Centre for Responsible Banking & Finance
RBF

University of St Andrews
School of Management

WORKING PAPERS IN RESPONSIBLE BANKING & FINANCE

Liquidity Creation and Bank Capital

By *Barbara Casu, Filippo di Pietro, and Antonio Trujillo-Ponce*

Abstract: This paper aims to evaluate the relationship between capital and liquidity following the implementation of the Basel III rules. These regulatory measures target both increased capital ratios and a reduction of banks' maturity transformation risk, which could result in excessive constraints on bank liquidity creation, thereby negatively affecting economic growth. Using a simultaneous equation model, we find a bi-causal negative relationship, which suggests that banks may reduce liquidity creation as capital increases; and when liquidity creation increases, banks reduce capital ratios. Our results therefore imply a trade-off between financial stability (higher capital, reduced risk) and economic growth (liquidity creation).

WP Nº 18-019

4th Quarter 2018

University of St Andrews
Scotland's first university
600 YEARS
1413 – 2013

LIQUIDITY CREATION AND BANK CAPITAL

Barbara Casu[a], Filippo di Pietro[b], Antonio Trujillo-Ponce[c,*]

[a]*Cass Business School, City, University of London, United Kingdom*

[b]*Department of Financial Economics and Operations Management, Universidad de Sevilla, ES- 41018 Seville, Spain*

[c]*Department of Financial Economics and Accounting, Universidad Pablo de Olavide, ES-41013 Seville, Spain*

This version: 24 September 2018

Abstract

This paper aims to evaluate the relationship between capital and liquidity following the implementation of the Basel III rules. These regulatory measures target both increased capital ratios and a reduction of banks' maturity transformation risk, which could result in excessive constraints on bank liquidity creation, thereby negatively affecting economic growth. Using a simultaneous equation model, we find a bi-causal negative relationship, which suggests that banks may reduce liquidity creation as capital increases; and when liquidity creation increases, banks reduce capital ratios. Our results therefore imply a trade-off between financial stability (higher capital, reduced risk) and economic growth (liquidity creation).

Keywords: bank capital; liquidity creation; illiquidity; net stable funding ratio; Basel III; Eurozone banking system.

JEL classification: G21; G28.

* Corresponding author at: Department of Financial Economics and Accounting, Universidad Pablo de Olavide, Ctra. de Utrera km. 1, 41013 Seville, Spain. Tel.: +34 954 349 185.

E-mail addresses: b.casu@city.ac.uk (B. Casu), fdi@us.es (F. di Pietro), atrujillo@upo.es (A. Trujillo-Ponce)

Acknowledgments

We are grateful to the participants of the 2016 Portsmouth-Fordham Conference on Banking and Finance (United Kingdom), the 2017 Javeriana University International Symposium of Experts in Finance (Colombia) and the 2017 Financial Intermediation Network of European Studies (FINEST) Conference (Italy) for their valuable comments. Special thanks are due to the anonymous referee and the editors for their guidance and very constructive remarks and suggestions. Part of this paper was written while Antonio Trujillo-Ponce was visiting Cass Business School (City, University of London). We also acknowledge the financial support of the Regional Government of Andalusia, Spain (Research Group SEJ-555). The usual disclaimer applies.

LIQUIDITY CREATION AND BANK CAPITAL

1. Introduction

In this paper, we study the relationship between liquidity creation and bank capital in the context of the new regulatory requirements introduced by the Basel Committee on Banking Supervision under the Basel III framework. Liquidity creation is one of the key functions of banks. Traditionally, banks create liquidity by financing relatively illiquid assets (for example, loans) with relatively liquid liabilities (such as deposits). By doing so, banks provide households with insurance against idiosyncratic consumption and depositors with on demand liquidity (Bryant 1980; Diamond and Dybvig 1983). In addition, banks create liquidity off the balance sheet through loan commitments and similar claims to liquid funds (Holmstrom and Tirole 1998; Kashyap et al. 2002).

Liquidity creation allows banks to enhance the flow of credit to the economy (Diamond and Rajan 2001). Recent evidence finds that bank liquidity creation is positively related to real economic output (Berger and Sedunov, 2017). However, high values of liquidity creation also expose banks to maturity transformation risk. Since maturity transformation (that is, funding longer-term loans or asset purchases with shorter-term deposits or debt obligations) is one of banks' key business areas, they are particularly exposed to funding liquidity risk. Indeed, the 2007-2008 global financial crisis revealed critical shortcomings in banks' management of funding liquidity risk, with significant consequences for system-wide financial stability.

In response to the severity of the financial crisis, the Basel Committee issued a new international regulatory framework for banks, known as Basel III, which proposed both enhanced capital standards and introduced liquidity regulation. In the new framework, banks are required to meet two quantitative liquidity ratios: the liquidity coverage ratio and the net

stable funding ratio.[1] While the former aims to promote short-term resilience, the latter aims to limit overreliance on short-term wholesale funding, to encourage better assessment of funding risk across all on- and off-balance sheet items, and to promote funding stability. In other words, the introduction of the net stable funding ratio aims to reduce banks' maturity transformation risk.

In addition, the Basel III framework has proposed enhanced rules for both the quantity and the quality of bank capital.[2] Recent evidence indicates that liquidity creation and bank capital are closely interrelated. The literature suggests a complex relationship between liquidity creation and bank capital, whereby capital can either enhance or hamper bank liquidity creation. Berger and Bouwman (2009) summarize this debate into two main hypotheses: the "*financial fragility-crowding out hypothesis*" and the "*risk absorption hypothesis*". The former posits a negative relationship and suggests that higher capital reduces liquidity creation. Conversely, the latter predicts a positive relationship and suggests that higher capital increases liquidity creation. As a result, recent regulatory measures aimed both at enhancing capital ratios and reducing maturity transformation risk could result in excessive constraints on bank liquidity creation, thereby decreasing their ability to channel funds to the economy and therefore negatively affect economic growth. Indeed, one of the main arguments against the introduction of the net stable funding ratio is that it may be too restrictive and undermine banks´ traditional role in liquidity creation and maturity transformation and could

[1] See Basel Committee on Banking Supervision (BCBS) (2010, 2013, 2014) for more details on the changes to capital requirements and the definitions of the liquidity ratios as well as the implementation timetable.

[2] Total regulatory capital now comprises the sum of the following elements: (i) Tier 1 capital (going-concern capital), that includes common equity Tier 1 (CET1) and additional Tier 1, and (2) Tier 2 capital (gone-concern capital). The CET1 capital must be at least 4.5% of risk-weighted assets (RWA) whereas Tier 1 capital must be at least 6% of RWA. Total capital (Tier 1 capital plus Tier 2 capital) must be at least 8.0% of RWA at all times. Moreover, Basel III establishes a capital conservation buffer comprised of CET1 that implies that banks, at least in normal times, should operate with a "minimum" capital of 10.5% of their total RWA. In addition, national authorities may require a countercyclical buffer. Finally, the Committee also agreed to introduce a simple, transparent, non-risk based leverage ratio, which is calibrated to act as a credible supplementary measure to the risk-based capital requirements.

lead to a shortage of long-term lending with negative consequences for economic growth (Gobat et al. 2014).

Against this background, this paper aims to empirically analyze the relationship between liquidity creation (or alternatively, illiquidity) and capital by considering an indicator related to the new liquidity requirements of Basel III (the inverse of the net stable funding ratio). Higher values of this metric indicate that the amount of illiquid assets in a bank's balance sheet is increasing in relation to the available amount of stable funding, therefore indicating higher liquidity creation (and correspondently higher maturity transformation). As liquidity creation and bank capital might be jointly determined (Distinguin et al. 2013; Horvath et al. 2014; Fu et al. 2016), we employ a simultaneous equations model to capture the relationship between capital and liquidity. As a laboratory for this analysis, we focus on the Eurozone, as an interesting case study.[3] The Eurozone, one of the largest economic regions in the world, was badly hit by the 2010-2011 sovereign debt crisis (also known as the Eurozone crisis). Concerns were raised that the new capital and liquidity regulation impacted on the post-crisis recovery, via a decrease in liquidity creation. We believe this particular setting makes the analysis of the relationship between capital and liquidity even more interesting. Our sample period starts in 1999, the year a number of countries in the European Union (EU) adopted the euro as their national currency. The creation of the monetary union resulted in Eurozone countries becoming increasingly integrated and set apart from other parts of the European Union by their economic management – in particular, monetary and economic policy-making. In addition, the Eurozone is currently undergoing a profound process of transformation, which started in the aftermath of the 2008 financial crisis and gained

[3] The Eurozone is a geographic and economic region which consists of all the European Union (EU) countries that have adopted the euro as their national currency. As per 2018, it is a monetary union of 19 of the 28 European Union member states. The original 11 eurozone countries are: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain. Greece joined in 2001. Since then, Cyprus (2008), Estonia (2011); Latvia (2014); Lithuania (2015); Malta (2008); Slovakia (2009) and Slovenia (2007) also joined the monetary union.

momentum as regulators tried to tackle the problems of the sovereign debt crisis in 2010–2011. In 2012, this resulted in the Banking Union, which aims to deliver an integrated financial safety net for the Eurozone. Through common supervision of banks, the Banking Union aims to ensure effective enforcement of stronger prudential requirements for banks, in particular by requiring them to keep sufficient capital reserves and liquidity. The EU Capital Requirements Directive (CRD IV) incorporates the Basel III proposals of the BCBS and introduces a number of important changes to the European banking regulatory framework (e.g., a new systemic risk buffer).[4] Importantly, while the Basel III requirements apply only to "internationally active banks", the CRD IV regulations apply to all banks and investment firms. For this reason, and unlike previous studies that focus only on listed banks (e.g., Distinguin et al. 2013), our sample includes commercial, savings and cooperative banks, which gives us a more representative picture of the Eurozone banking sector, as unlisted banks account for the majority of banks in this area (Köhler 2015). This also allows us to exploit the heterogeneity of bank size and ownership across countries and to investigate the impact that the new CRD IV rules could exert on the economic recovery of the Eurozone.

Our results show a negative relationship between capital ratios and our liquidity creation proxy, suggesting that banks may reduce liquidity creation as bank capital increases, thus providing evidence in support of the "financial fragility-crowding out hypothesis". This result holds both for small and large banks, indicating that size is not a determinant of the negative relationship. Interestingly, when we divide the sample by ownership, we find that the result does not hold for savings banks, which appear to increase their liquidity creation when their capital increases. For these types of banks, the "risk absorption" capacity of equity capital is an important driver to explain liquidity creation. Moreover, we report that savings banks strengthen their capital ratios when they face higher illiquidity. This could be explained

[4] See Directive 2013/36/EU of the European Parliament and of the Council of 26 June 2013 on access to the activities of credit institutions and prudential supervision of credit institutions and investment firms.

by the different ability of savings banks to raise external finance and their higher reliance on retained earnings. Finally, we find that the overall negative relationship between capital and liquidity creation is stronger during the crisis period (2008-2013), thereby suggesting that while the new regulatory ratios might have improved bank stability by increasing capital and decreasing maturity mismatch, they might also have contributed to the weak economic performance of the Eurozone, whose banks have reduced liquidity creation.

Our analysis contributes to the literature along different dimensions. First, we contribute to the strand of literature on liquidity creation and the impact of the new Basel III rules by using the inverse of the net stable funding ratio as an indicator of liquidity creation and providing evidence for Eurozone banks. Second, we contribute to the literature investigating the relationship between liquidity creation and bank capital. We extend the work of Distinguin et al. (2013) by including both listed and unlisted banks. Finally, we contribute to a recent strand of the literature focusing on the importance of bank liquidity creation for real economic output (Berger and Sedunov 2017) and for bank stability and financial crises (Berger and Bouwman 2017).

The remainder of this paper is structured as follows. Section 2 presents a review of the literature and develops our main hypotheses on the relationship between bank capital and liquidity creation. Section 3 describes the data and methodology employed in the empirical analysis and defines the explanatory variables. Section 4 presents and discusses the results obtained. Section 5 summarizes the results and presents our conclusions.

2. Literature Review and Hypotheses Development

2.1 Literature Review

Traditionally, the literature has focused on the role of banks as risk transformers and less so on their role as liquidity creators (e.g., Diamond 1984; Boyd and Prescott 1986). Some notable exceptions include the works of Kashyap et al. (2002), Gatev and Strahan (2006) and

Pennachi (2006). According to Kashyap et al. (2002), banks combine liquidity provision to both depositors and borrowers to reduce risk, as long as liquidity demands from these two classes of customers are not highly correlated. The reason for this combination is to diversify away some liquidity risk and thus reduce the need to hold cash. Gatev et al. (2006) extend the work of Kashyap et al (2002) to increase the understanding of the deposit-lending liquidity synergy by testing how bank equity risk and the supply of deposit funds reacted to the liquidity crisis of 1998. Their results suggest that this diversification effect becomes particularly powerful during periods of crisis, when the correlation in demand for liquidity by depositors and by borrowers becomes negative. Pennachi (2006) contributes to this literature by showing that banks' ability to specialize in liquidity provision appears to be linked to the federal safety net provided by deposit insurance. Other studies focus on specific components of liquidity creation, usually business lending or real estate lending (e.g., Berger and Udell 1994; Peek and Rosengren 1995).

Empirical papers analyzing the relationship between capital and liquidity creation remain scarce. Recent developments in this literature have followed the pioneering work by Berger and Bouwman (2009) and the establishment of new capital and liquidity requirements (in particular, the net stable funding ratio) in Basel III (BCBS 2010). Berger and Bouwman (2009) construct four measures of liquidity creation (based either on loan category –"cat"- or solely on maturity –"mat"- and alternatively including off-balance sheet activities –"fat"- or excluding them –"nonfat"). They apply them to a sample of US banks from 1993 to 2003 and show that the effect of capital on liquidity creation is positive for large banks and negative for small banks. Therefore, the findings by Berger and Bouwman (2009) suggest that the higher capital requirements established by regulators in the Basel III accord may increase the liquidity created by large banks but reduce the liquidity created by small banks. Distinguin et al. (2013) use a simultaneous equations framework to investigate the relationship between

bank regulatory capital and bank liquidity measured from on-balance sheet positions for European and US listed commercial banks over the period 2000-2006. They find that liquidity creation and bank capital are closely interrelated: higher capital ratios imply lower liquidity creation, as banks decrease their regulatory capital ratios when they create more liquidity. Horvath et al. (2014) perform Granger-causality tests in a dynamic GMM panel estimator framework on a data set of Czech banks, which mainly includes small banks from 2000 to 2010. Similar to Distinguin et al. (2013), they show that capital negatively affects liquidity creation. They also report that higher liquidity creation causes a reduction in bank capital. Finally, Fu et al. (2016) analyze the relationship between liquidity creation and bank capital for a sample of commercial banks in 14 Asia-Pacific countries from 2005 to 2012. Their empirical results are similar to those obtained by Distinguin et al. (2013) and Horvath et al. (2014), reporting a negative and significant bi-causal relationship between liquidity creation and regulatory capital. Fungáčová et al. (2017) examine how the introduction of deposit insurance influences the relationship between bank capital and liquidity creation in an emerging market. They conclude that the introduction of a deposit insurance scheme in Russia has different effects on the relationship between capital and bank liquidity creation across different types of banks, the banks characterized by relatively high household deposit ratios being the most affected. For these banks, deposit insurance reduces the impact of capital on liquidity creation.

More recently, some studies focus on the importance of bank liquidity creation in the economy and in predicting financial crises. Berger and Sedunov (2017) find that bank liquidity creation is positively related to real economic output, confirming that on- and off-balance sheet liquidity creation have positive effects on the economy. In the same vein, Berger and Bouwman (2017) examine the interplay among bank liquidity creation, monetary policy and financial crises. They conclude that high liquidity creation (relative to trend) helps

predict crises, controlling for other factors, thus suggesting that authorities should monitor bank liquidity creation closely to predict and perhaps lessen the likelihood of financial crises.

2.2 Hypotheses Development

In their seminal paper, Berger and Bouwman (2009) discuss two opposing hypotheses on the link between capital and liquidity creation: the "financial fragility-crowding out" hypothesis and the "risk absorption" hypothesis. The former predicts that higher capital reduces liquidity creation; the latter states that higher capital enhances the ability of banks to create liquidity.

Accordingly, we derive the following testable hypotheses:

H1: Higher capital reduces liquidity creation.

H2: Higher capital increases liquidity creation.

The "financial fragility-crowding out" view is based on previous works by Diamond and Rajan (2000, 2001) and Gorton and Winton (2000). Diamond and Rajan (2000, 2001) present a model where the bank's asset side and liability side are tied together. They consider a lender that raises funds from depositors to provide financing to an entrepreneur. Because loans are illiquid, lenders may demand a premium for illiquidity or even may want to liquidate early if they need funds before the loan matures. Nevertheless, the adverse consequences of illiquidity can be avoided if the relationship lender is a bank that borrows using demand deposits. Depositors enable banks to borrow against the full value of the illiquid loan they hold, and they also help to mitigate the costs of illiquidity, as depositors could precipitate a 'run' if the bank threatens to withhold efforts.[5] Therefore, fragility commits banks to create liquidity, whereas stabilization policies, such as capital requirements, may reduce liquidity creation. The Gorton and Winton (2000) model shows that an increase in

[5] Note that a deposit insurance system can limit the negative effect of capital on liquidity creation, as suggested by Diamond and Rajan (2000, 2001).

required bank capital forces investors to reduce their deposit holdings in favor of equity. Because deposits are liquid and bank equity is illiquid, changing deposits for capital may reduce liquidity creation. This "crowding out" effect is more likely to affect small banks, as in larger capital markets, an increase in capital may cause investors to shift to equities other than bank deposits (Berger and Bouwman 2009).

In summary, the "financial fragility-crowding out" theory states that higher capital reduces liquidity creation. Conversely, the "risk absorption" theory states that higher capital increases liquidity creation. Liquidity creation may increase bank losses, as it implies having more illiquid assets to meet the liquidity demands of customers (Allen and Gale 2004). Therefore, because capital may help banks to absorb greater risk (see, e.g., Coval and Thakor 2005; Repullo 2004; Von Thadden 2004), some authors (e.g., Berger and Bouwman 2009) infer that higher capital may allow banks to create more liquidity. The risk absorption hypothesis may apply more strongly to large banks as they are usually exposed to more intense regulatory scrutiny and greater market discipline (Berger and Bouwman 2009).

Recent literature also suggests a causal relationship that moves from liquidity creation to capital. Again, two opposing hypotheses are proposed. Horvath et al. (2014) analyze the relationship between liquidity creation and capital by examining empirical works regarding the impact of risk on banks' capital buffers (Jokipii and Milne 2011; Lindquist 2004). According to the so-called "liquidity risk" hypothesis, as greater liquidity creation increases the risk of illiquidity for banks, banks should strengthen their solvency because capital acts as a buffer against unexpected withdrawals from customers. Therefore, this hypothesis would imply a positive relationship between liquidity creation and bank capital. Nonetheless, the "liquidity substitution" hypothesis proposed by Distinguin et al. (2013) suggests a negative relationship between liquidity creation and bank capital. When banks face higher illiquidity, they may consider certain liquid liabilities as stable funding sources and thus substituting

capital with these 'stable' liabilities. The latter means that banks may not strengthen their capital when they face illiquidity, as defined in the new Basel rules.

We therefore derive the following testable hypotheses:

H3: Higher liquidity creation induces banks to increase capital.

H4: Higher liquidity creation induces banks to decrease capital.

We test the abovementioned hypotheses by implementing a simultaneous equations model to account for the fact that capital and liquidity creation may be jointly determined.

3. Sample and methodological aspects

3.1. Sample

Our sample comprises 1,367 commercial banks, savings banks and cooperative banks operating in 17 Eurozone countries over the period 1999–2013, for a total of 7,275 bank/year observations. Data are from the Bankscope database maintained by Bureau Van Dijk (now Orbis Bank Focus). For the reasons discussed above, we focus on Eurozone countries.[6] While some choices are driven by data availability (the estimation of the net stable funding ratio is data intensive), we use unconsolidated financial statements.[7] This allows us to treat foreign subsidiaries as separate credit institutions, thereby reducing the possibility of introducing aggregation bias in the results (Delis and Staikouras 2011).

Merged banks are considered separate entities before the merger and single entities afterward. All the ratios capturing bank-specific characteristics are calculated based on the standardized global accounting format. Those entities that present abnormal ratios or extreme values are eliminated from the sample as outliers to ensure that the analysis is not affected by

[6] We restrict the analysis to countries that adopted the euro during the sample period (firm-year observations are included only if the country is a Eurozone member in that specific year). We thus exclude the cases of Latvia (joined in 2014) and Lithuania (joined in 2015).

[7] If unconsolidated financial statements were unavailable (this is sometimes the case for small-size banks, which only report on a consolidated basis as the number of subsidiaries is small to warrant separate audited statements), then consolidated data were used to avoid dropping the banks from the sample.

potential measurement errors and misreporting.[8] After completing this filtering, we obtain a final dataset consisting of an unbalanced panel with 7,275 observations. In contrast to other studies that examine only listed banks (Distinguin et al. 2013), most banks in our sample are unlisted (approximately 94 percent), which gives us a more representative picture of the Eurozone banking sector as unlisted banks account for the majority of banks (Baselga-Pascual et al. 2015; Köhler 2015). Table 1 shows the number of banks and observations in the sample by country.

[INSERT TABLE 1 ABOUT HERE]

3.2. Methodology

As liquidity creation and bank capital might be jointly determined (Distinguin et al. 2013; Horvath et al. 2014; Fu et al. 2016), we employ a simultaneous equations model. We use the generalized method of moments (GMM) estimator to empirically estimate the two equations. The GMM estimator is not only robust for the distribution of errors but is also more efficient in the presence of heteroskedasticity than instrumental variables (IV) estimators such as the two stages least square (2sls) and three stages least square (3sls). In the first equation (i.e., the liquidity creation equation), we regress a liquidity creation proxy on a bank capital ratio as well as a set of independent variables influencing liquidity creation. In the second equation (i.e., the capital equation), we regress our capital ratio on a liquidity creation proxy and a set of factors influencing bank capital. Therefore, our empirical model is based on the following baseline simultaneous equations system:

$$\begin{cases} Liquidity\ Creation_{i,t} = \alpha + \delta Capital_{i,t} + \sum_{i=1}^{I} \beta control\ variables_{i,t} + \sum_{j=1}^{J} \beta\ control\ variables_{j,t} + e_{i,j,t} \\ Capital_{i,t} = \alpha + \delta Liquidity\ Creation_{i,t} + \sum_{i=1}^{I} \beta control\ variables_{i,t} + \sum_{j=1}^{J} \beta\ control\ variables_{j,t} + e_{i,j,t} \end{cases} \quad (1)$$

[8] To identify potential outliers, we use both the leverage statistics (Belsley et al. 1980) and the Cook's distance analysis (Cook 1977, 1979).

where *Liquidity Creation* denotes the proxy used to measure liquidity creation, i.e., the inverse of the net stable funding ratio; *Capital* represents a ratio used to measure bank capital; δ and β are vectors of coefficient estimates; the subscript i denotes the firm; j denotes the country; t is the time period and $e_{i,j,t}$ is the disturbance term.

We test the endogeneity of all the regressors for both equations to identify the best instruments matrix.[9] All the endogenous variables have been instrumented by their one-year or two-year lagged values.

3.3. Definition of variables

3.3.1. Liquidity creation indicator

As previously stated, we use as proxy of liquidity creation an indicator related to the new liquidity requirements established in Basel III, i.e., the inverse of the net stable funding ratio. We therefore calculate our liquidity creation indicator as the amount of required stable funding (RSF) relative to the amount of available stable funding (ASF). RSF refers to the bank assets and off-balance sheet activities that are considered illiquid over a one-year time horizon and thus should be backed by stable funding resources, and ASF refers to the capital and liabilities expected to be stable over a one-year time horizon. RSF and ASF are calculated by assigning the carrying values of bank assets and liabilities to several categories and then weighting those amounts. The RSF weights range from 0 to 100 percent to reflect the liquidity of asset categories, with illiquid assets enjoining the higher RSF factors (all assets that are encumbered for a period of 1 year or more are assigned a 100 percent RSF weight). Similarly, the ASF weights range from 0 to 100 percent to reflect the stability of liability types, with a higher ASF weight meaning a more stable funding (regulatory capital). Higher values for the inverse of the net stable funding ratio mean that the amount of illiquid assets is

[9] We check endogeneity with the Durbin score and the Wu-Hausman tests. Both tests have as a null hypothesis that the variable under consideration can be used as exogenous.

increasing in relation to the available amount of stable funding, thus indicating a higher liquidity creation (as well as a greater liquidity risk). Table 2 shows the composition of asset and liability categories (and their weights) used to calculate our liquidity creation indicator according to the Bankscope database terminology. In Appendix 1, we also report a comparison of the original Basel III net stable funding ratio with our proxy.[10] We consider only on-balance sheet positions because a detailed breakdown of off-balance sheet positions is not available for all the banks in our sample.[11]

[INSERT TABLE 2 ABOUT HERE]

3.3.2. Bank capital indicators

We use three ratios commonly used in the literature as a measure of bank capital: the equity to total assets ratio (*Equity*), the total regulatory capital ratio (*Total Capital*) and the Tier 1 ratio (*Tier 1*). The equity to total assets ratio is the book value of equity divided by the book value of total assets. The total regulatory capital ratio is the total capital adequacy ratio under the Basel rules, including Tier 1 and Tier 2 capital as a percentage of RWA and off-balance sheet risks. The Tier 1 ratio refers to shareholder funds plus perpetual non-cumulative preference shares as a percentage of the RWA and off-balance sheet risks.

3.3.3. Control variables affecting liquidity creation

In our liquidity creation equation, we also include a number of control variables, which the literature has identified as relevant for banks' liquidity choices. We control for credit risk by using the non-performing loan ratio (*Non-Performing*). As stated by Berger and Bouwman (2009), it is important to control for risk because it helps to isolate the role of capital in

[10] Although Bankscope does not give the required level of detail necessary to calculate the net stable funding ratio according to the BCBS (2014) guidelines for most of the banks in our sample, we can use this database to consistently approximate this ratio. Nevertheless, some assumptions are needed (Chiaramonte and Casu, 2017).
[11] Unfortunately, empirically testing the effect of off-balance sheet activities is hampered by the absence of detailed data in Bankscope. Although Bankscope gives information about off-balance sheet activities for some of the banks in our sample, considering only those banks would excessively reduce the sample size.

supporting the liquidity creation of banks from the role of capital in supporting banks' function as risk transformers. The theoretical financial intermediation literature, as modeled by Bryant (1980) and Diamond and Dybvig (1983), postulates that credit risk and liquidity risk should be positively correlated (Imbierowicz and Rauch 2014).[12] This idea of a positive relationship between credit and liquidity risk (i.e., both risks increase or decrease jointly) is also supported by recent studies that focus on the financial crisis of 2007-2008 (Acharya and Viswanathan 2011; He and Xiong 2012).[13]

Several empirical studies have shown that bank size may affect liquidity creation. A positive relationship could be expected between bank size and liquidity creation as larger banks could create more liquidity than smaller banks because they have easier access to the lender of last resort and because they would be the first to benefit from the safety net (Distinguin et al. 2013). Nonetheless, Horváth et al. (2014) and Fu et al. (2016) observe a significantly negative coefficient of bank size on their liquidity creation equation, suggesting that smaller banks create more liquidity (per total assets) than larger ones. As usual in the literature, we measure bank size by the natural logarithm of total assets (*Size*).

Market competition may have important effects on liquidity creation (Berger and Bouwman 2016; Horvath et al. 2016; Jiang et al. 2016). However, those effects are still ambiguous. The structure-conduct-performance hypothesis (Bain 1959) states that increased competition (or, alternatively, lower market power) induces banks to offer more favorable pricing to customers, resulting in higher liquidity creation. In support of this view, some empirical studies find that increased competition improves bank lending (Cetorelli and Strahan 2006; Canales and Nanda 2012). Conversely, some of the relationship banking literature argues that increased competition may reduce bank lending (Petersen and Rajan

[12] Liquidity creation is positively associated with liquidity risk and may be positively associated with credit risk if the high liquidity creation is caused by high business loans and commitments (Berger and Bouwman 2016).
[13] Nevertheless, a recent body of literature suggests the possibility that the relationship between liquidity risk and credit risk in banks might be negative (see e.g., Wagner 2007; Gatev et al. 2009; Acharya and Naqvi 2012).

1995). In addition, the "fragility channel" view states that bank competition should lead to a contraction in liquidity creation, as increased competition reduces bank profits and thus incentivizes banks to reduce their lending and deposit activities to diminish the threat of bank runs (Horvath et al. 2016). Recent works by Horvath et al. (2016), on a dataset of Czech banks from 2002 to 2010, and Jiang et al. (2016), on a sample of US commercial banks from 1984 to 2006, conclude that increased competition reduces liquidity creation. We use the number of bank branches per 10,000 inhabitants (*Competition*) as a proxy for market competition, which reflects structural differences in banking markets.

The macroeconomic environment is also likely to affect bank liquidity creation. Therefore, we add the annual growth rate of real gross domestic product (*GDP*) and the unemployment rate of the country (*Unemployment*) to our equation. We may expect that during economic booms, with higher rates of economic growth and lower unemployment rates, banks increase liquidity creation (Distinguin et al. 2013). We also incorporate the interest rate of the main refinancing operations of the ECB (*Interest*). This provides the bulk of the liquidity to the European banking system as monetary policy may influence liquidity creation (Berger and Bouwman, 2017).

Finally, we control for the public status of the bank (*Listed*) and the bank type (*Commercial Banks*; *Savings Banks*), as they may affect liquidity creation (Berger and Bowman 2009; Fu et al. 2016).

3.3.4. Control variables affecting bank capital

Similarly, we control for a set of bank-specific, regulation and macroeconomic variables that are likely to influence bank capital. The literature (see, e.g., Berger et al. 1995; Flannery and Rangan 2008) reports a positive relationship between the risk of bank assets and capital, as banks increase their capital buffers to protect them against unexpected losses. Nevertheless, a negative relationship between risk and capital could be expected, as we proxy the risk

profile of the bank by the non-performing loans ratio (*Non-Performing*), which is an ex-post measure of risk, and loan losses could reduce bank capital (Ayuso et al. 2004).

Controlling for bank size (*Size*) is also important, as larger banks may benefit from greater diversification, which reduces their risk exposure and thus their capital needs (Hughes et al. 2001; Altunbas et al. 2007). Additionally, larger banks may also be viewed as more likely to be "too-big-to-fail" and thus require less capital (Brewer III et al. 2008).[14] Consequently, the expected sign for the coefficient of this variable in the capital equation is negative.

We include the return on equity (*ROE*) in our capital equation, as several studies indicate that profitability may positively influence bank capital (Flannery and Rangan 2008; Gropp and Heider 2010). In line with the pecking-order-theory of the capital structure, capital accumulation could rely on funds generated internally (e.g., through higher retained earnings) because raising capital is usually more expensive.

We control for the funding structure of banks by adding the ratio of non-deposit funds to total liabilities (*Non-Deposits*). Nier and Bauman (2006) suggest that as uninsured liabilities are likely to face large losses in case of bank failure, stronger market discipline exercised by uninsured debtholders results in larger capital buffers. Therefore, we may expect a positive sign for this variable in our empirical specification.

Following Distinguin et al. (2013), because banks are likely to increase their capital holdings under stronger regulations, we include an indicator of the level of stringency of capital regulation extracted from the World Bank database on Bank Regulation and

[14] In response to the 2007 financial crisis, the BCBS imposes global systemically important banks (G-SIBs) additional loss absorbency requirements, which range from 1% to 2.5% CET1, depending on a bank's systemic importance.

Supervision developed by Barth et al. (2001) (*Stringency Index*).[15,16] Because regulatory initiatives are unlikely to affect the behavior of banks in the immediate term, we use the first lag of the corresponding index (Baselga-Pascual et al. 2015).

Bank capital also depends on macroeconomic conditions. Capital ratios may be procyclical if banks use an expansionary macroeconomic environment to accumulate capital (Laeven and Majnoni 2003; Schaeck and Cihák 2012). Moreover, during recessions, defaults on bank loans increase and generate higher losses that are charged against bank capital (Brewer III et al. 2008). We therefore expect a positive relationship between bank capital and *GDP* and a negative relationship between bank capital and unemployment rate *(Unemployment)*. Nonetheless, Ayuso et al. (2004) find that capital buffers were counter-cyclical in Spain over the period 1986–2000. They conclude that the negative relationship that they find between capital buffers and the business cycle offers some support to the view that certain institutions may behave in an excessively lax manner during upturns because they (or the risk models they use) do not take properly into account the cyclical nature of output and therefore tend to underestimate risks during economic upturns. The level of interest rates

[15] The capital stringency index is built by adding two measures of capital stringency: overall and initial capital stringency. Overall capital stringency indicates whether risk elements and value losses are considered while calculating the regulatory capital. It is based on the following questions: (i) Is the minimum capital–asset ratio requirement risk weighted in line with the Basel guidelines? (ii) Does the minimum ratio vary as a function of credit risk? (iii) Does the minimum ratio vary as a function of market risk? (iv) Are market values of loan losses not realized in accounting books deducted from capital? (v) Are unrealized losses in securities portfolios deducted from capital? (vi) Are unrealized foreign exchange losses deducted from capital? (vii) What fraction of revaluation gains is allowed as part of capital? Initial capital stringency refers to whether certain funds may be used to initially capitalize a bank and whether they are officially verified. It is based on the following questions: (viii) Are the sources of funds to be used as capital verified by the regulatory or supervisory authorities? (ix) Can the initial disbursement or subsequent injections of capital be performed with assets other than cash or government securities? (x) Can the initial disbursement of capital be performed with borrowed funds? We assign a value of 1 if the answer to questions (i), (ii), (iii), (iv), (v), (vi) and (viii) is yes, and 0 otherwise, while the opposite holds in the case of questions (ix) and (x). In addition, we assign a value of 1 if the fraction of revaluation gains that is allowed to count as regulatory capital (question (vii)) is less than 0.75. Otherwise, we assign a value of 0. By adding all these values together, we create the variable capital stringency index, which ranges in value from 0 to 10, with higher values indicating greater stringency.

[16] This database is based on four surveys conducted by the World Bank. Survey I was released in 2001, and, for most of the countries, the information corresponds to 1999. Survey II describes the regulatory situation at the end of 2002. Survey III describes the regulatory environment in 2005–2006. Finally, Survey IV provides information on bank regulation and supervision in 125 countries for 2011 (with some corrections in 2012) (Barth et al. 2013). This database is available from the World Bank website at http://go.worldbank.org/SNUSW978P0.

(*Interest*) may also affect capital ratios (see, e.g., Altunbas et al. 2007; Schaeck and Cihák 2012) although the expected sign for the coefficient of this variable is ambiguous. Higher interest rates can provide banks with greater profits and thus higher capital, yet rising interest rates may negatively affect capital ratios, as it may imply more loan defaults.

Finally, as in the bank liquidity equation, we control for the public status of the bank (*Listed*) and the bank type (*Commercial Banks*; *Savings Banks*), as they may also affect capital holdings.

Table 3 summarizes the variables considered in the current study.

[INSERT TABLE 3 ABOUT HERE]

4. Results

4.1. Descriptive statistics

Table 4 presents descriptive statistics of the variables considered in this paper. Although we drop those entities with abnormal ratios from the sample in a first step, the maximum and minimum values seem to still reflect the presence of some outliers in *Liquidity Creation*, *Tier 1* and *ROE*. We identify those outliers and estimate our models with and without outliers to avoid possible bias in the regressions. The results in both cases are very similar, probably because the GMM estimator - due to the lags used to manage endogeneity problems - excludes most of those extreme values.

Table 5 shows the evolution of mean values for *Liquidity Creation* and *Equity* from 1999 to 2013.[17] We observe a clear tendency of both variables. *Liquidity Creation* decreases slowly, with the only exception being for 2004. Conversely, we observe a slight increase over time of the capital ratio, *Equity*. The results are similar when the sample is divided by type and size of banks.

[17] We find similar results when *Total Capital* and *Tier 1* are used as the measure of bank capital.

[INSERT TABLES 4 & 5 ABOUT HERE]

4.2. The relationship between liquidity creation and bank capital in the Eurozone

Table 6 shows the regression results. We find an inverse relationship between capital ratios (i.e., *Equity*, *Total Capital* and *Tier 1*) and our liquidity creation proxy. Therefore, banks may reduce liquidity creation as bank capital increases, as suggested by the "financial-fragility-crowding out" hypothesis. This result is consistent with the findings of Distinguin et al. (2013), Horvath et al. (2014) and Fu et al. (2016).

Regarding the control variables affecting liquidity creation, we observe a positive relationship between credit risk and liquidity creation, suggesting that banks with a higher credit risk create more liquidity.[18] The influence of size on liquidity creation is positive, similar to that reported by Distinguin et al. (2013). Market competition is negatively associated with liquidity creation, in line with the relationship banking literature (Petersen and Rajan 1995) and the "fragility channel" view (Horvath et al. 2016). We also find that the macroeconomic environment affects bank liquidity creation. During crisis periods, with low rates of economic growth and high unemployment rates, banks reduce liquidity creation. The effect of interest rates on liquidity creation is negative, suggesting that increased interest rates negatively affect liquidity creation. Finally, similar to Fu et al. (2016), the coefficient of *Listed* is negative, indicating that listed banks create less liquidity than non-listed banks.

[INSERT TABLE 6 ABOUT HERE]

We also report an inverse relationship between liquidity creation and bank capital. As suggested by the "liquidity substitution" hypothesis, when banks face higher illiquidity, they may consider certain liquid liabilities as stable funding sources and thus substitute capital with these 'stable' liabilities. Again, our results are similar to those obtained by Distinguin et

[18] Berger and Bouwman (2016) state that there is little research to date on this topic, suggesting that examining this relationship would be a promising line of future research.

al. (2013), Horvath et al. (2014) and Fu et al. (2016), indicating that banks reduce capital when liquidity creation increases (or, alternatively, showing that banks do not strengthen their capital ratios when they face higher illiquidity, as defined in the Basel III capital accords). Most of the control variables have the expected sign in the regression. We report a significant negative relationship between risk and *Equity*. As *Non-Performing* is an ex post measurement of the risk-taking by banks, loan losses could reduce bank capital (Ayuso et al. 2004). *Size* has a significant negative sign, suggesting that larger banks may be viewed as more likely to be "too-big-to-fail" and thus require less capital (Brewer III et al. 2008). Profitability may positively influence bank capital as suggested by the positive sign of the *ROE* coefficient (though not in all of the regressions). We also find that a higher proportion of non-deposits in total liabilities may imply more capital. The significant positive sign for *Stringency Index* in the *Equity* regression would indicate that banks increase their capital holdings under stronger regulations. Bank capital also depends on macroeconomic conditions. Our results support the view that capital ratios were counter-cyclical, thus indicating that some institutions may behave in an excessively lax manner during upturns because they (or the risk models they use) do not take properly into account the cyclical nature of output and therefore tend to underestimate risks during economic upturns (Ayuso et al. 2004). Higher interest rates seem to negatively affect capital ratios, as they may imply more loan defaults. Finally, the coefficient of *Listed* is not significant.

4.3. Robustness checks

We conduct several robustness checks to confirm the aforementioned findings.

4.3.1. Considering alternative liquidity creation proxies

We construct two alternative liquidity creation proxies, *LC (cat non-fat)* and *LC (mat non-fat)*, based on the "cat non-fat" and "mat non-fat" indicators of Berger and Bouwman (2009). To this end, we first classify all bank assets, liabilities and equity as liquid, semiliquid

or illiquid according to their category ("cat") or their maturity ("mat") (see Table 7).[19,20] We then assign weights to those groups considering that maximum liquidity is created when liquid liabilities are transformed into illiquid assets and maximum liquidity is destroyed when illiquid liabilities or equity are transformed into liquid assets. Finally, we combine the groups and weights as suggested by Berger and Bouwman (2009) and divide this by the total assets. As in our baseline indicator of liquidity creation, we exclude off-balance sheet activities from *LC (cat non-fat)* and *LC (mat non-fat)*.

[INSERT TABLE 7 ABOUT HERE]

The main difference between these two new liquidity creation indicators and our main liquidity indicator stems from the liability side of the balance sheets. Berger and Bouwman (2009) consider some liabilities as liquid because they can be quickly withdrawn without penalty. However, a large share of these liquid liabilities is considered as stable in the Basel III liquidity indicator because they are expected to ''stay'' within the institution (for example, customer deposits) (Distinguin et al. 2013).

The results obtained do not differ substantially from those obtained previously; we find a negative and significant two-way relationship between liquidity creation and bank capital (see Table 8). Additionally, most of the control variables retain both their signs and their statistical significance, except that *Size* now shows a statistically significant negative relationship with liquidity creation.

[INSERT TABLE 8 ABOUT HERE]

[19] For details about the correspondence of the "cat non-fat" and "mat non-fat" metrics of Berger and Bouwman (2009) with our liquidity creation indicators, *LC (cat non-fat)* and *LC (mat non-fat)*, see Appendix 2.

[20] Unfortunately, the number of observations is drastically reduced from 7,275 to 2,396 when *LC (cat non-fat)* is used as the liquidity creation proxy. This reduction is mainly because Bankscope does not provide detailed date about loan categorization (e.g., corporate and commercial loans) for all the banks in our sample. Similarly, when we use *LC (mat non-fat)* as the liquidity creation indicator, the number of observations drops to 2,176. Now, this decrease in the number of observations is mainly due to the absence of exhaustive data on loan maturity (e.g., loans and advances to costumers less than or equal to 12 months).

Finally, following Berger and Bouwman (2009), we construct another indicator by excluding equity from our proxy of liquidity creation. This idea is based on theories that argue that banks create liquidity when illiquid assets are transformed into liquid liabilities but not when they are transformed into illiquid claims, such as equity. Moreover, as equity is included in both the liquidity creation indicator and the capital ratio, this may bias the results. Nevertheless, our findings (not reported) do not change our main conclusions, as most of the coefficients (both signs and statistical significances) are not affected.

4.3.2. Excluding banks with capital ratios below minimum requirements

We check the robustness of our results by excluding banks with regulatory capital ratios below the minimum requirements (i.e., 8% for the total regulatory capital ratio and 4% for the Tier 1 ratio). We also exclude observations that show equity to total assets ratios of less than 2%. In all cases, the results are consistent with those previously obtained (see Table 9).

[INSERT TABLE 9 ABOUT HERE]

4.3.3. Commercial banks, savings banks and cooperative banks

As a third robustness check, we test whether our results differ between commercial banks, savings bank and cooperative banks. When we divide the sample by bank type, we find that savings banks seem to have a different behavior to the other types banks. Table 10 shows that, in the case of savings banks, higher capital increases liquidity creation, as stated by the "risk absorption" theory. For these types of banks, the "risk absorption" capacity of equity capital is an important driver to explain liquidity creation. Moreover, we report that savings banks strengthen their capital ratios when they face higher illiquidity (i.e., they behave in the manner suggested by the "liquidity risk" hypothesis). This could be explained by the different ability of savings banks to raise external finance and their higher reliance on retained earnings.

[INSERT TABLE 10 ABOUT HERE]

4.3.4. Smaller versus larger banks

We now divide our sample according to the bank size (based on median total assets) to examine whether the relationship between capital and liquidity creation differs between small and large banks. Berger and Bouwman (2009) argue that the causal link that goes from bank capital to liquidity creation depends on size. They expect that the effects of the "financial fragility-crowding out" theory are likely to be relatively stronger for smaller banks.[21] Their empirical results corroborate this idea, finding that the negative effect from capital on liquidity creation is present only for small banks (being positive for large banks). Distinguin et al. (2013) state that the differences in accessing external funding is likely to affect the link that goes from bank illiquidity to capital. However, they do not report differences between large and small European banks, the coefficients of the liquidity creation indicators not being conclusive in both regressions.

Regarding our findings, Table 11 shows that they do not change substantially from those obtained for the baseline models, as most of the variables retain their original sign. We only appreciate that the negative link that goes from bank capital to liquidity creation seems to be stronger in the case of smaller banks, this result being consistent with that reported by Berger and Bouwman (2009).

[INSERT TABLE 11 ABOUT HERE]

4.3.5. Pre-crisis (1999-2007) versus crisis (2008-2013) period

As a new analysis, we divide the sample into two periods: a pre-crisis and relatively economically stable period (1999 to 2007) and a crisis period (2008 to 2013). We use this

[21] The close monitoring highlighted by Diamond and Rajan (2000, 2001) may be more important in smaller banks, which deal more with entrepreneurial-type small businesses (Distinguin et al. 2013). Additionally, the "crowding out" effect is more likely to affect smaller banks as they tend to be more funded by deposits than larger banks.

approach to examine possible differences in our regression due to the impact of both the 2008 financial crisis and the sovereign debt crisis that started in 2011 in the Eurozone. Table 12 shows that although the results obtained using this approach resemble those of our baseline models, the significance of the explanatory variables is substantially stronger during the crisis period. Therefore, requiring banks to operate with higher capital, particularly in crisis periods, could weaken economic recovery. The establishment of the Basel III capital conservation buffer, which seeks to ensure that banks build up capital buffers outside periods of stress, would be an adequate solution to this problem.

[INSERT TABLE 12 ABOUT HERE]

4.3.6. Considering alternative control variables

We also re-estimate our equations by changing some of the control variables (see Table 13). First, we replace the macroeconomic and regulatory variables with time and country dummies. As expected, our findings do not change substantially from those obtained for the baseline models. Second, we consider the Herfindahl–Hirschman index of industry concentration (*Concentration*) instead of *Competition* as a competition measure.[22] Using this metric, the results are similar to those obtained for the initial models. Finally, because credit risk seems to be an important variable affecting both liquidity creation and capital, we replace *Non-Performing* with the ratio of RWA and off-balance sheet activities divided by total assets (*RWATA*). Once again, our results do not change substantially, as most of the coefficients (both signs and statistical significances) are not affected. As could be expected, the sign of the coefficient for the credit risk proxy in the capital equation is now positive.

[22]*Concentration* is calculated as the sum of the squares of all credit institutions' market shares within a country in terms of total assets (in percentage). It is often said that a market is highly concentrated when the index exceeds 1800 (or 0.18, if we use units instead of percentages) and is unconcentrated when the index is below 1000 (or 0.1). Therefore, a higher value for *Concentration* would correspond to a lower market competition. The data on *Concentration* in the euro area countries were obtained from the Banking Structural Financial Indicators database of the ECB at http://sdw.ecb.europa.eu/browse.do?node=bbn2869.

[INSERT TABLE 13 ABOUT HERE]

4.3.7. Excluding Italy and Germany

We test whether our results are similar when Italy and Germany (i.e., the countries with a larger number of observations) are excluded from the sample. Again, our findings do not change substantially from those obtained for the baseline equation (see Table 14).

[INSERT TABLE 14 ABOUT HERE]

4.3.8. Extending the analysis to all EU, EEA and EFTA countries

As a final robustness check, we apply our empirical model to an extended sample that includes commercial banks, savings banks and cooperative banks from all the 28 EU member countries, plus Norway and Switzerland (see Table 15).[23] Our results remain stable, with most of the coefficients (both signs and statistical significances) not being affected. We thus confirm that the existence of an inverse bi-causal relationship between capital and liquidity creation is a generally valid hypothesis, not Eurozone specific.

[INSERT TABLE 15 ABOUT HERE]

5. Conclusions

This paper empirically analyzes the relationship between liquidity creation (or alternatively, illiquidity) and bank capital in the Eurozone. We consider a liquidity creation indicator in line with the new liquidity requirements established in Basel III (the inverse of the net stable funding ratio), one of the Basel Committee's key reforms to promote a more resilient banking sector. Our sample comprises an unbalanced panel data set of 7,275 observations from 1999 to 2013, which allows us to consider the impact of the financial and

[23] We added to the original sample (17 Eurozone countries over the period 1999-2013) observations from Bulgaria (65), Croatia (117), the Czech Republic (65), Denmark (92), Hungary (43), Latvia (9), Lithuania (14), Norway (222), Poland (80), Romania (66), Sweden (32), Switzerland (685) and the United Kingdom (204). The extended sample includes banks from 30 EU, EEA and EFTA countries.

economic crisis on the Eurozone banking system. As previous studies suggest that liquidity and capital could be jointly determined, we employ a simultaneous equations model.

We find a significant and inverse bi-causal relationship between capital and liquidity creation. This empirical result is consistent with the findings of Distinguin et al. (2013) (European and US listed commercial banks over the period 2000-2006), Horvath et al. (2014) (Czech banks over the period 2000-2010) and Fu et al. (2016) (Asia-Pacific commercial banks over the period 2005-2012). Therefore, our results indicate that banks may reduce liquidity creation as they increase capital, as stated by the "financial-fragility-crowding out" hypothesis. This suggests that a fragile capital structure can encourage banks to maximize liquidity creation (Diamond and Rajan 2000, 2001), whereas higher capital ratios limit liquidity creation by reducing bank deposits (Gorton and Wilton 2000). Our results also support the "liquidity substitution" hypothesis, which suggests that as liquidity creation increases, banks may consider certain liquid liabilities as stable funding sources, reducing bank capital. Alternatively, this negative relationship in the causal link that goes from liquidity to capital suggests that banks do not strengthen their capital ratios when they face higher illiquidity, as defined in the Basel capital accords.

Our findings have important policy implications and could have broader significance for supervisors concerned about benchmarking and validation issues related to banking regulation. They reinforce the idea of establishing minimum liquidity ratios in coordination with capital ratios, as both are closely related to each other. Although the establishment of new liquidity requirements could strengthen bank solvency, the higher capital requirements together with the need to comply with the new liquidity ratios recently established in Basel III (and the subsequent EU regulation) may limit the amount of bank funding available to firms and households and therefore weaken economic recovery in the Eurozone.

References

Acharya VV, Naqvi H (2012) The seeds of a crisis: a theory of bank-liquidity and risk-taking over the business cycle. *Journal of Financial Economics* 106:349–366

Acharya VV, Viswanathan, SV (2011) Leverage, moral hazard, and liquidity. *Journal of Finance* 66:99–138

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

Altunbas Y, Carbó S, Gardener EPM, Molyneux P (2007) Examining the relationships between capital, risk and efficiency in European banking. *European Financial Management* 13:49–70

Ayuso J, Pérez D, Saurina J (2004) Are capital buffers pro-cyclical? Evidence from Spanish panel data. *Journal of Financial Intermediation* 13:249–264

Bain JS (1959) *Industrial organization: A Treatise*. New York, NY: John Wiley & Sons

Barth JR, Caprio G Jr, Levine R (2001) The regulation and supervision of banks around the world: a new database. Policy Research Working Paper 2588, World Bank

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

Basel Committee on Banking Supervision (BCBS) (2010) *Basel III: A global regulatory framework for more resilient banks and banking systems*. Bank for International Settlements, December.

Basel Committee on Banking Supervision (BCBS) (2013) *Basel III: The liquidity coverage ratio and liquidity risk monitoring tools*. Bank for International Settlements, January.

Basel Committee on Banking Supervision (BCBS) (2014) *Basel III: The net stable funding ratio*. Bank for International Settlements, October.

Baselga-Pascual L, Trujillo-Ponce A, Cardone-Riportella C (2015) Factors influencing bank risk in Europe: evidence from the financial crisis. *The North American Journal of Economics and Finance* 34:138-166

Belsley D, Kuh E, Welsch R. (1980) *Regression diagnostics: identifying influential data and sources of collinearity*. John Wiley & Sons, New York

Berger AN, Bouwman CHS (2009) Bank liquidity creation. *Review of Financial Studies* 22:3779–3837

Berger AN, Bouwman CHS (2016) *Bank liquidity creation and financial crisis.* Elsevier

Berger AN, Bouwman, CHS (2017) Bank liquidity creation, monetary policy, and financial crises. *Journal of Financial Stability* 30: 139-155.

Berger AN, Herring R, Szegö G (1995) The role of capital in financial institutions. *Journal of Banking and Finance* 19:393–430

Berger AN, Sedunov J. (2017) Bank liquidity creation and real economic output. *Journal of Banking and Finance* 81:1-19.

Berger AN, Udell GF (1994) Did risk-based capital allocate bank credit and cause a "credit crunch" in the United States? *Journal of Money, Credit and Banking* 26:585–628

Boyd JH, Prescott EC (1986) Financial intermediary coalitions. *Journal of Economic Theory* 38:211–232

Brewer III E, Kaufman GG, Wall LD (2008) Bank capital ratios across countries: why do they vary? *Journal of Financial Services Research* 34:177-201

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

Canales R, Nanda R (2012) A darker side to decentralized banks: market power and credit rationing in SME lending. *Journal of Financial Economics* 105:353-366

Cetorelli N, Strahan PE (2006) Finance as a barrier to entry: bank competition and industry structure in local U.S. markets. *Journal of Finance* 61:437-461

Chiaramonte L, Casu, B (2017) Capital and liquidity ratios and financial distress. Evidence from the European banking industry. *The British Accounting Review* 49:138-161

Cook, RD (1977) Detection of influential observations in linear regression. *Technometrics* 19:15–18

Cook, RD (1979) Influential observations in linear regression". *Journal of the American Statistical Association* 74:169-174

Coval JD, Thakor AV (2005) Financial intermediation as a beliefs-bridge between optimists and pessimists. *Journal of Financial Economics* 75:535–569

Delis MD, Staikouras PK (2011). Supervisory effectiveness and bank risk. *Review of Finance* 15:511–543

Diamond DW (1984) Financial intermediation and delegated monitoring. *Review of Economic Studies* 51:393–414

Diamond DW, Dybvig PH (1983) Bank runs, deposit insurance, and liquidity. *The Journal of Political Economy* 91:401–419

Diamond DW, Rajan RG (2000) A theory of bank capital. *Journal of Finance* 55:2431–2465

Diamond DW, Rajan RG (2001) Liquidity risk, liquidity creation, and financial fragility: a theory of banking. *Journal of Political Economy* 109:287–327

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

Flannery MJ, Rangan KP (2008) What caused the bank capital build-up of the 1990s? *Review of Finance* 12:391–429

Fu XM, Lin YR, Molyneux P (2016) Bank capital and liquidity creation in Asia Pacific. *Economic Inquiry* 54:966-993

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

Gatev E, Schuermann T, Strahan PE (2006) How do banks manage liquidity risk? Evidence from the equity and deposit markets in the fall of 1998. In *Risks of Financial Institutions* 105–27. (eds.) M. Carey and R. Stulz, Chicago, IL: University of Chicago Press

Gatev E, Strahan PE (2006) Banks' advantage in hedging liquidity risk: theory and evidence from the commercial paper market. *Journal of Finance* 61:867–892

Gatev E, Schuermann T, Strahan PE (2009) Managing bank liquidity risk: how deposit-loan synergies vary with market conditions. *Review of Financial Studies* 22:995–1020

Gobat J, Yanase M, Maloney J (2014) The net stable funding ratio: impact and issues for consideration. International Monetary Fund, Working Paper (14/106)

Gorton G, Winton A (2000) Liquidity provision, bank capital, and the macroeconomy. University of Minnesota, Working Paper

Gropp R, Heider F (2010) The determinants of capital structure. *Review of Finance* 14:587–622

He Z, Xiong W (2012) Dynamic debt runs. *Review of Financial Studies* 25:1799–1843

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

Horvath R, Seidler J, Weill L (2014) Bank capital and liquidity creation: granger-causality evidence. *Journal of Financial Research* 45:341-361

Horvath R, Seidler J, Weill L (2016) How bank competition influences liquidity creation. *Economic Modelling* 52:155-161

Hughes JP, Mester L, Moon C (2001) Are scale economies in banking elusive or illusive. Evidence obtained by incorporating capital structure and risk-taking into models of bank production. *Journal of Banking and Finance* 25:2169–2208

Imbierowicz B, Rauch C (2014) The relationship between liquidity risk and credit risk in banks. *Journal of Banking and Finance* 40:242-256

Jiang L, Levine R, Lin C (2016) Competition and bank liquidity creation. National Bureau of Economic Research, Working Paper (22195)

Jokipii T, Milne A (2011) Bank capital buffer and risk adjustment decisions. *Journal of Financial Stability* 7:165–178

Kashyap AK, Rajan RG, Stein JC (2002) Banks as liquidity providers: an explanation for the coexistence of lending and deposit-taking. *Journal of Finance* 57:33–73

Köhler M (2015) Which banks are more risky? The impact of business model on bank stability. *Journal of Financial Stability* 16:195–212

Laeven L, Majnoni G (2003) Loan loss provisioning and economic slowdowns: too much, too late? *Journal of Financial Intermediation* 12:178–197

Lindquist K (2004) Banks' buffer capital: how important is risk? *Journal of International Money and Finance* 23:493–513

Nier E, Baumann U (2006) Market discipline, disclosure and moral hazard in banking. *Journal of Financial Intermediation* 15:332–361

Peek J, Rosengren ES (1995) The capital crunch: neither a borrower nor a lender be. *Journal of Money, Credit and Banking* 27:625–38

Pennacchi G (2006) Deposit insurance, bank regulation, and financial system risks. *Journal of Monetary Economics* 53:1–30

Petersen MA, Rajan RG (1995) The effect of credit market competition on lending relationships. *The Quarterly Journal of Economics* 110:407–443

Repullo R (2004) Capital requirements, market power, and risk taking in banking. *Journal of Financial Intermediation* 13:156–182

Schaeck K, Cihák M (2012) Banking competition and capital ratios. *European Financial Management* 18:836–866

Von Thadden EL (2004) Bank capital adequacy regulation under the new Basel accord. *Journal of Financial Intermediation* 13:90–95

Wagner W (2007) The liquidity of bank assets and bank liquidity. *Journal of Banking and Finance* 31:121–139

Appendix 1. Correspondence of Basel III net stable funding ratio with our liquidity creation proxy

Available Stable Funding (ASF) (BCBS, 2014)	**Weight**	**Bankscope (now Orbis Bank Focus) terminology**
Total regulatory capital (excluding Tier 2 instruments with residual maturity of less than 1 year) + Other capital instruments and liabilities (including term deposits) with effective residual maturity of 1 year or more	100%	Total equity + Total long-term funding
Stable non-maturity (demand) deposits and term deposits with residual maturity of less than 1 year provided by retail and small business customers	95%	Customer deposits (current) + Customer deposits (savings) + Customer deposits (term)
Less stable non-maturity deposits and term deposits with residual maturity of less than 1 year provided by retail and small business customers (e.g., Internet deposits)	90%	Not available
Funding with residual maturity of less than 1 year provided by non-financial corporate customers + Operational deposits + Funding with residual maturity of less than 1 year from sovereigns, public sector entities (PSEs) and multilateral and national development banks + Other funding with residual maturity between 6 months and less than 1 year not included in the above categories, including funding provided by central banks and financial institutions	50%	Other deposits and short-term borrowings
All other liabilities and equity not included in the above categories, including liabilities without a stated maturity (with a specific treatment for deferred tax liabilities and minority interests) + derivative liabilities net of derivative assets if derivative liabilities are greater than derivative assets + "Trade date" payables arising from purchases of financial instruments, foreign currencies and commodities	0%	Deposits from banks + Repos and cash collateral + Derivatives + Trading liabilities + Other liabilities (tax, pension, insurance)
Required Stable Funding (RSF) (BCBS, 2014)		
Coins and banknotes + All central bank reserves + All claims on central banks with residual maturities of less than 6 months + "Trade date" receivables arising from sales of financial instruments, foreign currencies and commodities	0%	Cash and due from banks
Unencumbered Level 1 assets, excluding coins, banknotes and central bank reserves	5%	Memo: Government securities included above
Unencumbered loans to financial institutions with residual maturities of less than 6 months, where the loan is secured against Level 1 assets, and where the bank has the ability to freely rehypothecate the received collateral for the life of the loan	10%	Not available
All other unencumbered loans to financial institutions with residual maturities of less than 6 months not included in the above categories + Unencumbered Level 2A assets	15%	Not available
Unencumbered Level 2B assets + High-quality liquid assets (HQLA) encumbered for a period of 6 months or more and less than 1 year + Loans to financial institutions subject to prudential supervision with residual maturities between 6 months and less than 1 year + Deposits held at other financial institutions for operational purposes + All other assets not included in the above categories with residual maturity of less than 1 year, including loans to non-financial corporate clients, loans to retail and small business customers, and loans to sovereigns and PSEs	50%	Total securities - Memo: Government securities included above - At-equity investments in associates + Loans and advances to banks
Unencumbered residential mortgages with a residual maturity of 1 year or more and with a risk weight of less than or equal to 35% under the Standardized Approach + Other unencumbered loans not included in the above categories, excluding loans to financial institutions, with a residual maturity of one year or more and with a risk weight of less than or equal to 35% under the Standardized Approach	65%	Residential mortgage loans
Cash, securities or other assets posted as initial margin for derivative contracts and cash or other assets provided to contribute to the default fund of a central counterparty (CCP) + Other unencumbered performing loans with risk weights greater than 35% under the Standardized Approach and residual maturities of 1 year or more, excluding loans to financial institutions + Unencumbered securities that are not in default and do not qualify as HQLA including exchange-traded equities + Physical traded commodities, including gold	85%	Net loans - Residential mortgage loans
All assets that are encumbered for a period of 1 year or more + derivative assets net of derivative liabilities if derivative assets are greater than derivative liabilities + All other assets not included in the above categories, including non-performing loans, loans to financial institutions with a residual maturity of one year or more, non-exchange-traded equities, fixed assets, pension assets, intangibles, deferred tax assets, retained interest, insurance assets, subsidiary interests, and defaulted securities	100%	Reserves for impaired loans/Non-performing loans + Non-earning assets (excluding cash and due from banks) + Other earning assets + Insurance assets + Investments in property + At-equity investments in associates

Appendix 2. Correspondence of Berger and Bouwman (2009)'s indicators with our alternative liquidity creation indicators

Assets (by category = "cat")	**Weight**	**Bankscope (now Orbis Bank Focus) terminology**
Illiquid assets = Commercial real estate loans (CRE) + Loans to finance agricultural production + Commercial and industrial loans (C&I) + Other loans and lease financing receivables	50%	Corporate & commercial loans + Reserves for impaired loans/Non-performing loans + Non-earning assets (excluding cash and due from banks) + Other earning assets + Insurance assets + Investments in property + At-equity investments in associates
Semiliquid assets = Residential real estate loans (RRE) + Consumer loans + Loans to depository institutions + Loans to state and local governments + Loans to foreign governments	0%	Net loans – Corporate & commercial loans + Loans and advances to banks
Liquid assets = Cash and due from other institutions + All securities (regardless of maturity) + Trading assets + Fed funds sold	-50%	Cash and due from banks + Total securities - At-equity investments in associates
Assets (by maturity = "mat")		
Illiquid assets = All loans and leases with a remaining maturity of more than 1 year	50%	Net loans – Loans & advances to customers < 3 months – Loans & advances to customers 3-12 months – Loans & advances to banks < 3 months – Loans & advances to banks 3-12 months + Reserves for impaired loans/Non-performing loans + Non-earning assets (excluding cash and due from banks) + Other earning assets + Insurance assets + Investments in property + At-equity investments in associates
Semiliquid assets = All loans and leases with a remaining maturity of 1 year or less	0%	Loans & advances to customers < 3 months + Loans & advances to customers 3-12 months + Loans & advances to banks < 3 months + Loans & advances to banks 3-12 months
Liquid assets = Cash and due from other institutions + All securities (regardless of maturity) + Trading assets + Fed funds sold	-50%	Cash and due from banks + Total securities – At-equity investments in associates
Liabilities + Equity		
Liquid liabilities = Transactions deposits + Savings deposits + Overnight federal funds purchased + Trading liabilities	50%	Customer deposits (current) + Customer deposits (savings) + Deposits from banks + Repos and cash collateral + Derivatives + Trading liabilities
Semiliquid liabilities = Time deposits + Other borrowed money	0%	Customer deposits (term) + Other deposits and short-term borrowings + Total long-term funding – Subordinated borrowing
Illiquid liabilities + Equity = Bank's liability on bankers acceptances + Subordinated debt + Other liabilities + Equity	-50%	Subordinated borrowing + Total equity + Other liabilities (tax, pension, insurance)

Table 1. Banks and observations in the sample by country

Country	Banks	Observations
Austria	12	79
Belgium	8	59
Cyprus	11	44
Estonia	2	9
Finland	9	39
France	139	700
Germany	554	2,270
Greece	6	47
Ireland	4	30
Italy	526	3,449
Luxembourg	5	32
Malta	2	10
Netherlands	12	77
Portugal	17	97
Slovakia	8	39
Slovenia	16	87
Spain	36	207
Total Eurozone	1,367	7,275

Table 2. Categories and weights used to calculate our liquidity creation proxy

Available Stable Funding (ASF)	**Weights**
Total equity	100%
Total long-term funding	100%
Customer deposits (current)	95%
Customer deposits (savings)	95%
Customer deposits (term)	95%
Other deposits and short-term borrowings	50%
Deposits from banks	0%
Repos and cash collateral	0%
Derivatives	0%
Trading liabilities	0%
Other liabilities (tax, pension, insurance)	0%
Required Stable Funding (RSF)	**Weights**
Cash and due from banks	0%
Memo: Government securities included above	5%
Total securities – [Memo: Government securities included above] – [At-equity investments in associates]	50%
Loans and advances to banks	50%
Residential mortgage loans	65%
Net loans – [Residential mortgage loans]	85%
Reserves for impaired loans/Non-performing loans	100%
Non-earning assets (excluding cash and due from banks)	100%
Other earning assets	100%
Insurance assets	100%
Investments in property	100%
At-equity investments in associates	100%

Notes: We calculate our liquidity creation proxy (*Liquidity Creation*) as the inverse of the net stable funding ratio, i.e., as the amount of required stable funding (RSF) relative to the amount of available stable funding (ASF). For further details about the weighting of bank balance sheet items to compute this ratio, see Appendix 1.

Table 3. Variable definition

Variable	Definition	Source
Liquidity creation measures		
Liquidity Creation	Measure of liquidity creation based on the inverse of the net stable funding ratio (Basel III)	Authors' calculation using Bankscope data (now Orbis Bank Focus)
LC (cat non-fat)	Measure of liquidity creation based on "cat non-fat" metric by Berger and Bouwman (2009). The measure classifies all activities other than loans by product category (cat) excluding off-balance sheet activities (non-fat) divided by total assets.	Authors' calculation using Bankscope data (now Orbis Bank Focus)
LC (mat non-fat)	Measure of liquidity creation based on "mat non-fat" metric by Berger and Bouwman (2009). The measure classifies all activities other than loans by maturity (mat) excluding off-balance sheet activities (non-fat) divided by total assets.	Authors' calculation using Bankscope data (now Orbis Bank Focus)
Bank capital measures		
Equity	Equity divided by total assets (%)	Authors' calculation using Bankscope data (now Orbis Bank Focus)
Total Capital	Total capital adequacy ratio estimated according to Basel III rules. It measures Tier 1 + Tier 2 capital, which includes subordinated debt, hybrid capital, loan loss reserves and the valuation reserves as a percentage of RWA and off-balance sheet risks (%)	Bankscope (now Orbis Bank Focus)
Tier 1	Shareholder funds plus perpetual non-cumulative preference shares as a percentage of RWA and off-balance sheet risks measured under Basel III rules (%)	Bankscope (now Orbis Bank Focus)
Bank-specific variables		
Non-Performing	Non-performing loans divided by gross loans (%)	Bankscope (now Orbis Bank Focus)
RWATA	Basel II risk weighted assets and off-balance sheet activities divided by total assets (%)	Bankscope (now Orbis Bank Focus)
Size	Total assets (in logarithmic form)	Authors' calculation using Bankscope data (now Orbis Bank Focus)
ROE	Return on equity (%)	Bankscope (now Orbis Bank Focus)
Non-Deposit	Non-deposit funds divided by total liabilities (%)	Bankscope (now Orbis Bank Focus)
Listed	Dummy variable. It takes value 1 for listed banks, and 0 otherwise	Bankscope (now Orbis Bank Focus)
Commercial Banks	Dummy variable. It takes value 1 for commercial banks, and 0 otherwise	Authors' calculation using Bankscope data Bankscope (now Orbis Bank Focus)
Savings Banks	Dummy variable. It takes value 1 for savings banks, and 0 otherwise	Authors' calculation using Bankscope data Bankscope (now Orbis Bank Focus)
Country-specific variables		
Competition	Proxy of market competition. Number of bank branches per 10,000 inhabitants	Bankscope (now Orbis Bank Focus)
Concentration	Herfindahl–Hirschman index of industry concentration	Bankscope (now Orbis Bank Focus)
Stringency Index	The capital stringency index is built by adding two measures of capital stringency: overall and initial capital stringency. Overall capital stringency indicates whether risk elements and value losses are considered while calculating the regulatory capital. Initial capital stringency refers to whether certain funds may be used to initially capitalize a bank and whether they are officially verified. It ranges in value from 0 to 10, with higher values indicating greater stringency	World Bank
GDP	Annual real GDP growth rate (%)	World Bank
Unemployment	Unemployment rate (%)	World Bank
Interest	Interest rate on the main refinancing operations of the ECB (%)	ECB

Note: This table defines the variables used in the study and the source of the data.

Table 4. Descriptive statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Median	Maximum
Liquidity Creation	7,275	0.89	0.33	0.06	0.83	6.3
Equity	7,275	8.51	3.81	0.02	8.56	58.73
Total Capital	7,275	16.6	10.47	0.1	15.1	417.1
Tier 1	7,275	14.08	9.96	0.09	12.5	393
Non-Performing	7,275	6.71	5.82	0	5.06	92.79
ROE	7,275	3.46	18.92	-832.9	3.99	83.59
Size	7,275	14.06	2.17	9.54	13.55	21.51
Competition	7,275	5.44	1.38	1.06	5.32	14.88
Non-Deposit	7,275	34.91	19.17	0	35.13	99.99
GDP	7,275	0.05	2.26	-8.86	0.38	8.26
Unemployment	7,275	7.87	3.05	3	7.1	27.3
Interest	7,275	1.3	1.13	0.25	1	4.75

Notes: This table reports descriptive statistics for the entire sample from 1999 to 2013. The sample includes 1,367 banks from the following Eurozone countries: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Malta, The Netherlands, Portugal, Slovakia, Slovenia and Spain. See Table 3 for a description of the variables.

Table 5. Evolution of liquidity creation and bank capital in the Eurozone (1999-2013)

	All banks		Commercial banks		Savings banks		Cooperative banks		Smaller banks		Larger banks	
Year	Liquidity Creation	Equity	Liquidity Creation	Equity	Liquidity Creation	Equity	Liquidity Creation	Equity	Liquidity Creation	Equity	Liquidity Creation	Equity
1999	1.115	6.054	1.193	11.185	0.966	5.214	1.012	4.631	1.139	6.977	1.104	4.840
2000	1.074	6.235	1.074	11.147	1.013	5.504	1.129	4.784	1.386	7.221	0.968	4.981
2001	1.261	6.405	1.362	11.119	1.086	5.794	1.016	4.951	1.116	7.622	1.307	4.983
2002	0.976	6.709	1.007	11.164	1.026	6.010	0.682	5.251	1.062	8.030	0.956	5.329
2003	0.907	6.853	0.930	11.211	0.968	5.989	0.679	5.456	0.988	8.142	0.879	5.562
2004	1.124	7.067	1.107	11.145	1.292	6.220	0.904	5.695	1.151	8.278	1.119	5.979
2005	0.938	8.552	1.113	11.205	0.863	8.380	0.871	6.260	0.756	9.931	1.055	6.851
2006	0.905	8.930	1.041	11.262	0.845	8.706	0.936	6.491	0.752	11.030	1.018	7.340
2007	0.870	8.943	1.035	11.189	0.828	8.849	0.905	6.660	0.774	11.050	0.974	7.297
2008	0.871	8.877	1.093	11.235	0.821	8.521	0.879	6.719	0.764	11.086	0.966	6.941
2009	0.893	8.955	1.188	11.263	0.829	8.470	0.878	6.917	0.795	11.076	0.973	7.237
2010	0.896	9.395	1.173	11.349	0.834	8.665	0.884	7.517	0.788	11.138	0.983	7.532
2011	0.896	9.795	1.087	11.296	0.854	8.663	0.882	9.588	0.812	11.157	0.963	8.167
2012	0.887	9.734	1.026	11.255	0.858	9.045	0.878	8.795	0.814	11.145	0.941	8.250
2013	0.881	9.772	1.023	11.211	0.852	9.291	0.862	8.803	0.815	11.117	0.922	8.758
All years	0.892	8.514	1.091	11.233	0.844	7.997	0.881	6.774	0.799	9.979	0.969	7.048

Notes: This table shows the mean values for our liquidity creation indicator, i.e., the inverse of the net stable funding ratio, and the equity to total assets ratio (*Equity*) from 1999 to 2013. The sample includes 1,367 banks from the following Eurozone countries: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Malta, The Netherlands, Portugal, Slovakia, Slovenia and Spain. See Table 3 for a description of the variables.

Table 6. Liquidity creation and bank capital in the Eurozone (1999-2013)

	(1) Liquidity Creation	(2) Liquidity Creation	(3) Liquidity Creation
Constant	0.882***	0.801***	0.769***
	(0.199)	(0.206)	(0.209)
Equity	**-0.005*** **		
	(0.002)		
Total Capital		**-0.002*** **	
		(0.000)	
Tier 1			**-0.002*** **
			(0.000)
Non-Performing	0.005***	0.004***	0.004***
	(0.001)	(0.001)	(0.001)
Size	0.055***	0.060***	0.059***
	(0.001)	(0.003)	(0.003)
Competition	-0.092***	-0.091***	-0.090***
	(0.000)	(0.026)	(0.027)
GDP	0.003	0.005**	0.004*
	(0.002)	(0.002)	(0.002)
Unemployment	-0.007***	-0.008***	-0.006***
	(0.002)	(0.002)	(0.002)
Interest	-0.034***	-0.036***	-0.031***
	(0.011)	(0.012)	(0.012)
Listed	-0.036*	-0.084***	-0.065***
	(0.020)	(0.021)	(0.021)
Commercial Banks	0.097***	0.102***	0.091***
	(0.015)	(0.017)	(0.018)
Savings Banks	0.000	0.077***	0.075***
	(0.019)	(0.021)	(0.021)
	Equity	**Total Capital**	**Tier 1**
Constant	20.394***	37.878***	38.474***
	(0.671)	(3.973)	(3.730)
Liquidity Creation	**-0.540** **	**-4.664*** **	**-3.901*** **
	(0.252)	**(1.350)**	**(1.321)**
Non-Performing	-0.033**	0.022	0.020
	(0.016)	(0.101)	(0.093)
Size	-0.652***	-0.932***	-1.100***
	(0.041)	(0.208)	(0.195)
ROE	0.043***	0.050	0.038
	(0.015)	(0.131)	(0.125)
Non-Deposits	0.045***	0.004	0.017
	(0.004)	(0.021)	(0.020)
Stringency Index	0.195***	0.197	0.145
	(0.053)	(0.282)	(0.272)
GDP	-0.059**	-0.360***	-0.311***
	(0.026)	(0.120)	(0.112)
Unemployment	0.075***	0.399***	0.314***
	(0.026)	(0.136)	(0.133)
Interest	-0.104	-2.210***	-2.156***
	(0.120)	(0.617)	(0.580)
Listed	0.272	-1.619	-2.081*
	(0.240)	(1.209)	(1.155)
Commercial Banks	-1.176***	5.313***	4.797***
	(0.183)	(1.052)	(1.016)
Savings Banks	-1.428***	0.956	-0.060
	(0.228)	(1.138)	(1.070)
No. of observations	7,275	7,275	7,275
Hansen	2.693	2.734	1.220

Notes: This table presents our main regression results estimated using a simultaneous equations model with a GMM estimator. The sample includes 1,367 banks from the following Eurozone countries: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Malta, The Netherlands, Portugal, Slovakia, Slovenia and Spain. See Table 3 for a description of the variables. We report heteroskedasticity-consistent asymptotic standard errors in parentheses. *Hansen* is a test of the over-identifying restrictions, asymptotically distributed as $\chi 2$ under the null hypothesis of no correlation between the instruments and the error term. Significance levels are indicated as follows: * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

Table 7. Categories and weights used to calculate alternative liquidity creation proxies

Assets by Category, excluding off-balance sheet activities (cat non-fat)	**Weights**
Illiquid assets	
Corporate & commercial loans	50%
Reserves for impaired loans/Non-performing loans	50%
Non-earning assets (excluding cash and due from banks)	50%
Other earning assets	50%
Insurance assets	50%
Investments in property	50%
At-equity investments in associates	50%
Semiliquid assets	
Net loans – [Corporate & commercial loans]	0%
Loans and advances to banks	0%
Liquid assets	
Cash and due from banks	-50%
Total securities – [At-equity investments in associates]	-50%
Assets by Maturity, excluding off-balance sheet activities (mat non-fat)	**Weights**
Illiquid assets	
Net loans – [Loans & advances to customers ≤ 12 months] – [Loans & advances to banks ≤ 12 months]	50%
Reserves for impaired loans/Non-performing loans	50%
Non-earning assets (excluding cash and due from banks)	50%
Other earning assets	50%
Insurance assets	50%
Investments in property	50%
At-equity investments in associates	50%
Semiliquid assets	
Loans & advances to customers < 3 months	0%
Loans & advances to customers 3-12 months	0%
Loans & advances to banks < 3 months	0%
Loans & advances to banks 3-12 months	0%
Liquid assets	
Cash and due from banks	-50%
Total securities – [At-equity investments in associates]	-50%
Liabilities + Equity	**Weights**
Liquid liabilities	
Customer deposits (current)	50%
Customer deposits (savings)	50%
Deposits from banks	50%
Repos and cash collateral	50%
Derivatives	50%
Trading liabilities	50%
Semiliquid liabilities	
Customer deposits (term)	0%
Other deposits and short-term borrowings	0%
Total long-term funding – [Subordinated borrowing]	0%
Illiquid liabilities plus equity	
Subordinated borrowing	-50%
Total equity	-50%
Other liabilities (tax, pension, insurance)	-50%

Notes: Following Berger and Bowman (2009), we construct *LC (cat non-fat)* and *LC (mat non-fat)* combining bank balance sheet items as follows: + ½ x illiquid assets + 0 x semiliquid assets – ½ x liquid assets + ½ x liquid liabilities + 0 x semiliquid liabilities – ½ x (illiquid liabilities + equity). We then divide this result by total assets. The measures differ in that we alternatively classify loans by category ("cat") or maturity ("mat"). "non-fat" means that we exclude off-balance sheet activities. For further details about the weighting of bank balance sheet items to compute these indicators, see Appendix 2.

Table 8. Considering alternative liquidity creation proxies

	(1) LC (cat non-fat)	(2) LC (cat non-fat)	(3) LC (cat non-fat)	(4) LC (mat non-fat)	(5) LC (mat non-fat)	(6) LC (mat non-fat)
Constant	1.300***	0.004	-0.019	0.513*	0.064	-0.265
	(0.270)	(0.129)	(0.130)	(0.281)	(0.260)	(0.253)
Equity	**-0.019*** **			**-0.013*** **		
	(0.005)			**(0.004)**		
Total Capital		**-0.000***			**-0.001*** **	
		(0.000)			**(0.000)**	
Tier 1			**-0.000***			**-0.003*** **
			(0.000)			**(0.000)**
Non-Performing	0.000	0.004***	0.004***	0.002	0.005**	0.003
	(0.003)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
Size	-0.044***	-0.018***	-0.020***	-0.029***	-0.011*	-0.005
	(0.008)	(0.008)	(0.004)	(0.007)	(0.006)	(0.006)
Competition	0.020	-0.068***	-0.073***	-0.047	-0.054*	-0.078***
	(0.032)	(0.014)	(0.015)	(0.034)	(0.030)	(0.030)
GDP	0.002	0.005*	0.006*	0.008	0.005	0.003
	(0.006)	(0.003)	(0.003)	(0.006)	(0.005)	(0.006)
Unemployment	-0.003	-0.004***	-0.004***	-0.010***	-0.005	-0.006*
	(0.004)	(0.002)	(0.002)	(0.004)	(0.003)	(0.003)
Interest	0.018	-0.016**	-0.017**	-0.041***	-0.035***	-0.027**
	(0.014)	(0.008)	(0.008)	(0.014)	(0.013)	(0.014)
Listed	-0.061*	0.023	0.026	-0.004	-0.013	-0.005
	(0.034)	(0.016)	(0.017)	(0.030)	(0.026)	(0.028)
Commercial Banks	0.089	0.016	0.017	-0.003	0.039	0.025
	(0.059)	(0.027)	(0.027)	(0.031)	(0.031)	(0.033)
Savings Banks	0.083	-0.059**	-0.061**	0.095***	0.153***	0.182***
	(0.062)	(0.029)	(0.029)	(0.035)	(0.052)	(0.055)
	Equity	**Total Capital**	**Tier 1**	**Equity**	**Total Capital**	**Tier 1**
Constant	18.790***	224.625***	203.878***	21.241***	259.526***	211.805***
	(1.568)	(49.461)	48.389	(2.133)	(41.336)	(38.880)
LC (cat non-fat)	**-2.885*** **	**-3.314**	**33.131**			
	(0.670)	**(102.190)**	**(102.494)**			
LC (mat non-fat)				**-2.480*** **	**-145.775*** **	**-110.620*** **
				(1.145)	**(33.853)**	**(32.595)**
Non-Performing	-0.083**	-2.252	-2.473	-0.155**	-2.288***	-1.415**
	(0.033)	(1.444)	(1.562)	(0.037)	(0.723)	(0.623)
Size	-0.555***	-9.614***	-9.252***	-0.675***	-9.117***	-6.931***
	(0.080)	(2.309)	(2.305)	(0.100)	(2.056)	(1.918)
ROE	0.032**	0.993	1.084	0.029*	0.080	0.179
	(0.014)	(1.289)	(1.085)	(0.015)	(0.282)	(0.287)
Non-Deposits	0.020*	0.485	0.425	-0.005	0.187	0.063
	(0.010)	(0.304)	(0.295)	(0.014)	(0.299)	(0.296)
Stringency Index	0.175**	8.536**	8.239***	0.253*	4.939**	5.915**
	(0.083)	(3.743)	(3.197)	(0.139)	(2.470)	(2.325)
GDP	-0.033	1.577	1.743	-0.055	2.514	2.361
	(0.075)	(2.383)	(2.373)	(0.101)	(1.881)	(1.820)
Unemployment	0.086**	2.194	2.791	0.185***	0.798	1.022
	(0.035)	(2.418)	(2.323)	(0.054)	(0.975)	(0.909)
Interest	-0.162	-10.089*	-10.625**	-0.734***	-12.815***	-9.649**
	(0.158)	(5.490)	(5.364)	(0.245)	(4.809)	(4.596)
Listed	1.090***	-16.672	-14.164	0.989*	-12.165	-11.445
	(0.003)	(16.919)	(14.968)	(0.521)	(10.112)	(9.671)
Commercial Banks	-1.047	23.133	22.221	-1.177**	22.526*	17.642
	(0.640)	(17.843)	(17.372)	(0.536)	(12.045)	(11.605)
Savings Banks	-0.511	2.619	2.779	-0.473	3.314	4.706
	(0.660)	(25.186)	(23.284)	(0.602)	(19.243)	(18.242)
No. of observations	2,396	2,396	2,396	2,176	2,176	2,176
Hansen	0.234	0.981	0.378	0.283	0.464	0.252

Notes: This table presents the regressions for alternative measures of liquidity creation using a simultaneous equations model with a GMM estimator. The sample includes banks from the following Eurozone countries: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Malta, The Netherlands, Portugal, Slovakia, Slovenia, and Spain. We construct *LC (cat non-fat)* and *LC (mat non-fat)* following Berger and Bowman (2009). The measures differ in that we alternatively classify loans by category ("cat") or maturity ("mat"); "non-fat" means that we exclude off-balance sheet activities. See Table 7 for the categories and weights used to calculate *LC (cat non-fat)* and *LC (mat non-fat)*. See Table 3 for a description of the variables. We report heteroskedasticity-consistent asymptotic standard errors in parentheses. *Hansen* is a test of the over-identifying restrictions, asymptotically distributed as $\chi 2$ under the null hypothesis of no correlation between the instruments and the error term. Significance levels are indicated as follows: * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

Table 9. Liquidity creation and capital: excluding banks with capital ratios below minimum requirements

	(1) Liquidity Creation	(2) Liquidity Creation	(3) Liquidity Creation
Equity	-0.005***		
	(0.002)		
Total Capital		-0.002***	
		(0.000)	
Tier 1			-0.002***
			(0.000)
	Equity	**Total Capital**	**Tier 1**
Liquidity Creation	1.211***	-5.143**	-4.071***
	(0.359)	(1.318)	(1.278)
No. of observations	7,226	6,558	6,428
Hansen	7.893	8.238	7.578

Notes: This table presents the regression results excluding observations with *Equity* less than 2% (model 1), *Total Capital* less than 8% (model 2), and *Tier 1* less than 4% (model 3). We use a simultaneous equations model with a GMM estimator. The sample includes banks from the following Eurozone countries: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Malta, The Netherlands, Portugal, Slovakia, Slovenia and Spain. We include the following control variables (not reported): *Non-Performing*, *Size*, *Competition*, *GDP*, *Unemployment*, *Interest*, *Listed*, *Commercial Banks* and *Savings Banks* (in the liquidity creation equation); *Non-Performing*, *Size*, *ROE*, *Non-Deposits*, *Stringency Index*, *GDP*, *Unemployment*, *Interest*, *Listed*, *Commercial Banks* and *Savings Banks* (in the bank capital equation). See Table 3 for a description of the variables. We report heteroskedasticity-consistent asymptotic standard errors in parentheses. Hansen is a test of the over-identifying restrictions, asymptotically distributed as $\chi 2$ under the null hypothesis of no correlation between the instruments and the error term. Significance levels are indicated as follows: * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

Table 10. Liquidity creation and capital by bank type

	Commercial banks			Savings banks			Cooperative banks		
	(1) Liquidity Creation	**(2) Liquidity Creation**	**(3) Liquidity Creation**	**(4) Liquidity Creation**	**(5) Liquidity Creation**	**(6) Liquidity Creation**	**(7) Liquidity Creation**	**(8) Liquidity Creation**	**(9) Liquidity Creation**
Equity	-0.006			0.009**			-0.005***		
	(0.004)			(0.004)			(0.001)		
Total Capital		-0.001*			0.003			-0.008***	
		(0.000)			(0.364)			(0.000)	
Tier 1			-0.001*			0.009**			-0.008***
			(0.000)			(0.002)			(0.000)
	Equity	**Total Capital**	**Tier 1**	**Equity**	**Total Capital**	**Tier 1**	**Equity**	**Total Capital**	**Tier1**
Liquidity Creation	-0.066	-6.706**	-6.013**	4.746***	2.417**	4.746***	-1.352	-18.205**	-18.009***
	(0.351)	(3.037)	(2.960)	(1.066)	(1.202)	(1.066)	(0.861)	(1.868)	(2.121)
No. of observations	1,583	1,583	1,583	1,165	1,165	1,165	4,527	4,527	4,527
Hansen	2.440	5.553	3.710	2.181	2.850	4.084	5.453	5.807	5.786

Notes: This table presents the regression results when the sample is divided by bank type. We use a simultaneous equations model with a GMM estimator. The sample includes 1,367 banks from the following Eurozone countries: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Malta, The Netherlands, Portugal, Slovakia, Slovenia and Spain. We include the following control variables (not reported): *Non-Performing*, *Size*, *Competition*, *GDP*, *Unemployment*, *Interest* and *Listed* (in the liquidity creation equation); *Non-Performing*, *Size*, *ROE*, *Non-Deposits*, *Stringency Index, GDP*, *Unemployment*, *Interest* and *Listed* (in the bank capital equation). See Table 3 for a description of the variables. We report heteroskedasticity-consistent asymptotic standard errors in parentheses. *Hansen* is a test of the over-identifying restrictions, asymptotically distributed as $\chi 2$ under the null hypothesis of no correlation between the instruments and the error term. Significance levels are indicated as follows: * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

Table 11. Liquidity creation and capital by bank size

	Smaller banks			Larger banks		
	(1) Liquidity Creation	**(2) Liquidity Creation**	**(3) Liquidity Creation**	**(4) Liquidity Creation**	**(5) Liquidity Creation**	**(6) Liquidity Creation**
Equity	-0.008***			-0.005*		
	(0.001)			(0.003)		
Total Capital		-0.008***			-0.001*	
		(0.000)			(0.000)	
Tier 1			-0.008***			-0.001
			(0.000)			(0.001)
	Equity	**Total Capital**	**Tier 1**	**Equity**	**Total Capital**	**Tier 1**
Liquidity Creation	-0.455	-24.076***	-24.208***	-0.498**	-4.288**	-3.394**
	(0.936)	(1.762)	(1.734)	(0.244)	(1.731)	(1.692)
No. of observations	3,637	3,637	3,637	3,638	3,638	3,638
Hansen	5.441	5.401	5.301	3.623	3.49	1.633

Notes: This table presents the regression results when the sample is divided by bank size (based on median total assets). We use a simultaneous equations model with a GMM estimator. The sample includes 1,367 banks from the following Eurozone countries: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Malta, The Netherlands, Portugal, Slovakia, Slovenia and Spain. We include the following control variables (not reported): *Non-Performing*, *Size*, *Competition*, *GDP*, *Unemployment*, *Interest, Listed, Commercial Banks* and *Savings Banks* (in the liquidity creation equation); *Non-Performing*, *Size*, *ROE*, *Non-Deposits*, *Stringency Index, GDP*, *Unemployment*, *Interest, Listed, Commercial Banks* and *Savings Banks* (in the bank capital equation). See Table 3 for a description of the variables. We report heteroskedasticity-consistent asymptotic standard errors in parentheses. *Hansen* is a test of the over-identifying restrictions, asymptotically distributed as $\chi 2$ under the null hypothesis of no correlation between the instruments and the error term. Significance levels are indicated as follows: * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

Table 12. Liquidity creation and capital: pre-crisis versus crisis period

	Pre-crisis (1999-2007)			Crisis (2008-2013)		
	(1) Liquidity Creation	**(2) Liquidity Creation**	**(3) Liquidity Creation**	**(4) Liquidity Creation**	**(5) Liquidity Creation**	**(6) Liquidity Creation**
Equity	0.002			-0.005***		
	(0.011)			(0.002)		
Total Capital		-0.002			-0.002***	
		(0.002)			(0.000)	
Tier 1			-0.005*			-0.002***
			(0.003)			(0.000)
	Equity	**Total Capital**	**Tier 1**	**Equity**	**Total Capital**	**Tier 1**
Liquidity Creation	1.270	-35.257***	-31.040***	0.571	-4.412***	-3.733***
	(1.504)	(10.408)	(8.705)	(0.771)	(1.344)	(1.316)
No. of observations	1,153	1,153	1,153	6,122	6,122	6,122
Hansen	2.263	4.854	2.712	2.915	4.954	7.567

Notes: This table presents the regression results when the sample is divided in two periods: pre-crisis (1999-2007) and crisis (2008-2013). We use a simultaneous equations model with a GMM estimator. The sample includes 1,367 banks from the following Eurozone countries: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Malta, The Netherlands, Portugal, Slovakia, Slovenia and Spain. We include the following control variables (not reported): *Non-Performing*, *Size*, *Competition*, *GDP*, *Unemployment*, *Interest, Listed, Commercial Banks* and *Savings Banks* (in the liquidity creation equation); *Non-Performing*, *Size*, *ROE*, *Non-Deposits*, *Stringency Index, GDP*, *Unemployment*, *Interest, Listed, Commercial Banks* and *Savings Banks* (in the bank capital equation). See Table 3 for a description of the variables. We report heteroskedasticity-consistent asymptotic standard errors in parentheses. *Hansen* is a test of the over-identifying restrictions, asymptotically distributed as $\chi 2$ under the null hypothesis of no correlation between the instruments and the error term. Significance levels are indicated as follows: * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

Table 13. Liquidity creation and capital: alternative control variables

	(1) Liquidity Creation	(2) Liquidity Creation	(3) Liquidity Creation
A) Including year and country dummies instead of macroeconomic variables			
Equity	-0.004***		
	(0.002)		
Total Capital		-0.002***	
		(0.000)	
Tier 1			-0.002***
			(0.000)
	Equity	**Total Capital**	**Tier 1**
Liquidity Creation	-0.081	-4.868**	-4.286***
	(1.062)	(2.179)	(1.456)
No. of observations	7,275	7,275	7,275
Hansen	3.019	3.850	2.094
B) Including Concentration instead of Competition			
Equity	-0.007***		
	(0.002)		
Total Capital		-0.002***	
		(0.000)	
Tier 1			-0.002***
			(0.000)
Concentration	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)
	Equity	**Total Capital**	**Tier 1**
Liquidity Creation	0.929	-4.713***	-3.944***
	(0.853)	(1.341)	(1.312)
No. of observations	7,275	7,275	7,275
Hansen	5.834	5.822	4.334
C) Including RWATA instead of Non-Performing			
Equity	-0.007***		
	(0.002)		
Total Capital		-0.002***	
		(0.000)	
Tier 1			-0.001***
			(0.000)
RWATA	0.002***	0.001**	0.001**
	(0.000)	(0.000)	(0.000)
	Equity	**Total Capital**	**Tier 1**
Liquidity Creation	-0.455*	-2.920**	-2.455*
	(0.246)	(1.146)	(1.257)
RWTA	0.039***	0.306***	0.305***
	(0.005)	(0.020)	(0.020)
No. of observations	7,275	7,275	7,275
Hansen	5.163	5.564	3.026

Notes: This table presents the results for our baseline equations after changing some of the explanatory control variables. We use a simultaneous equations model with a GMM estimator. The sample includes 1,367 banks from the following Eurozone countries: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Malta, The Netherlands, Portugal, Slovakia, Slovenia and Spain. The models in section *A)* consider year and country dummies in place of macroeconomic variables. We also include the following control variables (not reported): *Non-Performing*, *Size*, *Competition, Listed, Commercial Banks* and *Savings Banks* (in the liquidity creation equation); *Non-Performing*, *Size*, *ROE*, *Non-Deposits, Listed, Commercial Banks* and *Savings Banks* (in the bank capital equation). The models in section *B)* consider *Concentration* in place of *Competition*. We also include the following control variables (not reported): *Non-Performing*, *Size*, *GDP*, *Unemployment*, *Interest, Listed, Commercial Banks* and *Savings Banks* (in the liquidity creation equation); *Non-Performing*, *Size*, *ROE*, *Non-Deposits*, *Stringency Index, GDP*, *Unemployment*, *Interest, Listed, Commercial Banks* and *Savings Banks* (in the bank capital equation). The models in section *C)* consider *RWATA* in place of *Non-Performing*. We also include the following control variables (not reported): *Size*, *Competition*, *GDP*, *Unemployment*, *Interest, Listed, Commercial Banks* and *Savings Banks* (in the liquidity creation equation); *Size*, *ROE*, *Non-Deposits*, *Stringency Index, GDP*, *Unemployment*, *Interest, Listed, Commercial Banks* and *Savings Banks* (in the bank capital equation). See Table 3 for a description of the variables. We report heteroskedasticity-consistent asymptotic standard errors in parentheses. *Hansen* is a test of the over-identifying restrictions, asymptotically distributed as $\chi 2$ under the null hypothesis of no correlation between the instruments and the error term. Significance levels are indicated as follows: * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

Table 14. Liquidity creation and capital: excluding Italy and Germany

	Italy			Germany			Rest of the Eurozone		
	(1) Liquidity Creation	**(2) Liquidity Creation**	**(3) Liquidity Creation**	**(4) Liquidity Creation**	**(5) Liquidity Creation**	**(6) Liquidity Creation**	**(7) Liquidity Creation**	**(8) Liquidity Creation**	**(9) Liquidity Creation**
Equity	-0.007***			-0.211***			-0.007*		
	(0.003)			(0.046)			(0.004)		
Total Capital		-0.007***			0.014			-0.001**	
		(0.001)			(0.022)			(0.000)	
Tier 1			-0.007***			0.024			-0.001*
			(0.002)			(0.027)			(0.000)
	Equity	**Total Capital**	**Tier 1**	**Equity**	**Total Capital**	**Tier 1**	**Equity**	**Total Capital**	**Tier 1**
Liquidity Creation	0.764	-1.785*	-1.770**	0.811	-4.404**	-3.795*	-0.528	-8.301*	-6.546*
	(0.683)	(0.963)	(0.828)	(1.845)	(1.974)	(2.232)	(0.385)	(4.361)	(3.869)
No. of observations	3,449	3,449	3,449	2,270	2,270	2,270	1,556	1,556	1,556
Hansen	7.776	7.798	7.036	3.676	1.498	0.985	3.257	2.881	1.381

Notes: This table presents the regression results when Italian (526) banks and German (554) banks are excluded from the original sample. The "Rest of the Eurozone" sample includes 287 banks from the following countries: Austria, Belgium, Cyprus, Estonia, Finland, France, Greece, Ireland, Luxemburg, Malta, The Netherlands, Portugal, Slovakia, Slovenia and Spain. We use a simultaneous equations model with a GMM estimator. We include the following control variables (not reported): *Non-Performing*, *Size*, *Competition*, *GDP*, *Unemployment*, *Interest*, *Listed, Commercial Banks* and *Savings Banks* (in the liquidity creation equation); *Non-Performing*, *Size*, *ROE*, *Non-Deposits*, *Stringency Index, GDP*, *Unemployment*, *Interest*, *Listed, Commercial Banks* and *Savings Banks* (in the bank capital equation). We only report the results obtained for the variables of interest. See Table 3 for a description of the variables. We report heteroskedasticity-consistent asymptotic standard errors in parentheses. *Hansen* is a test of the over-identifying restrictions, asymptotically distributed as $\chi 2$ under the null hypothesis of no correlation between the instruments and the error term. Significance levels are indicated as follows: * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

Table 15. Liquidity creation and capital: all the EU-28 countries, Norway and Switzerland

	(1) Liquidity Creation	(2) Liquidity Creation	(3) Liquidity Creation
Equity	-0.005***		
	(0.002)		
Total Capital		-0.002***	
		(0.000)	
Tier 1			-0.002***
			(0.000)
	Equity	**Total Capital**	**Tier 1**
Liquidity Creation	-0.371	-4.260***	-3.930***
	(0.307)	(1.425)	(1.441)
No. of observations	8,969	8,969	8,969
Hansen	4.791	3.816	4.881

Notes: This table presents the regression results when we apply our empirical model to a new sample that includes all the EU-28 countries, plus Norway and Switzerland. The extended sample includes 8,969 bank/year observations from 17 Eurozone countries –Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Malta, The Netherlands, Portugal, Slovakia, Slovenia and Spain–; 11 EU (non-Eurozone) countries –Bulgaria, Croatia, the Czech Republic, Denmark, Hungary, Latvia, Lithuania, Poland, Romania, Sweden and the United Kingdom–; and 2 European (non-EU) countries –Switzerland and Norway. We use a simultaneous equations model with a GMM estimator. We include the following control variables (not reported): *Non-Performing*, *Size*, *Listed*, *Commercial Banks*, *Savings Banks*, country dummies and year dummies (in the liquidity creation equation); *Non-Performing*, *Size*, *ROE*, *Non-Deposits*, *Stringency Index*, *Listed*, *Commercial Banks*, *Savings Banks*, country dummies and year dummies (in the bank capital equation). See Table 3 for a description of the variables. We report heteroskedasticity-consistent asymptotic standard errors in parentheses. Hansen is a test of the over-identifying restrictions, asymptotically distributed as $\chi 2$ under the null hypothesis of no correlation between the instruments and the error term. Significance levels are indicated as follows: * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

The Centre for Responsible Banking & Finance
CRBF Working Paper Series
School of Management, University of St Andrews
The Gateway, North Haugh,
St Andrews, Fife,
KY16 9RJ.
Scotland, United Kingdom
http://www.st-andrews.ac.uk/business/rbf/

Recent CRBF Working papers published in this Series

Fourth Quarter | 2018

18-018 **Thomas Gehrig and Maria Chiara Iannino:** Did the Basel Process of Capital Regulation Enhance the Resiliency of European Banks?

18-017 **Oleksandr Talavera, Shuxing Yin, and Mao Zhang:** Tournament Incentives, Age Diversity and Firm Performance: Evidence from China.

18-016 **Ross Brown, Jose Liñares-Zegarra, and John O.S. Wilson:** The (Potential) Impact of Brexit on UK SMEs: Regional Evidence and Public Policy Implications.

18-015 **Daniel Oto-Peralías:** Frontiers, Warfare and the Economic Geography of Countries: The Case of Spain.

Third Quarter | 2018

18-014 **Solomon Y. Deku, Alper Kara, and David Marques-Ibanez:** Do Reputable Issuers Provide Better-Quality Securitizations?

18-013 **Neil Lee and Raffaella Calabrese:** Does Local Bank Structure Influence Access to Finance? Evidence from Online Mapping.

18-012 **Dimitris K. Chronopoulos, Anna L. Sobiech, and John O.S. Wilson:** The Australian Bank Levy: Do Shareholders Pay?

18-011 **Duc Duy Nguyen, Linh Nguyen, and Vathunyoo Sila:** Does Corporate Culture Affect Bank Risk-Taking? Evidence from Loan-Level Data.

Second Quarter | 2018

18-010 **Solomon Y. Deku, Alper Kara, and David Marques-Ibanez:** Trustee Reputation in Securitization: When Does It Matter?