Cyclicality of Bank Liquidity Creation

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Abstract

The aim of the paper is to investigate cyclicality of bank liquidity creation. Since liquidity creation is a major function of banks in the economy, banks can contribute to amplify business cycle fluctuations through their liquidity creation behavior. Using Berger and Bouwman (2009)'s methodology to compute liquidity creation measures, we analyze the relation between GDP growth and liquidity creation of Russian banks from 2004 to 2015. We find that liquidity creation of banks is procyclical and show that state-owned banks do not have a more or less procyclical liquidity creation behavior than domestic private banks. We find limited evidence that foreign-owned banks tend to have a lower procyclical liquidity creation than domestic private banks. Hence we support the view that liquidity creation behavior of banks can contribute to amplify business cycle fluctuations, while ownership of banks does not significantly influence this channel.

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1. Introduction

Liquidity creation is a major function of banks in the economy. Banks create liquidity by financing relatively illiquid assets with relatively liquid liabilities and thus contribute to financing the economy and facilitating transactions between economic agents. Liquidity creation is shown to favor economic growth in the economy (Fidrmuc, Fungáčová and Weill, 2015; Berger and Sedunov, 2015).

While this function of banks has long been ignored, literature on bank liquidity creation has recently expanded following the novel approach proposed by Berger and Bouwman (2009) to measure liquidity created by banks. A few works have been performed to examine the determinants of liquidity creation (e.g., Fungáčová, Zhou and Weill, 2015; Berger, Bouwman, Kick and Schaeck, 2016; Horvath, Seidler and Weill, 2016) and the consequences of liquidity creation on financial stability (Berger and Bouwman, 2012; Fungáčová, Turk and Weill, 2015).

The aim of this paper is to investigate cyclicality of bank liquidity creation. Berger and Bouwman (2015) argue that bank lending alone is not an optimal measure of bank output. In order to account for differences in loan categories and composition on the liability side, one should rather look at the bank liquidity creation. Indeed, while cyclicality of bank lending has been studied in the literature (e.g., Micco and Panizza, 2006; Bertay, Demirgüc-Kunt and Huizinga, 2015), no work has ever examined how bank core output in the form of liquidity creation reacts to business cycle fluctuations. Given the key function of banks as liquidity creators, cyclicality of bank liquidity creation can generate undesirable effects in the economy by amplifying recessions.

We also analyze if liquidity creation by state-owned banks is less procyclical than liquidity creation by domestic private banks and foreign banks. Such result would imply that state-owned banks have a more stabilizing role than domestic private banks and foreign banks for the function of liquidity creation. Bertay, Demirgüc-Kunt and Huizinga (2015) have shown that lending by state-owned banks is less procyclical than lending by private banks. We examine if this result stands for liquidity creation.

To investigate these issues, we follow the methodology of Berger and Bouwman (2009) to measure bank liquidity creation. We classify all bank assets and liabilities based

on their degree of liquidity, then assign weights to each item and compute the amount of liquidity created by each bank. We consider the Russian banking system for our analysis and use comprehensive quarterly data from financial reports of the Russian banks covering the period 2004-2015. The availability of a rich panel dataset on all Russian banks in terms of level of detail and frequency allows for the measurement of liquidity creation and for the investigation of business cycle fluctuations. The coexistence of state-owned, domestic private, and foreign banks, with significant market shares for each type makes this country of prime interest to analyze how ownership influences cyclicality of bank liquidity creation.

Our paper contributes to the literature on bank liquidity creation by providing evidence on its cyclicality and therefore on its potential amplifying role in economic recessions. It also constitutes a contribution to the analysis of the impact of state ownership of banks in the economy. It is especially important for the analysis of banks in emerging markets given the major role of banks in the financing of these economies and the persistent influence of the state in the banking industry in many of them.

The rest of the article is structured as follows. Section 2 reviews the related literature. Section 3 presents data and methodology. Section 4 displays the main estimations. Section 5 provides additional estimations on cyclicality of bank lending. Section 6 concludes.

2. Related literature

Our paper is related to two strands of literature, the first one on bank ownership and lending behavior, the second one on bank liquidity creation. We briefly survey both strands.

Lending behavior of banks has been extensively examined in the previous literature. Large strand of this literature finds strong association between bank ownership and lending behavior. Consistent with the political view of state ownership, several studies show that state-owned banks may be used by politicians and drive bank lending to suboptimal levels, especially around electoral periods (Sapienza, 2004; Dinç, 2005; Khwaja and Mian, 2005; Carvalho, 2014; Infante and Piazza, 2014). Yet, lending behavior of banks received distinctive attention in the academic literature especially after the credit crunch of 2008.

As the result, a number of studies show that state ownership of banks may actually be more valuable in times of financial turmoil. This part of literature argues that state-owned banks increase lending during crises, while foreign banks cut their lending more sharply than any other type of banks (Brei and Schclarek, 2013; Fungáčová, Herrala and Weill, 2013; Albetrazzi and Bottero, 2014; De Haas et al., 2015). Many other studies show extensive prevalence of state ownership of banks and its prominent role in one of the most important features of financial institutions – lending (Cull and Martinez Peria, 2013; Davydov 2016).

Despite the wide spectrum of literature, there is only scarce evidence on general reaction of different types of banks on business cycle fluctuations. Micco and Panizza (2006) link credit and GDP growth and find that lending by state-owned banks is less cyclical than lending by privately owned banks. Using extensive data set from 111 countries over the 1999-2010, Bertay, Demirgüc-Kunt and Huizinga (2015) show that state-owned banks lend countercyclically regardless of the occurrence of a financial crisis. While these results are especially strong in developed countries with good governance, general conclusions imply that state's involvement through the government ownership of banks, in fact, serves as a stabilizing power over the business cycles.

Duprey (2015) confirms these findings by using bank data over the 1990-2010 from 83 countries. He documents that privatized banks are associated with increased lending cyclicality by combining the state ownership with individual privatization/nationalization events. Furthermore, Behr, Foos and Norden (2015) examine the effect of government involvement in banks on cyclicality of lending to small and medium enterprises. Using unique German institutional settings they show that state involvement in a bank results in much less sensitivity of bank lending to GDP growth. On average, lending by banks with state involvement is 25 percent less cyclical than that of other type of local banks.

The second strand of literature to which we contribute is a recent literature on bank liquidity creation. A key motivation for the focus on the function of banks as liquidity creators is the argument from Berger and Bouwman (2015) that bank lending alone is not an optimal measure of bank output. In order to account for differences in loan categories and composition on the liability side, one should rather look at the bank liquidity creation measure suggested by Berger and Bouwman (2009). Existing empirical literature on bank

liquidity creation is fairly limited as its development just recently received a new start. Most of this literature focuses on determinants of bank liquidity creation. These studies suggest that bank capital, for instance, is negatively related to liquidity creation but may depend on the bank size and presence of deposit insurance system (Lei and Song, 2013; Fungáčová, Weill and Zhou, 2016). This relationship may also be reversed, implying that greater liquidity creation may negatively affect bank solvency (Horvath, Seidler and Weill, 2014) and increase the probability of bank failure (Fungáčová, Turk and Weill, 2015). At the same time, liquidity creation by banks is rather sensitive to the level of competition in the banking sector (Horvath, Seidler and Weill, 2016), regulatory interventions and bailouts (Berger et al., 2016), and monetary policy (Rauch et al., 2011) although the former link may depend on bank size and general economic conditions (Berger and Bouwman, 2012).

With respect to bank ownership, prior literature suggests that it may be one of the main determinants of bank liquidity creation. Fungáčová and Weill (2012) document that large state-owned banks have the greatest impact on liquidity creation in Russia. Moreover, while on average liquidity creation by private domestic and foreign banks contracted during the recent financial crisis, state-owned banks did not reduce liquidity creation. These results may also indicate potential countercyclical behavior in liquidity creation by state-controlled banks. In addition, Lei and Song (2013) argue further that general negative relation between bank capital and liquidity creation is not relevant for foreign banks operating in China. These findings particularly underline the importance of different types of bank ownership and its impact on liquidity creation.

Several recent studies show that liquidity creation by banks positively affects economic growth. Berger and Sedunov (2015) argue that higher levels of bank liquidity creation are associated with significantly higher GDP in individual US states. Fidrmuc, Fungáčová and Weill (2015), in turn, document that liquidity creation by banks is positively related to economic growth in Russian regions and this relationship holds even during the recent financial crisis. These results imply that development of the financial sector may significantly contribute to economic growth through the bank liquidity creation channel.

3. Data and methodology

3.1 Data Description

We employ quarterly bank-level financial statement data for Russian banks from the Central Bank of Russia (CBR). The time period covered is 2004 – 2015. The dataset contains detailed information that is necessary for calculation of the bank liquidity creation measures. Namely, we are able to distinguish among corporate, household, and government loans; different types of deposits and the data also contains detailed information on maturity of different balance sheet items. Moreover, it covers all Russian banks and thus there is no selection bias.

We augment the original dataset by additional data on state ownership of banks that comes from classification by Vernikov (2016) and the data on foreign ownership from CBR, www.allbanks.ru webpage and bank's webpages. We furthermore consider macro-level variables from the Russian Federal State Statistics Service (Rosstat).

By excluding non-bank organizations from the sample we ensure that the data include only commercial banks. We trim our dependent variables at the 2.5% and 97.5% to avoid extreme outliers. The final sample consists of unbalanced panel observations on 1215 individual banks. Depending on the model specification the number of observations varies between 36 566 and 38 703 bank-quarter observations. Descriptive statistics of the variables used in our analysis are provided in Table 1.

3.2 Liquidity Creation Measures

In order to construct bank liquidity creation measures, we employ the three-step procedure developed by Berger and Bouwman (2009). In the first step we classify all bank balance sheet items as liquid, semi-liquid or illiquid. This classification is based on the ease, cost, and time necessary for banks (customers) to turn their obligations into liquid funds (withdraw funds). In doing this, we take Russia-specific factors into account.

We further assign weights to all balance sheet items. Following the theory of financial intermediation according to which banks create liquidity by transforming illiquid assets to liquid liabilities, we apply positive weights to these two balance sheet categories.

This indicates that one unit face value of liquidity is created when a unit of liquid liabilities (e.g. current account deposits, weighted 0.5) is used to finance a unit of illiquid assets (e.g. corporate loan, weighted 0.5). In line with this, we assign negative weights to liquid assets, illiquid liabilities, and capital. One unit of liquidity is destroyed when one unit of illiquid liabilities or equity is used to finance a unit of liquid assets (e.g. government securities).

The following equation (1) presents the functional form used to construct the bank liquidity creation measures in the third step.

$$\textit{Liquidity Creation} = \{\tfrac{1}{2} \times \textit{Illiquid Assets} + 0 \times \textit{Semi-Liquid Assets} - \tfrac{1}{2} \times \textit{Liquid Assets}\} + \{\tfrac{1}{2} \times \textit{Liquid Liabilities} + 0 \times \textit{Semi-Liquid Liabilities} - \tfrac{1}{2} \times \textit{Illiquid Liabilities}\} - \tfrac{1}{2} \times \textit{Capital} \quad (1)$$

In line with Berger and Bouwman (2009), we construct two measures of liquidity creation from equation (1), using two definitions for each of the right-hand-side terms. The classification of balance sheet items is done based on category for the first measure and based on maturity of the individual balance sheet items for the second measure. Table 2 provides a detailed description of balance sheet items used to calculate these two liquidity creation measures, and the weights assigned to each group of items.

Our benchmark liquidity creation measure is based on the classification of balance sheet items by category. Liquid assets include cash, accounts with banks and total securities (stocks, debt securities and promissory notes). Customer loans are divided into corporate loans, loans to individuals and loans to government. Since banks generally lack the option of selling the corporate loans to meet their liquidity needs, these loans are considered illiquid. Other categories of loans, including loans to individuals, loans to the government, and interbank loans, are classified as semi-liquid. As mortgage lending is quite a recent phenomenon in Russia, the majority of loans to individuals are short-term loans to buy consumer goods. We view these 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. Illiquid assets category further includes other assets containing e.g. tangible and intangible assets.

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 clients (domestic and foreign firms, government, and households). These are classified as liquid because customers can easily withdraw these funds without penalty. The second category of claims of non-banking sector contains term deposits classified as semi-liquid because it may be difficult or costly to withdraw them immediately. The debt securities issued by banks belong either to liquid category (promissory notes and bonds) or semiliquid one (deposit and saving certificates). This categorization is based on the liquidity of these instruments in Russia. The illiquid liabilities category consists of other liabilities that we calculate as the difference between total liabilities and the sum of all of the above-mentioned claims. We treat also bank capital this way.

The alternative liquidity creation measure that we use in our analysis is based on the classification of balance sheet items by maturity. To calculate this measure we redefine the subgroups of balance sheet items. On the assets side, liquid assets are defined in the same way as it was the case for classification by category. Semiliquid assets consist of different types of loans with maturity lower than one year. Illiquid assets' category contains loans with maturity more than one year, loans with unknown maturity and other assets (e.g. tangible and intangible assets). Liability side classification follows the same logic as on the assets side. Liquid liabilities include settlement accounts, claims of banks and debt securities issued (bonds and promissory notes). Semiliquid liabilities contain all deposits with maturity lower than one year and debt securities issued (deposit and saving certificates). Illiquid liabilities consist of deposits with maturity over one year and undefined maturity and other liabilities. Similar to our benchmark measure of liquidity creation based on category classification, we treat bank capital as an illiquid portion of the balance sheet.

The category-based liquidity creation measure is our benchmark indicator in line withBerger and Bouwman (2009) who have developed the methodology to compute both measures. These authors prefer the category-based measure and motivate their opinion by

the fact that "what matters to liquidity creation on the asset side is the ease, cost, and time for banks to dispose of their obligations to obtain liquid funds. The ability to securitize loans is closer to this concept than the time until self-liquidation." (Berger and Bouwman, 2009, p.3797).

3.3 Methodology

We begin our empirical analysis of cyclicality of liquidity creation with two-way fixed effects estimations. More specifically, we estimate different specifications of the following model:

$$y_{i,t} = \alpha_i + \beta M_i + OWN_{i,t} + M_i * OWN_{i,t} + X_{i,t-1} + \omega_i + \tau_t + \varepsilon_{i,t} \quad (2)$$

where, $y_{i,t}$ is the change in liquidity creation by bank *i* in quarter *t* and M_i is the change in the macroeconomic indicator for business cycle. We utilize alternatively two indicators for business cycles. GDP growth per capita is used in the main estimations in line with former papers (e.g. Bertay, Demirgüc-Kunt and Huizinga, 2015). We adopt real investment growth in the robustness check as an alternative indicator.

To examine the effect of bank ownership characteristics we include $OWN_{i,t}$, which is a vector of dummy variables for state ownership and foreign ownership. We also include interaction terms of macro variables and ownership dummies in order to examine the differential effect of macroeconomic fluctuations on liquidity creation between state-owned, foreign and private banks. $X_{i,t-1}$ is a matrix of bank-specific control variables. Following previous literature we include lagged values of bank size (log of total assets), equity to assets, nonperforming loans to total loans and total loans to total assets ratios as control variables. ω_i and τ_t are the bank and time fixed effects and $\varepsilon_{i,t}$ is an error term.

Our baseline regression model with fixed effects is potentially a subject to endogeneity problem. To tackle this problem and to account for dynamic properties of our panel, we include lagged dependent variable to the right-hand-side of the equation and apply dynamic two-step system GMM estimator (Arellano and Bover, 1995; Blundell and Bond, 1998) using differenced variables as instruments. We assume that our macroeconomic and ownership variables together with interaction terms are predetermined, implying that they are not correlated with future error terms. All other bank-specific controls are considered as endogenous and instrumented with their lags. This approach however leads to relatively

high number of instruments. In order to avoid overidentification problem we limit the number of lags used as instruments accordingly. We apply the Windmeijer (2005) correction for standard errors and test for the autocorrelation in residuals with Arellano-Bond test. We report Sargan test for overidentifying restrictions where the null hypothesis is that used instruments are appropriate.

4. Results

This section presents the results on cyclicality of bank liquidity creation in Russia. We first report the main estimations before testing the sensitivity of the results with robustness checks.

4.1 Main estimations

Table 3 presents the main estimations. In columns 1 and 2 we report results without ownership variables while these variables are added in columns 3 and 4. In each case, we perform estimations alternatively with panel fixed effects and with system GMM to check the sensitivity of our results. Several conclusions emerge.

First, GDP per capita growth enters with positive and significant coefficients in all regressions. Liquidity creation behavior of banks is therefore procyclical. Banks would create higher liquidity in boom times and reduce it in bust times. This finding is of importance since liquidity creation has been shown to exert beneficial effects on economic activity (Fidrmuc, Fungáčová and Weill, 2015; Berger and Sedunov, 2015). Therefore liquidity creation behavior of banks can amplify business cycles.

Second, the interactions of GDP growth with ownership dummies are not significant. These results imply the absence of difference in cyclicality of liquidity creation by bank ownership. In other words, neither state-owned banks, nor foreign banks would have a more or less procyclical liquidity creation behavior than domestic private banks. In addition, ownership dummies are also not significant, suggesting no difference in liquidity creation behavior over the period between the different types of ownership.

These results differ from those observed on cyclicality of bank lending in Bertay, Demirgüc-Kunt and Huizinga (2015). However our results concern the broader concept than bank lending as we deal with liquidity creation. In addition, they are observed for Russia, while the analysis of Bertay, Demirgüc-Kunt and Huizinga (2015) is based on a cross-country sample of 111 countries. They also differ from the conclusion of Fungáčová, Herrala and Weill (2013) that foreign-owned banks reduce more and state-owned banks reduce less their credit supply than domestic private banks in Russia. However these authors find these results by considering credit supply and not with liquidity creation, and only during the period of the financial crisis.

All in all, our findings on the cyclicality of liquidity creation and the role of bank ownership show a different pattern to what has been observed on bank lending. They support the view that examining liquidity creation provides additional information to appraise how bank behavior can amplify business cycles.

A natural question emerges if cyclicality of liquidity creation is symmetric for ownership types. Namely the findings on cyclicality of liquidity creation by ownership type can be asymmetric. The average result can be driven by different liquidity creation behaviors during the stages of the business cycle. For instance, if state-owned banks create more liquidity in bust but also boom times than domestic private banks, the average result can be that state-owned banks do not have a more or less procyclical behavior since they would have a more procyclical one in boom times and a less procyclical one in bust times, while they do have a different behavior related to business cycle fluctuations.

To investigate this question, we follow the approach of Bertay, Demirgüc-Kunt and Huizinga (2015) and replace GDP growth by two variables: *Positive GDP growth* and *Negative GDP growth*. These variables take values of corresponding rate of GDP per capita growth in episodes of positive growth and negative growth respectively, and are equal to zero otherwise. This enables us to investigate if cyclicality in bank liquidity creation is symmetric through the whole business cycle or asymmetric by only occurring in certain stages of the business cycle.[1] Table 4 reports the estimations.

[1] Behr, Foos and Norden (2015) do a similar split in their analysis of cyclicality of SME lending in Germany.

We observe that both variables *Positive GDP growth* and *Negative GDP growth* are significantly positive. This finding shows that the conclusion of procyclical liquidity creation for all banks is observed in bust times and boom times. And it is not driven by one stage in business cycle fluctuations.

Interaction terms between state ownership dummies and GDP growth are not significant. Therefore, there is no asymmetry in the cyclicality of liquidity creation for state-owned banks which do not react neither to booms nor busts in comparison to domestic private banks.

The conclusion differs for foreign-owned banks. The interaction term of foreign ownership with *Positive GDP growth* is not significant, but the one with *Negative GDP growth* is significantly negative in both regressions. Cyclicality of liquidity creation for foreign banks is therefore asymmetric. While foreign banks do not react to booms, they appear to be countercyclical in their liquidity creation compared to domestic private banks during negative GDP growth periods. We therefore find evidence of lower cyclicality for foreign-owned banks but only in bust times.

4.2 Robustness checks

We check the robustness of our findings with two additional estimations.

First, we use an alternative measure for liquidity creation. We have used the category-based liquidity creation measure in our main estimations. We can however examine if our main findings change when liquidity creation is measured through classification of balance sheet items based on maturity rather than category. We repeat our regressions with the maturity-based liquidity creation measure in Table 5.

The results with the maturity-based liquidity creation measure corroborate the main findings obtained with the category-based liquidity creation measure. We again observe a significantly positive coefficient for GDP growth in all regressions, supporting our conclusion that liquidity creation is procyclical. We still point out no significance for interaction terms between ownership dummies and GDP per capita growth. This confirms the conclusion that cyclicality of liquidity creation does not differ across types of banks.

A different result emerges when it comes to ownership dummy variables. While they were not significant when the category-based liquidity creation measure was considered,

we now see positive and significant coefficients for *State-Owned* and *Foreign-Owned* dummy variables in the system GMM regression. These results provide some support that state-owned banks and foreign banks would have increased more liquidity creation over the period than domestic private banks. They are however only observed in the system GMM regression and are not confirmed by the panel regression with fixed effects.

To sum it up, the estimations with the maturity-based liquidity creation measure confirm both main findings obtained with the category-based liquidity creation measure.

Second, we use an alternative indicator for the business cycle. One could argue that real GDP per capita growth does not fully reflect the state of the Russian economy. We redo our estimations by utilizing real investment growth as the indicator of the business cycle. Table 6 displays these estimations.

The coefficient for real investment growth is significantly positive, supporting the finding of procyclical liquidity creation behavior. We find again no different behavior for state-owned banks. Interaction variables between state-owned banks and real investment growth are not significant.

However, in this case we observe significantly negative coefficients for the interaction variables between foreign ownership and business cycle indicator. This indicates that foreign-owned banks would have less procyclical liquidity creation behavior than domestic private banks. This result differs to what was observed overall when considering GDP growth where there was no significant difference for foreign-owned banks. But it is in line with the result of an asymmetric cyclicality observed with GDP growth for these banks: we found that foreign-owned banks may have countercyclical behavior during the episodes of negative GDP growth. So this finding tends to moderate the view that no cyclical difference would be observed between foreign-owned banks and domestic private banks by adding some piece of evidence of a less procyclical liquidity creation behavior for foreign-owned banks.

In a nutshell, the estimations with the alternative business cycle indicator confirm our findings on procyclicality of liquidity creation behavior for all banks, and lack of different behavior for state-owned banks. In addition, they suggest that foreign-owned banks could have less procyclical behavior and could moderate business cycles.

5. Does cyclicality of liquidity creation differ from cyclicality of lending?

Our investigation aims at providing new evidence on cyclicality of liquidity creation. We obtain two key findings for Russian banks: procyclicality of liquidity creation, and overall no significant difference between ownership types of banks for procyclicality of liquidity creation.

We further question if both of these findings are valid for bank lending. Bank liquidity creation is a broad measure of bank output which includes bank lending but also other types of assets and which considers liability structure as well. Therefore there is no reason that liquidity creation and bank lending would necessarily have the same cyclical behavior. In addition, cyclicality by ownership types can differ between bank liquidity creation and bank lending because different types of banks can have a different behavior for other items than loans.

We therefore perform our estimations by considering a new dependent variable: the growth rate of total loans. Bertay, Demirgüc-Kunt and Huizinga (2015) and Behr, Foos and Norden (2015) consider this variable in their analysis of the cyclicality of bank lending.

Table 7 reports the estimations for cyclicality of bank lending. As our previous estimations have shown that regressions with fixed effects and with system GMM provide very similar results, for the sake of brevity we only display the estimations with fixed effects here. In column 1, we consider GDP per capita growth. In column 2, we include the interaction terms between GDP per capita growth and ownership dummies while column 3 considers the possible asymmetric liquidity creation behavior of different types of banks.

First, we observe that bank lending is procyclical. *GDP growth* is significantly positive in the first two columns, while *Positive GDP growth* and *Negative GDP growth* are significantly positive in column 3. These results show a positive (negative) relation between GDP growth and bank lending which is observed in booms (busts).

Second, we find different patterns across ownership types. The interaction terms of GDP growth with *State-Owned* and with *Foreign-Owned* are both negative and significant in column 2, while *State-Owned* and *Foreign-Owned* on their own are not significant. In

other words, state-owned banks and foreign-owned banks have a lower cyclicality of bank lending than domestic private banks.

Third, cyclicality of bank lending is asymmetric for state-owned banks and symmetric for foreign-owned banks. In column 3, we observe that *State-Owned×Positive GDP growth* is not significant while *State-Owned×Negative GDP growth* is significantly negative. In other words, in booms, state-owned banks do not amplify the expansion by increasing bank lending more than domestic private banks. However they reduce their lending less when the business cycle turns out to be bad. This result corroborates other studies observed for Russia (Fungáčová, Turk and Weill, 2015) or at the world level (Bertay, Demirgüc-Kunt and Huizinga, 2015).

The pattern is different for foreign-owned banks since both interaction terms, *Foreign-Owned×Positive GDP growth* and *Foreign-Owned×Negative GDP growth*, are significantly negative. In other words, lending behavior of foreign banks would be symmetric and less procyclical than for other types of banks. In booms, foreign banks increase lending less while they diminish their lending by less in busts than domestic private banks. Foreign banks would therefore have a stabilizing role in the Russian economy. These results can be linked to those observed for liquidity creation in the sense that we also observe some leads that foreign-owned banks would have less procyclical bank lending behavior than domestic private banks.

All in all, the estimations on cyclicality of lending show similarities and differences with those on cyclicality of liquidity creation. In both sets of estimations, we find evidence of procyclicality for all banks. However they differ for results by ownership type. Only for lending, we observe lower procyclicality of state-owned banks relative to domestic private banks. In the case of foreign-owned banks, lower procyclicality is more pronounced for lending (in booms and busts) than for liquidity creation (only in busts). The implications of the results for the influence of bank ownership types on the amplification of business cycles are thus different when considering lending or liquidity creation.

6. Conclusion

This study examines cyclicality of liquidity creation. While liquidity creation is a major function of banks in the economy, no paper has ever investigated if it is procyclical and could contribute to amplify business cycle fluctuations. We analyze this question on the Russian banking system by taking into account the potential differences across types of banks. Literature has shown evidence of differences in cyclicality of bank lending between state-owned banks and it is of interest to check if such result is also observed for liquidity creation.

Our findings can be summarized as follows. First, we observe that liquidity creation of banks is procyclical. Business cycle fluctuations are positively associated with bank liquidity creation. Second, we show that state-owned banks do not have a more or less procyclical liquidity creation behavior than domestic private banks. Third, we find limited evidence that foreign-owned banks tend to have a lower procyclical liquidity creation than domestic private banks.

Therefore our findings have several implications. From a positive perspective, they suggest that liquidity creation behavior of banks can contribute to amplify business cycle fluctuations since liquidity creation has been shown to exert beneficial effects on economic activity. From a normative perspective, they do provide neither support, nor rejection to favor state ownership of banks. From a research perspective, they show that the analysis of liquidity creation, a broader concept of bank output than lending, can provide a different view than the focus on lending. Our work consequently opens avenues for further research on cyclicality of bank liquidity creation.

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Table 1
Descriptive statistics of the main variables

This table provides the descriptive statistics for the main variables included in the estimations.

	N	Mean	SD	Min
Δ Liquidity creation (cat)	40 609	0,04	0,35	-1,67
Δ Liquidity creation (mat)	40 572	-0,02	0,65	-3,35
Credit growth	38 707	0,06	0,16	-0,31
GDP growth	44 212	0,04	0,12	-0,25
Real investments growth (RIG)	44 212	0,16	0,44	-0,64
Lagged Log(assets)	41 702	14,60	2,00	6,39
Lagged Equity/Assets	41 702	0,22	0,17	0,00
Lagged Overdue loans/Loans	40 733	0,03	0,06	0,00
Lagged Loans/Assets	41 702	0,57	0,21	0,00
State-owned	44 207	0,05	0,21	0,00
Foreign-owned	44 207	0,09	0,29	0,00

Table 2
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). Category measure denotes the category-based liquidity creation measure, where bank activities are classified based on different categories. Maturity measure is the maturity-based liquidity creation measure, and it rests on a category as well as maturity classification for interbank loans and all liabilities.

CATEGORY MEASURE	**Illiquid assets (1/2)**	**Semi-liquid assets (0)**	**Liquid assets (-1/2)**
	Corporate loans	Interbank loans	Cash
	Other assets	Loans to government	Correspondent accounts with other banks
		Loans to individuals	Total securities (stocks, debt securities, promissory notes)
	Liquid liabilities (1/2)	**Semi-liquid liabilities (0)**	**Illiquid liabilities and capital (-1/2)**
	Debt securities issued (bonds and promissory notes)	Debt securities issued (deposit and saving certificates)	Other liabilities
	Claims of non-bank sector: settlement accounts (firms, households, government)	Claims of non-bank sector: term and other deposits (firms, households, government)	Capital
	Claims of banks		
MATURITY MEASURE	**Illiquid assets (1/2)**	**Semi-liquid assets (0)**	**Liquid assets (-1/2)**
	Corporate loans (maturity over 1 year)	Corporate loans (maturity lower than 1 year)	Cash
	Loans to government (maturity over 1 year)	Loans to government (maturity lower than 1 year)	Correspondent accounts with other banks
	Loans to individuals (maturity over 1 year)	Loans to individuals (maturity lower than 1 year)	Total securities (stocks, debt securities, promissory notes)
	Loans to banks (maturity over 1 year)	Loans to banks (maturity lower than 1 year)	
	Other loans		
	Other assets		
	Liquid liabilities (1/2)	**Semi-liquid liabilities (0)**	**Illiquid liabilities and capital (-1/2)**
	Debt securities issued (bonds and promissory notes)	Debt securities issued (deposit and saving certificates)	Deposits (maturity over 1 year and uncertain term to maturity)
	Claims of non-bank sector: settlement accounts (firms, households, government)	Deposits (maturity lower than 1 year)	Other liabilities
	Claims of banks		Capital

Table 3
Main estimations

The dependent variable is the growth in liquidity creation based on category. Regression type (OLS with fixed effects or System GMM) indicated at top of column. Standard errors in parentheses. *, **, and *** denote an estimate significantly different from 0 at the 10%, 5%, and 1% levels, respectively.

	Dependent variable = Δ liquidity creation (CAT)			
Regression type	OLS with FE	Sys. GMM	OLS with FE	Sys. GMM
GDP growth	0.105	0.096	0.106	0.091
	(6.72)***	(7.03)***	(6.45)***	(6.49)***
Lagged Δ Liquidity creation (cat)		0.014		0.010
		(1.04)		(0.81)
State-owned			-0.021	0.012
			(0.79)	(0.70)
State-owned x GDP growth			-0.007	-0.036
			(0.11)	(1.03)
Foreign-owned			-0.006	0.018
			(0.24)	(1.06)
Foreign-owned x GDP growth			-0.007	-0.014
			(0.10)	(0.31)
Lagged Log(assets)	-0.004	-0.006	-0.004	-0.004
	(0.79)	(0.51)	(0.75)	(0.44)
Lagged Equity/Assets	0.132	-0.077	0.132	-0.068
	(4.19)***	(0.58)	(4.20)***	(0.86)
Lagged Overdue loans/Loans	-0.201	-0.304	-0.199	-0.312
	(4.17)***	(3.96)***	(4.12)***	(4.04)***
Lagged Loans/Assets	-0.242	-0.184	-0.242	-0.203
	(10.77)***	(2.86)***	(10.76)***	(3.62)***
Constant	0.246	0.281	0.245	0.260
	(3.45)***	(1.42)	(3.42)***	(1.95)*
No. of obs.	38 675	36 822	38 672	36 820
Adjusted R-squared	0.014		0.014	
Number of banks	1 215	1 210	1 215	1 210
Number of instruments		966		1 065
AR(2) test p-value		0.529		0.594
Sargan OIR test p-value		0.113		0.872

Table 4
Positive and negative GDP growth

The dependent variable is the growth in liquidity creation based on category measure. Regression type (OLS with fixed effects or System GMM) indicated at top of column. Standard errors in parentheses. *, **, and *** denote an estimate significantly different from 0 at the 10%, 5%, and 1% levels, respectively.

	Dependent variable = Δ liquidity creation (CAT)	
Regression type	OLS with FE	Sys. GMM
Positive GDP growth	0.097	0.073
	(3.98)***	(3.63)***
Negative GDP growth	0.128	0.130
	(2.60)***	(3.12)***
Lagged Δ Liquidity creation (cat)		0.011
		(0.83)
State-owned	-0.026	0.016
	(0.92)	(0.89)
Foreign-owned	-0.022	0.001
	(0.80)	(0.08)
State-owned x Positive GDP growth	0.033	-0.066
	(0.41)	(1.58)
State-owned x Negative GDP growth	-0.098	0.017
	(0.55)	(0.17)
Foreign-owned x Positive GDP growth	0.129	0.121
	(1.09)	(1.42)
Foreign-owned x Negative GDP growth	-0.274	-0.275
	(1.66)*	(2.72)***
Lagged Log(assets)	-0.004	-0.004
	(0.76)	(0.47)
Lagged Equity/Assets	0.132	-0.062
	(4.20)***	(0.76)
Lagged Overdue loans/Loans	-0.198	-0.318
	(4.11)***	(4.03)***
Lagged Loans/Assets	-0.242	-0.197
	(10.72)***	(3.53)***
Constant	0.247	0.263
	(3.44)***	(2.01)**
No. of obs.	38 672	36 820
Adjusted R-squared	0.01	
Number of banks	1 215	1 210
Number of instruments		1 066
AR(2) test p-value		0.611
Sargan OIR test p-value		0.906

Table 5
Alternative liquidity creation measure

The dependent variable is the growth in liquidity creation based on maturity. Regression type (OLS with fixed effects or System GMM) indicated at top of column. Standard errors in parentheses. *, **, and *** denote an estimate significantly different from 0 at the 10%, 5%, and 1% levels, respectively.

	Dependent variable = Δ liquidity creation (MAT)			
Regression type	OLS with FE	Sys. GMM	OLS with FE	Sys. GMM
GDP growth	0.137	0.110	0.132	0.115
	(4.52)***	(3.51)***	(4.19)***	(3.81)***
Lagged Δ Liquidity creation (mat)		0.006		0.005
		(0.62)		(0.56)
State-owned			-0.037	0.069
			(1.05)	(2.62)***
State-owned x GDP growth			0.014	-0.077
			(0.10)	(0.84)
Foreign-owned			0.016	0.045
			(0.50)	(1.86)*
Foreign-owned x GDP growth			0.057	0.001
			(0.48)	(0.01)
Lagged Log(assets)	0.024	-0.005	0.023	-0.005
	(2.99)***	(0.23)	(2.94)***	(0.35)
Lagged Equity/Assets	0.103	-0.113	0.103	-0.148
	(2.73)***	(0.58)	(2.71)***	(1.39)
Lagged Overdue loans/Loans	-0.020	-0.097	-0.018	-0.148
	(0.30)	(1.08)	(0.27)	(1.35)
Lagged Loans/Assets	-0.226	-0.154	-0.226	-0.233
	(7.58)***	(1.70)*	(7.59)***	(2.81)***
Constant	-0.201	0.191	-0.196	0.241
	(1.82)*	(0.60)	(1.77)*	(1.23)
No. of obs.	38 589	36 568	38 586	36 566
Adjusted R-squared	0.01		0.01	
Number of banks	1 215	1 212	1 215	1 212
Number of instruments		965		1 063
AR(2) test p-value		0.792		0.803
Sargan OIR test p-value		0.227		0.993

Table 6
Alternative indicator of the business cycle

The dependent variable is the growth in liquidity creation based on category measure. Regression type (OLS with fixed effects or System GMM) indicated at top of column. Standard errors in parentheses. *, **, and *** denote an estimate significantly different from 0 at the 10%, 5%, and 1% levels, respectively.

	Dependent variable = Δ liquidity creation (CAT)			
Regression type	OLS with FE	Sys. GMM	OLS with FE	Sys. GMM
Real investment growth (RIG)	0.025	0.022	0.028	0.022
	(5.78)***	(5.50)***	(6.05)***	(5.40)***
Lagged Δ Liquidity creation (cat)		0.013		0.013
		(1.03)		(1.04)
State-owned			-0.021	0.032
			(0.76)	(1.63)
State-owned x RIG			-0.007	0.003
			(0.39)	(0.24)
Foreign-owned			0.001	0.040
			(0.03)	(2.20)**
Foreign-owned x RIG			-0.033	-0.029
			(2.02)**	(2.15)**
Lagged Log(assets)	-0.007	-0.018	-0.007	-0.015
	(1.31)	(1.71)*	(1.29)	(1.47)
Lagged Equity/Assets	0.128	-0.102	0.128	-0.081
	(4.07)***	(1.16)	(4.07)***	(0.97)
Lagged Overdue loans/Loans	-0.205	-0.306	-0.204	-0.322
	(4.26)***	(3.96)***	(4.22)***	(4.11)***
Lagged Loans/Assets	-0.242	-0.166	-0.242	-0.193
	(10.73)***	(2.90)***	(10.72)***	(3.38)***
Constant	0.283	0.435	0.282	0.401
	(3.94)***	(2.82)***	(3.92)***	(2.74)***
No. of obs.	38 675	36 822	38 672	36 820
Adjusted R-squared	0.01		0.01	
Number of banks	1 215	1 210	1 215	1 210
Number of instruments		1 083		1 063
AR(2) test p-value		0.568		0.569
Sargan OIR test p-value		0.169		0.708

Table 7
Cyclicality of bank lending

The dependent variable is the growth in bank lending. Regression type (OLS with fixed effects in all cases here) indicated at top of column. Standard errors in parentheses. *, **, and *** denote an estimate significantly different from 0 at the 10%, 5%, and 1% levels, respectively.

	Dependent variable = Δ loans		
Regression type	OLS with FE	OLS with FE	OLS with FE
GDP growth	0.218	0.232	
	(26.81)***	(27.62)***	
Positive GDP growth			0.282
			(24.16)***
Negative GDP growth			0.113
			(6.03)***
State-owned		-0.011	-0.018
		(0.83)	(1.42)
Foreign-owned		0.007	-0.002
		(0.55)	(0.17)
State-owned x GDP growth		-0.067	
		(1.91)*	
Foreign-owned x GDP growth		-0.178	
		(5.03)***	
State-owned x Positive GDP growth			-0.008
			(0.19)
State-owned x Negative GDP growth			-0.125
			(2.08)**
Foreign-owned x Positive GDP growth			-0.096
			(2.06)**
Foreign-owned x Negative GDP growth			-0.313
			(4.08)***
Lagged Log(assets)	-0.019	-0.019	-0.018
	(5.78)***	(5.83)***	(5.59)***
Lagged Equity/Assets	0.028	0.028	0.031
	(1.53)	(1.54)	(1.70)*
Lagged Overdue loans/Loans	-0.329	-0.328	-0.321
	(9.36)***	(9.26)***	(9.13)***
Lagged Loans/Assets	-0.236	-0.236	-0.238
	(20.92)***	(20.92)***	(21.03)***
Constant	0.558	0.558	0.532
	(11.90)***	(12.00)***	(11.41)***
No. of obs.	38 703	38 700	38 700
Adjusted R-squared	0.13	0.13	0.13
Number of banks	1 211	1 211	1 211