The Influence of Bank Ownership on Credit Supply:
Evidence from the Recent Financial Crisis

Zuzana Fungáčová[#]
Bank of Finland and Charles University

Risto Herrala[+]
Bank of Finland

Laurent Weill[*]
University of Strasbourg and EM Strasbourg Business School

Abstract

This study examines how bank ownership influenced the credit supply during the recent financial crisis in Russia, where the banking sector consists of a mix of state-controlled banks, foreign-owned banks, and domestic private banks. To estimate credit supply changes, we employ an exhaustive dataset for Russian banks that covers the crisis period and apply an original approach based on stochastic frontier analysis. Our findings suggest bank ownership affected credit supply during the financial crisis and that the crisis led to an overall decrease in the credit supply. Relative to domestic private banks foreign-owned banks reduced their credit supply more and state-controlled banks less. This supports the hypothesis that foreign banks have a "lack of loyalty" to domestic actors during a crisis, as well as the view that an objective function of state-controlled banks leads them to support the economy during economic downturns.

[#] Corresponding author. Bank of Finland Institute for Economies in Transition (BOFIT), Snellmaninaukio, PO Box 160, FI-00101 Helsinki, Finland and Institute of Economic Studies, Charles University, Prague, Czech Republic. Phone: +358 10 831 2334. Fax: +358 10 831 2294. Email: zuzana.fungacova@bof.fi

[+] Bank of Finland Institute for Economies in Transition (BOFIT), Snellmaninaukio, PO Box 160, FI-00101 Helsinki, Finland. Email: risto.herrala@bof.fi

[*] Institut d'Etudes Politiques, Université de Strasbourg, 47 avenue de la Forêt Noire, 67082 Strasbourg Cedex, France. Email : laurent.weill@unistra.fr

1. Introduction

The recent financial crisis has provoked major economic troubles. A key channel of transmission has been the contraction of credit supply by banks. This contraction was primarily caused by a reduction of transactions in the interbank markets and a clear reluctance on the part of banks to lend. The message to the broader global economy was unequivocal: banks were not just having a harder time lending, they were less willing to lend.

Credit supply by banks is of particular importance in emerging countries, where rudimentary financial markets place banks in a fundamental financing role. Foreign-owned banks and state-controlled banks typically hold significant market shares in these countries, so both groups are well poised to influence credit supply in times of crisis.

Our aim in this paper is to examine how bank ownership influences credit supply in troubled times. Our research is motivated by the fact that bank ownership can exert an impact on lending behavior in two ways.

Economic difficulties of the host country may cause foreign-owned banks to pull back on lending more than domestic banks. This is referred to in the literature as a "lack of loyalty" on the part of foreign banks (Weill, 2003).[1] Notably, the empirical literature comparing lending behavior of domestic and foreign banks in emerging markets in the 1990s does not support this hypothesis. In Latin America during the 1990s, for example, Peek and Rosengren (2000) and Dages, Goldberg and Kinney (2000) find that domestic and foreign banks exhibited the same lending behavior during periods of crisis. Arena, Reinhart and Vazquez (2007) also study the impact of lending of foreign banks on the lending channel in emerging countries and find no significant differences in the impacts of foreign and domestic banks. Nonetheless two studies on European transition countries provide some evidence of a different lending behavior of foreign banks in comparison to domestic banks depending on the macroeconomic conditions, even if these differences are not consensual. On the one hand, Haselmann (2006) concludes that loan supply of foreign banks is less sensitive to macroeconomic environment than the one of domestic banks in Central and Eastern Europe. On the other hand, De Haas and van Lelyveld (2006) find

---

[1] Several papers have also pointed out the role of greater informational asymmetries for foreign banks when granting loans to domestic borrowers (Berger, Klapper and Udell, 2001; Mian, 2006). This can explain systematic differences in lending behavior between domestic banks and foreign banks which do not depend on the business cycle and are thus not related to our investigation.

that foreign banks' behavior is more procyclical, which is in line with the "lack of loyalty" hypothesis.

State-controlled banks, in contrast, may bolster their lending during a crisis to support the economy. Two arguments can explain this behavior following Sapienza (2004)'s terminology; the political view, and the social view. According to the political view, the principal of state-controlled banks – the government – uses these institutions to pursue its interests, such as enhancing its chances of reelection or avoiding political unrest. According to the social view, the government asks state-controlled banks to compensate for market failures such as externalities that can lead to the lack of financing for socially profitable projects. Both views lead to the fact that the objective function of state-controlled banks is likely to include stabilization of the economy. As a consequence, the government may be willing to limit a credit contraction in troubled times.

The literature finds numerous instances in which state-owned banks display lending behavior different from private banks. For example, Dinc (2005) shows how lending of state-owned banks correlates with the electoral cycle in a cross-country study. State-owned banks boost lending in election years relative to private banks, suggesting a different objective function for both types of banks. Micco and Panizza (2006) perform a cross-country analysis to investigate the role of the business cycle in the comparative lending behavior of state-owned and private banks. They find that the lending of state-owned banks is less sensitive to macroeconomic shocks than that of private banks. This finding reinforces the view that state-owned banks consider macroeconomic stabilization in their objective function. In a related vein, Jia (2009) analyzes the relationship between ownership and the prudential behavior of banks in China by comparing state-owned and joint-equity banks. He observes that state-owned banks are less prudent in lending. This finding suggests that in times of crisis state-owned banks are more reluctant to pare back lending than other banks.

This investigation into the role of bank ownership on credit supply in troubled times contributes to the literature on two fronts.

First, Russia's banking industry consists of a mix of state-controlled, foreign-owned and domestic private banks, making it fairly straightforward to compare the lending behavior of foreign banks and state-owned banks against private domestic banks. The magnitude of recent financial crisis further provides an opportunity to analyze shifts in patterns of credit supply

according to bank ownership. We employ a rich dataset that includes quarterly data on all Russian banks that allows us to analyze thoroughly the evolution of credit supply over the period from the first quarter of 2007 to the fourth quarter of 2009.

Second, we employ an original approach to estimating credit supply from bank-level data that allows us to separate credit supply from credit demand without resorting to detailed data on borrowers and lenders. Unlike Khwaja and Mian (2008), we do not need detailed data on all credit market participants to disentangle both sides of the credit market. Our approach derives from the hypothesis formalized by Holmström and Tirole (1997) that credit supply is constrained by bank capital. If at least some banks are capital constrained, then credit supply can be estimated from the observed distribution of bank lending under relatively mild conditions. It is identified as the maximum of the bank lending distribution, and can be estimated in a parametric form using stochastic frontier analysis. To provide inference concerning the impact of bank type on credit supply, we allow credit supply to depend on bank type, bank capital, and idiosyncratic factors.[2] This method has been applied by Chen and Wang (2008) for Taiwan and Herrala (2009) for Finland to estimate credit supply constraints from borrower data. Stochastic frontier analysis has also been widely applied in the banking literature to estimate bank efficiency (most notably, the 2010 study of Karas, Schoors and Weill on Russian banks).

Our results on the link between bank ownership and lending during recession have normative implications for banking policy in emerging markets. A finding in favor of a stronger reduction in lending for foreign banks in comparison to domestic banks supports restricting foreign bank entry. Conversely, an observation of a small reduction in lending for state-owned banks relative to privately owned banks supports the continued existence of state-owned banks.

The rest of the article is organized as follows. Section 2 describes the evolution of the Russian banking industry during the recent financial crisis. Section 3 explicates our methodology and section 4 describes the data. Section 5 presents our results, and section 6 summarizes with a couple of policy observations.

---

[2] See Berrospide and Edge (2010) for a recent survey on the effects of bank capital on lending.

2. The Russian banking industry and the crisis

The development of Russia's banking sector in the 2000s mirrored much of what transpired elsewhere in emerging markets. In addition to a rapid expansion of the banking sector (total assets grew on average a more than 35% a year), Russian banks began to provide a wide variety of services to corporate and household clients. The ratios of banking sector assets to GDP and credit to GDP more than doubled during the decade, with these ratios reaching 75% and 40%, respectively, by end-2010 (Central Bank of the Russian Federation, 2011). Despite this significant increase in financial intermediation, however, both ratios were still lower than in most emerging markets.

Russian banks can be divided into three main groups in terms of ownership. The first group consists of the state-controlled banks that dominate the sector. Unlike the emerging economies of Central and Eastern Europe, which used privatization to create banking sectors today dominated by large international players, Russia preserved the dominance of its state banks (resembling in some respects the current arrangement in China). Depending on the definition used, Russia has about 40 state-controlled banks that control slightly more than half of total banking sector assets.[3] Russia's five largest banks are all state-controlled. As state banks, they face lower constraints in financing, hold an abundance of cheap household deposits, and enjoy ready access to refinancing from the Central Bank of the Russian Federation (CBR). Indeed, Anzoategui, Martinez Peria and Melecky (2012) find evidence of significantly higher market power for the state-owned banks in Russia.

The next group is made up of foreign-owned banks. Their share of the banking sector, while still below 20% of total assets, increased steadily over the past decade (up from 174 foreign-owned banks in 2000 to 220 at the end of 2010). Foreigners hold the majority in about half of banks with foreign participation. Three of Russia's top 10 banks were foreign-owned as of end-June 2011. Foreign-owned banks in Russia tend to rely on external funding from their parent companies.

---

[3] See Vernikov (2009) for detailed information on state ownership of banks in Russia.

All the other banks operating in Russia are domestic private banks. There are a lot of such banks, about 700 in total. Most are small, but they are in some cases important regional players. They account collectively for about 5% of total banking system assets.

Following a stretch of growth that included implementation of reforms and improvement in the legal environment, the Russian banking sector appeared in early 2008 to be in relatively good shape to withstand a crisis. Further, Russian banks were not directly exposed to the financial instruments that triggered the global turmoil. Yet the Russian banking sector, along with the rest of the economy, succumbed to the global financial crisis in mid-2008 with the dual shocks of a sudden lack of access to foreign financing and a significant drop in the price of oil.

As loan growth before the crisis exceeded growth of deposits, banks turned to external sources to finance the resulting gap. Russia has traditionally lacked long-term funding resources, so most funding came from abroad predominantly in the form of short-term borrowing. Banks were joined by Russian non-financial companies in turning to international markets to obtain financing. Thus, when the supply of foreign credit was cut, numerous banks and other companies found themselves in immediate difficulties. This situation was exacerbated by falling oil prices that led to a collapse in Russian share prices. Margin calls were especially hard for those who had used shares as collateral in lending. Capital flows reversed and Russia's trade balance suffered as oil prices slid and the country fell into recession. With intense depreciation pressure on ruble, the CBR implemented an incremental 30% devaluation of the ruble between November 2008 and February 2009.

The official response to the crisis was to move swiftly and go big. Starting in autumn 2008, the Russian government and CBR introduced a variety of measures to support stability of the financial system and prevent systemic collapse. These measures included a temporary decrease in bank reserve requirements, CBR guarantees of interbank lending to qualified banks, non-collateralized central bank loans, loosening of definition of acceptable collateral at the lombard window and in repo operations, as well as auctions allocating free budgetary funds to banks. The deposit insurance framework was enhanced by increasing the amounts covered by deposit insurance and Russia's deposit insurance agency assumed the task of restructuring individual troubled banks. Large and systemically important banks were targeted for capital injections. The funds were provided directly by the government or through unsecured

subordinated loans from the CBR or the state development bank Vneshekonombank (VEB).The government also made resources available to VEB to help refinance and service foreign debt of Russian firms.

All these actions helped stabilize not just the banking system but the economy as a whole. Measures to support liquidity in the banking system were gradually withdrawn in 2010, by which time most banks no longer suffered from liquidity shortfalls. Instead, banks were struggling with rising stocks of nonperforming loans on their balance sheets, a situation that made them reluctant to lend. Most chose to pull back on lending and pursue a less risky course of acquiring government bonds and sitting on them. Bank lending, which had seen growth averaging 45% a year between 2002 and 2007 dropped to -2.5% in 2009. It was not until the second quarter of 2010 that very modest growth returned.

3. Methodology

To establish whether bank ownership affects credit supply, we test it econometrically against an alternative hypothesis based on the theory of capital constrained lending. We discuss the alternative hypothesis first.

In line with Holmström and Tirole (1997), the alternative hypothesis states that banks supply credit up to their 'capital constraint' which is unaffected by ownership type. We assume that capital constraints are stochastic and log-linear:

$$(1)$$

In (1), i denotes bank, t time, L risk weighted assets, C bank capital and v an independent normal stochastic disturbance. The parameter α can be interpreted as a 'proportionality factor' of credit supply relative to capital, and β is the 'scale effect'. If $\beta=1$, no scale economies are present in credit supply relative to capital. If $\beta>1$, larger banks supply more loans than smaller banks relative to their capital. Since banks supply credit up to the capital constraint, L falls short of the capital constraint only if credit demand falls short of supply. The capital constraint (1) is consistent with the standard regulatory capital requirements on credit supply: the Basel II capital requirement is characterized as $\alpha=12.5$; $\beta=1$; and $v=0$.

In the capital constraint (1), bank capital and lending are simultaneously determined so that (1) is not a causal model: causality from C to L is not required in our empirical analysis. We do require that capital is independent of the stochastic disturbance   This is one of the assumptions that have to be imposed in order to estimate banks' capital constraints by standard statistical techniques. It is fulfilled if we can interpret the stochastic term as an independent random supply effect or a measurement error of L. The independence assumption can be somewhat relaxed by allowing heteroscedasticity of the distribution of v relative to C.

In our analysis, the capital constraint (1) is considered an empirical hypothesis rather than a complete model of the credit supply process. Credit policy in banks is influenced in a complex way by a number of factors: the banks' balance sheet structure and liquidity, profitability, monetary policy including the general level of interest rates, the economic environment, regulation, expectations, as well as the funding sources of the bank and the related market conditions. For this reason, we do not regard parameters α and β as unbiased estimators of underlying 'behavioral' credit policy parameters, i.e. a complete mapping of the diverse credit supply process in banks. Even so, under the assumption that v is standard normal the systemic part of (1) is an unbiased estimate of the average level of banks' capital constraints. Such unbiasedness in the average level of the constraint estimate is sufficient for our purposes since our focus is solely on testing whether credit supply varies systematically across different ownership groups. This research question can be investigated simply by testing the significance of group dummy variables on the right hand side of (1).

To transform (1) into an estimable equation, consider two types of banks. The first is the case studied by Holmström and Tirole (1997) − a *capital constrained bank* for which credit demand exceeds the bank's supply. Here, the capital constraint holds with equality and observed aggregate lending of the bank is accordingly supply-determined. The second is an *unconstrained bank* for which credit demand falls short of the capital constraint. In this case, observed bank lending is demand-determined.

To account for both types of banks in the analysis, we denote by exp[-u_{it}], the (inverse) distance of a bank from its capital constraint:

$$\rule{3cm}{0.4pt} \tag{2}$$

Since the constraint (the denominator) is by definition an upper bound of L, the domain of $\exp[-u_{it}]$ is the unit line. Capital constrained banks are characterized by $\exp[-u_{it}]=1$. For unconstrained banks, u falls below unity. We interpret $\exp[-u_{it}]$ as an indicator of credit demand relative to supply.

Equations (1) and (2) yield the equation:

$$(3)$$

where *l* and *c* are respectively the logged values of risk-weighted assets and capital. Equation (3) is a stochastic frontier model which can be estimated using bank level data. Standard estimation methods apply when *u* (like *v*) is an independent random variable from specific distribution. We employ the standard assumption that *u* is either exponential or half-normal. Our main estimation assumes an exponential distribution, as log-likelihood is higher for this model.

To investigate how the recent global financial crisis affected the loan supply of banks in Russia, equation (3) is estimated with Russian bank data that covers both the pre-crisis and the crisis period. We capture the time dimensionality by estimating the model in a series of pooled cross-sections, rather than a panel, because it is important that all model parameters, including residual distributions, can change over time. The main interest is in changes in parameters α and β, which reveal changes in loan supply of banks relative to bank capital as the crisis progresses. Changes in these parameters capture all supply shocks that affect banks' lending relative to their capital. Such shocks include disturbances in the operation of the interbank market, systemic deposit runs, monetary policy, and regulation. The idiosyncratic residual *v* captures bank specific supply shocks, such as runs on individual banks.

To investigate if bank ownership exerts an impact on credit supply during the financial crisis, we add dummy variables for state ownership and foreign ownership to the frontier model of equation (3), i.e. these variables are always viewed relative to domestic private ownership. Further, we include interaction between ownership and time dummy variables for each quarter of the sample period. We add time dummy variables for all periods except the first one and therefore all other dummy variables must be interpreted as a comparison with the first quarter of 2007. This setup enables us to analyze the evolution of credit supply behavior for each category of banks by considering the evolution of the interaction variables between ownership and time dummy variables over the period.

The estimated equation takes the following form:

$$(4)$$

where s stands for state ownership dummy variable, f is a foreign ownership dummy variable, i is the index for banks, and t indicates the quarters 0 to 11 corresponding with the period 2007Q1-2009Q4.

To interpret, the parameter α is the proportionality factor in 2007Q1 in private banks. Parameters α_s and α_f indicate the difference in the proportionality factor of state-controlled and foreign banks relative to private banks in 2007Q1. Parameters α_t indicate changes in the proportionality factor in private banks relative to 2007Q1. Parameters α_{st} and α_{ft} indicate the difference in the change of the proportionality factor of state-controlled and foreign banks relative to private banks. The β parameter is the scale effect in 2007Q1, and β_t the change in the scale effect relative to that period. Our interest focuses on parameters α_{st} and α_{ft}, which reveal whether credit supply constraints developed differently in state-controlled banks and foreign banks relative to domestic private banks.

4. Data

Our analysis is based on the detailed bank level dataset of all Russian banks covering the period from the beginning of 2007 to the end of 2009. It contains quarterly balance sheet and income statement information provided by the financial information agency Interfax, which collects and organizes this data from the CBR.[4] The data are further cleaned by dropping observations that fulfill at least one of the following conditions: the ratio of average total loans to total assets is less than or equal to 5%, the sum of deposits is zero, or the capital-to-assets ratio is larger than 100% or less than 2%.[5] We only consider banks that participate in deposit insurance scheme (those outside the scheme are not allowed to collect household deposits). Our final sample consists of over 10,000 bank-quarter observations. For the all-important risk-weighted assets variable, we have available some 6,000 observations. Fortunately, this does not constitute a

---

[4] For a more detailed description of the dataset, see Karas and Schoors (2005).
[5] Russian regulations call for withdrawal of a bank's license if its capital ratio falls below 2%.

problem since the data on risk-weighted assets are mostly missing for small banks that are not crucial to systemic stability of the banking sector. The descriptive statistics of capital adequacy ratio for all ownership subgroups are provided in Table 1.

We distinguish between foreign-owned and domestic banks (which can be either state-controlled or privately held). State-controlled banks are defined as banks that are majority-owned by the government, the central bank, state-controlled companies or municipalities. To identify them, we use the classification of Vernikov (2009). Foreign-owned banks are those that have foreign ownership in excess of 50%, which is in line with how CBR defines a foreign bank. We use CBR data to identify foreign-owned banks.

5. Results

In this section, we first present results from our main model and then results using alternative specifications.

5.1 Main estimations

Our main model assumes an exponential distribution for the inefficiency term. The results are presented in Table 2. Several striking results are immediately apparent.

First, given the level of capital credit supply falls with the arrival of the crisis. Time dummy variables are all significant and negative from the fourth quarter of 2008, when the world crisis hit Russia, until the end of the sample period. Before that time, most are not significant, even if the ones for 07Q4 and 08Q2 were also significantly negative. These results confirm the impact of the financial crisis with a significantly stronger influence starting in the fourth quarter of 2008.

Second, foreign banks overall reduce their credit supply more than domestic private banks. The interaction variables between foreign ownership and time dummy variables are not significant for 2007, i.e. there is no significant difference in the behaviors of foreign banks and domestic private banks. The estimated coefficients become significantly negative for the first two quarters of 2008 before the crisis reaches Russia. This time period corresponds to turmoil

elsewhere in the global markets. It appears the watershed moment for parent companies of foreign banks operating in Russia took place in late March 2008 after the collapse of Bear Stearns. We further find significant estimated coefficients of interaction variables for the last two quarters of 2009. Thus, even if the difference in behavior does not persist for all periods, these results support the view of a "lack of loyalty" on the part of foreign banks, i.e. foreign banks are less committed to assisting the domestic economy in troubled times. It is of interest to observe that the contraction of lending for foreign banks is not fully associated with the domestic economic situation in Russia. The fact that foreign banks react before the beginning of the crisis while other banks do not modify their lending behavior provides clear evidence of lack of loyalty. It means that foreign banks reduce their lending in a country even if it is not yet affected by the financial crisis, i.e. without reasons based on the negative macroeconomic situation. This shows a different lending behavior of foreign banks, which can be interpreted as the anticipation of the forthcoming negative economic evolution. It does not mean that only foreign banks predict the economic changes. However, domestic banks might consider the possible self-fulfilling mechanism of their behavior as reduced lending might increase the chances of economic troubles and thus prefer to act differently. That is why the difference between foreign banks and domestic banks does not stem from different skills to anticipate the development in the economy but in a different sense of loyalty towards the domestic economy.

These results for foreign banks do not comport with other findings for emerging countries (e.g. Peek and Rosengren, 2000). The differences may result from the fact that the examined crisis was so extreme that it drove foreign banks to such behavior. In other words, foreign banks may not behave differently in credit supply in normal times or during mild downturns. They only engage in disloyal behavior when bigger international crises arise.

Third, state-controlled banks reduce their credit supply less than domestic private banks during the crisis. The interaction variables between state ownership and time dummy variables are all significant and positive for the fourth quarter of 2008 and the first two quarters of 2009, the time when the crisis in Russia reached its peak. They are also significant for one quarter showing the first signs of the crisis, the fourth quarter of 2007, for which we observe a significantly negative time dummy variable showing a general reduction of credit supply.

Thus, our findings affirm the view that state-controlled banks have a different objective function than other banks: they support the economy in troubled times by limiting their reduction

of credit supply. These results are in accordance with Micco and Panizza (2006), who show that lending by state-owned banks is less sensitive to macroeconomic shocks than private bank lending at the cross-country level. They are also loosely related to the finding of Jia (2009) on the lower prudence of state-owned banks in China.

Figure 1 shows the time fixed effects in the various banking groups. The time fixed effect for period t is calculated as $\alpha + \alpha_t$ for domestic private banks, $\alpha + \alpha_t + \alpha_s + \alpha_{st}$ for state-controlled and $\alpha + \alpha_t + \alpha_f + \alpha_{ft}$ for foreign banks. The figure indicates differences in the development of credit supply relative to 2007Q1 across the banking groups. More negative values indicate tighter credit supply constraints and therefore lower credit supply. Since the scale effects do not vary across the different banking groups in this model, they do not affect the comparison.

We observe a tightening of credit supply starting from the beginning of the period for all banking groups. This tightening speeds up from the third quarter of 2008 and persists until overall credit availability starts to improve in 2009Q3 as the effects of the international financial crisis begin to ease.

Significant differences in the development of credit supply constraints across the banking groups are revealed. Credit availability from foreign banks differed from the domestic private banks mainly in terms of timing of the crisis reaction. Foreign banks reacted two quarters earlier: they tightened credit policy relative to the private domestic banks in 2008Q1 and 2008Q2. Afterwards no statistical difference can be observed between foreign and domestic private banks until 2009Q2, when private banks loosen their credit policy and foreign banks retain their tight credit policy stance.

The estimations indicate a significant difference between the crisis reactions of state-controlled banks and private banks. Figure 1 shows that credit availability from state-controlled banks was much higher relative to the private banks during the peak of the crisis (2008Q4-2009Q2). Starting from 2009Q3, the gap between private and state-controlled banks narrows as private banks expand credit supply. The gap between domestic and foreign banks is maintained as foreign banks keep their restrictive credit policies in place.

5.2 Alternative models

We now turn to the alternative models described in Table 3. We start with a robustness check to test the sensitivity of our results to the distribution of the inefficiency term. Several possibilities for this distribution have been proposed and applied in the literature on stochastic frontier approach.[6] We consider a half-normal distribution rather than an exponential distribution for the inefficiency term in this robustness check as the half-normal distribution is commonly used in works applying stochastic frontier approach (e.g. Karas, Schoors and Weill, 2010). The log-likelihood is slightly lower with this distribution than with the exponential distribution, justifying our choice of the latter for our main model.

With few exceptions, this specification does not affect the results. We still observe the reduction of credit supply during the financial crisis with significantly negative time dummy variables for all quarters from the fourth quarter of 2008 until the fourth quarter of 2009, while no time dummy variables are significant before this time.

We show again that foreign banks have reduced their credit supply more than domestic private banks during the financial crisis. The results are similar for the interaction variables between foreign ownership and time dummy variables, which are significantly negative for the two first quarters of 2008 and the three last quarters of 2009. Finally, we still see the lower reduction of credit supply for state-controlled banks relative to domestic private banks. The interaction variables between state ownership and time dummy variables are all significant and positive for the fourth quarter of 2008 and three quarters of 2009.

Second, we test an alternative specification of our model in which we add interaction variables between capital and ownership dummy variables. This allows the sensitivity of the maximum risk-weighted assets-to-capital ratio to vary across bank ownership type. It is important to test this since the scale effect of capital on credit supply constraints may vary significantly across types of banks.

Our main results remain unchanged even if we allow the scale effect of capital to vary across types of banks. The reduction of credit supply is again supported by the fact that time dummy variables are significantly negative for the fourth quarter of 2007 and all quarters from

---

[6] See Kumbhakar and Lovell (2000) for the stochastic frontier approach and its different applications.

the fourth quarter of 2008 to the fourth quarter of 2009. We also observe a greater reduction of credit supply for foreign banks than for domestic private banks with significantly negative coefficients for the interaction variables between foreign ownership and time dummy variables for most quarters. Furthermore, we can still see that state-controlled banks can be characterized by a lower decrease in credit supply during the financial crisis; the interaction terms between state ownership and time dummy variables are significantly positive for the last quarter of 2008 and the two first quarters of 2009. We conclude that even if the scale effect of capital appears to vary across the banking groups, our main findings are robust to such variation.

6. Conclusion

In this paper, we investigate how bank ownership influenced credit supply during the recent financial crisis in Russia. The Russian banking industry is of particular interest as it is characterized by a mix of foreign-owned banks, state-controlled domestic banks, and privately owned domestic banks. We apply an innovative methodology to analyze credit supply using the stochastic frontier approach that allows assessment of bank credit supply in comparison to the level of capital − a key constraint for the bank.

The literature suggests that the behavior of banks during economic downturns may vary with bank ownership. Specifically, there is an expectation that foreign banks might reduce their lending more than other banks because of a potential "lack of loyalty" to actors in the domestic economy. State-owned banks, in contrast, might tend to keep lending as their objective function might include macroeconomic stabilization.

Our main conclusion is that bank ownership exerted an impact on credit supply during the recent financial crisis in Russia. Whereas credit supply overall diminished during the crisis, we observe that this reduction was greater for foreign banks and lower for state-controlled banks relative to domestic private banks.

Thus, we find support for the "lack of loyalty" hypothesis, whereby foreign banks are prone to a stronger reduction in lending than domestic banks in troubled times. We also provide evidence in favor of the view according to which the objective function of state-owned banks would lead them to support the economy during economic downturns.

The implications of our findings are that the privatization of state-owned banks and foreign bank entry may contribute to deterioration of the economic situation during an economic downturn. This does not mean that the policies to encourage entry of foreign banks should be abandoned; foreign banks generate many benefits such as efficiency gains in the sector (Karas, Schoors and Weill, 2010).

Looking ahead, our methodology for studying the bank credit channel holds considerable promise. Unlike the approach proposed by Khwaja and Mian (2008) and extended by Jimenez et al. (2010) for estimation of credit supply of banks by analyzing the bank credit channel, our methodology avoids the need for data on borrowers. It simply requires data on banks, and thereby opens avenues for broad research on the lending channel of monetary policy transmission.

References

1. Anzoategui, D., Martinez Peria, M. and Melecky M., 2012. Bank Competition in Russia: An Examination at Different Levels of Aggregation. Emerging Markets Review 13, 42-57.
2. Arena, M., Reinhart, C. and Vazquez, F., 2007. The Lending Channel in Emerging Economies: Are Foreign Banks Different? IMF Working Paper 07/48, March 2007.
3. Berger, A., Klapper, L. and Udell, G., 2001. The Ability of Banks to Lend to Informationally Opaque Small Businesses. Journal of Banking and Finance 25, 12, 2127-2167.
4. Berrospide, J.M., Edge, R.M., 2010. The Effects of Bank Capital on Lending: What Do We Know, and What Does It Mean? International Journal of Central Banking 6, 4, 5-54.
5. Central Bank of the Russian Federation, 2011. Review of the Banking Sector of the Russian Federation, various issues.
6. Chen, N., Wang, H.J., 2008. Demand and Supply Effects in Financial Crises. Southern Economic Journal 75, 1, 26-49.
7. Dages, B., Goldberg, L., Kinney, D., 2000. Foreign and Domestic Bank Participation in Emerging Markets: Lessons from Mexico and Argentina. Federal Reserve Bank of New York Economic Policy Review, 6, 3, 17-36.
8. De Haas, R., van Lelyveld, I., 2006. Foreign Banks and Credit Stability in Central and Eastern Europe. A Panel Data Analysis. Journal of Banking and Finance 30, 1927-1952.
9. Dinc, S., 2005. Politicians and Banks: Political Influences on Government-Owned Banks in Emerging Countries. Journal of Financial Economics 77, 453-479.
10. Haselmann, R., 2006. Strategies of Foreign Banks in Transition Economies. Emerging Markets Review 7, 283-299.
11. Herrala, R., 2009. Credit Crunch? An Empirical Test of Cyclical Credit Policy. Bank of Finland Research Discussion Papers 10/09.
12. Holmström, B., Tirole, J., 1997. Financial Intermediation, Loanable Funds and the Real Sector. Quarterly Journal of Economics 112, 663-691.
13. Jia, C., 2009. The Effect of Ownership on the Prudential Behavior of Banks – The Case of China. Journal of Banking and Finance 33, 77-87.
14. Jimenez G., Mian, A., Peydro, J.L., Saurina, J., 2010. Estimating the Aggregate Impact of Credit Supply Channel: Evidence from Securitization in Spain. Working Paper 16595, NBER.
15. Karas, A., Schoors, K., Weill, L., 2010. Are Private Banks More Efficient than Public Banks: Evidence from Russia. Economics of Transition 18, 1, 209-244.
16. Kumbhakar, S., Lovell, C.A.K., 2000. Stochastic Frontier Analysis. Cambridge University Press.
17. Khwaja, A., Mian, A., 2008. Tracing the Impact of Bank Liquidity Shocks: Evidence from an Emerging Market, American Economic Review 98, 4, 1413-1442.
18. Mian, A., 2006. Distance Constraints: The Limits of Foreign Lending in Poor Economies, Journal of Finance 61, 3, 1465-1505.
19. Micco, A., Panizza, U., 2006. Bank Ownership and Lending Behavior. Economics Letters 93, 248-254.

20. Peek, J., Rosengren, E., 2000. Implications of the Globalization of the Banking Sector: The Latin American Experience. New England Economic Review, September/October, 45-63.
21. Sapienza, P., 2004. The Effects of Government Ownership on Bank Lending. Journal of Financial Economics 72, 357-384.
22. Vernikov, A., 2009. Russian Banking: The State Makes a Comeback. BOFIT Discussion Papers 24/2009, Bank of Finland.
23. Weill, L., 2003. Banking Efficiency in Transition Countries: The Role of Foreign Ownership. Economics of Transition 11, 3, 569-592.

Table 1. Capital adequacy ratio by ownership subgroups

This table presents the descriptive statistics for the capital adequacy ratio in percentage by ownership subgroups.

Quarter	State-controlled banks			Foreign banks			Domestic private banks		
	Obs.	Mean	s.d.	Obs.	Mean	s.d.	Obs.	Mean	s.d.
1Q2007	22	16.1	5.6	37	20.2	11.5	423	22.8	17.8
2Q2007	23	16.9	10.3	18	24.7	24.7	401	22.8	19.4
3Q2007	19	14.1	3.3	24	22.9	21.0	381	22.1	15.6
4Q2007	23	17.8	8.9	29	18.6	9.8	395	25.2	24.1
1Q2008	22	16.3	10.3	54	23.3	18.9	458	22.1	13.0
2Q2008	22	17.3	10.6	54	23.6	20.8	436	22.0	15.2
3Q2008	31	15.9	9.5	59	20.1	13.6	413	23.2	16.9
4Q2008	32	18.1	12.5	60	24.7	18.1	407	26.5	16.1
1Q2009	31	20.5	19.1	61	25.1	17.0	413	27.1	16.0
2Q2009	33	19.2	8.6	60	30.0	23.1	403	27.5	17.2
3Q2009	37	20.5	8.1	60	32.1	25.3	428	28.9	20.5
4Q2009	34	19.8	7.0	55	32.1	29.5	371	28.0	25.8

Table 2. Estimation results for the benchmark model

Estimations by maximum likelihood on a pooled cross-section. All variables are in natural logarithms. Constant terms and time variable effects for capital are included but not reported. All models allow heteroscedasticity of the residuals in time. Residual parameters are not reported. Standard errors appear in parentheses next to estimated coefficients. *, **, *** denote an estimate significantly different from 0 at the 10%, 5%, or 1% level. All models converge normally.

Explanatory variables		Estimated coefficients
Capital		1.03*** (0.01)
State-controlled		-0.06* (0.04)
Foreign-owned		-0.004 (0.03)
	07Q2	0.05 (0.07)
	07Q3	-0.02 (0.08)
	07Q4	-0.19* (0.1)
	08Q1	-0.08 (0.08)
	08Q2	-0.15* (0.08)
Time fixed effects	08Q3	-0.12 (0.08)
	08Q4	-0.63*** (0.12)
	09Q1	-0.8*** (0.14)
	09Q2	-0.8*** (0.13)
	09Q3	-0.9*** (0.13)
	09Q4	-0.67*** (0.14)
	07Q2	0.04 (0.07)
	07Q3	0.07 (0.07)
	07Q4	0.12* (0.06)
	08Q1	0.03 (0.07)
	08Q2	0.04 (0.07)
State-controlled banks time fixed effects	08Q3	0.07 (0.07)
	08Q4	0.25*** (0.09)
	09Q1	0.29*** (0.09)
	09Q2	0.21** (0.09)
	09Q3	0.13 (0.1)
	09Q4	0.11 (0.11)
	07Q2	-0.07 (0.05)
	07Q3	-0.05 (0.06)
	07Q4	-0.03 (0.06)
	08Q1	-0.09* (0.05)
	08Q2	-0.1* (0.05)
Foreign-owned banks time fixed effects	08Q3	-0.06 (0.05)
	08Q4	0.0002 (0.08)
	09Q1	0.0001 (0.08)
	09Q2	-0.1 (0.08)
	09Q3	-0.2** (0.08)
	09Q4	-0.17** (0.08)
Observations		5829
Log-likelihood		-3263.453
Info criterion: AIC		1.144
Finite sample AIC		1.145
Info criterion: BIC		1.227

Table 3. Estimation results for alternative specifications as robustness check

Estimations by maximum likelihood on a pooled cross section. All variables are in natural logarithms. Constant terms and time variable effects for capital are included but not reported. All models allow heteroscedasticity of the residuals in time. Residual parameters are not reported. Standard errors appear in parentheses next to estimated coefficients. *, **, *** denote an estimate significantly different from 0 at the 10%, 5%, or 1% level. All models converge normally.

Explanatory variables		Specification with half-normal distribution	Specification with interaction terms between capital and ownership dummy variables
Capital		1.03*** (0.01)	1.03*** (0.01)
State-controlled		-0.06 (0.07)	0.13 (0.11)
Foreign-owned		-0.01 (0.04)	-0.28*** (0.09)
State-controlled* capital			0.04*** (0.01)
Foreign-owned*capital			-0.02*** (0.01)
Time fixed effects	07Q2	0.07 (0.13)	0.05 (0.07)
	07Q3	-0.01 (0.11)	-0.01 (0.08)
	07Q4	-0.16 (0.13)	-0.17* (0.10)
	08Q1	-0.05 (0.1)	-0.07 (0.08)
	08Q2	-0.09 (0.11)	-0.13 (0.08)
	08Q3	-0.07 (0.12)	-0.11 (0.09)
	08Q4	-0.5*** (0.14)	-0.62*** (0.12)
	09Q1	-0.69*** (0.16)	-0.78*** (0.14)
	09Q2	-0.68*** (0.15)	-0.79*** (0.13)
	09Q3	-0.74*** (0.15)	-0.89*** (0.13)
	09Q4	-0.5*** (0.16)	-0.65*** (0.14)
State-controlled banks time fixed effects	07Q2	0.02 (0.14)	0.05 (0.07)
	07Q3	0.07 (0.12)	0.02 (0.08)
	07Q4	0.12 (0.1)	0.08 (0.08)
	08Q1	0.01 (0.11)	0.01 (0.10)
	08Q2	0.03 (0.12)	0.04 (0.09)
	08Q3	0.07 (0.13)	0.09 (0.08)
	08Q4	0.24** (0.11)	0.25** (0.10)
	09Q1	0.28*** (0.11)	0.30*** (0.10)
	09Q2	0.22* (0.12)	0.22** (0.10)
	09Q3	0.13 (0.13)	0.13 (0.11)
	09Q4	0.11 (0.14)	0.11 (0.11)
Foreign-owned banks time fixed effects	07Q2	-0.07 (0.09)	-0.16*** (0.05)
	07Q3	-0.07 (0.08)	-0.11* (0.06)
	07Q4	-0.04 (0.08)	-0.05 (0.05)
	08Q1	-0.09* (0.05)	-0.14*** (0.04)
	08Q2	-0.11 (0.06)	-0.17*** (0.05)
	08Q3	-0.05 (0.07)	-0.12*** (0.05)
	08Q4	-0.02 (0.08)	-0.05 (0.08)
	09Q1	-0.01 (0.09)	-0.04 (0.08)
	09Q2	-0.11 (0.08)	-0.15** (0.08)

	09Q3	-0.2** (0.09)	-0.25*** (0.08)
	09Q4	-0.17* (0.09)	-0.23*** (0.08)
Observations		5829	5829
Log-likelihood		-3266.061	-3246.010
Info criterion: AIC		1.145	1.139
Finite sample AIC		1.146	1.139
Info criterion: BIC		1.228	1.224

Figure 1. Proportionality factors of credit policy for different banking groups

The figure shows the proportionality factors in the various banking groups. More negative values indicate tighter credit supply constraints, and therefore lower credit supply relative to period 2007Q1.