Does Excessive Liquidity Creation Trigger Bank Failures?

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Abstract

This paper introduces the "Excessive Liquidity Creation Hypothesis" as a new hypothesis to explain bank failures, whereby a proliferation in the core liquidity creation activity of banks increases the probability of failure. Using Berger and Bouwman's (2009) liquidity creation measures, we test our hypothesis on the Russian banking industry, which presents itself as a natural field experiment due to the large number of bank failures in the last decade. We find that excessive liquidity creation significantly increases the probability of bank failure and this result survives several robustness checks. Our main finding has policy implications for regulatory authorities who may want to identify excessive liquidity creators in the system early on and monitor them as financial institutions that could potentially be in distress.

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1. Introduction

The prediction of bank failures is a major challenge confronting regulators, analysts, and other stakeholders. It enables the identification of weak banks at an early stage, fostering the monitoring and regulation of such banks more efficiently and thus contributing to financial stability. It is also desirable from a social and private viewpoint because it helps eliminate losses as well as reduce the length of time that losses are incurred.

The literature on bank failures advances two hypotheses, the "Weak Fundamentals Hypothesis" (WFH) and the "Liquidity Shortage Hypothesis" (LSH) to explain why banks fail. Under the WFH, bank fundamentals are instrumental in predicting bank failures and traditional proxies for the CAMEL components serve as key determinants of an early warning system (EWS). With a worsening of capital ratios, reduction in liquidity, deterioration of loan quality, and depletion of earnings, the likelihood of bank failure increases. Whereas bank failures are information-based under the WFH, the LSH assumes that bank fragility can result from the irrational behavior of uninformed depositors who are unable to distinguish between liquidity and solvency shocks. The LSH assumes that banks are solvent institutions, but because they finance illiquid assets with liquid liabilities, they are vulnerable to external shocks that may lead to a shortage in liquidity. Under the sequential servicing constraint whereby first in line depositors receive all their deposits, a bank's ability to meet deposit withdrawals may be impaired, thereby amplifying the probability of failure. Thus, the literature on bank failures as explained by either the WFH or LSH generally focuses on one of two alternative sources of fragility that generally stem from either asset or liability risk, respectively.

In this paper, we suggest that the interaction between both asset and liability risk may additionally drive bank failures and we develop a new hypothesis to explain the causes of bank distress, following the tradition of Meyer and Pifer (1970) that financial measures and their trends can be used to discriminate between viable and failing banks. We capture the connectedness of asset

and liability risk through a comprehensive measure of the core output of a bank in the form of liquidity creation. According to the financial intermediation literature, one of the primary functions of banks is liquidity creation through the granting of liquid claims against the illiquid items that they hold. Banks create liquidity on balance sheet by financing relatively illiquid assets with relatively liquid liabilities (Bryant, 1980; Diamond and Dybvig, 1983) or off-balance sheet through loan commitments and other liquidity claims (Kashyap, Rajan, and Stein, 2002).

In our view, bank failures need not be only attributed to the WFH or LSH, but they may additionally result from an excessive activity in their *raison d'être* as liquidity creators. We propose the "Excessive Liquidity Creation Hypothesis" (ELCH) to explain bank failures, complementing the WFH - which identifies banks with weak fundamentals- and the LSH – which focuses on the inability of banks to meet liquidity commitments. According to the ELCH, the probability of failure will increase with a proliferation of the bank's main output in the form of excessive liquidity creation.

Our ELCH has both theoretical and empirical foundations. On the theoretical side, Diamond and Rajan (2000, 2001, 2002) argue that the activities of transforming illiquid assets into more liquid demand deposits are fundamentally incompatible and can only prevail in the presence of financial fragility. The model by Allen and Gale (2004) also shows that the role of financial intermediaries as risk transformers and liquidity creators exposes these institutions to the risk of failure. As banks create more liquidity, the likelihood of distress increases and the severity of losses exacerbates if assets are liquidated to meet liquidity demands. Allen and Gale (2004) even argue that there may be a role for regulating bank liquidity provision in the system.[1]

Similarly, recent empirical work suggests that the liquidity creation activity of banks is inextricably coupled with an increase in risk exposure. Indeed, liquidity creation increases when a bank sells long term illiquid loans, whereas it is reduced when the bank invests in short term

[1] In contrast, Williamson (1988) shows that, although liquidity provision may lead to bank failure, government intervention may not be warranted.

government bonds (Berger and Bouwman, 2009). However, the risks associated with financing a long term illiquid loan are generally more pronounced than the risk of investing in short term government securities. Berger and Bouwman (2011) report that liquidity creation of banks in the U.S. tends to be high prior to financial crises and they propose that a contraction in liquidity creation may be desirable to contain the build-up of system-wide financial fragility.

The three hypotheses, WFH, LSH, and ELCH, may not define the universe of all sources of bank fragility. Nonetheless, identifying the causes of bank failures has important implications for the development of regulatory policies toward banks. Prudential macroeconomic policies designed to promote bank stability and limit moral hazard incentives are appropriate under the WFH, and confidence-building assistance mechanisms to reduce the depositors' incentives for bank runs (deposit insurance, last resort lending by the central bank, and government bailouts) address problems related to the LSH. Additionally, the monitoring of liquidity creation in the system may be warranted under the ELCH. The sooner a bank is identified as an excessive liquidity creator, the more prompt regulatory action would be in bringing this core activity back to acceptable levels, thus reducing the likelihood of failure and controlling taxpayers' losses.

We use the banking system in Russia as a natural field experiment to test our ELCH, due to numerous bank failures that were unrelated to business cycles. More than 200 banks failed in Russia between 2000 and 2007. Furthermore, the availability of a rich panel dataset on all banks allows for the measurement of liquidity creation following the methodology of Berger and Bouwman (2009) that requires detailed data at the bank level. The quarterly frequency of data allows a more precise tracking of early developments that lead to the failure of banks; considering all banks in the system also ensures that no selection bias problem prevails.

To gauge the impact of excessive liquidity creation on the probability of bank failures, we perform logit regressions with bank random effects. We account for excessive liquidity creation by creating dummy variables based on different thresholds for liquidity creation in a given quarter. Our

findings confirm that excessive liquidity creation increases the probability of bank failures, and they are robust to several validity checks. Rather than suggesting a cut-off rate for excessive liquidity creation, we propose a screening procedure for financial intermediaries based on their ranking in terms of liquidity creation in the system. By identifying excessive liquidity creators, regulators could subject them to additional foresight in an endeavor to reduce the number of failures while strengthening incumbent institutions.

The rest of the paper is structured as follows. Section 2 reviews the literature. Section 3 presents the data and the methodology. Section 4 discusses the results. Section 5 concludes.

2. Literature Review

We group the extant literature on bank failures under two broad hypotheses, the WFH and the LSH. According to the WFH, banks that fail are ex-ante weaker and have less solid fundamentals compared to banks that survive, notably in terms of deteriorating levels of capital adequacy, less liquidity, worse asset quality, and lower profitability. In seminal papers, Meyer and Pifer (1970) use a set of financial ratios to predict the likelihood of bank failures, and Rolnick and Weber (1984) find that banks with weaker fundamentals are disciplined by markets because they fail when market conditions deteriorate and asset prices fall. After U.S. regulators introduced CAMEL ratings in 1979 to assess bank conditions, a number of scholars developed early warning systems using traditional proxies for the CAMEL components. These studies include, among others, Avery and Hanweck (1984), Whalen (1991), Thompson (1991, 1992), Cole and Gunther (1995), Wheelock and Wilson (2000), DeYoung (2003), and Oshinsky and Olin (2005). Research concerning emerging markets also finds that weak bank fundamentals significantly affect the likelihood of failure.[2]

[2] See Arena (2008) for evidence from Latin America and East Asia; Lanine and Vander Vennet (2006) and Claeys and Schoors (2007) for Russia; Molina (2002) for Venezuela; and Ozkan-Gunay and Ozkan (2007) for Turkey.

In addition to CAMEL-based models, other studies in the WFH literature focus on particular fundamentals to predict bank failures. Estrella, Park, and Peristiani (2000) advocate the use of simple and informative measures of capital adequacy such as leverage and the ratio of capital to gross revenues to predict subsequent bank failures. Wheelock and Wilson (2000) find that managerial inefficiency increases the likelihood of bank failure, with inefficient banks less likely to be acquired, and a bank closer to insolvency being more likely acquired. DeYoung (2003) shows that the number of bank failures is likely to increase with operational cost inefficiencies both for established and *de novo* banks.

Interest in the prediction of bank failures resurged in the aftermath of the recent global financial crisis, again using bank fundamentals as the basis for EWS. Torna (2010) attributes the underlying causes of deterioration in bank condition and subsequent failures to specific nontraditional banking (modern banking) activities such as investment banking, insurance, securitization, derivatives trading, and venture capital practices. Aubuchon and Wheelock (2010) assess the importance of regional economic characteristics in driving bank failures rather than using bank-specific characteristics. Ng and Roychowdhury (2010) report that additions to loan loss reserves positively relate to subsequent bank failures. Cole and White (2012) revisit traditional proxies for the CAMELS ratings and find that they explain bank failures well, the most significant predictors being commercial real estate investments.

In contrast to the WFH, the LSH attributes bank failures to a liquidity shortage shock that impairs the ability of banks to meet inexorable contractual debt obligations. When there is a real shock in the economy, the financing of illiquid assets with liquid liabilities may lead to a liquidity shortage in which banks curtail credit (Diamond and Rajan, 2001). In a review of the theory and history of banking crises, Calomiris (2007) identifies a panic view and a fundamentalist view to explain the causes of liquidity shortages that lead to bank failures during events of contagion. Under the panic view, banks fail during events of fear because of liquidity shortage due to unwarranted

deposit withdrawals that are unrelated to the solvency of the bank. Under the fundamentalist view, banks fail during crises following an exogenous adverse change in economic conditions because fundamental losses to bank borrowers lead to endogenous contractions of deposits and loans and curb the supply of money and credit, thereby producing a liquidity shortage.

A large body of evidence supports the LSH, whether the liquidity shortage stems from unwarranted deposit withdrawals or from weakened bank fundamentals. Early evidence from the Great Depression by Friedman and Schwartz (1963) suggests that bank failures result from unwarranted panic and that failing banks are more illiquid than insolvent. Such panics are due to "mob psychology" or "mass hysteria" (Kindleberger, 1978). In the conceptual framework of Diamond and Dybvig (1983) where banks finance illiquid assets with demandable debts and in the presence of the first-come first-served constraint, bank runs are self-fulfilling prophecies (Postlewaite and Vives, 1987). In a recent study, Vazquez and Federico (2012) provide empirical evidence on the link between liquidity shortage and probability of failure for a bank during the global financial crisis. The authors measure liquidity by the net stable funding ratio defined in the proposed Basel III reform and observe that banks characterized by weaker liquidity in the pre-crisis period were more likely to fail during the crisis.

Liquidity shortage can also unfold following an economic downturn that reduces the value of bank assets. As the likelihood of not meeting commitments increases at banks, depositors will exert pressure and withdraw their funds. Under the fundamentalist view, bank failures are not random events but a response to an unfolding economic recession (Gorton, 1988). According to Calomiris and Gorton (1991), nineteenth century banking crises were predicted by leading economic indicators, and Calomiris and Mason (2003) contend that most bank failures during the Depression can be explained by weakened fundamentals due to holding relatively illiquid and low quality assets, as well as little capital. A number of authors have modeled banking panics as an aggregate uncertainty risk that results from business cycle risk (Jacklin and Bhattacharya, 1988;

Hellwig, 1994; and Alonso, 1996), and which is heightened when liquidity needs are high (Chari and Jagannathan, 1988). Allen and Gale's (1998) model assumes that depositors can observe a leading economic indicator that correlates with future asset returns, consistent with the business cycle view of bank panics. Fundamental shocks are also the driver of financial crises in Allen and Gale's (2004) general equilibrium framework for understanding crises.

In addition to weak fundamentals that can undermine bank solvency under the WFH, a liquidity shortage shock may lead to bank failures that may even turn systemic because liquidity (or its lack thereof) serves as a channel through which contagion is spread from one bank to the other (Allen and Gale, 2004). A drop in liquidity creation at banks reduces credit supply and can lead to economic recessions (Bernanke, 1983; Peek and Rosengren, 2000). Liquidity shocks can also result in contagion and a systemic meltdown (Diamond and Rajan, 2005) as well as severe distributional effects across large and small firms in the economy (Khwaja and Mian, 2008).

Just as a liquidity shortage can have serious implications on bank survival, an excess in bank liquidity creation may also have severe repercussions. According to Diamond and Rajan (2000, 2001, 2002), financial fragility is a necessary condition for bank liquidity creation, suggesting that bank failures are more likely to occur when liquidity creation is at high levels. As liquidity creation increases, banks may find themselves forced to dispose of illiquid assets to meet depositors' withdrawals, thereby raising the risk of failures when assets are insufficient to meet noncontingent commitments (Allen and Gale, 2004).

Berger and Bouwman (2009) develop measures of bank liquidity creation and find that this comprehensive measure of bank output has substantially increased in the U.S. between 1993 and 2003. The authors also contrast the characteristics of the top 25% and bottom 25% liquidity creators among large, medium, and small banks. They find that multi-bank holding companies tend to create the most liquidity, that retail banks create far less liquidity per dollar of assets or equity, and that wholesale banks tend to be low liquidity creators. Also, banks that are engaged in mergers and

acquisition (M&A) tend to create more liquidity, whereas banks with no M&A activity create less liquidity. In a follow-up research, Berger and Bouwman (2011) investigate whether high aggregate bank liquidity creation is a good predictor of a financial crisis. They find that high levels of liquidity creation are a better indicator of crises than GDP, the federal funds rate, or stock market returns. In our paper, we propose that individual – rather than just aggregate – bank liquidity creation may have incremental explanatory power in predicting bank failures, even after controlling for the macroeconomic environment.

The intuition that excessive liquidity creation may be detrimental to bank stability is also underlined in the literature on banking crises that uses private credit as a proxy for liquidity creation. Cottarelli, Dell'Ariccia, and Vladkove (2005) find that the ratio of credit to GDP increases by 5 to 10 percentage points prior to banking crises. Studies by Demirguc-Kunt and Detragiache (1998), Drees and Pazarbasioglu (1998), and Kaminsky and Reinhart (1999) similarly establish that credit expansion to the private sector usually precedes banking crises.

3. Data Description and Methodology

3.1 Data

We use bank-level financial statement data for Russian banks from the financial information agency Interfax that collects and organizes data from the Central Bank of Russia (CBR).[3] This rich dataset has several advantages. First, it provides data on all banks in Russia and thus ensures that no selection bias problem arises. Second, the frequency of the data is quarterly, allowing us to track even more precisely developments that precede the failure of banks. Finally, the dataset provides detailed financial information that is necessary for the calculation of liquidity creation measures. For instance, the breakdown of loan portfolios enables us distinguish between corporate, household,

[3] For a more detailed description of the dataset, see Karas and Schoors (2005).

and government loans; deposits are classified by type; securities portfolios are reported by asset classes; and detailed information on the maturity of all liabilities is also available.

The original data feature an unbalanced panel for the period starting from the first quarter of 1999 to the fourth quarter of 2009. In our analysis, however, we opt to rely on the data covering the period between 2000 and 2007 to exclude possible contamination from bank failures that are connected to the 1998 Russian crisis and the global financial crisis that hit the country in the second half of 2008.[4] Our perspective is that bank failures are likely to occur under "normal" economic times when the system is not subject to any major shock but following a proliferation in the production of the bank's main output.

To make sure that we consider deposit-taking banking institutions only, we apply a series of filters on our dataset. First, we drop observations for which the ratio of total loans to total assets is lower than 5%. Second, we exclude observations for which the sum of all deposits equals to 0. Finally, we drop observations where the capital-to-assets ratio is larger than 100%. Our final sample includes over 33,000 bank-quarter observations.

We complement the main dataset using additional information. We first identify failed banks based on the list that is published by the Central Bank of Russia (CBR), resulting in about 230 failed institutions distributed over the whole period of study. The last column of Table 2 provides the breakdown of the number of bank failures by quarter. We also hand-collect data on the location of banks and their branches from the CBR website. We use this information to control for the regional characteristics of the environments in which banks operate using data from the Russian Federal State Statistics Service (Rosstat).

[4] Despite the fact that Russian banks were not directly exposed to the financial instruments that triggered the global financial turmoil, both the banking sector and the economy as a whole were hit by the crisis due to a sudden lack of access to foreign financing and a significant drop in the price of oil. Starting September 2008, the Russian government and the Central Bank of Russia rapidly implemented a wide variety of measures to support the stability of the financial system.

3.2 Liquidity Creation Measures

We follow the three-step procedure developed by Berger and Bouwman (2009) to construct measures of liquidity creation for Russian banks.[5] We first classify bank activities as liquid, semi-liquid or illiquid, considering all items included under assets, liabilities, and capital. The classification is based on the ease, cost, and time necessary for banks (customers) to turn their obligations into liquid funds (to withdraw their funds from banks), taking into account Russian-specific factors, e.g. active trading in certain securities.

Second, we assign weights to all balance sheet items. In line with financial intermediation theory that banks create liquidity by transforming illiquid assets to liquid liabilities, we apply positive weights to these two balance sheet categories. By the same token, we assign negative weights to liquid assets, illiquid liabilities, and capital, since bank liquidity creation is destroyed if illiquid liabilities are used to finance liquid assets.

Equation 1 shows the functional form used to measure bank liquidity creation.

$$\textit{Liquidity Creation} = \{\tfrac{1}{2} \times \textit{illiquid assets} + 0 \times \textit{semi-liquid assets} - \tfrac{1}{2} \times \textit{liquid assets}\} + \{\tfrac{1}{2} \times \textit{liquid liabilities} + 0 \times \textit{semi-liquid liabilities} - \tfrac{1}{2} \times \textit{illiquid liabilities}\} - \tfrac{1}{2} \times \textit{capital} \quad (1)$$

We construct two measures of liquidity creation (LC) from equation 1, using two different definitions for each of the right-hand-side terms. The first liquidity creation measure, LC1, is based on a category classification of balance sheet items, whereas the second measure, LC2, is a liquidity creation measure that rests on a maturity classification of bank activities. Table 1 provides a detailed description of balance sheet items used to calculate our two liquidity creation measures, their classification according to categories and maturities, and the weights that we assign to each grouping.

[Table 1 about here]

[5] Unlike Berger and Bouwman (2009), we do not consider off-balance sheet items. The reason is that, in our sample, off-balance sheet activities are not significant for most of the sampled period.

For LC1, the liquid assets category consists of (a) correspondent accounts with other banks (i.e. central bank, domestic, and foreign banks) (b) investments in government securities, and (c) investments in promissory notes. We do not consider investments in non-government securities as their values are quite low for most of the observation period.[6]

In examining loans, we follow the literature and consider corporate loans as illiquid assets since banks generally lack the option of selling them to meet liquidity needs. We classify other types of loans as semi-liquid assets, including consumer loans, loans to government, and interbank loans. Due to the fact that mortgage loans started to emerge in Russia only in recent years, the majority of consumer loans are short-term loans to buy consumer goods. We view consumer loans as semi-liquid following the idea that items with shorter maturity tend to be more liquid than longer term items, notwithstanding rare loan securitization in Russia. All other assets (calculated as the difference between total assets and the sum of all loans and liquid assets) include fixed assets and are regarded as illiquid items.

On the liability side, we distinguish between three broad categories: claims of banks, claims of the non-banking sector, and debt securities issued by banks. Claims of banks are readily available for withdrawal and fall into the liquid liabilities category. In contrast, claims of the non-banking sector are of two types. The first category includes the settlement accounts of different clients (domestic and foreign firms, government, and households) and is classified as liquid because customers can quickly withdraw these funds without penalty. The second category of claims of non-banking sector contains term deposits that are semi-liquid because their withdrawal is generally more difficult and costly. The last category of liabilities, debt securities issued by banks, includes promissory notes, deposit and saving certificates, and bonds. Since Russia has liquid markets for promissory notes, we classify these instruments as liquid liabilities. In contrast, the market for

[6] Russia's capital markets are still not liquid enough for banks to invest in non-governments securities. Also, banks have little incentives to hold these securities as, unlike government securities, they cannot be used as collateral when borrowing from the CBR. Moreover, data on investments in non-government securities is only available starting from 2004 and not from the beginning of our study period. However, we do recalculate the two liquidity creation measures using this data, but find that their trend is in line with that of LC1 and LC2.

deposit and saving certificates and for bonds has just emerged and started to gain importance only in recent years. Issuance of these instruments is not significant in our sample period, and we categorize these securities as semi-liquid liabilities. Following the same logic as on the asset side of the balance sheet, we calculate other liabilities as the difference between total liabilities and the sum of all of the above mentioned claims and view them as illiquid items, similar to the treatment of bank capital.

Furthermore, a careful examination of the balance sheet information of Russian banks shows a more detailed breakdown of the reporting of some items based on maturity. Maturity-based information provides us with important additional information to define liquidity creation in a more precise manner and construct our second liquidity creation measure, LC2. On the asset side, the maturity breakdown is available for interbank loans only. Thus, we classify all assets other than interbank loans in a similar manner to LC1 but do not categorize all of the latter in the semi-liquid portion anymore. We group interbank loans with maturity less than one week in the category of liquid assets; interbank loans with maturity higher than one year and nonperforming interbank loans are viewed as illiquid; and all other interbank loans are labeled as semi-liquid assets.

The classification of liabilities for the LC2 calculation is based solely on maturity. We apply the general principle that items of shorter maturity are more liquid than longer term liabilities. The liquid liabilities category includes term deposits and debt securities with maturities shorter than 90 days as well as current and correspondent accounts. Liabilities with maturity between 90 days and one year belong to the semi-liquid category, whereas liabilities that have maturities over one year, overdue liabilities, and liabilities with uncertain terms to maturity are classified as illiquid. Similar to LC1, we treat bank capital as an illiquid portion of the balance sheet. Both liquidity creation measures, LC1 and LC2, are normalized by total assets for better comparability across banks and to avoid attributing excessive liquidity creation weight for large banks.

3.3 Methodology

We examine the distribution of the liquidity creation measures in each quarter and generate a series of dummy variables that correspond to four different segments of the upper and lower tails of the distribution to account for both excessive and extremely low liquidity creation, respectively. In doing so, we aim to capture the effect of excessive liquidity creation as well as shortages in liquidity creation.

The dummy variables *LC_80-85%*, *LC_85-90%*, *LC_90-95%*, and *LC_Top5* are equal to 1 if the liquidity creation measure in a given quarter ranges between the 80^{th} and 85^{th} percentile, between the 85^{th} and 90^{th} percentile, between the 90^{th} and 95^{th} percentile, and above the 95^{th} percentile, respectively. Similarly, the dummy variables *LC_15-20%*, *LC_10-15%*, *LC_5-10%*, and *LC_Bottom5* are equal to 1 if the liquidity creation measure in a given quarter falls between the 15^{th} and 20^{th} percentile, between the 10^{th} and 15^{th} percentile, between the 5^{th} and 10^{th} percentile, and below the 5^{th} percentile, respectively.

To gauge the impact of different levels of liquidity creation on the probability of bank failures and to test for our ELCH, we implement a panel logit model under the random effect assumption. We estimate a bank-level model where the dependent variable is a dummy variable that is equal to 1 if the bank's license is withdrawn in a given quarter and 0 otherwise. We thus define bank failure as the official closure of a bank when it is declared as no longer viable and its license is withdrawn. This definition of bank failures is in line with prior studies on the determinants of bank failures in Russia (e.g. Claeys and Schoors, 2007; Fungacova and Weill, 2009).

In addition to our primary explanatory variable expressed in terms of different levels of liquidity creation, we also consider in all estimations bank-specific control variables that are common in the literature on bank failures as well as control variables related to the local market environment in which banks operate. At the bank level, we control for firm size measured by the logarithm of total assets (*Size*) and for bank profitability proxied by return on assets (*ROA*). Since

the scale of operations can influence the probability of failure as it enables banks better diversify their loan portfolio (Calomiris and Mason, 2000), we expect the sign on the estimated coefficient of *Size* to be negative. The "too big to fail" argument also supports this expectation, in line with the argument that larger banks are more likely to receive the support of the government and not fail. As for bank profitability, the WFH predicts that weak bank performance is a major determinant of bank failure. By considering profitability as an ex-ante measure of asset risk (Arena, 2008), we expect a negative association between the probability of bank failure and *ROA*.

In Russia, about half of the banks have their headquarters in Moscow and all other banks are geographically spread throughout the country. Our region-level variables take into account the local macroeconomic environment of the regions in which banks are operating, which we define as the region where bank headquarters and/or its branches are located. Given that we do not have information regarding the operations associated with each branch, we use the distribution of branch offices as a proxy for bank output in a given region. Each of the regional variables for a given bank is thus calculated as a weighted average of the regional variable's value of regions in which a bank operates, using the distribution of branch offices in different regions as weights. Our regional variables include *Household Income Growth* and *Small Business Growth*; we also consider local market concentration among the robustness checks. *Household Income* is defined as regional household income per capita. Small enterprise business is proxied by the number of small and medium-sized enterprises (SMEs) in a given region multiplied by the average number of employees that SMEs have in that region. We expect a negative relation between each of the regional variable and the probability of bank failure, as a more favorable macroeconomic environment is expected to foster bank activity and enhance financial stability.

4. Results

Table 2 summarizes the quarterly evolution of LC1 and LC2 as a share of total assets, and Figure 1 depicts their trend over our sample period.

[Table 2 about here]

[Figure 1 about here]

Between 2000 and 2007, LC1 is consistently larger than LC2, exhibiting an upward trend from 22 to 30 percent of assets whereas LC2 hovers around 18 to 21 percent of assets. LC1 also exhibits more volatility than LC2, which is relatively more stable over the sample period. The growth in both LC ratios results from increasing levels of liquidity creation throughout the sample period at a time where total bank assets are also rising.

We next perform multivariate logit regressions and conduct a series of robustness checks.

4.1 Regression Results

In all of the logit regressions, we show the results using percentile ranges for both LC1 and LC2 ratios across four different lags (one lag for each of the four quarters preceding a failure). We present the results of the baseline models in Table 3.

[Table 3 about here]

The figures in Table 3 indicate that the coefficient estimate of *LC_Top5* is positive and significant at the 1% level across all quarters preceding bank failures and using the two measures of liquidity creation. This finding suggests that banks with liquidity creation ratios that exceed the 95th percentile of the liquidity creation distribution in the system in all four quarters prior to a failure are more likely to fail compared to banks with more moderate levels of liquidity creation. Therefore, the estimation results lend strong support to the hypothesis that excessive liquidity creation increases the probability of bank failures. We also observe some other positive and significant coefficients for *LC_85-90%* and *LC_90-95%*. In line with the theoretical work of Allen and Gale

(2004) and the empirical evidence for the U.S. (Berger and Bouwman, 2011), the likelihood of bank distress increases when the financing of liquid liabilities with illiquid assets proliferates. The more liquidity banks create, the greater the likelihood of failure. Indeed, when financial intermediaries carry a larger share of loans on their balance sheet, they become more sensitive to liquidity risk. In parallel, when the deposit share in total liabilities increases, banks additionally become vulnerable to bank runs. Thus, the problem of high liquidity creation ratios might originate from an excessive concentration in either or both sides of the bank's balance sheet. As banks become more entrenched into their core liquidity creation activity, a counterproductive "self-destruction" process that increases the probability of failure might be at work, which eventually shrinks the common pool of liquidity creation in the economy.

In parallel, the estimated coefficient of the lowest liquidity creators in the system, *LC_Bottom5*, is positive and significant, suggesting that shortages in liquidity creation may also be associated with a greater probability of failure, i.e., banks with the lowest liquidity creation ratios are also more prone to fail. This finding may be not so surprising since the *raison d'être* of banks is liquidity creation for the economy, and shortages in performing this main function might jeopardize their existence.[7] An alternative explanation might be that banks with low liquidity creation ratios are more likely to rely less on core funding and more on non-deposit long-term sources of funds such as bonds or syndicated loans, which can be rather volatile. Whereas less reliance on deposit funding makes a bank less sensitive to bank runs, a larger share of these alternative sources of financing also results in making a bank sensitive to a sudden reduction of funding and increases the risk of failure (Hahm, Shin, and Shin, 2011). Further, shortages in liquidity creation may also stem from a smaller concentration in loans and a larger share in other investments, making the bank more sensitive to market risk.

[7] Further, liquidity shortages may lead to a contagion of failures in the system (Diamond and Rajan, 2005).

As for the control variables that enter our baseline specification, they are all of the expected sign in corroboration with the former literature (e.g. Arena, 2008). We observe a negative and significant sign for *Size* and *ROA* in all estimations. Larger banks have a lower probability of failure, probably because they are "too big to fail" or because they may have more diversified loan portfolios and investments. The negative and significant sign on *ROA* indicates that banks with strong fundamentals are less likely to fail, in accordance with the predictions of the WFH and because their higher charter value may preclude excessive risk-taking.

Finally and in line with our expectations, the signs on the estimated coefficients of the regional macroeconomic variables, small business growth and household income growth, are negative; they are also consistently significant for the latter variable. These findings confirm that a prosperous macroeconomic environment enhances the financial situation of banks by reducing loan losses, among others, as well as increasing the demand for financial services (Jimenez and Saurina, 2006). The fact that household income growth plays a greater role in preserving bank stability than small business growth suggests that Russian banks are more sensitive to the financial situation of households than to SMEs' growth.

4.2 Alternative Estimations

We perform a series of alternative estimations to test the sensitivity of our results to alternative specifications.

In the first robustness check, we run our baseline model in which we employ longer time horizons prior to failure: 15, 18, 21, and 24 months. This allows testing the influence of the number of lags chosen for the explanatory variables. This analysis is also of importance because it provides an indication regarding the possible use of liquidity creation measures as early warning indicators. Longer time horizons are of greater interest to help identify early enough whether the probability of failure of certain banks increases. Table 4 displays the estimations. The results of the estimations

correspond to our main findings. We find support for the ELCH as the sign of the estimated coefficient for *LC_Top5* is significantly positive across all estimations. We also show that the coefficient concerning *LC_Bottom5* is significantly positive in most estimations which indicates positive relation between liquidity shortages and the probability of bank failure. Overall, these estimations support the view that liquidity creation indicators might be used to identify future bank failures.

[Table 4 about here]

In the second robustness check, we use an alternative definition of bank failure based on the level of the equity to assets ratio because it is possible that the decision to revoke a banking license may be influenced by non-economic concerns. Brown and Dinç (2005) show that political considerations play a significant role in delaying government intervention to allow a bank to fail in emerging markets. In choosing an alternative definition of bank failure, we follow the approach of Wheelock and Wilson (2000) who analyze the determinants of bank failures in the U.S. The authors first consider banks that were closed by the FDIC (similar to our approach), and later they employ an alternative definition of bank failure based on the ratio of equity less goodwill to total assets being less than 2 percent. We use the same threshold and define failed banks in Russia as those institutions with a ratio of equity to total assets less than 2 percent. Table 5 presents the estimations results using this alternative definition of failed banks.

[Table 5 about here]

Here again, the coefficient on *LC_Top5* is positive and highly significant, lending support to the ELCH; the coefficient on *LC_90-95%* is also positive and significant in all LC1 estimations but it is significant only once with LC2. However, we do not observe that banks with the lowest liquidity creation ratios have greater probability of failures, as *LC_Bottom5* is not significant in any of the estimated specifications.

In the third robustness check, we perform all estimations for Moscow-based banks only. Not only about half of banks in Russia have their headquarters in Moscow, but banks in the capital are also the largest financial institutions in the country. According to Cole and Gunther (1994), regulatory flexibility differs among large and small banks, warranting a special treatment for Moscow-based banks. Once again, the results (reported in Table 6) are broadly consistent with the ELCH as *LC_Top5* is positive and significant across all estimations, but low liquidity creation has no impact on the incidence of bank failures.

[Table 6 about here]

In the fourth robustness check, we only consider domestic private banks in our estimations instead of including all banks in Russia. It is possible that the probability of bank failure at state-controlled banks and foreign banks is lower than at domestic banks. State-controlled banks may be less likely to fail because of the higher likelihood of state intervention in case of trouble and because of the greater confidence from depositors. Similarly, foreign banks are likely to benefit from the support of their parent institutions abroad. Thus, it could be that the relation between excessive liquidity creation and the incidence of bank failures is driven by the presence of state-controlled and foreign banks in our sample. Table 7 presents the estimation results for the sample of domestic private banks.

[Table 7 about here]

The coefficient on *LC_Top5* is positive and significant at the 1% level, again corroborating the ELCH. It is interesting to point that, unlike the two former robustness checks, we also observe positive and significant coefficients for *LC_Bottom5* as was the case in the baseline model.

In the fifth robustness check, we consider the effect of introducing the deposit insurance scheme that the Russian authorities implemented in 2004. Research on banking crises concurs that the greater the protection offered by a country's bank safety net, the higher is the risk of a banking collapse (e.g. Wheelock and Wilson, 1995; Caprio and Klingebiel, 1996; Demirgüc-Kunt and

Detragiache, 2002; Barth et al., 2006). We thus generate a dummy variable (*Deposit Insurance*) that is equal to 1 for quarters following the introduction of the deposit insurance scheme, i.e. starting from beginning of 2005, and re-run our baseline model using both liquidity creation measures for four different lags. We display the results in Table 8.

[Table 8 about here]

We observe that the coefficient on *Deposit Insurance* is positive and highly significant across all estimations, suggesting that the implementation of the deposit insurance scheme increases the probability of bank failure. More importantly, our main findings are maintained, as the estimated coefficient of *LC_Top5* is still positive and significant across all estimations. We also find evidence that shortage in liquidity creation associates with a higher probability of bank failure.

Finally, we examine whether our results are sensitive to including a measure of bank concentration, motivated by the unsettled debate between the "competition-fragility" and "competition-stability" views. In the context of Russian banking, Fungacova and Weill (2009) provide evidence in support of the "competition-fragility" view using the Lerner index as a measure of bank competition and other concentration indices.[8] We measure bank concentration by the Herfindahl-Hirschman index for assets (*Herfindahl*) computed at the regional level by applying the same approach as in the case of other regional variables included in our estimations. Table 9 reports the results.

[Table 9 about here]

The results are again in concordance with the ELCH as the sign on *LC_Top5* is positive and highly significant across all estimations; the coefficients for *LC_90-95%* and *LC_85-90%* are also positive and significant in some of the estimations. However, the coefficient on *LC_Bottom5* is significant in half of the estimations, thus providing limited evidence for the positive link between liquidity shortages and the probability of bank failure. In parallel, we observe a significant and

[8] Berger and Bouwman (2009) also examine the role of bank concentration but in relation to liquidity creation.

negative coefficient for bank concentration, which is in line with the view that concentration reduces the probability of bank failure in Russia.

Overall, the robustness tests are congruent with our main finding that excessive liquidity creation increases the probability of bank failure in Russia. In all estimations, we show that banks with a liquidity creation measure above the 95th percentile have a significantly greater probability of failure compared to other banks. This result lends support to our "Excessive Liquidity Creation Hypothesis".

Nevertheless, the analysis provides only limited evidence in favor of the link between low liquidity creation or liquidity creation shortages and the probability of bank failure. While the main estimations are in favor of such a relation, this result is not maintained using alternative specifications, notably when considering an alternative definition of bank failure and when only Moscow banks are included.

V. Conclusion

In this paper, we introduce a new hypothesis to explain bank failures related to the core liquidity-creating role of banks. According to the "Excessive Liquidity Creation Hypothesis", excessive liquidity creation by banks may eventually lead to a higher probability of failure. We test this hypothesis using the Russian banking system as a natural field experiment because of the large number of bank failures that it witnessed during the last decade. We propose a screening procedure of banks, ranking them based on their liquidity creation in the system and do not suggest a cut-off rate to identify excessive liquidity creators. Specifically, we define excessive liquidity creators as banks whose liquidity creation level in a given quarter exceeds the 95th percentile of the distribution of liquidity creation in the system. When liquidity creation becomes excessive, the probability of failure for such a bank increases significantly more than for other banks. Our results are robust to alternative measures of liquidity creation and definitions of bank failure, and controlling for bank

location, market concentration, and regulatory changes. They are also in line with the theoretical predictions of Allen and Gale (2004) and the empirical results for the U.S. (Berger and Bouwman, 2011) and therefore lend support to the ELCH.

The ELCH has two main implications. First, it suggests that liquidity creation by banks can be counterproductive if it becomes excessive. When liquidity creation rises above a certain threshold, the probability of bank failure increases, leading to the disappearance of the liquidity-creating institution and to a reduction in the volume of liquidity creation in the economy. Therefore, regulatory authorities may need to be careful when corroborating liquidity-creating activities by banks. Second, our main finding may provide insights for regulatory authorities that are interested in uncovering potential vulnerabilities in the financial system and predicting bank failures. Specifically, financial regulators may want to consider incorporating liquidity creation in the development of an early warning system to identify financial institutions in potential distress at an early stage and subject them to additional foresight, thus preventing bank failure and limiting taxpayers' losses.

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Table 1

Liquidity Creation Measures

This table classifies all balance sheet items in terms of their liquidity. The weight of each category is given in parentheses and it is used to calculate two liquidity creation measures following Equation (1). LC1 denotes the category-based liquidity creation measure, where bank activities are classified based on different categories. LC2 is the maturity-based liquidity creation measure, and it rests on a category as well as maturity classification for interbank loans and all liabilities.

LC1: CATEGORY MEASURE	**Illiquid assets (1/2)**	**Semi-liquid assets (0)**	**Liquid assets (-1/2)**
	Loans to firms	Interbank loans	Correspondent accounts with other banks
	Other assets	Loans to government	Government securities (incl. securities issued by regions and municipalities)
		Loans to individuals	Investments to promissory notes
	Liquid liabilities (1/2)	**Semi-liquid liabilities (0)**	**Illiquid liabilities and capital (-1/2)**
	Debt securities issued (promissory notes)	Debt securities issued (deposit and saving certificates, bonds)	Other liabilities
	Claims of non-bank sector : settlement accounts (firms, households, government)	Claims of non-bank sector : term deposits accounts (firms, households, government)	Capital
	Claims of banks		
LC2: MATURITY MEASURE	**Illiquid assets (1/2)**	**Semi-liquid assets (0)**	**Liquid assets (-1/2)**
	Interbank loans (maturity more than 1 year)	Interbank loans (maturity more than a week and less than 1 year)	Interbank loans (maturity less than a week)
	Loans to firms	Loans to government	Correspondent accounts with other banks
	Other assets	Loans to individuals	Government securities (incl. securities issued by regions and municipalities)
			Investments into prom. notes
	Liquid liabilities (1/2)	**Semi-liquid liabilities (0)**	**Illiquid liabilities and capital (-1/2)**
	Liabilities with maturity lower than 90 days	Liabilities (term deposits and debt securities) with maturity less than 1 year	Liabilities (term deposits, debt securities) with maturity more than 1 year and overdue liabilities and liabilities with uncertain term to maturity
	Current and corresponding accounts		Capital

Table 2

Development of the Main Variables

This table presents the development of the main variables employed in our analysis. *LC1* and *LC2* are the category and maturity liquidity creation measures, respectively, as explained in Table 1. They are expressed as proportion of total assets. *Size* denotes total assets in million of roubles. We also report the number of failed banks that occurred in every quarter by considering those failed banks for which data are available 4 quarters before the failure.

	Obs.	LC1/assets (mean in %)	LC2/assets (mean in %)	Size	Number of failures
2000q1	1214	20.91	17.50	1 280.7	14
2000q2	1222	21.30	17.89	1 389.5	7
2000q3	1227	22.49	18.84	1 597.7	9
2000q4	1218	21.63	18.23	1 739.4	8
2001q1	1217	23.64	19.83	1 882.7	3
2001q2	1223	23.44	19.71	2 031.5	6
2001q3	1219	24.37	20.51	2 207.4	8
2001q4	1227	23.70	20.03	2 348.0	6
2002q1	1149	25.38	20.60	2 605.7	5
2002q2	1227	25.72	21.01	2 658.8	8
2002q3	1235	25.96	21.10	2 786.1	5
2002q4	1231	25.53	20.54	3 074.9	6
2003q1	1228	26.27	21.42	3 349.4	3
2003q2	1233	26.08	21.04	3 630.7	5
2003q3	1229	27.04	21.21	3 920.2	5
2003q4	1234	25.22	20.04	4 196.0	5
2004q1	1238	26.34	19.94	4 436.6	3
2004q2	1225	28.12	20.72	4 664.4	4
2004q3	1208	26.16	18.19	4 951.8	10
2004q4	1198	25.01	18.80	5 488.3	12
2005q1	1197	26.02	18.21	5 886.5	11
2005q2	1191	26.89	18.41	6 429.5	5
2005q3	1175	26.65	17.68	7 059.0	19
2005q4	1163	25.27	17.43	7 803.9	6
2006q1	845	30.35	18.39	11 127.6	7
2006q2	850	30.11	18.82	12 175.8	14
2006q3	934	29.35	18.41	12 060.9	12
2006q4	984	28.05	19.11	13 171.9	9
2007q1	996	29.59	18.74	14 435.8	3
2007q2	995	29.69	18.96	16 026.3	4
2007q3	987	30.56	19.40	17 020.2	7
2007q4	983	28.60	18.63	19 276.4	4

Table 3

Liquidity Creation and Bank Failures: Baseline Model

Logit estimations are performed under the random effects assumption. The dependent variable is a dummy variable, bank failure, equal to one when a bank's license is revoked and zero otherwise. *LC1* denotes the category-based liquidity creation measure and *LC2* is the maturity-based liquidity creation measure. These measures enter into the regressions as dummy variables depending on their distribution across several percentiles. *Size* is the logarithm of total assets; *ROA* is return on assets; *Small business growth* is the growth in regional SMEs; and *Household income growth* is the growth in regional household income per capita. Marginal effects of a change in the relevant explanatory variable are reported. Standard errors appear in square brackets below estimated coefficients. *, **, *** denote an estimate significantly different from 0 at the 10%, 5%, and 1% level, respectively. Dummy variables for quarters and years are included in the regressions but are not reported.

	LC1/Assets				LC2/Assets			
	Quarters before failure							
	1 quarter	2 quarters	3 quarters	4 quarters	1 quarter	2 quarters	3 quarters	4 quarters
LC_Bottom5	1.002***	0.766***	0.570**	0.522*	1.153***	0.859***	0.485*	0.453
	[3.97]	[3.15]	[2.21]	[1.92]	[4.55]	[3.54]	[1.74]	[1.58]
LC_5-10%	0.054	-0.497	0.426	0.447	0.529	-0.109	0.165	0.207
	[0.14]	[1.18]	[1.58]	[1.61]	[1.63]	[0.30]	[0.52]	[0.65]
LC_10-15%	-0.618	0.341	-0.346	0.183	-0.253	0.295	0.075	0.502*
	[1.23]	[1.19]	[0.92]	[0.60]	[0.55]	[0.96]	[0.22]	[1.81]
LC_15-20%	0.079	-0.675	-0.157	-0.350	-0.084	-0.591	0.471*	-0.143
	[0.21]	[1.47]	[0.45]	[0.90]	[0.20]	[1.29]	[1.70]	[0.39]
LC_80-85%	-0.192	-0.167	-0.131	-0.249	0.295	-0.172	-0.095	-0.578
	[0.42]	[0.43]	[0.36]	[0.64]	[0.79]	[0.44]	[0.26]	[1.26]
LC_85-90%	0.515	-0.152	0.100	0.223	0.713**	0.366	0.226	0.663**
	[1.52]	[0.39]	[0.30]	[0.70]	[2.28]	[1.20]	[0.71]	[2.53]
LC_90-95%	0.560*	0.127	0.129	0.835***	-0.086	0.230	0.493*	0.430
	[1.66]	[0.36]	[0.39]	[3.39]	[0.20]	[0.72]	[1.78]	[1.50]
LC_Top5	1.714***	1.493***	1.104***	1.096***	1.770***	1.344***	1.148***	1.373***
	[7.95]	[7.37]	[4.91]	[4.79]	[8.59]	[6.54]	[5.29]	[6.84]
Size	-0.195***	-0.176***	-0.153***	-0.123***	-0.163***	-0.155***	-0.144***	-0.106***
	[4.77]	[4.64]	[4.13]	[3.38]	[4.00]	[4.13]	[3.94]	[2.94]
ROA	-5.283***	-3.965***	-3.559***	-4.123***	-5.431***	-4.235***	-3.401***	-4.091***
	[6.84]	[4.04]	[3.57]	[3.84]	[6.74]	[4.20]	[3.46]	[3.77]
Small business growth	-0.111	-0.080	-0.063	-0.011	-0.117	-0.084	-0.067	-0.017
	[0.64]	[0.58]	[0.46]	[0.10]	[0.66]	[0.59]	[0.49]	[0.16]
Household income growth	-0.014***	-0.010**	-0.017***	-0.007*	-0.013***	-0.010**	-0.016***	-0.007*
	[2.75]	[2.20]	[4.06]	[1.77]	[2.62]	[2.07]	[4.03]	[1.70]
Constant	-2.645***	-2.930***	-2.143***	-3.553***	-3.007***	-3.152***	-2.273***	-3.721***
	[3.72]	[4.42]	[3.59]	[5.81]	[4.27]	[4.74]	[3.81]	[6.07]
Observations	35287	34966	34748	34586	35287	34966	34748	34586
Number of banks	1386	1385	1386	1385	1386	1385	1386	1385
LogLikelihood	-1072.677	-1250.062	-1316.295	-1339.396	-1068.246	-1255.674	-1316.477	-1331.950

Table 4

Liquidity Creation and Bank Failures: Longer lags

Logit estimations are performed under the random effects assumption. The dependent variable is a dummy variable, bank failure, equal to one when a bank's license is revoked and zero otherwise. *LC1* denotes the category-based liquidity creation measure and *LC2* is the maturity-based liquidity creation measure. These measures enter into the regressions as dummy variables depending on their distribution across several percentiles. *Size* is the logarithm of total assets; *ROA* is return on assets; *Small business growth* is the growth in regional SMEs; and *Household income growth* is the growth in regional household income per capita. Marginal effects of a change in the relevant explanatory variable are reported. Standard errors appear in square brackets below estimated coefficients. *, **, *** denote an estimate significantly different from 0 at the 10%, 5%, and 1% level, respectively. Dummy variables for quarters and years are included in the regressions but are not reported.

	LC1/Assets				LC2/Assets			
	Months before failure							
	15 months	18 months	21 months	24 months	15 months	18 months	21 months	24 months
LC_Bottom5	0.816***	0.848***	1.069***	0.520*	0.907***	0.800***	1.142***	0.367
	[3.15]	[3.36]	[4.37]	[1.68]	[3.51]	[3.03]	[4.79]	[1.10]
LC_5-10%	0.362	0.155	0.434	0.434	-0.028	0.140	-0.014	0.110
	[1.18]	[0.47]	[1.41]	[1.41]	[0.08]	[0.42]	[0.04]	[0.31]
LC_10-15%	0.522*	0.340	0.662**	0.837***	0.488*	-0.136	0.166	0.655**
	[1.88]	[1.15]	[2.44]	[3.32]	[1.71]	[0.37]	[0.50]	[2.42]
LC_15-20%	-0.255	0.052	0.344	0.427	0.231	0.472*	0.793***	0.634**
	[0.65]	[0.16]	[1.12]	[1.44]	[0.73]	[1.71]	[3.16]	[2.35]
LC_80-85%	0.092	-0.101	0.007	-1.101*	0.290	-0.343	-0.838	-0.025
	[0.28]	[0.29]	[0.02]	[1.88]	[0.95]	[0.88]	[1.64]	[0.07]
LC_85-90%	0.649**	-0.326	0.475*	-0.230	-0.393	0.215	-0.002	-0.589
	[2.46]	[0.83]	[1.65]	[0.59]	[0.94]	[0.71]	[0.01]	[1.28]
LC_90-95%	0.017	0.379	0.138	0.536*	0.438	0.112	0.428	0.431
	[0.05]	[1.32]	[0.41]	[1.92]	[1.54]	[0.35]	[1.50]	[1.51]
LC_Top5	0.829***	0.738***	0.756***	0.978***	1.049***	0.735***	0.889***	0.854***
	[3.17]	[2.83]	[2.77]	[3.94]	[4.58]	[2.93]	[3.62]	[3.41]
Size	-0.035	-0.004	-0.002	0.007	-0.026	-0.002	0.001	0.006
	[0.91]	[0.11]	[0.04]	[0.18]	[0.67]	[0.04]	[0.02]	[0.15]
ROA	-3.355**	-3.521**	-1.575	-0.882	-3.324**	-3.640**	-1.556	-1.007
	[2.27]	[2.43]	[0.78]	[0.40]	[2.27]	[2.52]	[0.78]	[0.44]
Small business growth	-0.058	-0.089	0.016	0.077	-0.062	-0.090	0.015	0.079
	[0.42]	[0.57]	[0.18]	[1.36]	[0.44]	[0.57]	[0.16]	[1.40]
Household income growth	-0.006	-0.004	-0.007*	-0.008*	-0.006	-0.004	-0.007*	-0.008*
	[1.34]	[1.05]	[1.66]	[1.81]	[1.31]	[1.03]	[1.65]	[1.81]
Constant	-4.184***	-4.417***	-4.180***	-4.116***	-4.260***	-4.437***	-4.161***	-4.073***
	[6.47]	[6.78]	[6.46]	[6.38]	[6.57]	[6.82]	[6.43]	[6.29]
Observations	31310	30280	29291	28279	31310	30280	29291	28279
Number of banks	1311	1294	1280	1267	1311	1294	1280	1267
LogLikelihood	-1275.407	-1275.440	-1261.489	-1209.891	-1271.945	-1275.870	-1254.357	-1215.736

Table 5

Liquidity Creation and Bank Failures: Alternative Measure of Failure

Logit estimations are performed under the random effects assumption. The dependent variable is a dummy variable, bank failure, equal to one when the ratio of equity to assets is less than 2 %. *LC1* denotes the category-based liquidity creation measure and *LC2* is the maturity-based liquidity creation measure. These measures enter into the regressions as dummy variables depending on their distribution across several percentiles. *Size* is the logarithm of total assets; *ROA* is return on assets; *Small business growth* is the growth in regional SMEs; and *Household income growth* is the growth in regional household income per capita. Marginal effects of a change in the relevant explanatory variable are reported. Standard errors appear in square brackets below estimated coefficients. *, **, *** denote an estimate significantly different from 0 at the 10%, 5%, and 1% level, respectively. Dummy variables for quarters and years are included in the regressions but are not reported.

	LC1/Assets				LC2/Assets			
	Quarters before failure							
	1 quarter	2 quarters	3 quarters	4 quarters	1 quarter	2 quarters	3 quarters	4 quarters
LC_Bottom5	0.190	0.645	0.930	0.400	-0.539	0.580	1.010*	0.168
	[0.25]	[1.02]	[1.46]	[0.53]	[0.52]	[0.93]	[1.83]	[0.23]
LC_5-10%	-0.449	-21.346	0.899	-20.627	-23.962	-22.546	0.289	-22.716
	[0.44]	[0.00]	[1.41]	[0.00]	[0.00]	[0.00]	[0.39]	[0.00]
LC_10-15%	-0.476	-0.486	-0.328	0.331	0.155	0.134	0.225	0.096
	[0.46]	[0.47]	[0.31]	[0.44]	[0.21]	[0.18]	[0.30]	[0.13]
LC_15-20%	-22.869	0.141	-0.318	0.704	0.583	0.133	-21.639	0.082
	[0.00]	[0.19]	[0.31]	[1.12]	[0.94]	[0.18]	[0.00]	[0.11]
LC_80-85%	0.415	-0.365	-0.230	0.744	-24.022	-22.290	0.190	0.441
	[0.55]	[0.35]	[0.22]	[1.18]	[0.00]	[0.00]	[0.26]	[0.72]
LC_85-90%	0.415	0.701	0.432	1.234**	0.881	0.104	-21.859	0.726
	[0.55]	[1.10]	[0.57]	[2.38]	[1.60]	[0.14]	[0.00]	[1.33]
LC_90-95%	1.400***	1.531***	2.075***	1.076*	0.865	0.990*	0.764	0.316
	[2.72]	[3.20]	[4.83]	[1.92]	[1.57]	[1.95]	[1.37]	[0.51]
LC_Top5	2.548***	2.011***	2.265***	2.142***	1.950***	1.702***	2.019***	1.485***
	[7.13]	[5.06]	[5.57]	[5.39]	[5.29]	[4.30]	[5.47]	[3.62]
Size	-0.157**	-0.116	-0.071	-0.027	-0.068	-0.049	-0.001	0.039
	[1.96]	[1.43]	[0.90]	[0.35]	[0.85]	[0.60]	[0.01]	[0.50]
ROA	-2.247***	-3.693***	-3.827**	-4.474***	-2.739***	-3.799***	-3.855**	-5.192***
	[2.85]	[2.97]	[2.16]	[3.01]	[3.46]	[3.08]	[2.39]	[3.63]
Small business growth	-0.749	-0.402	-0.430	-0.131	-0.783	-0.427	-0.485	-0.152
	[1.14]	[0.75]	[0.76]	[0.41]	[1.20]	[0.79]	[0.84]	[0.46]
Household income growth	0.028***	0.040***	0.041***	0.041***	0.028***	0.041***	0.041***	0.043***
	[3.01]	[5.52]	[6.88]	[7.08]	[3.19]	[5.72]	[7.13]	[7.39]
Constant	-9.81***	-11.76***	-12.39***	-12.62***	-10.164***	-12.105***	-12.6***	-12.93***
	[6.99]	[9.41]	[11.02]	[11.38]	[7.49]	[9.70]	[11.31]	[11.60]
Observations	35287	34966	34748	34586	35287	34966	34748	34586
Number of banks	1386	1385	1386	1385	1386	1385	1386	1385
logLikelihood	-319.684	-308.610	-307.394	-320.817	-328.219	-311.776	-310.477	-328.191

Table 6

Liquidity Creation and Bank Failures: Only Moscow Banks

Logit estimations are performed under the random effects assumption. The dependent variable is a dummy variable, bank failure, equals to one when a bank's license is revoked and zero otherwise. *LC1* denotes the category-based liquidity creation measure and *LC2* is the maturity-based liquidity creation measure. These measures enter into the regressions as dummy variables depending on their distribution across several percentiles. *Size* is the logarithm of total assets; *ROA* is return on assets; *Small business growth* is the growth in regional SMEs; and *Household income growth* is the growth in regional household income per capita. Marginal effects of a change in the relevant explanatory variable are reported. Standard errors appear in square brackets below estimated coefficients. *, **, *** denote an estimate significantly different from 0 at the 10%, 5%, and 1% level respectively. As we only consider banks located in Moscow, we skip regional variables *Small business growth* and *Household income growth* from the estimations. Dummy variables for quarters and years are included in the regressions but are not reported.

	LC1/Assets				LC2/Assets			
	Quarters before failure							
	1 quarter	2 quarters	3 quarters	4 quarters	1 quarter	2 quarters	3 quarters	4 quarters
LC_Bottom5	0.506	0.388	0.158	-0.288	0.676**	0.479	-0.079	-0.261
	[1.51]	[1.21]	[0.48]	[0.72]	[2.02]	[1.50]	[0.21]	[0.65]
LC_5-10%	-0.215	-1.046*	0.018	-0.175	0.262	-0.111	0.007	-0.005
	[0.49]	[1.76]	[0.05]	[0.47]	[0.68]	[0.28]	[0.02]	[0.02]
LC_10-15%	-0.834	0.195	-1.178**	-0.048	-0.657	-0.064	-0.201	0.025
	[1.40]	[0.57]	[1.99]	[0.14]	[1.10]	[0.16]	[0.50]	[0.07]
LC_15-20%	-0.466	-0.642	-0.402	-0.386	-0.331	-1.280*	-0.027	-0.540
	[0.89]	[1.24]	[0.94]	[0.90]	[0.63]	[1.78]	[0.07]	[1.17]
LC_80-85%	0.063	0.011	-0.430	-0.365	0.465	0.358	-0.495	-0.933
	[0.12]	[0.02]	[0.83]	[0.71]	[0.98]	[0.83]	[0.83]	[1.30]
LC_85-90%	0.286	-0.510	0.119	-0.410	0.839**	0.194	0.490	0.466
	[0.61]	[0.86]	[0.30]	[0.80]	[2.06]	[0.42]	[1.31]	[1.25]
LC_90-95%	0.047	-0.589	0.048	0.885***	0.472	0.316	0.150	-0.060
	[0.09]	[0.99]	[0.12]	[3.06]	[1.00]	[0.73]	[0.35]	[0.13]
LC_Top5	1.605***	1.583***	0.989***	1.125***	1.721***	1.630***	1.339***	1.577***
	[6.19]	[6.75]	[3.74]	[4.32]	[6.38]	[6.61]	[5.21]	[6.69]
Size	-0.297***	-0.244***	-0.206***	-0.214***	-0.242***	-0.200***	-0.175***	-0.165***
	[5.38]	[4.84]	[4.31]	[4.60]	[4.47]	[4.09]	[3.77]	[3.62]
ROA	-5.225***	-5.489***	-5.257***	-3.097	-5.350***	-5.294***	-5.058**	-3.343
	[4.42]	[3.40]	[2.58]	[1.46]	[4.35]	[3.42]	[2.46]	[1.51]
Constant	-3.287***	-3.376***	-3.420***	-3.432***	-3.717***	-3.684***	-3.688***	-3.733***
	[9.46]	[10.57]	[11.29]	[11.74]	[10.49]	[11.46]	[12.17]	[12.59]
Observations	16240	16029	15886	15776	16240	16029	15886	15776
Number of banks	687	686	687	688	687	686	687	688
logLikelihood	-638.736	-733.685	-804.263	-816.328	-638.438	-738.292	-802.579	-808.479

Table 7

Liquidity Creation and Bank Failures: Only Domestic Private Banks

Logit estimations are performed under the random effects assumption. The dependent variable is a dummy variable, bank failure, equal to one when a bank's license is revoked and zero otherwise. *LC1* denotes the category-based liquidity creation measure and *LC2* is the maturity-based liquidity creation measure. These measures enter into the regressions as dummy variables depending on their distribution across several percentiles. *Size* is the logarithm of total assets; *ROA* is return on assets; *Small business growth* is the growth in regional SMEs; and *Household income growth* is the growth in regional household income per capita. Marginal effects of a change in the relevant explanatory variable are reported. Standard errors appear in square brackets below estimated coefficients. *, **, *** denote an estimate significantly different from 0 at the 10%, 5%, and 1% level, respectively. Dummy variables for quarters and years are included in the regressions but are not reported.

	LC1/Assets				LC2/Assets			
	Quarters before failure							
	1 quarter	2 quarters	3 quarters	4 quarters	1 quarter	2 quarters	3 quarters	4 quarters
LC_Bottom5	1.064***	0.828***	0.635**	0.589**	1.291***	0.996***	0.622**	0.595**
	[4.20]	[3.39]	[2.46]	[2.17]	[5.06]	[4.08]	[2.23]	[2.07]
LC_5-10%	0.091	-0.456	0.471*	0.494*	0.577*	-0.059	0.217	0.261
	[0.24]	[1.08]	[1.74]	[1.78]	[1.78]	[0.16]	[0.68]	[0.82]
LC_10-15%	-0.591	0.368	-0.319	0.213	-0.233	0.314	0.090	0.519*
	[1.17]	[1.28]	[0.85]	[0.69]	[0.50]	[1.02]	[0.27]	[1.87]
LC_15-20%	0.094	-0.660	-0.142	-0.333	-0.070	-0.574	0.488*	-0.123
	[0.25]	[1.44]	[0.41]	[0.85]	[0.17]	[1.25]	[1.76]	[0.33]
LC_80-85%	-0.211	-0.185	-0.147	-0.266	0.294	-0.171	-0.094	-0.576
	[0.45]	[0.47]	[0.40]	[0.68]	[0.79]	[0.44]	[0.26]	[1.26]
LC_85-90%	0.500	-0.166	0.088	0.215	0.720**	0.376	0.234	0.669**
	[1.48]	[0.42]	[0.27]	[0.68]	[2.30]	[1.23]	[0.74]	[2.55]
LC_90-95%	0.548	0.116	0.116	0.824***	-0.092	0.223	0.485*	0.419
	[1.62]	[0.33]	[0.35]	[3.35]	[0.21]	[0.69]	[1.75]	[1.46]
LC_Top5	1.730***	1.509***	1.124***	1.120***	1.757***	1.331***	1.136***	1.366***
	[8.04]	[7.45]	[5.00]	[4.90]	[8.53]	[6.48]	[5.24]	[6.81]
Size	-0.163***	-0.143***	-0.120***	-0.088**	-0.131***	-0.122***	-0.111***	-0.071*
	[3.85]	[3.65]	[3.12]	[2.32]	[3.09]	[3.16]	[2.94]	[1.91]
ROA	-5.278***	-3.951***	-3.589***	-4.241***	-5.461***	-4.263***	-3.458***	-4.256***
	[6.83]	[3.97]	[3.59]	[3.95]	[6.74]	[4.16]	[3.50]	[3.90]
Small business growth	-0.115	-0.083	-0.067	-0.013	-0.120	-0.086	-0.069	-0.019
	[0.65]	[0.60]	[0.48]	[0.12]	[0.67]	[0.60]	[0.50]	[0.18]
Household income growth	-0.014***	-0.010**	-0.016***	-0.007*	-0.013***	-0.009**	-0.016***	-0.007
	[2.73]	[2.15]	[4.00]	[1.67]	[2.59]	[2.02]	[3.97]	[1.61]
Constant	-2.796***	-3.093***	-2.302***	-3.749***	-3.167***	-3.316***	-2.430***	-3.911***
	[3.90]	[4.63]	[3.81]	[6.06]	[4.47]	[4.94]	[4.03]	[6.31]
Observations	33097	32802	32598	32450	33097	32802	32598	32450
Number of banks	1322	1322	1323	1322	1322	1322	1323	1322
Log Likelihood	-1063.419	-1238.971	-1304.143	-1326.320	-1058.613	-1244.493	-1304.736	-1319.304

Table 8

Liquidity Creation and Bank Failures: Effect of Deposit Insurance

Logit estimations are performed under the random effects assumption. The dependent variable is a dummy variable, bank failure, equal to one when a bank's license is revoked and zero otherwise. *LC1* denotes the category-based liquidity creation measure and *LC2* is the maturity-based liquidity creation measure. These measures enter into the regressions as dummy variables depending on their distribution across several percentiles. *Size* is the logarithm of total assets; *ROA* is return on assets; *Small business growth* is the growth in regional SMEs; and Household Income Growth is the growth in regional household income per capita. Marginal effects of a change in the relevant explanatory variable are reported. Standard errors appear in square brackets below estimated coefficients. *, **, *** denote an estimate significantly different from 0 at the 10%, 5%, and 1% level, respectively. We now include the dummy variable Deposit Insurance equal to one for the quarters after the implementation of deposit insurance scheme in 2004. Dummy variables for quarters and years are included in the regressions but are not reported.

	LC1/Assets				LC2/Assets			
	Quarters before failure							
	1 quarter	2 quarters	3 quarters	4 quarters	1 quarter	2 quarters	3 quarters	4 quarters
LC_Bottom5	0.936***	0.694***	0.546**	0.504*	1.131***	0.815***	0.469*	0.442
	[3.64]	[2.83]	[2.12]	[1.86]	[4.31]	[3.35]	[1.69]	[1.53]
LC_5-10%	0.008	-0.546	0.407	0.435	0.509	-0.144	0.153	0.202
	[0.02]	[1.29]	[1.51]	[1.57]	[1.55]	[0.39]	[0.48]	[0.63]
LC_10-15%	-0.657	0.303	-0.361	0.170	-0.283	0.266	0.063	0.485*
	[1.30]	[1.06]	[0.96]	[0.56]	[0.61]	[0.87]	[0.19]	[1.72]
LC_15-20%	0.049	-0.709	-0.171	-0.366	-0.121	-0.615	0.460*	-0.162
	[0.13]	[1.55]	[0.49]	[0.93]	[0.28]	[1.34]	[1.66]	[0.44]
LC_80-85%	-0.159	-0.128	-0.117	-0.230	0.326	-0.146	-0.084	-0.562
	[0.34]	[0.33]	[0.32]	[0.59]	[0.87]	[0.37]	[0.23]	[1.22]
LC_85-90%	0.558	-0.114	0.118	0.246	0.738**	0.378	0.234	0.683**
	[1.64]	[0.29]	[0.36]	[0.77]	[2.33]	[1.23]	[0.74]	[2.55]
LC_90-95%	0.611*	0.179	0.152	0.862***	-0.048	0.246	0.499*	0.443
	[1.79]	[0.51]	[0.46]	[3.50]	[0.11]	[0.77]	[1.80]	[1.53]
LC_Top5	1.775***	1.550***	1.130***	1.126***	1.803***	1.350***	1.154***	1.391***
	[7.93]	[7.63]	[5.01]	[4.91]	[8.17]	[6.57]	[5.32]	[6.59]
Size	-0.248***	-0.235***	-0.180***	-0.154***	-0.211***	-0.207***	-0.168***	-0.137***
	[5.22]	[5.81]	[4.59]	[4.03]	[4.39]	[5.22]	[4.38]	[3.43]
ROA	-5.516***	-4.079***	-3.583***	-4.112***	-5.718***	-4.372***	-3.426***	-4.159***
	[6.05]	[4.19]	[3.59]	[3.80]	[6.22]	[4.37]	[3.48]	[3.62]
Small business growth	-0.157	-0.135	-0.084	-0.034	-0.162	-0.139	-0.088	-0.041
	[0.83]	[0.91]	[0.59]	[0.31]	[0.84]	[0.92]	[0.62]	[0.36]
Household income growth	-0.011**	-0.006	-0.015***	-0.005	-0.011*	-0.005	-0.015***	-0.005
	[1.99]	[1.16]	[3.58]	[1.18]	[1.96]	[1.09]	[3.57]	[1.16]
Deposit Insurance	0.617***	0.770***	0.376**	0.511***	0.574***	0.723***	0.358**	0.507**
	[3.12]	[4.74]	[2.27]	[2.99]	[2.77]	[4.50]	[2.17]	[2.39]
Constant	-2.999***	-3.375***	-2.245***	-3.775***	-3.384***	-3.590***	-2.378***	-3.978***
	[3.80]	[4.71]	[3.62]	[5.97]	[4.27]	[5.02]	[3.85]	[5.97]
Observations	35287	34966	34748	34586	35287	34966	34748	34586
Number of banks	1386	1385	1386	1385	1386	1385	1386	1385
logLikelihood	-1067.144	-1239.353	-1313.824	-1335.181	-1063.627	-1246.031	-1314.215	-1328.136

Table 9

Liquidity Creation and Bank Failures: Effect of Bank Concentration

Logit estimations are performed under the random effects assumption. The dependent variable is a dummy variable, bank failure, equal to one when a bank's license is revoked and zero otherwise. *LC1* denotes the category-based liquidity creation measure and *LC2* is the maturity-based liquidity creation measure. These measures enter into the regressions as dummy variables depending on their distribution across several percentiles. *Size* is the logarithm of total assets; *ROA* is return on assets; *Small business growth* is the growth in regional SMEs; and *Household Income Growth* is the growth in regional household income per capita. Marginal effects of a change in the relevant explanatory variable are reported. Standard errors appear in square brackets below estimated coefficients. *, **, *** denote an estimate significantly different from 0 at the 10%, 5%, and 1% level, respectively. Dummy variables for quarters and years are included in the regressions but are not reported.

	LC1/Assets				LC2/Assets			
	Quarters before failure							
	1 quarter	2 quarters	3 quarters	4 quarters	1 quarter	2 quarters	3 quarters	4 quarters
LC_Bottom5	0.811***	0.579**	0.374	0.333	0.969***	0.681***	0.291	0.262
	[3.19]	[2.36]	[1.44]	[1.22]	[3.80]	[2.79]	[1.04]	[0.91]
LC_5-10%	-0.166	-0.685	0.231	0.258	0.315	-0.303	-0.040	0.018
	[0.44]	[1.62]	[0.85]	[0.92]	[0.96]	[0.82]	[0.12]	[0.06]
LC_10-15%	-0.725	0.196	-0.476	0.032	-0.413	0.144	-0.089	0.343
	[1.48]	[0.68]	[1.28]	[0.10]	[0.89]	[0.47]	[0.27]	[1.23]
LC_15-20%	-0.058	-0.796*	-0.287	-0.480	-0.226	-0.721	0.333	-0.273
	[0.16]	[1.73]	[0.83]	[1.23]	[0.53]	[1.57]	[1.20]	[0.74]
LC_80-85%	-0.125	-0.110	-0.076	-0.196	0.417	-0.057	0.017	-0.468
	[0.27]	[0.28]	[0.21]	[0.50]	[1.11]	[0.15]	[0.05]	[1.02]
LC_85-90%	0.588*	-0.097	0.149	0.264	0.822***	0.462	0.320	0.756***
	[1.74]	[0.25]	[0.45]	[0.83]	[2.62]	[1.51]	[1.00]	[2.87]
LC_90-95%	0.628*	0.178	0.168	0.876***	0.003	0.318	0.569**	0.499*
	[1.85]	[0.51]	[0.51]	[3.55]	[0.01]	[0.99]	[2.04]	[1.73]
LC_Top5	1.693***	1.482***	1.086***	1.089***	1.807***	1.377***	1.171***	1.406***
	[7.84]	[7.31]	[4.82]	[4.76]	[8.76]	[6.69]	[5.39]	[7.00]
Size	-0.300***	-0.269***	-0.245***	-0.208***	-0.265***	-0.245***	-0.234***	-0.189***
	[6.58]	[6.42]	[6.01]	[5.21]	[5.88]	[5.96]	[5.86]	[4.81]
ROA	-5.193***	-3.659***	-3.711***	-3.894***	-5.251***	-3.847***	-3.494***	-3.829***
	[7.22]	[3.76]	[3.73]	[3.57]	[7.11]	[3.87]	[3.55]	[3.48]
Small business growth	-0.080	-0.041	-0.029	0.037	-0.090	-0.045	-0.033	0.031
	[0.36]	[0.25]	[0.17]	[0.31]	[0.39]	[0.27]	[0.19]	[0.25]
Household income growth	-0.016***	-0.011**	-0.018***	-0.007*	-0.015***	-0.011**	-0.018***	-0.007*
	[3.07]	[2.38]	[4.12]	[1.78]	[2.96]	[2.25]	[4.09]	[1.72]
Herfindahl	-3.838***	-3.376***	-3.520***	-3.306***	-3.941***	-3.481***	-3.627***	-3.430***
	[5.90]	[5.89]	[6.26]	[6.04]	[6.01]	[6.03]	[6.41]	[6.20]
Constant	-1.253	-1.769**	-0.943	-2.555***	-1.600**	-2.013***	-1.077	-2.722***
	[1.63]	[2.49]	[1.44]	[3.90]	[2.09]	[2.84]	[1.64]	[4.16]
Observations	35287	34966	34748	34586	35287	34966	34748	34586
Number of banks	1386	1385	1386	1385	1386	1385	1386	1385
logLikelihood	-1051.129	-1229.105	-1292.319	-1317.256	-1045.804	-1233.703	-1291.320	-1308.623

Figure 1

Liquidity Creation over the Period 2000-2007

This figure illustrates the development of mean liquidity creation as share of total assets for both category and maturity liquidity creation measures. It is based on yearly data.