

# Central Bank Liquidity Provision and Segmentation of Collateral Markets

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## Abstract

This paper provides empirical evidence on the effects of a central bank collateral framework on pricing of pledgeable assets. We investigate a policy modification by the Central Bank of Russia that established a set of local administrations whose debts were accepted as collateral in refinancing operations regardless of their credit ratings. Employing a difference-in-difference approach, we demonstrate that, due to the collateralizability, these administrations obtained a discount of 50 basis points on the interest rates on their credit contracts. Furthermore, we analyze the interest rate offered by multiple banks for the same credit contract as they compete in a formal auction. We document that banks with limited marketable collateral or substantial dependence on central bank funding submitted the lowest bids for contracts eligible as collateral. These findings indicate that asset collateralizability in monetary policy operations can significantly affect bank credit supply.

*Keywords:* central bank collateral framework, liquidity provision, monetary policy implementation, credit supply, asset liquidity

*JEL classification:* G01, G21, G28, E58

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# 1 Introduction

In most modern economies, when implementing monetary policy, central bank stand ready to lend to commercial banks against eligible collateral. Despite the prevalent reliance on collateralized lending, the impact of the collateral framework on the assets deemed eligible remains understudied. Do banks attribute a higher value to assets that the central bank recognizes as collateral? Which institutions are inclined to pay a premium to hold such assets? And how large is the eligibility premium? These questions are important in assessing the efficacy of central bank interventions, considering the potential dilemma they face: collateral accessibility can influence the transmission of monetary policy, yet the operational aspects of this policy might inadvertently alter the market valuation of assets that are pledgeable at the central bank.

The empirical study of collateral frameworks faces limitations due to data availability and challenges in econometric identification. Thus, central banks often adapt collateral requirements to manage credit risk exposure and address liquidity needs in periods of financial stress. The fact that changes in the collateral framework often occur simultaneously with financial shocks makes it challenging to separate the eligibility premium from changes in aggregate credit risk. The issue is further exacerbated by a lack of detailed data on banks' asset portfolios, which hinders a more nuanced characterization of bank behavior.

This study seeks to address these concerns and examines the pricing effects of collateral eligibility for the refinancing operations of the Central Bank of Russia's (BoR), with a focus on collateralizability of non-marketable debts of local administrations. Focusing on the Russian banking system, we leverage the availability of granular data and the institutional setup which facilitates econometric identification. In this setup, banks extend loans to public administrations via auctions, which reveal the interest rates offers of all potential lenders competing for the same credit contract. We construct a dataset containing these offers, and then link the offered rates with the collateralizability of credit claims in the BoR and with collateral utilization of banks. Our findings indicate that the BoR's collateral framework significantly impacts the pricing of collateralizable debts due to the banks' demand for pledgeable credit contracts.

To demonstrate this impact on credit supply, we examine the effects of a collateral policy shift in Russia that occurred in 2015. Faced with the potential erosion of the collateral base due to imminent credit rating withdrawals, the BoR guaranteed the acceptability of certain non-marketable debts in its refinancing operations and decoupled the eligibility status of

selected debtors from the assessment by international credit rating agencies. Simultaneously, the central bank also reduced the haircut on eligible collateral. By doing so, the central bank maximised the expected pledgeability of the chosen issuers and eliminated the risk of them becoming ineligible during periods of heightened liquidity demand.

Our findings suggest that the policy shift resulted in a notable fragmentation of the underlying credit markets and introduced a discernible gap between borrowers of different eligibility statuses. Employing a difference-in-difference approach, we demonstrate that the BoR's decision led to a divergence in the credit costs for the two types of borrowers. Thus, in contrast to non-eligible claims, collateralizable debts received an additional discount of at least 50 basis points when their eligibility status was secured.

We then provide further evidence that the interest rate gap was driven by credit supply rather than by a shift in credit risk premiums or other confounding factors. To do this, we explore the auction setup, which reveals the interest rates offers of all competing lenders. Accounting for unobserved credit contract heterogeneity, we demonstrate that after the collateral policy adjustment the most attractive loan conditions to eligible issuers were offered by banks that strongly depended on central bank funding or had high rates of utilization of marketable assets as collateral. As a consequence, banks with high collateral valuations won the competition more frequently. In short, while it helped to accommodate the liquidity demand of banks that needed it most, collateralizability came at the price of distorting the cost of debt via the eligibility premium.

These findings contribute to the literature on asset liquidity, bank credit supply, and monetary policy implementation.<sup>1</sup> In a simple theoretical model, [Bindseil \(2013\)](#) relates liquidity provision to asset fire sales and notes that the central bank collateral framework acts as a monetary policy tool. [Brunnermeier \(2010\)](#) points out that the collateral framework can be used to adjust monetary policy stance among the members of a monetary union. [Ashcraft et al. \(2011\)](#) discuss the role of collateral haircuts in the transmission of monetary policy. [Bindseil et al. \(2009\)](#) and [BIS \(2013\)](#) provide a comprehensive overview of central bank risk management practices, in particular, on the collateral policy. This paper adds to the aforementioned theoretical discussion by empirically demonstrating that the pledgeability of assets in refinancing operations affects market interest rates when bank collateral demand is

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<sup>1</sup>More generally, the eligibility premium can emerge when the interbank market is impaired by information asymmetries among banks as conceptualized by [Ennis and Weinberg \(2013\)](#) and [Jennifer et al. \(2014\)](#), or because of search frictions as modelled by [Lagos and Rocheteau \(2009\)](#). Under these conditions, banks might place additional value on holding collateral eligible for central bank lending facilities to ensure direct access to them.

high.

The central banks acknowledge the importance of collateral frameworks in monetary policy implementation. Thus, [Bindseil et al. \(2017\)](#) outline market neutrality as one of the main principles underlying a well-functioning collateral framework of the European Central Bank and note that the framework “should not lead to the preferential treatment of distinct asset classes, issuers or sectors and should avoid market distortion (implying that, e.g., individual issuers or sectors benefit unduly from eligibility requirements).” Furthermore, [Bindseil and Laeven \(2017\)](#) argue that, even though liquidity insurance may distort banks’ incentive to store liquidity *ex-ante*, these costs are small due to adequate regulation and disincentives to the central bank credit. This view does not preclude, however, that eligibility premium can be significant as documented in this paper.

The empirical analysis of the effects of liquidity provision on the collateral markets continues to develop.<sup>2</sup> A number of studies have focused on bank choice of collateral when sourcing liquidity from the European Central Bank. For instance, [Fecht et al. \(2016\)](#) document the existence of systemic arbitrage, wherein weaker banks shift a portion of their credit risk exposure to the central bank by borrowing against low-quality collateral. Similarly, [Drechsler et al. \(2016\)](#) document risk-shifting behavior among weakly capitalized banks that relied on the central bank funding during the European sovereign debt crisis. Additionally, [Cassola and Koulischer \(2019\)](#) model bank collateral choice using country-level data. In contrast, we focus on allocation of pledgeable claims among banks outside of the European context. We demonstrate that, when collateral is scarce, the ability to post collateral at the central bank comes at the price of earning a lower interest on pledgeable assets. Furthermore, contrary to the above studies, our evidence does not support the hypothesis that the possibility of using assets as collateral prompts banks to take excessive risks, at least in the phase preceding refinancing. Specifically, our evidence indicates that, when competing for collateralizable debts, banks extend more favorable credit terms to safer debtors.

Several empirical studies have explored the consequences of eligibility on asset pricing and credit provision. [Ai et al. \(2020\)](#) uncover a substantial collateralizability premium associated with the ability of the U.S. firms to use capital as collateral and relax financial con-

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<sup>2</sup>While there is a separate body of literature on the stigma associated with borrowing from a central bank, this paper focuses on a different aspect. Specifically, [Armantier et al. \(2015\)](#) show that during the 2007-2008 financial crisis, U.S. banks were inclined to pay a premium to avoid borrowing from the discount window of the Federal Reserve. However, the stigma effect is less relevant to our study’s context, as Russian banks routinely accessed the central bank’s liquidity facilities during periods of both market stress and stability. Furthermore, due to data constraints, our analysis does not investigate the actual use of these liquidity facilities by commercial banks but rather concentrates on how asset pledgeability influences their lending behavior.

straints in times of aggregate shocks. [Nyborg \(2017\)](#) provides a comprehensive description of the Eurosystem’s collateral framework, suggesting that it might impede market discipline and lead to an excess of illiquid assets. [Corradin and Rodriguez-Moreno \(2016\)](#) document mispricing in marketable securities associated with the Eurosystem’s collateral policy, while [D’Amico et al. \(2015\)](#) quantify the scarcity premium of Treasury collateral. Furthermore, [Van Bakkum et al. \(2017\)](#) examine an expansion in eligible collateral of the Eurosystem, shedding light on its impact on the mortgage market in the Netherlands. Their findings suggest that eligibility broadens the credit supply for banks specializing in originating pledgeable credit claims.

Our analysis enhances this discourse in multiple dimensions. Firstly, it quantifies the effects of the eligibility status on the pricing of non-marketable credit claims in a developing economy. The analysis demonstrates that characterizing the effects as a “over-pricing” of collateralizable assets rather than as an “over-production” of illiquid collateral might be a more precise portrayal of the consequences of eligibility, particularly in an environment where asset supply exhibits relative inelasticity. Secondly, the paper illustrates that the influence of eligibility on credit provision varies among banks with differing levels of asset encumbrance. Thus, during times of increased liquidity risk, banks with limited marketable collateral appear to prioritize the origination of assets that can be subsequently pledged in the central bank. Moreover, distinct from the studies cited earlier, we investigate a case of “grandfathering”<sup>3</sup> in which a central bank commits to keep “frozen” the eligibility status irrespective of credit ratings of the issuers for as long as required to maintain the efficacy of monetary policy transmission.

Lastly, the granular data and institutional context examined in this study afford a refined identification of the effects of collateral eligibility. In particular, the research design allows to account for the unobserved determinants of market outcomes that are common to all banks competing for the same credit contract. As a result, one can establish a direct link between collateralizability, banks’ liquidity position, and the interest rate they offer, isolating the credit supply from confounding factors.

The paper is organized as follows. Section 2.1 offers a detailed exploration of the institutional context. The data used in our study and the approach to identification are explained

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<sup>3</sup>The concept of “grandfathering” emerged as a descriptor for the measures enacted by central banks in response to the financial shocks triggered by the COVID-19 crisis. Generally, this term encapsulates the central bank’s decision to utilize assets in its monetary operations—whether conventional or not—despite these assets exhibiting credit qualities that fall below the standards for acceptance. See, for instance, [Boyarchenko et al. \(2022\)](#) for an analysis of the “grandfathering” executed by the Federal Reserve within its asset purchase program.

in Sections 2.2 and 2.3, respectively. We present our core findings in Section 3. The paper concludes with Section 4, where we summarize our main points and implications of the research.

## 2 Institutional Setting, Data and Identification

In this section, we describe the principles governing collateral management by the BoR, the change in the framework studied in this paper, as well as data sources and econometric identification.

### 2.1 The role of non-marketable assets in the operational framework of the Bank of Russia

The operational framework of the BoR mirrors those commonly utilized by central banks operating in the inflation targeting regime during periods deemed “conventional”.<sup>4</sup> Specifically, the BoR uses instruments such as required reserves, intra-day credit, and standing lending and deposit facilities. The latter two make up the interest rate corridor. The corridor, set at a width of 200 basis points, is centered on the key policy interest rate as determined by the Governing Council of the Bank. The key rate targets the intermediate target—the interbank money market rate. The central bank’s liquidity provision mechanisms include:

- Main weekly repo auctions, that are employed to control aggregate liquidity and steer the level of money market rates towards the mid-point of the corridor. These auctions provide one-week liquidity;
- Standing overnight and short-term (up to six days) credit and repo facilities and fine-tuning operations, which serve to keep market rates within the interest rate corridor and guarantee liquidity accessibility for those banks unable to fulfill their demand in the market;
- Mid-term lending operations, that are aimed at enhancing the efficiency of the main refinancing operations. These operations include credit auctions and permanent long-

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<sup>4</sup>The BoR interprets the mandate of maintaining price stability in terms of stable inflation rate with the target of 4%, the objective that was adopted in 2014 and reached for the first time in May 2017. Previously to that, the BoR acted under the managed floating exchange rate regime which was discontinued in November 2014.

term credit facilities offering liquidity for up to three months, as well as a one-year repo facility.

The objective of the refinancing operations is to ensure an adequate level and distribution of liquidity in the banking sector, so that the interbank lending rate remains close to the key rate and experiences minimal fluctuations.

Throughout the analyzed period, the country's banking system operated under the conditions of an aggregate liquidity shortage, leading banks to regularly seek refinancing from the central bank. In offering liquidity to commercial banks, the BoR accepts both marketable and non-marketable assets as collateral. Non-marketable assets are used in all credit auctions and lending facilities. As a result, banks that have limited marketable collateral (that can be employed both in private arrangements or central bank refinancing operations), as well as those aiming to secure longer-term funding, may place higher value on this type of collateral.<sup>5</sup>

The eligible non-marketable credit claims include liabilities of public administrations, such as the Russian Federation, its regions, and municipalities, as well as claims on non-public entities. The BoR varies the haircuts on non-marketable credit claims based on the debtor type (public vs. non-public), their credit quality, and the overall availability of general collateral in the economy.<sup>6</sup>

The existing collateral framework was, in part, developed in response to the significant shocks that impacted the Russian economy in 2014. Following the annexation of Crimea by Russia in March of that year, major Russian banks were cut off from the European capital markets. This, coupled with a sharp decline in oil prices, led to heightened economic uncertainty in the latter half of 2014, prompting a widespread bank run. As a result, Russian banks saw their demand for liquidity from the central bank more than double. By the end of 2014, in an effort to maintain control over monetary policy transmission, the BoR extensively utilized available lending facilities, which required a stable collateral base.

Anticipating that in 2015 the rate of utilization of marketable collateral could approach

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<sup>5</sup>In 2017, the BoR introduced an Emergency Liquidity Assistance Mechanism which also accepted non-marketable assets as eligible collateral. By 2023, the Bank had further refined its operational framework by distinguishing between two categories of instruments: Main and Additional Liquidity Provision Mechanisms. Both mechanisms offer funding secured by marketable and non-marketable assets. The Main mechanism offers lower funding costs but necessitates higher-quality collateral. The collateral framework has been explicitly recognized as countercyclical, extending the range of eligible collateral and reducing both haircuts and credit quality requirements during periods of structural liquidity shortages (and conversely tightening these measures during periods of liquidity surplus).

<sup>6</sup>Section 2.3 provides further details on the creditworthiness of the eligible issuers studied in this paper.

80%, the BoR took measures to guarantee the pledgeability of non-marketable credit claims on local administrations. Until 2015, the eligibility for such collateral was restricted to public administrations with robust credit ratings, as affirmed by the leading international rating agencies.<sup>7</sup> The economic and geopolitical turmoil of 2014, however, set off a cascade of credit reassessments and downgrades, leading to apprehensions that local issuers could fall out of eligibility due to rating withdrawals. The prospect of a concurrent credit withdrawal posed a systemic risk, impacting the core operations of the central bank, particularly those related to liquidity provision.<sup>8</sup> In response to growing uncertainties concerning the collateral base, the BoR implemented two key measures to safeguard the collateralizability of assets: first, it established a list of administrations whose debts would be considered pledgeable, thus decoupling their eligibility from assessments by external rating agencies; second, it significantly reduced haircuts on non-marketable debt issued by local governments, slashing them from 20% to 2%.<sup>9</sup>

The BoR enacted the collateral policy modification through its decree on February 24, 2015 (**BoR (2015)**), right before the next round of credit rating revisions. In this directive, the Bank specified sixty-five municipal and regional governments whose debts were granted unconditional eligibility for refinancing operations against non-marketable assets. The list included all public entities that had previously acquired credit ratings from any international rating agency before the collateral framework was revised.<sup>10</sup> By “freezing” the list of eligible issuers, the BoR increased the expected pledgeability of selected credit claims and mitigated the operational risks for banks associated with assets potentially becoming ineligible. Reducing collateral haircuts increased the expected pledgeability further.<sup>11</sup> Symmetrically, the

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<sup>7</sup>Eligible assets needed a minimum rating of “B-” by Fitch Ratings and Standard & Poor’s, or “B3” by Moody’s Investors Service.

<sup>8</sup>Indeed, as early as July 2015, the Russian government enacted legislation regulating the issuance of credit ratings. The legislation effectively prevented the official use of credit ratings issued by international agencies without domestic subsidiaries and also barred rating withdrawals influenced by foreign governmental or supranational decisions. The BoR’s officials deemed this legal framework crucial in upholding the central bank’s core activities (**BoR (2016)**). Following these legal changes, international rating agencies began scaling back their activities within Russia.

<sup>9</sup>This corresponds to the adjustment coefficient for collateralized credit claims on public administrations with a default probability deemed positive but not surpassing 20%.

<sup>10</sup>By January 2015, all the rated public administrations held ratings above the eligibility benchmark set by the earlier version of the collateral framework. In July 2015, six additional issuers were incorporated in the list. For the purposes of our analysis, we omit the issuers added in this subsequent phase, as the market could have foreseen the second amendment to the collateral list well in advance of its enactment. The complete list of eligible issuers is provided in Appendix B.1.

<sup>11</sup>We conceptualize pledgeability as the product of two factors: the probability that an asset remains eligible for refinancing operations and the amount of funding available per unit of collateral value. From this perspective, both policy actions contributed to increasing the expected pledgeability, although the reduced haircuts



BoR assumed greater risk by agreeing to accept such collateral even if the underlying credit quality deteriorated or became more uncertain. By taking this risk, the Bank reinforced its capacity to sustain liquidity provision and likely mitigated the risk of monetary policy transmission weakening, which could have emerged from an ineffective distribution of liquidity among banks.

Throughout the remainder of this paper, we analyze how the increase in the expected pledgeability affected the pricing of debt of selected administrations.

## 2.2 Data sources and descriptive statistics

In this subsection, we outline the datasets employed for our analysis.

The allocation of bank credit to local governments in Russia follows standardized auction procedures as outlined in the country’s procurement law. Loans that may subsequently serve as collateral with the BoR are no exception from this rule. In this process, the public administrations specify the desired loan amount, term, repayment schedule, and the maximum acceptable interest rate, known as the reservation rate. Subsequently, they collect bids from banks via online auction platforms on a predetermined date. With a few exceptions, these auctions adhere to the English open format, where participants compete solely based on the interest rate.<sup>12</sup>

The Russian Procurement Information System discloses auction details, from which we derive the information regarding interest rate offers and credit allocation. Starting from mid-2014, the Procurement Information System began providing auction documents in a machine-readable format. In order to expand the sample to include auctions from the beginning of 2014 and account for outcomes not reported under the machine-readable standard, we conduct web scraping of the protocols from the auction organizers’ websites. To supplement this raw data on offers, which is stated in absolute monetary terms, we hand-collect information on reservation rates, loan volumes, and maturities from contract specifications available at the Procurement platform.

We complement the procurement data with bank balance sheet files and macroeconomic statistics supplied by the BoR, along with the municipal and regional database from the Russian Federation State Statistics Service. The latter provides information on the fiscal position of borrowers, sourced from two databases: the Socio-Economic Conditions of Subjects of the Russian Federation (providing regional data) and the Database of Municipal Entities (pro-

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only mattered as long as the collateral’s eligibility was sustained via the promised “grandfathering”.

<sup>12</sup>For a detailed exposition of the auction process, see Appendix B.2.

viding municipal data). The borrowers' characteristics utilized in this paper serve to reflect their credit risk, encompassing their budget deficit, dependency on transfers from higher-level administrations and size. We use the standard code of public administrations provided by the Statistics Service as the identifier for borrowers.

The bank balance sheet data is published by the BoR monthly. We aggregate this data following a scheme similar to the one employed by the BoR in its statistical publications and merge it with the auction dataset using the lenders' tax identifiers. We utilize banks' financial characteristics to examine the effects of the collateral framework adjustment on bank's credit supply. To this end, our main variables of interest capture the reliance of banks on central bank funding, as well as the general level of encumbrance of marketable assets. We use these variables as proxies for liquidity demand from the central bank due to collateral constraints.

Finally, to examine robustness of the main findings on credit supply, we utilize non-financial characteristics of the banks. Specifically, for assessing the role of the political ties of the lenders, we rely on financial disclosures by the candidates in the 2011 Members of Parliament elections. This dataset, published by the Central Election Committee of the country, contains information on the reported deposits of each candidate in each bank registered in Russia, as well as the annual income of the candidate.<sup>13</sup>

To preprocess the auction data for analysis, we apply the following restrictions to the original sample. First, we exclude auctions where at least one participant has an erroneously coded application date, indicating that the application for the auction occurred later than the actual bidding date. We also omit auctions with multiple bidders where only one bid is recorded. In order to balance the sample across periods and eligibility groups, we retain only those borrowers that had at least one auction announced both before and after the collateral adjustment. The baseline econometric model applied in this study necessitates an additional sample refinement, ensuring that every borrower within the dataset has participated in a minimum of two auctions with more than one bidder present. Hence, the main results of this paper are derived from a sample of successful auctions with multiple bidders that, in turn, participate in multiple auctions.<sup>14</sup> This sample comprises 1673 loan contracts issued by 201 borrowers, offered in the market by 54 banks.

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<sup>13</sup>Further details on data construction and cleaning is provided in Appendix B.3.

<sup>14</sup>Auctions with multiple bidders account for 44% of credit allocated to public administrations in Russia in 2014-2015, with the remainder of the credit assigned in auctions with only one participant. This aligns with the banking literature that explores within-borrower variation of firms with multiple banking relationships to identify bank credit supply. For instance, [Khwaja and Mian \(2008\)](#) report that about 66% of total firm credit is provided to firms borrowing from multiple banks.

**Table 1:** Summary statistics of contracts, borrowers, and lenders

	Mean	SD	Min	Med	Max
Sample of contracts, $N = 1673$					
Contract interest rate	13.2	2.37	7.87	12.9	26.1
2nd-lowest interest rate	13.4	2.40	7.92	13.1	26.1
Contract interest rate premium	3.11	1.74	-0.86	2.67	13.3
Loan volume	263.5	354.6	0.40	100	4000
Loan maturity	1.61	0.89	0.25	1	5
Credit line	0.79	0.41	0	1	1
Eligible	0.37	0.48	0	0	1
Post	0.73	0.45	0	1	1
Sample of borrowers, $N = 201$					
Region	0.21	0.41	0	0	1
Budget surplus	-3.71	7.46	-41.5	-3.20	28.2
Budget dependence	43.9	21.2	0	48.3	88.8
Sample of lenders, $N = 54$					
Collateral use	0.25	0.30	0	0.063	0.88
CB funding	0.41	0.39	0	0.42	1
High-income MP bank	0.13	0.34	0	0	1
State-owned bank	0.15	0.36	0	0	1
Bank size	10.9	2.34	6.94	10.5	16.9
Early applicant	0.31	0.47	0	0	1

The variables Contract interest rate premium and Second-lowest interest rate premium are measured as the corresponding interest rates net of the contemporaneous yield on the federal government bonds of similar maturity. Borrowers' characteristics are as of 2014. Banks' balance sheet characteristics are as of January, 2015. See Table A.1 for variable definitions.

Descriptive statistics of contracts, borrowers, and lenders included in the main sample are reported in Table 1. We list definitions of all variables in Table A.1 in Appendix. The primary focus of our analysis is the contractual interest rate and the interest rate premium over the safe nominal rate. The latter is computed by subtracting the contemporaneous yield on federal government bonds with similar maturity from the actual contract interest rates and offers. As shown in the upper panel of Table 1, the average sampled contract has a maturity of 1.6 years and charges an interest rate of 13.2%. This is about two percentage points below the average reservation rate. Approximately 37% of these contracts are auctioned by eligible administrations. The second-lowest offers tend to be around 16 basis points higher than the

winning bids, suggesting a competitive process in which lenders offer gradually decreasing rates. Notably, the variation in the winning interest rate offers is relatively small, at 1.5%. The vast majority of contracts stipulate that credit is to be provided under renewable credit line arrangements.

The summary data presented in the middle and lower sections of Table 1 shed light on the fiscal health of local governments and the attributes of banks participating in the auctions. Borrowers' characteristics are assessed based on 2014 data, whereas lender balance sheet attributes are measured as of January 2015. The local governments in our sample typically operate at a budget deficit, with an average of approximately 3.7%. They are also quite dependent on financial support from superior government levels, as indicated by the average ratio of subsidies and transfers to total revenue standing at 44%. Both metrics suggest that local administrations exhibit a relatively inelastic demand for external financing.

From the lenders' perspective, the central bank is a substantial funding source, contributing 41% to the average bank's money market financing. Similarly, on average, banks have about 25% of their securities tied up in secured funding agreements. There is a significant diversity in the extent to which banks leverage collateral and the degree of reliance on central bank funding across the sector.<sup>15</sup> Our sample encompasses a broad spectrum of banks, including major state-owned entities as well as a variety of medium and smaller-sized private institutions in Russia.

It is worth noting that, despite the abundance of banks, Russia's banking sector is largely dominated by a handful of institutions many of which are state-owned or maintain close links with the public officials. The largest lender, a state-owned bank, accounted for approximately 35% of total credit to legal entities at the beginning of 2014. Similarly, roughly half of bids in our sample are submitted by state-owned banks. Credit supply could be influenced by close governmental ties, particularly if officials are inclined to utilize cooperating banks as conduits to direct funds toward favored administrations.

We employ a set of indicators to account for potential political affiliations of each lender in our analysis. First, given that the major banks in Russia are state-owned, their political linkages are indicated by a state-ownership dummy and by the bank size variable (the logarithm of total assets). Second, to identify less formal connections, we use the income and

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<sup>15</sup>The correlation coefficient between the rate of collateral utilization and reliance on central bank funding across banks is high (0.65). This suggests that banks identified by these metrics likely committed a substantial part of their marketable assets to secured funding arrangements, both in private markets and through central bank refinancing operations. Public accounting standards in Russia, as applied by banks during the analyzed period, do not differentiate between assets encumbered in private transactions and those tied up in the central bank's refinancing operations.

**Table 2:** Summary statistics of borrowers by their pledgeability status

	Mean	SD	Min	Med	Max
Borrowers with pledgeable debt, $N = 43$					
Region	0.77	0.43	0	1	1
Budget surplus	-8.36	5.02	-20.7	-8.34	1.26
Budget dependence	28.5	14.6	10.1	23.1	56.1
Borrowers with non-pledgeable debt, $N = 158$					
Region	0.063	0.24	0	0	1
Budget surplus	-2.44	7.53	-41.5	-2.28	28.2
Budget dependence	48.1	20.8	0	52.2	88.8

Borrowers' characteristics are as of 2014. "Eligible" ("Non-eligible") denotes the borrowers whose debts are pledgeable (not pledgeable) in the BoR as specified by the collateral framework adjustment. See Table A.1 for variable definitions.

asset disclosures from the 2011 Russian parliamentary election candidates. We calculate the mean yearly income of all candidates who maintain accounts with a specific bank. A bank is then classified as "politically connected" if the ratio of these candidates' average income to the bank's total assets is above the mean for our sample. This designation, "High-income Members of Parliament (MP) bank," applies to approximately 13% of banks in our dataset. This metric is designed to spotlight mid-tier banks that are notable for holding accounts of affluent politicians.

### 2.3 The Determinants of Collateral Eligibility and Identification

As outlined in Section 2.1, the BoR ensured issuer eligibility for its refinancing operations for administrations that had been rated prior to 2015 by an international agency. In this section, we provide more details about the distinctive features of eligible borrowers and contracts. We then explore the econometric identification of the eligibility premium.

Table 2 sheds light on the differences between eligible and non-eligible administrations. We observe that regional authorities, in contrast to municipal ones, are more inclined to meet the criteria stipulated by the central bank's collateral decision. Additionally, eligible administrations tend to exhibit greater financial autonomy.<sup>16</sup>

<sup>16</sup>With few exceptions, regional administrations generally tend to have larger budget deficits than municipal ones, a trend mirrored in the summary statistics of the eligible borrowers.

**Table 3:** Summary statistics of contracts by their pledgeability status and origination period

	Non-eligible		Eligible	
	Before			
Contract interest rate	10.69	(1.78)	10.93	(0.89)
2nd-lowest interest rate	10.81	(1.79)	11.01	(0.88)
Contract interest rate premium	2.27	(1.10)	2.09	(0.59)
Loan volume	113.41	(140.87)	367.90	(312.96)
Loan maturity	1.35	(0.64)	2.24	(0.98)
Credit line	0.85	(0.36)	0.80	(0.40)
Number of contracts	247		209	
	After			
Contract interest rate	14.37	(2.10)	13.58	(1.66)
2nd-lowest interest rate	14.55	(2.11)	13.79	(1.67)
Contract interest rate premium	3.73	(1.97)	2.93	(1.48)
Loan volume	128.26	(245.81)	558.45	(432.26)
Loan maturity	1.27	(0.53)	2.12	(1.09)
Credit line	0.82	(0.39)	0.70	(0.46)
Number of contracts	799		418	

The table reports means and standard deviations (in parenthesis) of contract characteristics by the eligibility status of the borrower and origination period. The variables Contract interest rate premium and Second-lowest interest rate premium are measured as the corresponding interest rates net of the contemporaneous yield on the federal government bonds of similar maturity. See Table A.1 for variable definitions. The sample includes all auctions that have at least two participants in the years 2014–2015. “Before” (“After”) denotes auctions with bidding scheduled to be before (after) the collateral framework amendment (February 26, 2015). “Eligible” (“Non-eligible”) denotes the borrowers whose debts are pledgeable (not pledgeable) in the BoR as specified by the collateral framework adjustment.

Table 3 summarizes the details on the characteristics of contracts, categorized by their pledgeability status and origination period. As a preliminary observation of the primary findings, we note that interest rates (winning bids) for both eligible and non-eligible loans experienced an uptick in the period following the collateral framework adjustment, indicating a general rise in the interest rates in the credit market in 2015. However, this increase was notably lower in the case of eligible loans. In the same table, we also present non-price characteristics of loans that might be relevant for their pricing. The data indicates that loan maturity remained relatively stable over time. The time-to-maturity of eligible loans is about 10 months longer both before and after the collateral framework adjustment. Regarding total loan volumes, both eligible and non-eligible administrations experienced substantial increases in their credit liabilities in 2015. Non-eligible administrations achieved this by

increasing the number of auctioned contracts, while eligible ones were able to adapt both the quantity and average volume of contracts.

Given that the assignment of eligibility status was not random, a simple comparison of interest rates between eligible and non-eligible contracts would yield inconclusive results. To address this issue, we adopt a difference-in-differences methodology. Conceptually, this involves comparing the changes in interest rate spreads between eligible and non-eligible contracts around the collateral framework adjustment. Specifically, we estimate versions of the following baseline regression:

$$y_c = \delta \text{Post}_t \times \text{Eligible}_b + \Gamma X_c + \theta_b + \vartheta_t + \varepsilon_c, \quad (1)$$

where  $c$  indexes the credit contracts,  $b = b(c)$  indicates the borrower corresponding to each contract, “Eligible” is an indicator equal to one for issuers whose debts constitute eligible collateral in BoR,  $t = t(c)$  is the month corresponding to auction  $c$ , “Post” is an indicator equal to one for auctions held after the effective date of the collateral framework adjustment (February 26th, 2015),  $\theta_b$  is borrower fixed effect,  $\vartheta_t$  is month-of-bidding fixed effect,<sup>17</sup> and  $\varepsilon_c$  is the error component.

The dependent variable in the equation (1) is the contractual interest rate or the interest rate premium.<sup>18</sup> A negative estimate of  $\delta$  in (1) would suggest that, following the assignment of pledgeability status, interest rates in pledgeable contracts are lower compared to non-eligible issuers, relative to the same difference in the pre-announcement period. The regression equation (1) includes a vector of observables,  $X_c$ , covering borrower characteristics in 2014, contract attributes, and macroeconomic indicators. Additionally, borrower fixed effects are added to account for unobservable heterogeneity in the level of their creditworthiness. Within-borrower difference eliminates time-invariant characteristics that could be confounded with eligibility. Time fixed effects, in turn, capture the factors that affect the evolution of loan pricing common to both groups of borrowers.

The difference-in-difference estimator is consistent provided that one could reasonably assume that there was no anticipation of the collateral framework adjustment and that the

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<sup>17</sup>Since the collateral adjustment occurred in late February 2015, we categorize the sole February auction that followed the adjustment as taking place in March 2015. This enables us to omit the non-interacted “Post” indicator from the specification that includes month fixed effects. No result reported herein is sensitive to this adjustment in auction timing.

<sup>18</sup>In an additional exercise, we assess the impact of eligibility on bank competition. For this purpose, we enlarge the sample and apply equation (1) to analyze the probability that an auction attracts several bidders rather than a single participant.

contract rates would have moved in parallel in the absence of policy intervention. Given the rapid onset of macroeconomic shocks in the end of 2014, the former assumption seems reasonable.<sup>19</sup> However, given the distinctive characteristics of eligible borrowers and contracts, along with the macroeconomic environment in which the collateral framework was adjusted, the parallel trends assumption may be deemed overly restrictive. Hence, it is plausible that credit risk spreads increased precisely during the period when the collateral policy was introduced, resulting in safer (eligible) borrowers paying less for their funding compared to the riskier (non-eligible) administrations. Furthermore, credit spreads of different maturities might respond distinctively to the prevailing macroeconomic shocks, potentially creating a discrepancy in the pricing between longer-term (eligible) contracts and their shorter-term (non-eligible) counterparts.

Finally, concerns may arise regarding whether the BoR's decision on the collateral list was confounded with the intention of the officials to facilitate financing for eligible administrations through banks with governmental ties. This confounding factor is relevant if banks with political ties are the ones facing collateral constraints.

To address these concerns, we proceed in three steps. Firstly, we demonstrate graphically that the parallel trend assumption describes the market outcomes well in the pre-adjustment period. Secondly, when estimating the equation (1), we introduce additional controls: the interactions of borrower and loan characteristics with the post-adjustment indicator, the eligibility indicator,<sup>20</sup> as well as the triple interactions of these variables. The double interactions with the "Post" indicator capture the heterogeneous variation in interest rate spreads during the post-adjustment period. These changes stem from shocks to the credit risk premium that are either specific to loan maturity or shared among borrowers with similar observable characteristics. Therefore, the parallel trends assumption needs to hold only conditionally. The triple interactions, on the other hand, allow us to identify heterogeneous effects.

Finally, we explicitly examine the relationship between changes in interest rate offers and bank liquidity conditions, controlling for other determinants of credit supply. In doing so, we leverage a unique aspect of our study: the use of the auction mechanism for allocating credit to local administrations in Russia. Specifically, we compare the interest rates offered by the winning bidder to those proposed by other participants in the same credit auction. The advantage of this comparison is that it allows us to control for factors common to all lenders

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<sup>19</sup>As a robustness check, we omit the final two months of 2014 from our sample. Our main findings remain unaffected by this exclusion.

<sup>20</sup>Given that we utilize a borrower fixed effects estimator and that borrower characteristics are fixed as of 2014, only the interaction between the eligibility status and the loan characteristics is identified.



pricing the same credit contract.

We implement this idea by estimating the following regression:

$$y_{cl} = \alpha \text{Post}_t \times x_l + \beta \text{Eligible}_b \times x_l + \delta \text{Post}_t \times \text{Eligible}_b \times x_l + \Gamma X_{cl} + \phi_c + \psi_l + \varepsilon_{cl}, \quad (2)$$

where  $l$  denotes the index for lenders, and  $y_{cl}$  represents either the final interest rate offer presented by bank  $l$  in auction  $c$ , or an indicator variable set to one if bank  $l$  successfully secures contract  $c$ . Additionally,  $\phi_c$  accounts for contract-specific effects,  $\psi_l$  represents bank-specific effects, and  $X_{cl}$  is a vector of bank-level controls interacted with the “Post” and “Eligible” indicators. The bank-level variable  $x_l$  stands for a proxy for the collateral demand of bank  $l$  prior to the collateral adjustment announcement (January 2015).

The approach we take conceptually mirrors the triple difference-in-difference estimator (Olden and Møen (2022)). This estimator would compare the bids from two distinct groups of banks (those with high versus low collateral values) across two sets of borrowers (those who are eligible and those who are not) submitted during two different time periods (before and after adjustments were made to the collateral framework). Given the potential variability in contract characteristics within the same borrower-subperiod, our model goes a step further: we enhance the specification by including contract fixed effects, which control for unobserved factors common to all lenders competing for the same contract. By analyzing the within-contract variation, we effectively account for and isolate from our analysis the influence of aggregate-level, borrower-specific, and borrower-time factors. In particular, if eligible and non-eligible borrowers exhibited different trends during the post-policy period, the validity of our identification would not be compromised, provided that these differences in trends were common to all banks.

In this specification, a negative coefficient  $\delta$  implies that, following the collateral framework adjustment, banks with a higher collateral demand tend to offer lower interest rates to eligible borrowers compared to their offers to non-eligible issuers. We measure the bank’s collateral demand using two interrelated metrics: first, the proportion of money market funding sourced from the BoR; and second, the portion of a bank’s securities used as collateral in repo financing, which may encompass more than just central bank funding. These measures capture the challenges in obtaining liquidity from the market, particularly against marketable assets. For easier interpretation, we discretize the two continuous measures and label banks with ratios of central bank funding or asset encumbrance exceeding their sample averages as “High central bank funding” and “High encumbrance” banks, respectively.

The proposed identification strategy readily allows for the inclusion of other factors that influence credit supply within the control variables  $X_{cl}$ . For example, we can condition the main effect estimates on the bank’s political exposure. Specifically, in our primary exercise, we also incorporate the double and the triple interactions of potential bank-level confounders—namely, bank size, state ownership, and political ties—with the “Post” and “Eligible” indicators. Furthermore, we incorporate an indicator reflecting whether a bank was the first in applying to participate in the auction. This serves to identify potential lenders who may have had advanced knowledge about the contracts up for auction. Within the range of bank characteristics examined, the size of a bank emerges as the most significant predictor of both the degree of securities encumbrance and dependence on central bank funding. Nevertheless, to address the concerns regarding confounding factors, we include all mentioned variables in our robustness exercises.

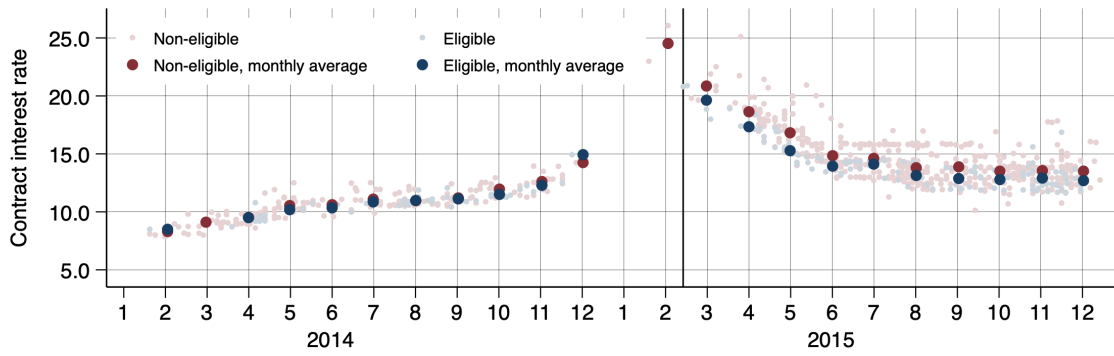
### 3 Results

This section presents the primary results of our research. Figures 1 and 2 illustrate the evolution of contract interest rates and the spread between eligible and non-eligible contracts within our sample. To simplify the comparison between these two types of loans, we depict the interest rates from individual contracts alongside their monthly averages, grouped by eligibility status. Figure 2 highlights the difference in monthly average interest rates between eligible and non-eligible loans.

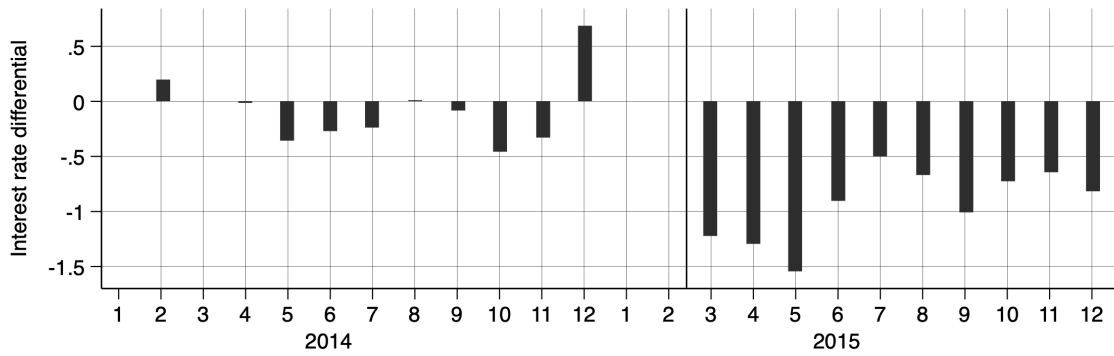
The graphs indicate that, in the period before the amendment, the disparity in rates between eligible and non-eligible contracts was not large and that the eligible borrowers faced moderately lower interest rates. This is consistent with the observation that eligible borrowers are, on average, marginally safer. The charts also clearly depict that the spread on eligible loans significantly widened, turning decisively negative immediately following the adjustment to the collateral policy, denoted by the vertical line.

It is worth noting a clear reduction in activity in the municipal credit market in December 2014. During this time, interest rates spiked unexpectedly, leading many contracts’ pre-established reservation rates to fall below the prevailing money market rate. Consequently, December 2014 saw only a limited number of contract allocations. Furthermore, January 2015 lacked auctions with more than one bidder. This slowdown can be attributed partly to the public holiday period in Russia, which spanned from January 1 to January 12 that year, and also to the typically reduced market activity during this season. Additionally, credit

**Figure 1:** Contract interest rates by eligibility status.



**Figure 2:** Interest rate differential between eligible and non-eligible loans.



Vertical lines indicate the adjustment of collateral framework by the BoR.

demands that were left unmet in December 2014 due to the interest rate surge, were deferred to a later period. Considering that it typically takes around 20 days from announcing an auction to the actual bidding date, market activity only picked up again in February. Hence, the first multi-lender auction of 2015 occurred at the beginning of that month, marking the start of a renewed upward trend in activity throughout the year.

Table 4 presents these results in a regression form and provides estimates of equation (1) for the main sample of contracts. The dependent variable is the winning offer, which represents the actual interest rate assigned to the contract. Column 1 removes borrower-level variation and the common factors from the post-policy period. Column 2 introduces additional controls for macroeconomic variables and contract characteristics. These characteristics comprise the “Credit line” dummy, as well as controls for loan maturity, which, in turn, is discretized into three categories (with short-term credit, having a maturity of not more than one year, serving as the baseline category). Such discretization offers a flexible approach to model the effects of maturity. Column 3 further includes month-of-bidding fixed effects. According to these results, the premium earned by eligible issuers is approximately 1%. In all specifications, the estimated effect is both economically and statistically significant at conventional levels.

In Column 4, we incorporate the double and triple interactions of both borrower and contract characteristics with the “Post” and “Eligible” indicators. Following [Wooldridge \(2021\)](#), we adjust the former by subtracting the average of the “treated” (i.e., eligible) group. The double interaction involving the “Post” indicator and the maturity categories suggests that the rise in interest rates for loans with longer maturities was more subdued (whereas the interactions with the “Eligible” indicators are not statistically significant). Turning to the heterogeneous effects, we document that the effect of eligibility appears to amplify with an administration’s budget surplus, and this heterogeneous effect is itself larger for regional administrations. Such findings imply that the eligibility premium is higher for larger and more creditworthy borrowers.<sup>21</sup>

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<sup>21</sup>We also analyze whether the baseline conclusions can be applied to lenders’ valuations more generally. Conceptually, the valuation of the winning lender, that is, the lowest interest rate it is willing to accept, remains unobserved ([Paarsch et al. \(2006\)](#)). However, valuations of the banks offering second-lowest rates are less subject to this censoring issue. Intuitively, the fact that a bank is being ranked second indicates that its valuation is not higher than its final offer and not lower than the winning interest rate. More formally, under the framework of a simple clock model of an English auction with independent private values, as illustrated by [Milgrom and Weber \(1982\)](#), the optimal strategy in continuous bidding is for a bidder to drop out from the auction once the price reaches their valuation. Therefore, non-winning bids can be seen as reflecting the valuations of the unsuccessful bidders. Hence, we conduct a regression analysis of the equation (1) using the second-lowest auction interest rates as the dependent variable. We report the estimates in Tables 9 and 10 in

**Table 4:** The effect of collateral adjustment on contract interest rates

	(1)	(2)	(3)	(4)
Post × Eligible	-1.17*** (0.38)	-0.97*** (0.25)	-0.71*** (0.16)	-1.29*** (0.30)
Post	3.68*** (0.28)	-1.41*** (0.31)		
Post × Eligible × Region				-1.09 (0.67)
Post × Eligible × Budget surplus				-0.36*** (0.060)
Post × Eligible × Region × Budget surplus				-0.35*** (0.11)
Post × Eligible × Budget dependence				0.017 (0.013)
Post × Eligible × Loan maturity (1y, 2y]				0.11 (0.42)
Post × Eligible × Loan maturity > 2y				0.71 (0.45)
Post × Eligible × Credit line				0.10 (0.35)
Fixed effects	<i>b</i>	<i>b</i>	<i>b, t</i>	<i>b, t</i>
Macroeconomic variables	No	Yes	Yes	Yes
Contract attributes	No	Yes	Yes	Yes
Post × Borrower attributes	No	No	No	Yes
Post × Contract attributes	No	No	No	Yes
Eligible × Contract attributes	No	No	No	Yes
$R^2$	0.60	0.84	0.91	0.91
# observations	1673	1673	1673	1673
# borrowers	201	201	201	201

The table presents estimates of equation (1). The sample includes all auctions held between 2014 and 2015 with a minimum of two participants. The dependent variable is the winning interest rate. “Post” takes a value of one for auctions held after the collateral framework adjustment on February 26, 2015, and zero otherwise. “Eligible” equals one for borrowers whose liabilities are considered pledgeable according to the BoR collateral framework adjustment, and zero otherwise. Macroeconomic variables include the Mosprime overnight interest rate and 5-year CDS Russia. Borrower characteristics include “Budget dependence”, “Budget surplus”, “Region”, and the interaction of the latter two. See Table A.1 for further variable definitions.

Standard errors (in parentheses) are clustered by borrower. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

† “*b*” refers to borrower, “*t*” denotes the month of bidding.

the Appendix A.2. We find that the average and heterogeneous effects of eligibility on the second-lowest offers

We extend our analysis in several ways. First, we redefine the outcome variable in terms of the interest rate premium over the safe nominal interest rate with a comparable maturity. This adjustment seems necessary, considering the observed decrease in the estimated effects from columns 1 to 3 in Table 4, which can be attributed to increasingly precise controls for aggregate shocks. The results are reported in Table 5. The estimated average effect is smaller in magnitude ( $-0.5\%$ ), but in line with the baseline results discussed above. Given the results reported below, we adopt a cautious approach and regard this value as our baseline estimate. In our examination of interest rate premiums, we also observe that the eligibility effect is less pronounced for financially dependent administrations. Furthermore, the gradient of the premium with respect to contract maturity is steeper, with the discount on shorter-term eligible contracts being twice as large as that on the long-term ones. Putting these findings together, we conclude that we do not find strong evidence of risk-taking in which banks, when competing for eligible issuers, offer better terms to riskier borrowers.

Additionally, we examine the effect of eligibility on the extensive margin of bank competition. To do so, we expand the sample and estimate equation (1) using an outcome variable that indicates whether an auction attracted multiple bidders (with a value of one) or just a single bidder (with a value of zero). The results are detailed in Table 11 in the Appendix. These estimates, albeit less precise, suggest that eligible issuers have a higher likelihood of attracting multiple potential lenders after the collateral framework adjustment.

Our analysis next focuses on the bids submitted by banks. We utilize equation (2) to interpret these bids, with results detailed in Tables 6 and 7. The distinction between the two lies in the bank-specific factors capturing the demand for eligibility: Table 6 considers banks with a significant portion of securities tied up as collateral, while Table 7 looks at banks with a heavy dependence on central bank funding.<sup>22</sup>

By examining the within-contract bid dynamics reported in these tables, we can draw direct comparisons between banks competing for the same credit contract. The evidence suggests that banks with less available collateral were inclined to submit lower interest rate bids for borrowers deemed eligible after the BoR affirmed their pledgeability (refer to column 1, Table 6). Similarly, banks with a greater reliance on central bank funding offered more competitive rates for eligible debts (see column 1, Table 7). In both instances, the pattern of bidding lead to higher chances of securing auctions that allocated eligible debts (as shown in column 3 of both tables).

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are quantitatively similar to the baseline results discussed in the main text.

<sup>22</sup>The findings reported below remain consistent when employing continuous variables to measure the demand for eligible collateral instead of binary indicators.

**Table 5:** The effect of collateral adjustment on contract interest rate premiums

	(1)	(2)	(3)	(4)
Post × Eligible	-0.62** (0.26)	-0.58** (0.24)	-0.46*** (0.16)	-1.56*** (0.28)
Post	1.44*** (0.21)	-1.88*** (0.29)		
Post × Eligible × Region				-0.94 (0.70)
Post × Eligible × Budget surplus				-0.36*** (0.060)
Post × Eligible × Region × Budget surplus				-0.44*** (0.11)
Post × Eligible × Budget dependence				0.024* (0.014)
Post × Eligible × Loan maturity (1y, 2y]				0.064 (0.39)
Post × Eligible × Loan maturity > 2y				0.79* (0.47)
Post × Eligible × Credit line				-0.11 (0.35)
Fixed effects	<i>b</i>	<i>b</i>	<i>b, t</i>	<i>b, t</i>
Macroeconomic variables	No	Yes	Yes	Yes
Contract attributes	No	Yes	Yes	Yes
Post × Borrower attributes	No	No	No	Yes
Post × Contract attributes	No	No	No	Yes
Eligible × Contract attributes	No	No	No	Yes
$R^2$	0.47	0.70	0.81	0.82
# observations	1673	1673	1673	1673
# borrowers	201	201	201	201

The table presents estimates of equation (1). The sample includes all auctions held between 2014 and 2015 with a minimum of two participants. The dependent variable is the winning interest rate net of the contemporaneous yield on federal bonds of similar maturity. “Post” takes a value of one for auctions held after the collateral framework adjustment on February 26, 2015, and zero otherwise. “Eligible” equals one for borrowers whose liabilities are considered pledgeable according to the BoR collateral framework adjustment, and zero otherwise. Macroeconomic variables include the Mosprime overnight interest rate and 5-year CDS Russia. Borrower characteristics include “Budget dependence”, “Budget surplus”, “Region”, and the interaction of the latter two. See Table A.1 for further variable definitions.

Standard errors (in parentheses) are clustered by borrower. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

† “*b*” refers to borrower, “*t*” denotes the month of bidding.

**Table 6:** The effect of collateral adjustment on interest rate offers

	Interest rate offer		Winner	
	(1)	(2)	(3)	(4)
Post × High encumbrance	0.0053 (0.09)	-0.091 (0.16)	0.030 (0.19)	-0.22 (0.24)
Eligible × High encumbrance	0.100 (0.12)	0.093 (0.15)	-0.25 (0.22)	-0.42 (0.26)
Post × Eligible × High encumbrance	-0.66*** (0.24)	-0.68*** (0.21)	0.48* (0.25)	0.58* (0.31)
Post × Eligible × State-owned bank		0.78** (0.33)		-0.65 (0.47)
Post × Eligible × Bank size		-0.064 (0.06)		0.067 (0.11)
Post × Eligible × High-income MP bank		-0.74*** (0.28)		-0.61 (0.76)
Post × Eligible × Early applicant		-0.27*** (0.10)		0.19 (0.12)
Fixed effects <sup>†</sup>	<i>c, l</i>	<i>c, l</i>	<i>c, l</i>	<i>c, l</i>
Post × Bank attributes	No	Yes	No	Yes
Eligible × Bank attributes	No	Yes	No	Yes
$R^2$	0.96	0.96	0.25	0.27
# observations	4294	4294	4294	4294
# contracts	1668	1668	1668	1668
# borrowers	200	200	200	200
# lenders	54	54	54	54

The table presents estimates of equation (1). The sample includes all auctions held between 2014 and 2015 with a minimum of two participants. The dependent variable is either the interest rate offer (columns 1 and 2) or the winner indicator (columns 3 and 4). “High encumbrance” equals to one for banks with a ratio of encumbered securities above the average, and zero otherwise. “Post” takes a value of one for auctions held after the collateral framework adjustment on February 26, 2015, and zero otherwise. “Eligible” equals one for borrowers whose liabilities are considered pledgeable according to the BoR collateral framework adjustment, and zero otherwise. See Table A.1 for further variable definitions.

Standard errors (in parentheses) are clustered by borrower and lender. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

<sup>†</sup> “*c*” refers to contract, “*l*” denotes the lender.

In Columns 2 and 4 of Tables 6 and 7, we introduce additional double- and triple interactions to account for potential bank-level confounders. These include the indicator for banks that hold deposits from wealthy politicians, the dummy variable for state ownership, as well as the measure of bank size and the indicator of whether a bank was the first to apply



**Table 7:** The effect of collateral adjustment on interest rate offers

	Interest rate offer		Winner	
	(1)	(2)	(3)	(4)
Post $\times$ High CB funding	0.13 (0.11)	0.081 (0.16)	-0.10 (0.18)	-0.47** (0.22)
Eligible $\times$ High CB funding	-0.13 (0.14)	-0.14 (0.15)	-0.43* (0.22)	-0.71*** (0.25)
Post $\times$ Eligible $\times$ High CB funding	-0.49* (0.26)	-0.60** (0.29)	0.75*** (0.27)	1.06*** (0.30)
Post $\times$ Eligible $\times$ State-owned bank		0.99*** (0.34)		-0.85* (0.46)
Post $\times$ Eligible $\times$ Bank size		-0.12** (0.06)		0.095 (0.10)
Post $\times$ Eligible $\times$ High-income MP bank		-0.63 (0.47)		-0.66 (0.77)
Post $\times$ Eligible $\times$ Early applicant		-0.27*** (0.10)		0.17 (0.12)
Fixed effects <sup>†</sup>	<i>c, l</i>	<i>c, l</i>	<i>c, l</i>	<i>c, l</i>
Post $\times$ Bank attributes	No	Yes	No	Yes
Eligible $\times$ Bank attributes	No	Yes	No	Yes
$R^2$	0.96	0.96	0.25	0.27
# observations	4294	4294	4294	4294
# contracts	1668	1668	1668	1668
# borrowers	200	200	200	200
# lenders	54	54	54	54

The table presents estimates of equation (1). The sample includes all auctions held between 2014 and 2015 with a minimum of two participants. The dependent variable is either the interest rate offer (columns 1 and 2) or the winner indicator (columns 3 and 4). “High CB funding” equals to one for banks with a share of central bank funding in money market liabilities above the average, and zero otherwise. “Post” takes a value of one for auctions held after the collateral framework adjustment on February 26, 2015, and zero otherwise. “Eligible” equals one for borrowers whose liabilities are considered pledgeable according to the BoR collateral framework adjustment, and zero otherwise. See Table A.1 for further variable definitions.

Standard errors (in parentheses) are clustered by borrower and lender. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

<sup>†</sup> “*c*” refers to contract, “*l*” denotes the lender.

to participate in the auction. We observe that state-owned banks offer higher rates when competing for eligible contracts after the collateral framework adjustment. On the contrary, larger banks and those with potential informal links to politicians tend to offer lower rates in auctions involving eligible debt after adjustments to the collateral framework. Similarly,

early applicants tend to offer lower rates for eligible contracts. Notwithstanding these additional sources of bank heterogeneity, our main findings persist as both economically and statistically significant: banks with a higher rate of collateral utilization or greater reliance on central bank funding act more competitively, offering lower interest rates in auctions for eligible debt after the pledgeability has been enhanced.

## 4 Conclusions

This study provides evidence on how a central bank's collateral policy influences the pricing of assets deemed pledgeable. Our analysis reveals that the ability to use assets as collateral in monetary policy operations can have a significant impact on bank lending behavior. This conclusion is drawn from an examination of a policy shift by the Central Bank of Russia, which cut collateral haircuts and allowed debts from certain local administrations to be used as collateral for refinancing, independently of their credit ratings. We demonstrate that, due to the collateralizability, these administrations obtained a discount on the interest rates on their credit contracts. Additionally, we find that the most competitive loan terms for these eligible borrowers typically came from banks that either had a scarcity of marketable collateral or a significant reliance on funding from the central bank.

The findings underscore the unintended consequences of monetary policy implementation that should be taken into account when designing central bank's operational framework. They also highlight the potential for collateral policy to be a tool rather than a source of the unintended distortions of policy implementation.

Future research could examine the impact of similar policies in other jurisdictions or consider the long-term consequences of collateral eligibility changes on broader economic outcomes. Additionally, the heterogeneous effects documented in this study also highlight the need to delve deeper into the risk profiles that banks adopt in response to such policy changes. A critical examination of the drivers that affect banks' incentives to generate and pledge loans with varying degrees of credit quality is central to understanding of the implications of central bank operations.

# Appendix

## A Definitions and additional results

### A.1 Variables description

Notation	Description	Source
<i>Contract attributes</i>		
Post	An indicator variable equal to one for auctions with the scheduled bidding date after February 26, 2015	
Eligible	An indicator variable is set to one for borrowers whose credit liabilities can be pledged at the Bank of Russia.	BoR, PS
Interest rate (offer)	The interest rate offered by a lender, %	PS
Interest rate (offer) premium	The interest rate offered by a lender net of the contemporaneous yield on federal bonds of similar maturity, %	PS
Loan maturity	Loan maturity required by the borrower, years	PS
Loan size	Loan volume required by the borrower, mln. RUB	PS
<i>Borrower attributes</i>		
Budget dependence	The ratio of total subsidies, subventions, and transfers received from other budgets to the borrower's own budget revenue, %	SSR
Budget surplus	The ratio of the borrower's net budget revenue (budget revenue minus expenditures) to total budget revenue, %	SSR
Region	An indicator variable equal to one if the borrower is a regional administration, and zero if it is a municipality	PS
<i>Bank attributes</i>		
Collateral use	The share of the bank's securities holdings encumbered under repurchase agreements relative to its total securities holdings	BoR
CB funding	The ratio of the bank's liabilities to the Central Bank of Russia relative to its total interbank borrowing	BoR
High-income MP bank	An indicator variable set to one for banks where the average income of parliamentary election candidates who held deposits with these banks, in relation to the banks' total assets, is above the sample average	CEC
State-owned bank	An indicator variable assigned a value of one for banks where the Russian Federation or its public administrations own 50% or more of the common equity	BoR
Bank size	The logarithm of bank's total assets	BoR
<i>Macroeconomic variables</i>		
Mosprime rate	The interbank money market rate on unsecured lending between banks of high credit quality, %	BoR
CDS Russia	CDS premium on the Russian public debt issued by, %	BLMB

The sources: Bank of Russia (BoR), Procurement System (PS), Statistical Service of Russia (SSR), Central Election Committee (CEC), Bloomberg (BLMB).

## A.2 Additional results

**Table 9:** The effect of collateral adjustment on second-lowest interest rate offers

	(1)	(2)	(3)	(4)
Post × Eligible	-1.13*** (0.39)	-0.93*** (0.27)	-0.66*** (0.16)	-1.24*** (0.30)
Post	3.76*** (0.29)	-1.38*** (0.31)		
Post × Eligible × Region				-1.46** (0.66)
Post × Eligible × Budget surplus				-0.37*** (0.060)
Post × Eligible × Region × Budget surplus				-0.29** (0.12)
Post × Eligible × Budget dependence				0.023* (0.014)
Post × Eligible × Loan maturity (1y, 2y]				0.15 (0.40)
Post × Eligible × Loan maturity > 2y				0.52 (0.44)
Post × Eligible × Credit line				0.20 (0.36)
Fixed effects	<i>b</i>	<i>b</i>	<i>b, t</i>	<i>b, t</i>
Macroeconomic variables	No	Yes	Yes	Yes
Contract attributes	No	Yes	Yes	Yes
Post × Borrower attributes	No	No	No	Yes
Post × Contract attributes	No	No	No	Yes
Eligible × Contract attributes	No	No	No	Yes
$R^2$	0.60	0.84	0.91	0.91
# observations	1673	1673	1673	1673
# borrowers	201	201	201	201

The table presents estimates of equation (1). The sample includes all auctions held between 2014 and 2015 with a minimum of two participants. The dependent variable is the second-lowest interest rate offer. “Post” takes a value of one for auctions held after the collateral framework adjustment on February 26, 2015, and zero otherwise. “Eligible” equals one for borrowers whose liabilities are considered pledgeable according to the BoR collateral framework adjustment, and zero otherwise. See Table A.1 for further variable definitions. Standard errors (in parentheses) are clustered by borrower.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

† “*b*” refers to borrower, “*t*” denotes the month of bidding.

**Table 10:** The effect of collateral adjustment on second-lowest offered interest rate premiums

	(1)	(2)	(3)	(4)
Post × Eligible	−0.59** (0.27)	−0.54** (0.25)	−0.41** (0.16)	−1.51*** (0.28)
Post	1.52*** (0.22)	−1.85*** (0.29)		
Post × Eligible × Region				−1.31* (0.67)
Post × Eligible × Budget surplus				−0.36*** (0.060)
Post × Eligible × Region × Budget surplus				−0.38*** (0.12)
Post × Eligible × Budget dependence				0.030** (0.015)
Post × Eligible × Loan maturity (1y, 2y]				0.10 (0.37)
Post × Eligible × Loan maturity > 2y				0.61 (0.46)
Post × Eligible × Credit line				−0.017 (0.36)
Fixed effects	<i>b</i>	<i>b</i>	<i>b, t</i>	<i>b, t</i>
Macroeconomic variables	No	Yes	Yes	Yes
Contract attributes	No	Yes	Yes	Yes
Post × Borrower attributes	No	No	No	Yes
Post × Contract attributes	No	No	No	Yes
Eligible × Contract attributes	No	No	No	Yes
$R^2$	0.47	0.70	0.82	0.82
# observations	1673	1673	1673	1673
# borrowers	201	201	201	201

The table presents estimates of equation (1). The sample includes all auctions held between 2014 and 2015 with a minimum of two participants. The dependent variable is the second-lowest interest rate offer premium. “Post” takes a value of one for auctions held after the collateral framework adjustment on February 26, 2015, and zero otherwise. “Eligible” equals one for borrowers whose liabilities are considered pledgeable according to the BoR collateral framework adjustment, and zero otherwise. See Table A.1 for further variable definitions. Standard errors (in parentheses) are clustered by borrower.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

† “*b*” refers to borrower, “*t*” denotes the month of bidding.

**Table 11:** The effect of collateral adjustment on auction participation

	(1)	(2)	(3)	(4)
Post × Eligible	0.088 (0.089)	0.12 (0.072)	0.12* (0.064)	0.23** (0.11)
Post	0.35*** (0.032)	0.47*** (0.034)		
Post × Eligible × Region				−0.51** (0.20)
Post × Eligible × Budget surplus				−0.021 (0.017)
Post × Eligible × Region × Budget surplus				0.010 (0.024)
Post × Eligible × Budget dependence				−0.010* (0.0055)
Post × Eligible × Loan maturity (1y, 2y]				0.25* (0.15)
Post × Eligible × Loan maturity > 2y				0.23* (0.13)
Post × Eligible × Credit line				0.11 (0.12)
Fixed effects	<i>b</i>	<i>b</i>	<i>b, t</i>	<i>b, t</i>
Macroeconomic variables	No	Yes	Yes	Yes
Contract attributes	No	Yes	Yes	Yes
Post × Borrower attributes	No	No	No	Yes
Post × Contract attributes	No	No	No	Yes
Eligible × Contract attributes	No	No	No	Yes
$R^2$	0.43	0.47	0.51	0.53
# observations	3921	3921	3921	3921
# borrowers	403	403	403	403

The table presents estimates of equation (1). The sample includes all auctions held between 2014 and 2015 with a minimum of two participants. The dependent variable is the indicator equal to one for auctions with multiple participants, and to zero for single-participant auctions. “Post” takes a value of one for auctions held after the collateral framework adjustment on February 26, 2015, and zero otherwise. “Eligible” equals one for borrowers whose liabilities are considered pledgeable according to the BoR collateral framework adjustment, and zero otherwise. See Table A.1 for further variable definitions. Standard errors (in parentheses) are clustered by borrower.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

† “*b*” refers to borrower, “*t*” denotes the month of bidding.

## **B Institutional Details**

### **B.1 The list of public administrations whose liabilities constitute eligible collateral as of February 26, 2015**

City of Moscow

Moscow region

Saint-Petersburg

Khanty-Mansi Autonomous Okrug–Yugra

Tatarstan Republic

Kazan

Mordovia

Bashkortostan

Tumenskaya oblast

Samarskaya oblast

Samara

Kemerovskaya oblast

Izhevsk

Republic of Komi

Murmanskaya oblast

Sverdlovskaya oblast

Yamalo-Nenetsky Autonomous Okrug

Kransondarsky Krai

Republic of Saha (Yakutia)

Lipeckaya oblast

Republic of Karelia

Irkutskaya oblast

Nizhegorodskaya oblast

Krasnoyarsky Krai

Vologodskaya oblast

Kaluzhskaya oblast

Magadanskaya oblast

Nizhny Novgorod

Novosibirsk

Novosibirskaya oblast

Tomskaya oblast  
Tomsk  
Tverskaya oblast  
Kirovskaya oblast  
Leningradskaya oblast  
Surgut  
Voronezhskaya oblast  
Omskaya oblast  
Orenburgskaya oblast  
Astrahanskaya oblast  
Omsk  
Republic of Chuvashiya  
Tambovskaya oblast  
Ufa  
Belgorodskaya oblast  
Altaisky Krai  
Udmurtiya Republic  
Yaroslavskaia oblast  
Ulyanovskaya oblast  
Tul'skaya oblast  
Dzerzhinsk  
Kostromskaya oblast  
Republic of Mariy-El  
Volzhsky  
Volgograd  
Volgogradskaya oblast  
Stavropolsky Krai  
Penzenskaya oblast  
Republic of Hakasia  
Ryazanskaya oblast  
Krasnoyarsk



## B.2 Details on the credit auction process

Under Russian public procurement legislation, the distribution of bank credit to local governments is organized via a formal auction process. Credit auctions are typically conducted in an open English format, where competing bids are placed based on the interest rate. The auction proceeds in three steps:

1. **Auction Announcement:** The details of the loan, such as the required credit volume, maturity, repayment schedule, and the upper limit for the interest rate (the reservation rate), are disclosed. The reservation rate is set by the borrower, guided by benchmarks from recent auctions or prevailing market rates. While statutory guidelines exist for setting this rate, the borrower exercises final discretion.
2. **Application Collection:** Interested banks submit their applications to the auction organizer, who validates the documentation. If the bank meets all criteria, its participation is confirmed. The application phase concludes on a pre-announced date, and the organizer publicly shares the number of qualified applicants without revealing their identities.
3. **Bidding and Contract Award:** The auction proceeds on the scheduled date, provided there are at least two qualified bidders. Banks then sequentially propose interest rates in descending order, with the opportunity for multiple revisions. The bidding is transparent, with all offers disclosed to the participants. The auction culminates when no bank is willing to undercut the lowest bid within a set time period. The organizer then validates the final bids and announces the winning bank along with the other bidders.

This process is recorded in the auction protocols, which, distributed through an electronic procurement system, include the final bids of all participants, tax identifiers, and additional details. The procedure may halt before reaching step 3. Thus, if no banks apply, the borrower might adjust the loan terms and reattempt to attract bidders. The process can also stop at step 2, either because only one bank qualifies or because it is the sole applicant; in such cases, the loan is granted at the reservation rate. For the purposes of this paper, we focus primarily on auctions with two or more bidders.

The three outcomes discussed above account for over 96% of auction instances in 2014–2015. Other less frequent outcomes can occur, such as no applicants passing documentation checks, or multiple bidders failing to submit valid offers. These scenarios result in no contract allocation, auction cancellation, or contract repudiation by the winner.

## **B.3 Data Construction**

The data utilized in this study comes from three primary sources: the Russian Procurement Information System, bank balance sheet records and macroeconomic statistics provided by the Central Bank of Russia (BoR), and the municipal and regional data maintained by the Russian Federation State Statistics Service.

### **B.3.1 The Russian Procurement Information System Data Files**

The procurement data is accessible via FTP (<ftp://zakupki.gov.ru/>) and is arranged into a collection of XML files. These files collectively exceed 72 GB of compressed data, spanning the years 2014 to 2015.

For auction data preparation, we extract auction characteristics from auction notification tables, filtering contracts with descriptors containing the Russian terms for “credit” or “loan,” or marked with the “Financial intermediation industry” industry classification (7675 files in total). Having verified manually the filtered notifications and excluded erroneously classified credit auctions, we remove any auction announcements that were subsequently cancelled. In cases when announcements were modified, the latest valid version is considered. The “Customer Registration Number” is used as the borrower identifier rather than the “Buyer Registration Number” to account for instances where auctions may be managed by customer representatives. After refining and removing any redundant entries, the dataset is narrowed down to 7218 contracts.

To compile data on auction outcomes, XML protocols are filtered by their corresponding purchase numbers from the auction notifications. Each auction stage, as described in Section [B.2](#), is documented in a protocol, which contains the structured details of the outcomes. In cleaning the protocols, we follow the same approach as with auction notifications: we eliminate duplicates, drop cancelled protocols, and keep only the final versions of modified protocols. Protocols for Stages 2 and 3 are matched by purchase numbers and “journal numbers,” the latter of which identifies the individual bidders. The auction outcomes are classified into categories: “No bidders,” “One bidder,” “Multiple bidders,” and “Other/Unmatched.”

In order to expand the sample to include auctions from the beginning of 2014 and account for outcomes not reported under the machine-readable standard, we conduct web scraping of the protocols from the auction organizers’ websites. It is not feasible to extend the sample further into the past due to two reasons: (1) no index of auctions in machine-readable format was distributed by the procurement system, and (2) hosting platforms were not required to

store detailed auction results.

As the last step of auction data preparation, we collect loan contract details. Auction-related documentation—stored in MS Word, Excel, or PDF formats—is not standardized for machine parsing; therefore, attributes like reservation rates, loan volumes, and maturities are gathered manually. When reservation rates are not explicitly stated, they are inferred using the simple interest rate formula, combining data on credit volume, maturity, and total interest payments. For accuracy, the extracted data is cross-referenced with a subset of auctions collected by a third-party (<http://trp.tomsk.ru>).

### **B.3.2 The Bank Balance Sheet Files**

The BoR disseminates detailed monthly bank balance sheets and profit and loss statements for each bank (<http://cbr.ru/credit/forms.asp>) The bank balance sheet variables are calculated using a methodology parallel to that employed by the BoR, with modifications that align with common Russian banking analytical practices.<sup>23</sup> Subsequent sections outline the bank-level aggregates used as lender characteristics in Table A.1, with parenthetical notations corresponding to account numbers as defined by the Russian Bank Accounting Standards (details provided in the Appendix to the BoR Order 385-P).

CB funding:

- Bank liabilities to the BoR: sum of
  - short-term liabilities (31201, 31202, 31203, 31210, 31213, 31214, 31215, 31216),
  - mid-term liabilities (31204, 31205, 31217, 31218),
  - long-term liabilities (31206, 31207, 31212, 31219, 31220, 31221, 31222),
  - overdue debts (31701, 31704, 31801, 31804),
  - other funding from BoR (32901).
- Bank total borrowing in the interbank market: sum of
  - bank liabilities to the BoR (as above),
  - all liabilities to the resident and non-resident banks (accounts starting with 313 or 314, 20313, 20314, 32901).

Collateral use:

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<sup>23</sup>See for example <http://kuap.ru/methodics/>

- Bank securities encumbered under repo agreements: sum of
  - encumbered bonds (50113, 50115, 50118, 50218, 50318),
  - encumbered stocks (50611, 50613, 50618, 50718),
- Bank total security holdings:
  - holdings of bonds and stocks (sum of accounts starting with 50), notes (51) and mutual funds (60106, 60118),
  - net of provisions and re-evaluations (50114, 50213, 50219, 50312, 50319, 50507, 51210, 51310, 51410, 51510, 51610, 51710, 51810, 51910, 50719, 50809, 50120, 50220, 50620, 50720).

Bank size: bank total assets calculated as the sum of all Section A accounts net of provisions and re-evaluations.

## **B.4 The Russian Federation State Statistics Service**

The construction of borrower characteristics relies on two distinct datasets from the municipal and regional databases of the Russian Federation State Statistics Service. The regional data is accessible through a collection of publications titled “Socio-Economic Conditions of the Regions,” available on the service’s website ([http://www.gks.ru/free\\_doc/new\\_site/region\\_stat/sep\\_region.html](http://www.gks.ru/free_doc/new_site/region_stat/sep_region.html)) This data is merged with the auction dataset by matching the region names.

At the municipal level, data is sourced from the Database of Municipality Characteristics ([http://www.gks.ru/free\\_doc/new\\_site/bd\\_munst/munst.htm](http://www.gks.ru/free_doc/new_site/bd_munst/munst.htm)). The database does not feature all budgetary characteristics for every municipality that can be potentially active in the credit market. In particular, for a number of small borrowers, the required details are only available in an aggregated format wherein several municipalities are combined into broader districts. The proportion of incomplete data is relatively minimal. For these instances, values are imputed using the mean characteristics of their larger district conglomerates. The final step involves integrating the statistics service data with the auction dataset by the municipal identifier (denoted as “OKTMO” in Russian).

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