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# COVID-19, CORPORATE NON-PERFORMING LOANS, AND CORPORATE LENDING DYNAMICS: EVIDENCE FROM RUSSIAN REGIONS

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# COVID-19, Corporate Non-performing Loans, and Corporate Lending Dynamics: Evidence from Russian Regions[2]

The COVID-19 pandemic had an extremely negative impact on the corporate sector across many economies. This study examines the relationship between the spread of the COVID-19 virus and the quality of corporate loan portfolios and the volume of corporate loans in Russian regions. Using cross-regional variation in the number of COVID-19 cases in Russia from April 2020 to February 2022, we document lower corporate loan portfolio quality among banks operating in regions with higher COVID-19 rates, as well as an inverse relationship between corporate non-performing loans and the volume of corporate loans issued by Russian banks. We conclude that Russian banks adjusted their credit policy, observing a decrease in the quality of corporate loan portfolios. We also quantitatively analyze specific business support measures introduced in Russian regions during the COVID-19 crisis.

Keywords: COVID-19, Policy interventions, Company loans, Banks, Russia, Regions

JEL Classification: Z

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# 1 Introduction

The COVID-19 pandemic had an unprecedented impact on the economic activity of many countries. The implementation of lockdowns, coupled with a significant drop in aggregate demand and other adverse effects of COVID-19, resulted in many sectors of the economy experiencing a decline. This had an impact on the financial sector's vulnerability.

During the pandemic, the state of the banking sector can be assessed through key indicators such as non-performing loans (NPL) and loan portfolio dynamics (Norden, Mesquita and Wang, 2021). These indicators feature prominently in the literature on the COVID-19 pandemic effects and consequences (Benavides-Franco *et al.*, 2023).

The analysis of economic and financial stability in the corporate sector provides a significant and broad area for research. This is applicable from the perspectives of the banking sector and the effectiveness of support measures implemented by the government. The credit quality of corporate borrowers and changes in the volume of corporate loans granted by banks during the COVID-19 pandemic can provide information about the behavior of companies and banks in the crisis triggered by the pandemic. This could help to draw out important lessons useful for possible economic scenarios in the future. A comprehensive review of government support measures for the business sector can reveal their effectiveness and can be applied in future crises.

Russia offers a unique opportunity to conduct research in certain areas, for a number of reasons. Firstly, its vast territory and numerous regions mean that COVID-19 transmission statistics vary considerably, providing researchers with a large sample of data.

Secondly, Russian companies suffered economic setbacks no less than companies in other countries, as a number of negative consequences of the COVID-19 pandemic were experienced, including rising prices, reduced demand, postponed deliveries, and disruptions in the supply chain. In order to meet escalating costs, it was common for companies to borrow from banks. However, some companies were unable to withstand the adverse conditions and went bankrupt.[3] On the contrary, some industries made strategic adjustments to the new conditions and as a result required additional financing through bank loans. The diverse reactions of Russian companies to the effects of the pandemic play a significant role in motivating this research.

Thirdly, the availability of data on Russian banks and their indicators makes it possible to track the volume of corporate loans issued and the dynamics of NPL in the corporate sector. According to the Central Bank of Russia,[4] the corporate loan portfolio of Russian banks grew significantly: in 2020 and 2021, the volume of corporate loans grew by 5.7 billion rubles and 7.2

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[3] The Central Bank of Russia. (2021). Analytical Review of The Lending Market for Small and Medium-Sized Enterprises. URL: https://www.cbr.ru/collection/collection/file/39663/inf_material_msp_fh_2021.pdf (In Russian)
[4] The Central Bank of Russia. (2022). Banking sector — 2021: lending. URL: https://www.banki.ru/news/research/?id=10962645 (In Russian)

trillion rubles, respectively, indicating an increase in lending. This might suggest that Russian businesses were facing a shortage of their own funds. On the positive side, this could also indicate an increase in the business activity of Russian companies even in times of crisis. Meanwhile, the Central Bank of Russia[5] reported a decline in the overall volume of corporate NPL in 2020–2021. There are two main factors contributing to this: firstly, there was a reduction in the number of borrowers, especially those who faced difficulties and subsequently filed for bankruptcy; secondly, the efforts of the government to support businesses during the COVID-19 pandemic had a positive impact. Figure 1 illustrates the dynamics of corporate NPL and the volume of corporate loans issued by Russian banks for the corporate sector.
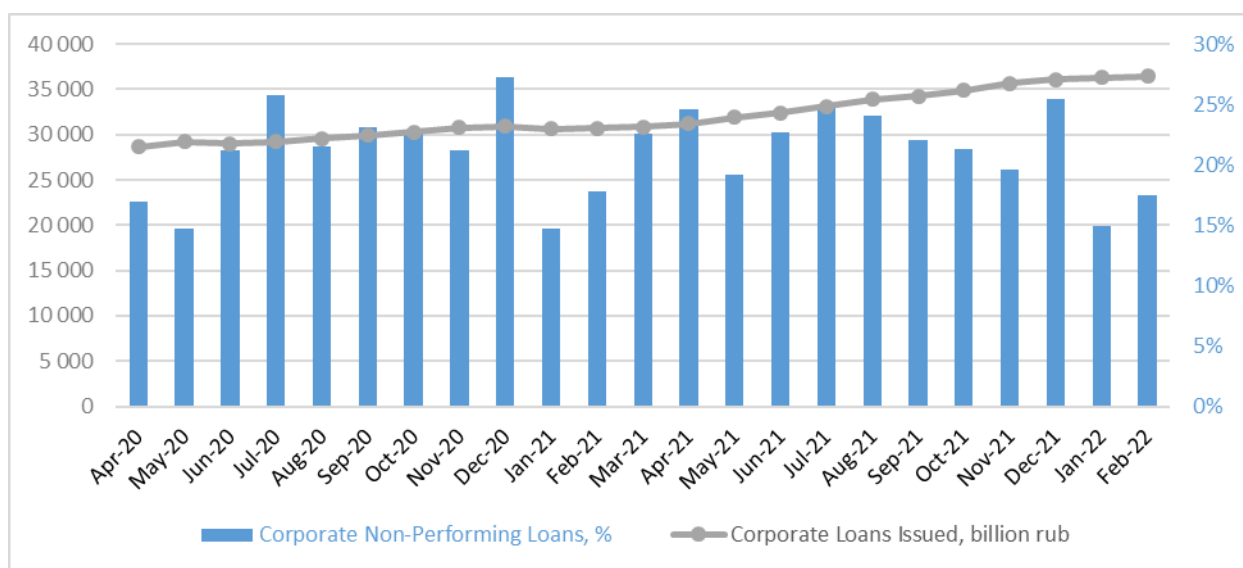


**Figure 1.** The share of corporate NPL and corporate loans issued by Russian banks, April 2020–February 2022

Finally, federal and regional authorities contributed to supporting the business sector by introducing various support measures, for example, tax concessions, temporary suspension of business inspections, the postponement of permit renewals, grants for small and medium-sized enterprises (SME), support for individual entrepreneurs, the state provision of loans for salaries, preferential loans, support for tenants, and others.[6] The wide range of measures that were introduced provides the basis for a more comprehensive analysis of how the COVID-19 pandemic affected the quality of the corporate loan portfolio and the volume of corporate loans issued by Russian banks.

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[5] The Central Bank of Russia. (2020). Banking sector — 2020: lending. URL: https://www.banki.ru/news/research/?id=10943188 (In Russian)
[6] Official information about coronavirus in Russia// The official website of the State Duma the Federal Assembly of the Russian Federation: http://duma.gov.ru/news/48315/ (In Russian)

This paper explores whether Russian banks tended to adapt their credit policy under pandemic pressure, facing current or expecting changes in the behavior of corporate borrowers. Therefore this study focuses on the level of non-performing corporate loans and the level of loans issued by Russian banks to the corporate sector. How the implementation of business support measures affected the volume of corporate loans was then analyzed. These steps are carried out using monthly bank-level data for Russian regions for the period from April 2020 to February 2022, taking into account the financial characteristics of banks, differences between regions, and data on the measures introduced to support the corporate sector.

The findings suggest a negative correlation between the increase in COVID-19 cases in Russian regions and the corporate sector's loan portfolio quality.

Our findings also support the suggestion that the pandemic prompted companies to borrow from banks. This reliance could mean that firms faced problems during the pandemic, in particular, firms needed funds to compensate workers, manage more expensive delivery services due to international and regional border closures, and cover additional expenses such as the overall increase in costs. This dependence might have positive reasons, including business expansion and technological development. These were particularly evident during the pandemic in companies such as caterers, who offered delivery services, marketplaces, and those in the IT and online-education sectors. In such cases, the ability of banks to issue loans supported economic activity for companies and regions overall.

There was an inverse relationship between the quality of corporate loans portfolio and the volume of corporate loans issued by Russian banks. This indicates that Russian banks adjusted their credit policy during the crisis. (Kapan *et al.*, 2021) found that during the COVID-19 pandemic, companies started utilizing approved *ex ante* credit lines (i.e. credit lines approved before the pandemic), resulting in a reduction of liquidity provided by banks under the loans terms. (Burova, Kozlovtceva and Sinyakov, 2022) reached a similar conclusion based on data from Russian banks. However, the study of this type of corporate funding is beyond the scope of this research.

The inverse relationship between the variable responsible for the interaction term of new COVID-19 cases in Russian regions and the quality of corporate loan portfolios and the amount of corporate loans issued by Russian banks is another indication that Russian banks adjusted their credit policy towards the corporate sector. According to the Central Bank of Russia,[7] lending to the corporate sector continued to rise during the pandemic, while we find an inverse correlation

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[7] The Central Bank of Russia. (2022). Banking sector — 2021: lending. URL: https://www.banki.ru/news/research/?id=10962645 (In Russian)

between the quality of corporate loan portfolios and the volume of corporate loans, which suggests that banks adopted a more rational approach to lending and assessed borrowers more thoroughly.

With the aim of compensating for the shocks caused by the restrictions imposed by the COVID-19 pandemic, several governments implemented comprehensive support measures for firms, especially in industries severely affected by the pandemic, such as banking and trade (Bessonova *et al.*, 2022). The next part of our analysis is therefore devoted to assessing the impact of the support measures provided by Russian authorities. For the analysis, we considered typical measures implemented in Russian regions. These include a deferral on lease payments; the issuance of grants, subsidies, and direct financial assistance for SMEs; reduced rates under the simplified taxation system (STS) for legal entities and individual entrepreneurs; and an exemption or a significant reduction of the amount of property, transport, and land taxes.

Our analysis revealed that these measures had varying effects. In particular, a positive correlation with the amount of corporate credit issued by Russian banks is found for the deferral of rent payments and the provision of grants, subsidies, and direct financial assistance for SMEs. These provide firms with a temporary respite from payments. This can strengthen their financial stability and increase banks' confidence in them. Banks may perceive these companies as less risky borrowers and may consequently grant them larger loans. However, the result could be viewed less positively if we consider that companies are compelled to request loans due to insufficient funds, even with the introduction of state support measures. A similar conclusion regarding the ineffectiveness of state support measures is drawn by (Burova, Kozlovtceva and Sinyakov, 2022). Such a result can be an incentive for the improvement of state support programs for enterprises in the future.

The reduced rate under STS for legal entities and individual entrepreneurs and exemptions for or a significant reduction of property, transport, and land taxes can be regarded as more efficient support measures. Our results show that these support measures are inversely correlated with the volume of corporate loans issued by Russian banks, which reduces the need for additional funding for Russian companies.

The paper contributes to the literature on the economics of the COVID-19 pandemic. We aim not only to improve the understanding of the correlation between fluctuating corporate NPL and corporate loans issued by Russian banks, taking into account the impact of the pandemic, but also to examine the impact of the support measures for businesses implemented by Russian authorities.

The rest of the paper is structured in the following way. Section 2 includes the analysis of the literature and the hypotheses. Section 3 describes the methodology, the econometric models, and the variables and data used. Section 4 interprets the empirical results and the results of testing the

effectiveness of the support measures implemented by Russian authorities to assist companies during the COVID-19 pandemic. The policy implications of the research is discussed in the conclusion.

## 2 Literature Review and Hypothesis Development

The shock which occurred from the end of 2019 due to the COVID-19 pandemic and lasted until 2022 had an unprecedented effect on global economy, especially in the financial sector as banks which tried to help firms to survive during the period noted. As expected, during the crisis period business clientele increased their liquidity demands that led to the necessity of loans from banks (Acharya and Steffen, 2020; Beck and Keil, 2021). The reasons for this, most relevant to the COVID-19 pandemic, are the disruption of the supply chains, the slowdown in production, the increase in unemployment rate, and the precautionary saving behavior of consumers (Demirguc-Kunt, Pedraza and Ruiz-Ortega, 2020). (Li, Strahan and Zhang, 2020) highlight the 50-fold growth in firms' borrowing during three weeks of March 2020 in the US. (De Vito and Gómez, 2020) predict that about 1,500 firms across 26 countries could spend all their cash within six months which again led to the need to borrow from banks. (Greenwald, Krainer and Paul, 2020) show that the increase in firm borrowing occurred in existing credit lines rather than in new credit facilities. All these factors caused credit risk and default rates to increase in the banking system (Sinkala *et al.*, 2022).

In terms of borrowing, we should consider that not only the demand side, i.e. firms, but also the side of supply, i.e. banks, might affect the dynamics of borrowing. If banks experience an increase in liquidity, this does not definitely lead to a stimulation of the real economy and an increase in loans issued, on the contrary, it might lead to a situation when banks hoard cash, as, for example, during the 2008 crisis in the US banking system (Cornett *et al.*, 2010). Since the reactions of banks are often ambiguous, it is important to analyze how banks adopted their credit politics in response to the COVID-19 outbreak.

In response to the onset of the COVID-19 health crisis, banks reduced new lending. This type of adjustment to credit supply was found by (Greenwald, Krainer and Paul, 2020) and (Bodellini and Lintner, 2020). (Beck and Keil, 2021) explain this through loan portfolio's problems after the pandemic begun, which are expressed in the increase in NPL. (Marcu, 2021) confirms the growing vulnerability of banks due to the higher level of NPL.

Some authors note the increase in credit supply provided by banks after the spread COVID-19 (Ozlem, Neef and Schandlbauer, 2021). They explain such evidence in terms of "zombie lending". (Beck and Keil, 2021) state this was possible due to the Paycheck Protection Program (PPP) as government support in the US which was also in line with (Chodorow-Reich *et al.*, 2021). Although it seems to be more likely that banks with better financial performance are able to accommodate the liquidity demand as (Cornett *et al.*, 2010) conclude after the 2008 crisis, the COVID-19 pandemic might be considered as an exception to these findings. (Li, Strahan and

Zhang, 2020) explain this phenomenon based on the sufficient amount of capital from deposits that are used to finance loans.

Returning to the more expected adjustments of banking credit supply, (Tölö and Virén, 2021) describe numerous studies about the effects of NPL on lending dynamics. As a consequence, it is interesting to analyze whether banks changed their credit policy depending on NPL and its dynamics during the COVID-19 pandemic.

(Ari, Chen and Ratnovski, 2021) conduct a comprehensive analysis of NPL, especially during banking crises in 82 countries begun in 1990, that allows them to identify three groups of the main predictors determining NPL such as macroeconomic, banking, and corporate predictors. The authors capture GDP growth, unemployment, inflation, public debt, the exchange rate, and interest rates as macroeconomic NPL predictors (Kılıç Depren and Kartal, 2021; Petkovski, Kjosevski and Jovanovski, 2021; Bukowski and Kosztowniak, 2022; Foglia, 2022). Among banking determinants of NPL, the authors explore bank profitability (i.e., bank return on assets and equity), cost efficiency (i.e., net interest margin), ownership concentration, and diversification (Khan, Siddique and Sarwar, 2020; Olarewaju, 2020; Petkovski, Kjosevski and Jovanovski, 2021; Naili and Lahrichi, 2022). The last group of predictors pertaining to corporate conditions is investigated through corporate leverage, service capacity, the maturity profile of debt, and international competitiveness. The effect of NPL determinants might be ambiguous due to the different goals of the authors, the data collected, and the specifications used. More details are presented in the next section.

Having investigated the influence of NPL on lending dynamics in European Economic Area banks from 2014 to 2019, (Tölö and Virén, 2021) also acknowledge how NPL affect measures of bank performance such as profitability, capital adequacy, and funding costs. This approach was conceptualized by (Aiyar *et al.*, 2015) and again proves the importance of NPL not only in bank loan portfolio performance, but also in decision-making by banks.

Despite the fact that higher liquidity demand from firms and the credit supply adjustments provided by banks are observed in a great number of studies, these findings depend on the data or the set of countries. This allows us to be the first authors to study the case of Russian regions.

*Hypothesis 1: Higher COVID-19 exposure in a region is accompanied by an increase in the share of corporate NPL.*

Building on previous studies, our research examines the impact of the COVID-19 pandemic on the dynamics of corporate loans issued by Russian banks, taking into account NPL (Dursun-de Neef and Schandlbauer, 2021). This correlation sheds light on the complicated changes

made by Russian banks in their loan provisions, reflecting the impact of the pandemic and the corporate NPL.

*Hypothesis 2: The increase in new COVID-19 cases significantly increases bank lending to businesses in regions with relatively low volumes of corporate NPL.*

Another aspect that is most often mentioned in the literature on the relationship between the COVID-19 pandemic and the banking sector is government or policy support measures. Indeed, measures taken at the state or more local level might affect both the behavior of corporate borrowers and adjustments made by the banking side, so we also analyze this aspect in the current study.

(Marcu, 2021) compares the 2008–2009 economic crisis with the crisis induced by the COVID-19 outbreak and concludes that despite the fact that the banking system was capitalized enough compared to 2008–2009, in 2020, the measures of public authorities and central banks should have been (and were) more versatile compared to the previous crisis. (Li, Strahan and Zhang, 2020) highlight that the faster start of regulatory support compared to the crisis of 2008, especially the Federal Reserve's liquidity supply, was one of the reasons why banks were able to meet the cash demand. This finding is in line with the results by (Beck and Keil, 2021) who also called the government-backed loan programs a subsidy for business. As stated earlier, some policy measures, for instance, PPP, even allow banks to increase the credit supply (Beck and Keil, 2021; Chodorow-Reich *et al.*, 2021).

(Demirguc-Kunt, Pedraza and Ruiz-Ortega, 2020) describe in detail the policy decisions already in 2020 in the banking sector to lower the negative impact of the pandemic. In general, the authors identify four categories: measures to protect individuals, companies, banks, and national health systems. (Leuven, 2022) and (Degryse and Huylebroek, 2023) highlight the most popular government business support programs implemented in different countries such as the postponement of loan payments, tax deferrals, interest-free loans, and the temporary relaxation of certain loan restructuring programs. The impact of a diverse array of support measures is again ambiguous because depends not only on certain aspects of policy interventions, but also on the pre-pandemic conditions in different countries (Feyen *et al.*, 2021). The following hypothesis accounts for the effect of government support measures implemented in Russia:

*Hypothesis 3: Support measures implemented in Russian regions are positively associated with the future credit growth for the banks even with higher rates of COVID-19 infections.*

## 3 Empirical Strategy

To shed light on the specific contribution of the corporate NPL to the dynamics of corporate lending during the COVID-19 pandemic, we use a two-step approach.

At the first step we examine loan portfolio quality during the pandemic. We investigate the determinants of the NPL ratio (hypothesis 1) using a generalized method of moments (GMM) estimator for dynamic panel data (Arellano and Bover, 1995). This estimator takes into consideration the unobserved heterogeneity and persistence of the dependent variable over time, and the serial correlation if it exists, ensuring consistent estimations (Arellano, 2002). The inclusion of the lagged variables, both dependent and explanatory, deals with the potential endogeneity problem and mitigates the potential problems of reverse causality and simultaneity (Tölö and Virén, 2021). To account for time fixed effects, monthly dummy variables are included, while dummies on banks are introduced to control for the heterogeneity of banks in Russian regions.

The baseline dynamic regression model using panel GMM techniques is:

$$NPL\ Ratio_{b,r,t} = \delta_0 + \delta_1 \cdot NPL\ Ratio_{b,r,t-1} + \delta_2 \cdot New\ COVID\ Cases_{r,t-1} + \delta_3 \cdot Banks_{b,r,t} + \delta_4 \cdot Regions_{r,t} + +\alpha_i + \gamma_t + \varepsilon_{b,r,t},$$

(1)

where: $b$ indexes the Russian banks, $r$ — the Russian regions, $t$ — month; $\alpha_i$ are individual fixed effects (on the bank-level), and $\gamma_t$ are time fixed effects.

The dependent variable $NPL\ Ratio_{b,r,t}$ is measured as the size of corporate NPL to the total gross loans in bank $b$ registered in region $r$ during month $t$. By NPL we understand loans with overdue payments (interest and/or principal amount) which exceed 90 days (International Monetary Fund, 2002). The division by total gross loans allows us to normalize banks in the sample (Acharya *et al.*, 2020; Naili and Lahrichi, 2022).

$New\ COVID\ Cases_{r,t-1}$ represents the number of new confirmed COVID-19 cases in thousands of people in region $r$ in month *(t-1)*. This measure is directly observed in most of the public information sources.[8] Following (Norden, Mesquita and Wang, 2021), the lagged value of the main independent variable reflects on the fact that the business responds with a delay to an increase in the incidence rate. Both the sign and the significance of the spread of COVID-19 are key to investigate whether the COVID-19 outbreak affect corporate NPL. We expect to find a positive relationship between new cases of COVID-19 in Russian regions and the corporate NPL ratio ($\delta_1 > 0$). The data on the spread of COVID-19 in Russian regions is extracted from Yandex

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[8] We also estimate the models for the different lags of the new Covid-19 cases, the region growth rates of the COVID-19 cases with and without the lags, however, they do not provide sustainable results (are available upon request).

DataLens[9] and verified by Johns Hopkins University,[10] on стопкоронавирус.рф,[11] and Yandex services.

Following the literature, we control for bank characteristics, using the set of independent determinants, $Banks_{b,r,t}$, including the control variables: bank size, capital adequacy ratio, and deposits to total assets ratio.

The capital adequacy ratio, $CAR_{b,r,t-1}$, characterizes bank sustainability. The literature shows an ambiguous impact of this predictor on the share of corporate NPL in the total credit portfolio, explaining this based both on "bad management" hypothesis (a positive link) and "moral hazard" hypothesis (a negative association) (Keeton and Morris, 1987; Khan, Siddique and Sarwar, 2020; Naili and Lahrichi, 2022). In Russia, the minimum level of the capital adequacy ratio, set by the Central Bank of Russia,[12] is 10%.

$Bank\ Size_{r,t-1}$ is calculated as the natural logarithm of bank total assets (Naili and Lahrichi, 2022). However, evidence concerning the link between bank size and the level of corporate NPLs share is mixed. Larger banks might be a signal of good management which leads to higher quality models for borrower monitoring. In this case the impact of the bank size on the NPLs is inverse (Cincinelli and Piatti, 2021). In contrast, some authors find a positive effect confirming the "too big to fail" hypothesis that means "bad management" in terms of borrower screening and a high level of risk-taking (Naili and Lahrichi, 2022).

The ratio of all bank deposits to total assets ($Deposits/Assets_{b,r,t-1}$) is used as a critical measure to the bank's deposit policy which is also connected with the credit policy provided by banks (Anani *et al.*, 2023). Based on the existing empirical results, we expect the following relationship: a higher ratio reflects a more effective credit supervision system (Olarewaju, 2020).

The data about banking variables is obtained from the CBR website, which publishes regular bank financial statements, at the bank level. Nevertheless, the banks registered in Moscow, Saint-Petersburg, Moscow Region, and Leningrad Region were excluded from the sample in order to mitigate the problem of consolidated reporting of a significant number of banks which are registered in these territories and have branches in different regions of Russia, which does not allow the division of the indicators of banks into central and regional ones. All bank control

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[9] Coronavirus. Dashboard and data // The official website of Yandex Cloud:
https://cloud.yandex.com/en/marketplace/products/yandex/coronavirus-dashboard-and-data
[10] Official information about coronavirus in Russia// The official website of the Government of the Russian Federation:
https://xn--80aesfpebagmfblc0a.xn--p1ai/ (In Russian)
[11] Coronavirus Resource Center // The official website of Johns Hopkins University:
https://coronavirus.jhu.edu/map.html
[12] The Central Bank of Russia. (2017). Bulletin of the Central Bank of Russia. Instruction of the Central Bank of Russia Dated June 28, 2017 No. 180-I "On Mandatory Standards of Banks". URL: https://www.cbr.ru/Queries/XsltBlock/File/86297/-1/1899-1900/ (In Russian)

variables are monthly and considered with lags according to the assumption that past bank performance influence the current indicators.

We further control for regional characteristics using a set of independent determinants, $Regions_{r,t}$, including gross regional product per capita (GRP per capita) and inflation. There is sufficient empirical evidence of an association between these macroeconomic conditions and corporate NPL (Ari, Chen and Ratnovski, 2021; Petkovski, Kjosevski and Jovanovski, 2021; Staehr and Uusküla, 2021; Naili and Lahrichi, 2022).

A large body of literature has attempted to address the impact of GDP on the level of NPLs. Authors point that higher GDP more likely characterizes the higher income of business which gives borrowers additional opportunities to service their corporate loans. On the contrary, during economic challenges, the level of NPL increases due to higher unemployment rate and lower income, as borrowers experience more difficulties repaying their loans (Ari, Chen and Ratnovski, 2021; Petkovski, Kjosevski and Jovanovski, 2021; Staehr and Uusküla, 2021; Naili and Lahrichi, 2022). We explore not the growth rate of Russian GDP but $GRP\ per\ capita_{r,t-1}$, reflecting the economic development of Russian regions, and expect an inverse relationship between GRP per capita and the level of corporate NPL. The data about GRP per capita in Russian regions is collected from Fedstat.[13]

$Inflation_{r,t-1}$ as another important determinant demonstrates an unclear effect on NPL. An opposite relationship between these factors might be interpreted as a reduction of the loan value in real terms, while a positive link indicates the negative influence of inflation on NPL due to a reduction of business revenue which reduces cuts their funds for repayment of their loans (Naili and Lahrichi, 2022). The inflation data is collected from Fedstat[14] on a monthly basis, using lagged values, and calculated by a subtraction of 100% from the consumer price index (CPI).

The second step investigates not only how the pandemic influenced the quality of banks' loan portfolio through the analysis of corporate NPL (*Hypothesis 1*), but also which side of the credit process might have had a greater impact on the dynamics of the banking sector during the onset of the pandemic: the banks or the business (*Hypothesis 2*). To estimate the regression equation at the second step, we again implement a GMM estimator (Arellano and Boverb, 1995). The baseline dynamic regression model using panel GMM techniques is:

$$\boldsymbol{Corporate\ Loans/Total\ Assets}_{b,r,t} = \boldsymbol{\beta_0} + \boldsymbol{\beta_1} \cdot \boldsymbol{Corporate\ Loans/}$$
$$\boldsymbol{Total\ Assets}_{b,r,t-1} + \boldsymbol{\beta_2} \cdot \boldsymbol{New\ COVID\ Cases}_{r,t-1} + \boldsymbol{\beta_3} \cdot \boldsymbol{NPL\ \widehat{Ratio}}_{b,r,t-1} + \boldsymbol{\beta_4} \cdot \tag{2}$$

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[13] Gross regional product per capita // The official website of Unified Interdepartmental Statistical Information System (UniSIS): https://www.fedstat.ru/indicator/42928

[14] Basic consumer price index for goods and services // The official website of Unified Interdepartmental Statistical Information System (UniSIS): https://www.fedstat.ru/indicator/33568

$$New\ COVID\ Cases_{r,t-1} \cdot NPL\ \widehat{Ratio}_{b,r,t-1} + \beta_5 \cdot Banks_{b,r,t} + \beta_6 \cdot Regions_{r,t} +$$
$$\alpha_i + \gamma_t + \varepsilon_{b,r,t},$$

The second step dependent variable, $Corporate\ Loans/Total\ Assets_{b,r,t}$, represents the ratio of the corporate loans granted over the total assets for bank $b$ registered in region $r$ during month $t$. The choice of this variable based on the previous literature, for example, (Norden, Mesquita and Wang, 2021).

Similar to the first step, the one of the main variables of interest is $New\ COVID\ Cases_{r,t-1}$. According to the literature, the relationship between the severity of COVID-19 and the volume of corporate credit issued by banks is mixed. According to (Kryzanowski, Liu and Zhang, 2023), a significant number of companies filed for bankruptcy during the pandemic, making it impossible for them to obtain bank loans which reduced the volume of corporate loans provided by banks. On the other hand, companies experiencing economic difficulties, for example due to the introduction of quarantine restrictions, delayed deliveries, or a drop in demand caused by the COVID-19 pandemic, might more actively turn to banks for financial support, as can companies, for example in the field of medicine, the delivery of goods, or adapting the business to the new conditions. This allows banks to more actively provide credit to support these businesses and stimulate economic growth. Therefore, at this step we expect to find a positive relationship between the new cases of COVID-19 in Russian regions and the dynamic of corporate loans ($\beta_2 > 0$).

The dependent variable at the second step, $NPL\ \widehat{Ratio}_{b,r,t-1}$, is the estimated value from the first step of the share of corporate NPL over the total gross loans in bank $b$ registered in region $r$ during month *(t-1)*. Following the assumption of a less rapid reaction of banks to changes in the loan portfolio quality, we use the lagged value. We expect an inverse relationship between this variable and the dynamics of corporate loans, assuming that Russian banks, under the pressure of the COVID-19 crisis, adjusted their credit policies to the observed conditions ($\beta_3 < 0$).

$\beta_4$ provides an estimation of interaction term, $New\ COVID\ Cases_{r,t-1} \cdot NPL\ \widehat{Ratio}_{b,r,t-1}$, meaning the effect of COVID-19 severity on bank decisions in response to the decrease in the quality of their credit portfolio. We expect $\beta_4$ to be negative because the higher the number of new COVID-19 cases, the greater the number of loans granted by banks, given that the number of NPL is reduced, and the higher the number of NPL, the lower the number of corporate loans from banks given the larger number of new COVID-19 cases.

To control for bank characteristics at this stage, we use the set of independent determinants, $Banks_{b,r,t}$, including bank size, capital adequacy ratio, deposits to total assets ratio, and return on assets (ROA).

$Bank\ Size_{r,t-1}$: here we expect to find a positive relationship with the corporate loans issued by banks, since larger banks are more reliable and have more opportunities to provide loans even in times of crisis (Beck, Jakubik and Piloiu, 2015; Naili and Lahrichi, 2022).

The same suggestion about the direction of the relationship with the dependent variable is used for the capital adequacy ratio (CAR), $CAR_{b,r,t-1}$ (Gao *et al.*, 2023).

Again, we use $Deposits/Assets_{b,r,t-1}$. At this stage it allows us to control for funding conditions (Norden, Mesquita and Wang, 2021). As (Greenwald, Krainer and Paul, 2020) point out, banks might use their deposit inflow to match demand for credit. Consequently, we expect a positive relationship with corporate loans provided by Russian banks during the COVID-19 pandemic.

$ROA_{r,t-1}$ is used as a proxy for bank profitability that should be positively connected with the loan portfolio provided by the banks (Norden, Mesquita and Wang, 2021).

At the second step we also control for regional characteristics using the set of independent determinants, $Regions_{r,t}$, including both GRP per capita and inflation, which are used at the first step.

Including $GRP\ per\ capita_{r,t-1}$, we expect to find a positive relationship with loans for businesses in Russian regions. This relationship might indicate a favorable economic environment when companies need additional funds for investments, expansion, and the launch of new projects, which is also reflected in the growth of GRP.

$Inflation_{r,t-1}$, in the case of loans provided for companies during the pandemic, should positively affect the need for funds for corporations, which may be reflected in an increase in the corporate loans provided by banks.

Again, we exclude the banks registered in Moscow, St. Petersburg, Moscow Region, and Leningrad Region.

We use bank-level data on Russian banks to document the corporate NPL dynamic and business lending changes under pandemic pressure.

The final sample consists of 3,066 observations including 148 unique banks. Using publicly available COVID-19 and bank performance statistics in Russia, the dependent variables reflecting the NPL of businesses and the volume of the corporate loans are studied from April 2020 to February 2022. The control variables used with lags are captured from March 2020 to January 2022.

Table 1 shows the descriptive statistics of the variables analyzed at both steps. The correlation matrix appears in Table A1 in Appendix A, confirming that the data are not exposed to the multicollinearity problem.

**Table 1.** Descriptive statistics

| Variable | N | Mean | Standard deviation | Min | Max |
|---|---|---|---|---|---|
| Dependent variables | | | | | |
| NPL Ratio$_{b,r,t}$ | 3066 | 482.275 | 2062.278 | 0.000 | 31861.580 |
| Corporate Loans /Total Assets $_{b,r,t}$ | 3044 | 0.441 | 0.194 | 0.000 | 0.889 |
| Independent and control variables | | | | | |
| New COVID Cases$_{r,t-1}$ | 3066 | 75.085 | 175.129 | 0.140 | 1639.990 |
| Bank Size$_{r,t-1}$ | 3044 | 8.602 | 1.575 | 0.288 | 14.545 |
| CAR$_{b,r,t-1}$, | 3066 | 29.683 | 18.551 | 10.120 | 99.140 |
| Deposits/Assets$_{b,r,t-1}$ | 3044 | 0.675 | 0.185 | 0.001 | 0.955 |
| ROA$_{r,t-1}$ | 3066 | 2.592 | 4.936 | 0.010 | 94.410 |
| GRP per capita$_{r,t-1}$ | 3066 | 585716.420 | 449794.510 | 5443.100 | 2733622.700 |
| Inflation$_{r,t-1}$ | 3066 | 4.493 | 1.679 | 1.870 | 11.820 |

## 4 Results

### 4.1 Effects of COVID-19 on corporate NPL in Russian regions

We start with investigating the determinants of the corporate NPL dynamic in Russian regions under COVID-19 pressure as the first step of the analysis. Table 2 contains the empirical results: column (1) shows the basic results of the estimations, which, in addition to the variable of interest, include specific bank characteristics, while column (2) adds a basic set of regional control variables, i.e., the full set of controls.

For specifications 1 and 2, we obtain stable results for the first step, showing that the main variable of interest measuring the spread of COVID-19 virus in Russian regions is positively associated with NPL. This means that *Hypothesis 1* should not be rejected. Our result is in line with the findings of (Kryzanowski, Liu and Zhang, 2023), who report a significant increase of NPL ratios with increases in COVID-19 cases for Chinese banks. The introduction of stricter isolation measures, lower consumer demand, and lower incomes are among the reasons explaining the findings.

We use the predicted values from the first step as the data on corporate NPL in Russian banks for the second step.

**Table 2.** Estimated coefficients of the first-step model

| VARIABLES | (1) NPL Ratio$_{b,r,t}$ | (2) NPL Ratio$_{b,r,t}$ |
|---|---|---|
| NPL Ratio$_{b,r,t-1}$ | 0.9367*** | 0.9310*** |
|  | (0.0000) | (0.0000) |
| New COVID Cases$_{r,t-1}$ | 1.3366*** | 0.3414*** |
|  | (0.0022) | (0.0025) |
| Bank Size$_{r,t-1}$ | 12.1358*** | 12.8266*** |
|  | (0.2167) | (0.2808) |
| CAR$_{b,r,t-1}$ | -8.0778*** | -9.4340*** |
|  | (1.5886) | (1.0837) |
| Deposits/Assets$_{b,r,t-1}$ | -9.7271*** | -11.0906*** |
|  | (0.0032) | (0.0038) |
| GRP per capita$_{r,t-1}$ |  | -2.5237*** |
|  |  | (0.4810) |
| Inflation$_{r,t-1}$ |  | -5.1511*** |
|  |  | (1.7694) |
| Constant | -1.1666*** | 3.2854*** |
|  | (0.4048) | (0.6411) |
| Time FEs | ✓ | ✓ |
| Observations | 3,001 | 3,001 |
| Number of banks | 148 | 148 |
| Chi-sq (p-value) | 0 | 0 |
| Sargan test (p-value) | 0 | 0 |
| Hansen test (p-value) | 1 | 1 |
| AR(1) | 4.41e-08 | 4.96e-08 |
| AR(2) | 0.327 | 0.320 |

Note: Robust standard errors in parentheses $^{+}p < 0.1,\ ^{*}p < 0.05,\ ^{**}p < 0.01,\ ^{***}p < 0.001$.

The results of this step emphasize the importance and relevance of the determinants described in the literature on our data on Russian regions. For instance, the positive association between the bank size and NPL ratio and the negative association between the CAR and NPL ratio might reflect the necessity of bank management to adjust their credit policy under the major negative impact of the COVID-19 pandemic. Therefore, more qualified management might mean better processes in the bank, which is reflected in the fact that banks carefully issue loans, and therefore the level of overdue debt should decrease.

The negative impact of GRP per capita on the level of corporate NPL means that in Russian regions which demonstrate a high level of GRP as a characteristic of developing regional economic potential, companies might experience less difficulties with financing their activities and repayment of loans, which might lead to a decrease in the level of corporate NPL.

## 4.2 The effects of COVID-19 and corporate NPL on the lending dynamic in Russian regions

At the second step we estimate how the number of new COVID-19 cases in Russian regions and the quality of the credit portfolios represented through the estimated level of corporate NPL from

the first step, controlling for banking and regional characteristics, affects the volume of loans issued to corporates during the COVID-19 pandemic in Russian regions. Table 3 shows these results: column (1) includes only the measure of COVID-19 and the estimated level of corporate NPL from the first step, column (2) adds the interaction term between the number of new COVID-19 cases in Russian regions and the estimated value of corporate NPL from the first step.

The stable positive relationship found between the number of COVID-19 cases in Russian regions and the volume of the corporate loans issued in both specifications confirms the assumption that during the crisis period companies needed additional funds. The significantly negative impact of COVID-19 on loans is also found by (Norden, Mesquita and Wang, 2021). A one standard deviation increase in the number of new confirmed cases causes a significant increase of approximately 0.1% in the loans provided by banks in $1^{st}$ and $2^{nd}$ specifications. A similar effect size is reported by (Kryzanowski, Liu and Zhang, 2023).

The coefficients before the estimated value of corporate NPL also show stable and expected results in both specifications: the higher the share of corporate NPL, the lower the volume of loans provided to corporates (Guo *et al.*, 2023). This finding confirms that Russian banks have adjusted their credit policy observing a higher level of corporate NPL during the COVID-19 pandemic.

The negative impact of the interaction term of the number of new COVID-19 cases in Russian regions and the estimated value of corporate NPL from the first step supports *Hypothesis 2*. This result reflects how the effect of the number of COVID-19 cases affect the reaction of banks to the decline of the loan portfolio quality. This finding shows that Russian banks might expand the volume of the loans issued in response to the increase in the number of COVID-19 cases in Russian regions while banks make adjustments for the changes of the loan portfolio quality.

Regarding the coefficients of all the control variables in both specifications, we confirm the robustness of the results.

The positive coefficients before bank size, capital adequacy ratio, and ROA correspond to the abovementioned assumptions about their impact on the volume of corporate loans in Russian regions during the pandemic. All these variables characterize the stability of the banks and their ability to provide corporate loans even during the crisis period.

The finding of a negative coefficient before the relationship between deposits and assets corroborates the results found by (Greenwald, Krainer and Paul, 2020) and might mean that credit supply is covered not only through deposit inflows, but also through other liquidity channels for banks that are out of the scope of current paper.

**Table 3.** Estimated coefficients of the second-step model

| VARIABLES | (1) Corporate Loans /Total Assets $_{b,r,t}$ | (2) Corporate Loans /Total Assets $_{b,r,t}$ |
|---|---|---|
| Corporate Loans/Total Assets $_{b,r,t-1}$ | 0.9590*** | 0.9532*** |
| | (0.0014) | (0.0028) |
| New COVID Cases$_{r,t-1}$ | 0.0106*** | 0.0115*** |
| | (0.0007) | (0.0009) |
| *Estimated* NPL Ratio$_{b,r,t-1}$ | -0.0032*** | -0.0029*** |
| | (0.0002) | (0.0002) |
| New COVID Cases$_{r,t-1}$ | | |
| · *Estimated* NPL Ratio$_{b,r,t-1}$ | | -0.0004*** |
| | | (0.0002) |
| Bank Size$_{r,t-1}$ | 0.6201*** | 0.6245*** |
| | (0.0448) | (0.0584) |
| CAR$_{b,r,t-1}$ | 0.0637*** | 0.0581*** |
| | (0.0049) | (0.0062) |
| Deposits/Assets$_{b,r,t-1}$ | -0.0145*** | -0.0196*** |
| | (0.0030) | (0.0051) |
| ROA$_{r,t-1}$ | 0.0644*** | 0.0653*** |
| | (0.0045) | (0.0066) |
| GRP per capita$_{r,t-1}$ | 0.6782*** | 0.4367** |
| | (0.0781) | (0.1929) |
| Inflation$_{r,t-1}$ | 0.1856*** | 0.2223*** |
| | (0.0397) | (0.0225) |
| Constant | 0.6364*** | 0.4218* |
| | (0.0090) | (0.0244) |
| Time FEs | ✓ | ✓ |
| Observations | 2,859 | 2,820 |
| Number of banks | 148 | 148 |
| Chi-sq (p-value) | 0 | 0 |
| Sargan test (p-value) | 0 | 0 |
| Hansen test (p-value) | 1 | 1 |
| AR(1) | 5.46e-08 | 4.96e-08 |
| AR(2) | 0.168 | 0.148 |

Note: Robust standard errors in parentheses    $^+ p < 0.1$, $^* p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$.

The positive coefficient of GRP per capita supports the existing empirical findings by (Kryzanowski, Liu and Zhang, 2023). We might interpret this as the willingness of Russian companies to reinsure themselves during the crisis.

As expected, the higher the rate of inflation, the higher the businesses' need for additional financing, which is reflected in the positive relationship between the inflation rate and the volume of corporate loans provided in Russian regions during the COVID-19 outbreak.

We also observe positive dynamics of corporate loans issued which is demonstrated through the positive coefficient of the lag of the dependent variable which confirms the need for financing during the pandemic.

## 4.3 Effects of policy interventions on the relationship between COVID-19 and lending dynamics in Russian regions

Finally, we investigate whether and how the COVID-19 pandemic and policy interventions affected corporate loans in Russian regions.

Despite the fact that the policy support measures were aimed at protecting firms since the COVID-19 pandemic began, some authors found significantly negative consequences of policy measures not only for the banking sector but also deepening the economic recession (Eichenbaum, Rebelo and Trabandt, 2021). As stated by (Norden, Mesquita and Wang, 2021) based on (Goel and Thakor, 2020), the direction of the support measures' impact depends on their rigidity: for example, mass gathering restrictions and social distancing are classified as soft policy interventions, while the closure of non-essential services and public venues are considered more restrictive and classified as hard policy interventions. These authors note that more soft policy interventions are more likely to show a positive effect on lending dynamics, while more restrictive measures exacerbated the economic crisis. Similar findings are made by (Eichenbaum, Rebelo and Trabandt, 2021) and (Goel and Thakor, 2020).

(Bessonova *et al.*, 2022) emphasize the rapid imposition of policy support measures for enterprises aimed at retaining employment in Russian regions. These authors analyze the evolving conditions of the loan guarantee programs implemented through the banking sector. Investigating the 2020–2021 loan guarantee programs, the authors observe an increase in the volume of loans at subsidized interest rates, but the share of such loans considered as liquidity support is quite small in the total amount of lending. The authors also found that the loan guarantee programs had a positive impact on the economic activity of the companies that received this support.

(Zemtsov *et al.*, 2022), who also analyze the Russian economic environment during the COVID-19 pandemic, focus on the state support measures for SMEs and highlight the crucial importance of subsidies for the payment of wages that were provided by regional governments.

The next step investigating not only the influence of the number of COVID-19 cases and the dynamic of corporate NPL but also the federal and regional support measures for Russian companies on corporate loan dynamics contributes to the literature, especially about Russian regions and provides some important findings.

Since policy support measures should be considered as endogenous because they might be implemented as a response to the number of COVID-19 cases, a two-step approach is applied (Aizenman *et al.*, 2023).

First we examine the factors influencing the probability of implementing support measures in Russian regions during the pandemic. We estimate Probit models regressing the probability of

ensuring a particular support measure on the spread of COVID-19 in a particular region in a particular month and the pull of regional characteristics.

$$y_{r,t} = \begin{cases} 1, & \text{a particular support measure is implemented in a Russian region} \\ 0, & \text{a particular support measure is not implemented in a Russian region} \end{cases} \quad (3)$$

$$P(y_{r,t} = 1) = F(Z_{r,t}) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{Z_{r,t}} e^{-\frac{u^2}{2}} du - \text{Probit-model,} \quad (4)$$

The list of the bank and regional characteristics ($Z_{r,t}$) includes the variables from the first step of the main study:

- $New\ COVID\ Cases_{r,t-1}$;
- $GRP\ per\ capita_{r,t-1}$;
- $Inflation_{r,t-1}$:
- Time fixed effects.

In this study we investigate the policy measures supporting businesses in Russian regions which are presented in the Table 4. We manually collect a new dataset on the federal and regional measures to support Russian companies during the COVID-19 pandemic. Specifically, the data are collected from the website of the Russian government[15] and from the website of Kommersant,[16] a leading Russian media outlet, and from a website with statistical information about the spread of COVID-19 in Russian regions – стопкоронавирус.рф.[17] The data were collected manually: for this it was necessary to analyze each Russian region separately and note the measures introduced to promote business and their validity period. We then define the variables which represent support measures relevant to companies and can be used in the empirical part of the study.

Since we have the data on corporate NPL over the total gross loans and the volume of corporate loans without dividing by company size, we use the special approach in order to estimate the effect of the financial support for SMEs. Firstly, we collect the data about SMEs from SberiIndex.[18] Then, we multiply this measure by the implementation of the financial support for SMEs in order to estimate the volume of SMEs in each region. Finally, we use this new term as

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[15] Measures of the Government of the Russian Federation to combat coronavirus infection and support the economy // The official website of Government of the Russian Federation: http://gouvernement.ru/support_measures/ (In Russian)

[16] Support measures introduced by the Government in Russian regions // The official website of Kommersant: https://www.kommersant.ru/doc/4315561 (In Russian)

[17] Measures of the Government of the Russian Federation to support the economy and citizens // The official website of Coronavirus Resource Center: https://xn--90aivcdt6dxbc.xn--p1ai/measures/finansy / (In Russian)

[18] The change in activity of SMEs in Russian regions // The official website of SberIndex: https://sberindex.ru/ru/dashboards/izmenenie-aktivnosti-msp-po-regionam (In Russian)

the dependent variable for the measure of $Fin\ support\ for\ SMEs_{r,t}$ using the approach similar for other support measures analyzed.

**Table 4.** Analyzed support measures in Russian regions during the COVID-19 pandemic

| Support measure | Expected sign for the second step | Explanation |
|---|---|---|
| $Deferral\ of\ rent_{r,t}$ | – | The effect of provision of deferral on payment of lease payments, subject to the conclusion of a lease agreement before the introduction of an emergency due to coronavirus. |
| $Fin\ support\ for\ SMEs_{r,t}$ | – | The effect of the issuance of grants, subsidies and direct financial assistance for small and medium-sized enterprises (SMEs). |
| $Tax\ reduction\ for\ STS_{r,t}$ | – | The effect of reduced rate under the simplified taxation system (STS) for legal entities and individual entrepreneurs, for the most affected industries. |
| $Exemption\ from\ other\ taxes_{r,t}$ | – | The effect of exemption/significant reduction in the amount of tax on: property of organizations/ transport tax/ land tax. |

The results of the first stage, assessing the probability of introducing support measures for enterprises in the regions of Russia depending on the spread of COVID-19 (taking into account the differences in the regions of Russia), are presented in Table A2 in Appendix A. In all specifications, we observe positive and statistically significant coefficients reflecting the spread of COVID-19, which confirms the necessity of such measures to support Russian companies in response to the shock caused by the COVID-19 pandemic.

After estimating the Probit regression, we use the estimated probability of implementing a particular support measure as one of the main predictors of the corporate credit dynamic in Russian regions during the COVID-19 pandemic. Consequently, the second step panel data regression is:

$$Corporate\ Loans/Total\ Assets_{b,r,t} = \beta_0 + \beta_1 \cdot Corporate\ Loans/$$
$$Total\ Assets_{b,r,t-1} + \beta_2 \cdot New\ COVID\ Cases_{r,t-1} + \beta_3 \cdot \widehat{Support\ Measure}_{r,t-1} +$$
$$\beta_4 \cdot New\ COVID\ Cases_{r,t-1} \cdot \widehat{Support\ Measure}_{r,t-1} + \beta_5 \cdot \widehat{NPL\ Ratio}_{b,r,t-1} + \beta_6 \cdot$$
$$Banks_{b,r,t} + \beta_7 \cdot Regions_{r,t} + \alpha_i + \gamma_t + \varepsilon_{b,r,t}, \tag{5}$$

The impact of implementing support measures could be mixed. On the one hand, a positive $\beta_3$ coefficient could indicate that banks perceive the companies that benefit from support measures as less risky due to the larger amount funds available that could be used to service loans. This leads to banks becoming more willing to grant corporate loans, especially to such companies. In addition, some companies could use their funds available due to the support measures to adapt to new environmental conditions during the COVID-19 pandemic, and for this purpose companies may need more funds, leading to the issuance of new business loans. This may also mean that the support measures put in place by policymakers are not as effective and companies will have to continue to borrow to meet their obligations. Therefore, the volume of corporate loans granted continues to increase. On the other hand, a negative $\beta_3$ coefficient could mean that the support measures implemented by the policy are effective and companies need to borrow less to meet their obligations. Taking into account the statistical information from the Central Bank of Russia on the growth of business loans issued by Russian banks during the COVID-19 pandemic (LINK TO THE FORM!), we expect a positive relationship between business support measures and the volume of business loans provided by Russian banks.

Similar to (Norden, Mesquita and Wang, 2021), $\beta_4$ provides an estimation of the interaction term capturing the joint effect of the number of COVID-19 cases and ensuing corporate support measures.

Table 5 presents the main results of the investigation of the effect of state support for corporations on the loan dynamics in Russian regions. The full version of the results is presented in Table A3 in Appendix A.

Based on the results of specification 1, we might conclude that the companies which received a deferral on rent are less in need of additional lending during the crisis which means that the volume of loans issued might decrease. As (Bessonova *et al.*, 2022) find, the support measures for companies had a positive impact on their financial condition during the crisis, which resulted in fewer corporate loans issued.

A similar finding is observed for the results of specification 2 for the companies that received financial support as SMEs, which is in line with (Zemtsov *et al.*, 2022), who conclude that the support measures made available by the Russian authorities had a positive effect on SME survival.

In contrast, the results of specification 3 might indicate a smaller strength of the positive effect from a reduction in the tax rate under the simplified taxation system compared to other support measures which demonstrate a negative relationship with the dependent variable. Since companies under the simplified taxation system have limited financial results (they are SMEs), this result might indicate that it was difficult for companies from this category to operate during

the COVID-19 pandemic even with the introduction of tax benefits for them, which led to the fact that such companies had to take out loans during the crisis.

**Table 5.** Estimated coefficients of the second-step models with the support measures in Russian regions during the COVID-19 pandemic

| VARIABLES | (1) Corporate Loans /Total Assets $_{b,r,t}$ | (2) Corporate Loans /Total Assets $_{b,r,t}$ | (3) Corporate Loans /Total Assets $_{b,r,t}$ | (4) Corporate Loans /Total Assets $_{b,r,t}$ |
|---|---|---|---|---|
| Corporate Loans /Total Assets $_{b,r,t-1}$ | 0.8659*** (0.0153) | 0.8030*** (0.0091) | 0.9700*** (0.0067) | 0.9599*** (0.0141) |
| New COVID Cases$_{r,t-1}$ | 0.1299*** (0.0331) | 0.0037*** (0.0002) | 0.0616*** (0.0084) | 0.1075*** (0.0096) |
| *Estimated* Defferal of rent$_{r,t-1}$ | -0.5370*** (0.0642) | | | |
| New COVID Cases$_{r,t-1}$ · · *Estimated* Defferal of rent$_{r,t-1}$ | -0.6164*** (0.0794) | | | |
| *Estimated* Fin support for SMEs$_{r,t-1}$ | | -0.3094*** (0.0143) | | |
| New COVID Cases$_{r,t-1}$ · · *Estimated* Fin support for SMEs$_{r,t-1}$ | | -0.0025*** (0.0000) | | |
| *Estimated* Tax reduction for STS$_{r,t-1}$ | | | 0.4827*** (0.0413) | |
| New COVID Cases$_{r,t-1}$ · *Estimated* Tax reduction for STS$_{r,t-1}$ | | | 0.0656*** (0.0074) | |
| *Estimated* Exemption from oth tax | | | | 0.6908*** (0.1037) |
| New COVID Cases$_{r,t-1}$ · *Estimated* Exemption from oth tax$_{r,t-1}$ | | | | 0.0169*** (0.001) |
| *Estimated* NPL Ratio$_{b,r,t-1}$ | -0.0082*** (0.0009) | -0.0032*** (0.0002) | -0.0053*** (0.0005) | -0.0023*** (0.0006) |

The extended set of the control variables is included

| | | | | |
|---|---|---|---|---|
| Time FEs | ✓ | ✓ | ✓ | ✓ |
| Observations | 2,859 | 2,857 | 2,859 | 2,859 |
| Number of banks | 123 | 145 | 119 | 117 |
| Chi-sq (p-value) | 0 | 0 | 0 | 0 |
| Sargan test (p-value) | 0 | 0 | 0 | 0 |
| Hansen test (p-value) | 0.605 | 0.999 | 1 | 1 |
| AR(1) | 2.52e-05 | 7.00e-05 | 0.000286 | 7.36e-05 |
| AR(2) | 0.980 | 0.709 | 0.537 | 0.512 |

Note: Robust standard errors in parentheses   $^{+}p < 0.1,$ $^{*}p < 0.05,$ $^{**}p < 0.01,$ $^{***}p < 0.001.$

A similar interpretation of the findings might be used for the results in specification 4 which means that the effects of exemption for or a significant reduction in the amount of property,

transport, and land tax might be insignificant for companies in terms of their financial performance, which forces them to apply to banks for loans.

In these specifications we also find positive coefficients before the estimated value of corporate NPL, as expected.

The bank and regional control variables show unstable results in this approach which is why we focused on interpreting the effects of the main variable of interest.

Again, we observe the positive dynamics of corporate loans issued by Russian banks during the COVID-19 pandemic.


# 5 Conclusions

The external shock caused by the COVID-19 pandemic affected all sectors of the economy, particularly credit activity, in almost all countries. Using the monthly bank-level data on Russian regions from April 2020 to February 2022 and statistics on new confirmed COVID-19 cases, we analyze the quality of corporate loan portfolios using the NPL ratio and examine how this affectsin the dynamics of corporate loans issued by Russian banks. The results confirm that Russian banks adjusted their credit policy during the COVID-19 pandemic, because the higher the share of NPL, the lower the volume of loans issued to companies.

Our analysis of data collected manually on the measures provided by the authorities in Russian regions to support companies allowed us to identify more and less effective support measures. We found that the deferral of rent payments and the provision of grants, subsidies, and direct financial assistance for SMEs had a more positive impact on corporate loans issued than the reduced tax rate under the simplified taxation system (STS) for legal entities and individual entrepreneurs and the exemption for or significant reduction of the amount of property, transport, or land tax.

Our research provides a significant contribution to the rapidly expanding COVID-19 literature. In order to obtain more reliable regression results, we use monthly data. We not only investigate the independent dynamics of the NPL ratio and corporate loans issued by Russian banks, but also apply a two-step approach to ensure greater consistency in our analysis. Finally, the results have numerous policy implications for the Russian government when determining how to provide support for companies in times of crisis. Policymakers should take into account the most efficient support measures mentioned above.

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**Table A1** Pairwise correlation matrix

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| NPL Ratio$_{b,r,t}$ | 1.000 | | | | | | | | |
| Corporate Loans/Total Assets $_{b,r,t}$ | -0.175*** | 1.000 | | | | | | | |
| New COVID Cases$_{r,t-1}$ | -0.095*** | -0.002 | 1.000 | | | | | | |
| Bank Size$_{r,t-1}$ | -0.615*** | 0.181*** | 0.012 | 1.000 | | | | | |
| CAR$_{b,r,t-1}$, | 0.502*** | -0.292*** | -0.005 | -0.587*** | 1.000 | | | | |
| Deposits/Assets$_{b,r,t-1}$ | -0.062*** | 0.025 | -0.006 | 0.382*** | -0.614*** | 1.000 | | | |
| ROA$_{r,t-1}$ | 0.027 | -0.138*** | 0.035** | -0.076*** | 0.153*** | -0.292*** | 1.000 | | |
| GRP per capita$_{r,t-1}$ | -0.015 | 0.038** | 0.016 | 0.132*** | -0.123*** | 0.220*** | -0.096*** | 1.000 | |
| Inflation$_{r,t-1}$ | 0.126*** | 0.020 | 0.236*** | -0.027 | 0.034* | 0.000 | 0.138*** | -0.073*** | 1.000 |

$p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

**Table A2** Estimated coefficients of the probability of implantation the support measures in Russian regions during the COVID-19 pandemic (full version)

| VARIABLES | (1) Deferral of $Rent_{r,t}$ | (2) Fin Support for $SMEs_{r,t}$ | (3) Tax Reduction for $STS_{r,t}$ | (4) Exemption from Other $Taxes_{r,t}$ |
|---|---|---|---|---|
| New COVID $Cases_{r,t-1}$ | 0.2725*** | 0.4978*** | 0.7738*** | 0.2267*** |
| | (0.0816) | (0.0037) | (0.0114) | (0.0370) |
| GRP per $capita_{r,t-1}$ | 0.0831 | 0.8989 | 1.5165 | 0.2738 |
| | (0.3353) | (6.5187) | (1.7183) | (0.2232) |
| $Inflation_{r,t-1}$ | 22.2336 | -30.4878* | 25.3387** | 43.0816*** |
| | (19.0173) | (18.3332) | (11.9475) | (14.3376) |
| Constant | 17.8141*** | 5.6435*** | 18.6770*** | -5.7849* |
| | (2.0216) | (0.7178) | (3.2041) | (3.2513) |
| Time FEs | ✓ | ✓ | ✓ | ✓ |
| Observations | 2,859 | 2,857 | 2,859 | 2,859 |

Note: Robust standard errors in parentheses  $^+ p < 0.1$, $^* p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$.

**Table A3** Estimated coefficients of the second-step models with the support measures in Russian regions during the COVID-19 pandemic (full version)

| VARIABLES | (1) Corporate Loans /Total Assets $_{b,r,t}$ | (2) Corporate Loans /Total Assets $_{b,r,t}$ | (3) Corporate Loans /Total Assets $_{b,r,t}$ | (4) Corporate Loans /Total Assets $_{b,r,t}$ |
|---|---|---|---|---|
| Corporate Loans /Total Assets $_{b,r,t-1}$ | 0.8659*** | 0.8030*** | 0.9700*** | 0.9599*** |
| | (0.0153) | (0.0091) | (0.0067) | (0.0141) |
| New COVID Cases $_{r,t-1}$ | 0.1299*** | 0.0037*** | 0.0616*** | 0.1075*** |
| | (0.0331) | (0.0002) | (0.0084) | (0.0096) |
| *Estimated* Defferal of rent $_{r,t-1}$ | -0.5370*** | | | |
| | (0.0642) | | | |
| New COVID Cases $_{r,t-1}$ · · *Estimated* Defferal of rent $_{r,t-1}$ | -0.6164*** | | | |
| | (0.0794) | | | |
| *Estimated* Fin support for SMEs $_{r,t-1}$ | | -0.3094*** | | |
| | | (0.0143) | | |
| New COVID Cases $_{r,t-1}$ · · *Estimated* Fin support for SMEs $_{r,t-1}$ | | -0.0025*** | | |
| | | (0.0000) | | |
| *Estimated* Tax reduction for STS $_{r,t-1}$ | | | 0.4827*** | |
| | | | (0.0413) | |
| New COVID Cases $_{r,t-1}$ · *Estimated* Tax reduction for STS $_{r,t-1}$ | | | 0.0656*** | |
| | | | (0.0074) | |
| *Estimated* Exemption from oth tax | | | | 0.6908*** |
| | | | | (0.1037) |
| New COVID Cases $_{r,t-1}$ · *Estimated* Exemption from oth tax $_{r,t-1}$ | | | | 0.0169*** |
| | | | | (0.001) |
| *Estimated* NPL Ratio $_{b,r,t-1}$ | -0.0082*** | -0.0032*** | -0.0053*** | -0.0023*** |
| | (0.0009) | (0.0002) | (0.0005) | (0.0006) |
| Bank Size $_{r,t-1}$ | 0.6021*** | 0.6129*** | 0.5820** | -0.2840* |
| | (0.1812) | (0.0494) | (0.2625) | (0.1566) |
| CAR $_{b,r,t-1}$ | 0.0138** | 0.0161*** | 0.0193** | -3.0266** |
| | (0.0062) | (0.0056) | (0.0024) | (1.4624) |
| Deposits/Assets $_{b,r,t-1}$ | 0.2088*** | 0.0531*** | 0.1193*** | -0.0265*** |
| | (0.0269) | (0.0142) | (0.0239) | (0.0098) |
| ROA $_{r,t-1}$ | 0.0787*** | 0.1502*** | 0.0439** | 0.0967*** |
| | (0.0083) | (0.0076) | (0.0179) | (0.0204) |
| GRP per capita $_{r,t-1}$ | 1.1873** | 6.2669*** | 0.4093*** | 0.4921*** |
| | (0.5048) | (0.4206) | (0.1149) | (0.1691) |
| Inflation $_{r,t-1}$ | 0.0267 | 0.4773*** | 0.3221*** | 0.1466*** |
| | (0.0317) | (0.0095) | (0.0320) | (0.0399) |
| Constant | 17.8141*** | 77.5047*** | 18.6770*** | 6.3732 |
| | (2.0216) | (0.7178) | (3.2041) | (4.1232) |
| Time FEs | ✓ | ✓ | ✓ | ✓ |
| Observations | 2,859 | 2,857 | 2,859 | 2,859 |
| Number of banks | 123 | 145 | 119 | 117 |
| Chi-sq (p-value) | 0 | 0 | 0 | 0 |
| Sargan test (p-value) | 0 | 0 | 0 | 0 |
| Hansen test (p-value) | 0.605 | 0.999 | 1 | 1 |
| AR(1) | 2.52e-05 | 7.00e-05 | 0.000286 | 7.36e-05 |
| AR(2) | 0.980 | 0.709 | 0.537 | 0.512 |

Note: Robust standard errors in parentheses   $^{+}p < 0.1,$ $^{*}p < 0.05,$ $^{**}p < 0.01,$ $^{***}p < 0.001.$