Shareholder common capital		1
Retained earnings		1

This table presents the balance sheet weights used to calculate the net stable funding ratio based on Basel III accords (BIS, 2009).