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Assessing the Efficiency of Bank of Russia Macroprudential Policy Aimed at Limiting Unsecured Consumer Lending Using the Modified Difference-in-Differences Method

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Henry Penikas

Abstract

After the 2020 pandemic, unsecured consumer lending started growing as much as at the pre-crisis times. The Bank of Russia is responsible for overall financial stability. To curb emerging risks, it again activated disincentive macroprudential measures (risk-weight add-ons), and expects to obtain the right to implement prohibiting measures. To further use the two groups of measures, the regulator has to know the efficiency of these measures. Conventional approaches of the Bank for International Settlements (BIS) and the difference-in-differences method deliver poorly interpretable results. This is because of the fact that they do not account for the complex process of measures implementation (including its multistep nature) and the banks' reactions to these measures. That is why we need to modify the difference-in-differences approach. Due to such modification, we are able to trace the scope of efficient measures' application. As many as 10% of banks with the proportion of consumer loans to assets in excess of 20% reduce such a share by 0.3 pp. per quarter for each 100 pp. of the risk-weight add-on starting from the measure announcement date. As many as 70% of banks with the proportion of consumer loans to assets in excess of 1.5% tend to decrease overall lending pace by 2–6 pp. per quarter for each 100 pp. of the risk-weight add-on starting from the measure application date.

Keywords: regulation, risk-weight, capital adequacy ratio, capital buffer, difference-in-differences method, risk-weight add-ons, data resampling, IRB.

JEL Codes: C21, C26, C52, G21, G28, G32.

1. Introduction

The pandemic period of 2020 saw a significant decrease in the volumes of unsecured consumer lending (consumer loans) on Russian banks' balance sheets. Nevertheless, the Bank of Russia notes restoration of these indicators up to the pre-pandemic level as soon as 2021 Q1. The review (Bank of Russia, 2021) mentions that such trends can recreate risks to financial stability that were in place before 2020 (Gospodarchuk & Suchkova, 2020). Therefore, the regulator has made two decisions to limit these risks:

1) From 1 July 2021, the Bank of Russia will restore the increased burden on the capital of banks disbursing unsecured consumer loans (Bank of Russia, 2021). This burden is named **macroprudential add-ons** (macro add-ons, RW_{ADD-ON}) to risk weights according to a standard approach of Bank of Russia Instruction No. 199-I (RW_{ST}), in the capital adequacy requirements (CAR), where K is the bank's capital, and A is, in simple terms, the amount of assets exposed to accepted risks, see [1].

$$CAR = \frac{K}{\left(RW_{ST} + RW_{ADD-ON}\right) \cdot A}, \quad [1]$$

This means that with the same amount of own funds (capital), the bank will disburse more loans to companies, or mortgages, than unsecured consumer loans. This measure can be attributed to a regulatory *disincentive*, i.e. it does not limit the action, but makes its consequences less attractive for banks. These capital adequacy ratios (N1.1, N1.2, N1.0) were adopted in Russia from the Basel Committee on Banking Supervision before the 2007–2009 crisis. Thereafter, other types of measures aimed at quantitative restrictions have been more widespread, regardless of how much the bank is willing to pay an increased 'price' for these measures within the framework of the regulatory disincentive.

2) Starting in 2022, the Bank of Russia is planning to have a tool to limit volumes of unsecured consumer loans (**macroprudential limits**), specifically, with high debt service to income ratio (DSTI) or high maturity. The corresponding Federal law No. 398-FZ was signed by the President of the Russian Federation on December 06, 2021 (https://sozd.duma.gov.ru/bill/1135194-7). The respective draft regulation of the Bank of Russia was made public on December 06, 2021 (Bank of Russia, 2021). This measure is in fact *restrictive*, since it would be impossible to increase volumes of such loans disbursed to individual entities, regardless of the increased burden on capital in accordance with the previous paragraph. The Bank of Russia has experience in using

restrictive measures. Basically, these are measures of relative restriction. For example, in addition to the capital adequacy requirements, financial leverage ratio N1.4 was introduced, which is calculated according to formula [1], where all risk weights are assumed to be equal to one (100%), i.e. assets are not differentiated by risk for the purposes of this ratio. Similar relative restrictions are represented by the following ratios: maximum exposure per borrower or a group of related borrowers (N6), total large credit exposure relative to capital (N7), bank investments in other legal entities' shares (stakes) relative to capital (N12), and maximum exposure per a bank's affiliates (N25).

The second measure can be considered as complementing the regulator's arsenal, on the one hand. However, on the other hand, its appearance can be caused by criticism of the first type of disincentive measures. The reason for such criticism comes from the statistic data, see Fig. 1. Disincentive (macroprudential) measures have been in place in Russia since 2013. Moreover, they have been tightening in the last five years. We will discuss this issue in more detail later. Nevertheless, it is worth mentioning that since the measures were in place, to say nothing of being tightened, and volumes of consumer loans were growing, the disincentive measures are ineffective, and they (measures) need an alternative in the form of restrictive measures.

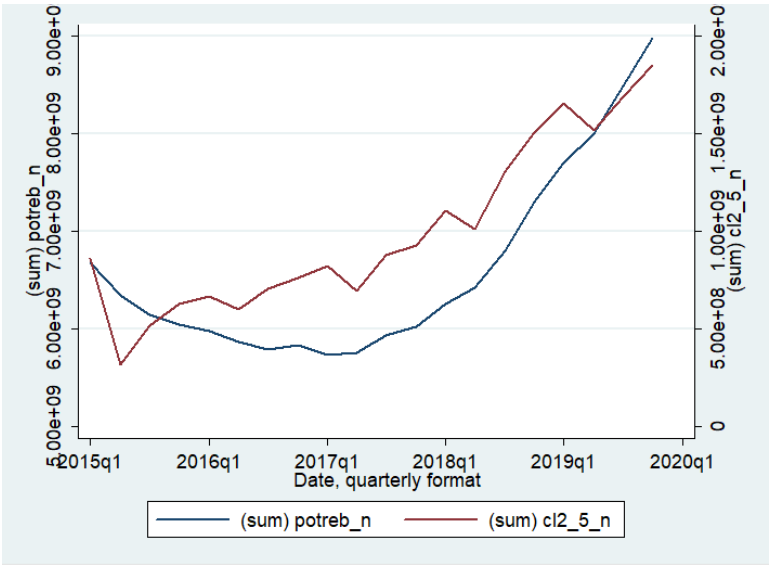


Fig. 1. Volumes of consumer loans on balance sheets kept growing in 2016–2020

Note: (sum) potreb_n (blue line, made on the left vertical axis, thousand rubles) is the amount of all banks' consumer loans on the balance sheet; (sum) cl2_5_n (red line, made on the right vertical axis, thousand rubles) is the amount of unsecured consumer loans disbursed by Russian banks.

In fact, the above criticism is superficial. It is not based on a strict proof. First of all, we should not forget that the described disincentive macroprudential measures were applied to all banks. This means that we do not have an ideal experiment with banks to which measures would not be applied.

Secondly, it should be recalled that the total Russian banking system assets were also growing in the specified period of 2015–2019. Taken into account, this clearly shows that, in relative terms, the volume of consumer loans did not grow, but decreased, see *Fig. 2*.

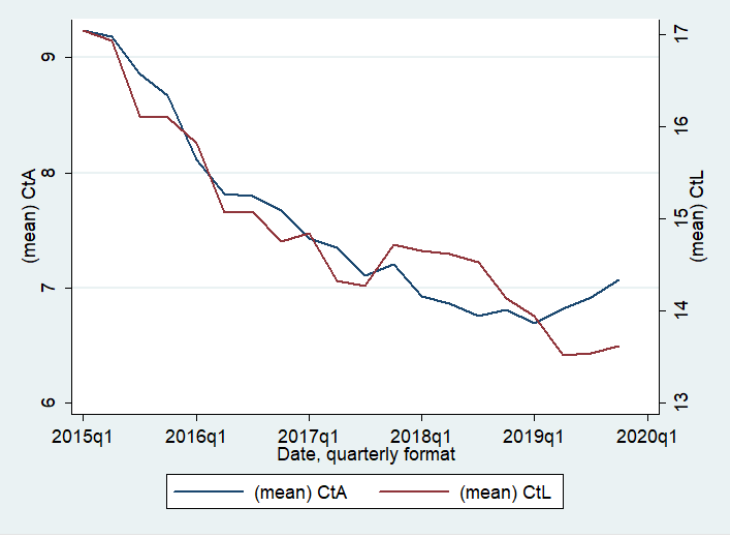


Fig. 2. The share of consumer loans in the assets (CtA, blue line, made on the left vertical scale, pp of assets) and in the loan portfolio (CtL, red line, made on the right vertical axis, pp of the loan portfolio) of banks was decreasing in 2015–2020

Then a logical question arises: were the disincentive macroprudential measures of the Bank of Russia effective or not? The answer to this question essentially determines which of the measures (disincentive or restrictive) the regulator will use starting 2022, when both types of measures will be at the disposal thereof.

To answer the research question about the effectiveness of measures, Section 2 will remind us of other experts' conclusions in terms of those measures effectiveness. Then, in Section 3, we will observe the data and list the challenges that they pose for the researcher. Section 4 contains description of the methodology that needs to be applied to model such data. We will show how the difference-in-differences method should be improved in order to take into account the data features. Substantive conclusions will be discussed in Section 5. The results will be summarised in Section 6.

2. Literature review

Traditionally, banking supervision was based on microprudential measures. Micro means that the measures will relate to each bank, to keep each bank stable at its own (microeconomic) level. At the same time, measures are similar for all of the banks. They became most widespread after the adoption of the Basel I Accord (Basel Committee on Banking Supervision (BCBS), 1988). At the time, the main measure of microprudential regulation was the requirement to maintain a minimum capital adequacy. The latter is calculated as the ratio of the bank's capital to the amount of the bank's risks assumed, or risk-weighted assets. The essence of the regulation is that the

regulator sets the weighing rules (determines the risk weighting coefficients, or risk weights) and sets the minimum value of this ratio. The latter was equal to 8% for the total capital. After the financial crisis of 2007–2009, the minimum level was raised using various buffers (systemic importance buffer, capital conservation buffer). The peculiarity of microprudential measures is that during periods of economic recovery and credit boom, measures will indicate that banks have no problems.

However, the Bank for International Settlements (BIS) representative, Claudio Borio (Borio, 2003, p. 8) notes that it is during these periods that banks have problems. Microprudential requirements do not restrict banks in such periods. Therefore, other measures are needed. They are called macroprudential measures. Macro reflects the fact that measures will take into account the overall macroeconomic situation. Macroprudential measures started to be publicly discussed after the Asian crisis of 1997 (Crockett, 2000) and after the crisis of Dotcoms in 2001 (dotcom) (Borio, 2003). However, Clement (2010) claims the knowledge and importance was given to macroprudential measures early in the onset BCBS in 1970s. Nevertheless, wider adoption of macroprudential policy tools started after the Global financial crisis of 2007–2009. It was then that (Schoenmaker, 2014) introduced the term 'macroprudentialism'.

For example, during periods of overheated economies, macroprudential measures indicate availability of risks for banks and become restrictive for them. Therefore, during a recession and reduction in lending, microprudential measures restrict banks, and macroprudential measures make it possible to ease the effect of microprudential measures to activate lending. For example, the Bank of Russia's cancelling of macro add-ons in 2020. The period of recovery, on the contrary, will see macroprudential measures to help cool down overheating in the economy. Therefore, the Bank of Russia will resume application of macro add-ons by the middle of 2021.

Most often, the third type of capital buffer is considered as a macroprudential measure – the countercyclical capital buffer (Gospodarchuk, Reserve Capital buffer as a tool of macroprudential policy, 2019), (Basten, 2020), (Gertler, Kiyotaki, & Prestipino, 2020). It is provided for in Russia but has never been introduced until 2021. In this connection, another measures to be considered is the required reserve ratio (Agenor, 2019), (Gómez, Murcia, Lizarazo, & Mendoza, 2020). Sometimes, regulation of the debt burden indicator or the loan size to the value of collateral are used: LTI, LTV (McCann & O'Toole, 2019), (Morgan, Regis, & Salike, 2019). Detailed classifications of such measures are available in the reviews (Kahou & Lehar, 2017) and (Lubis, Alexiou, & Nellis, 2019). They studied 250 and 125 papers, respectively.

Despite the fact that all macroprudential measures differ significantly in terms of regulatory goals and objects of impact, a common approach is the use a generalised index (MaP_t) that counts

the number of measures implemented (Bruno, Shimb, & Shin, 2017), (Cerutti, Claessens, & Laeven, 2017), (BIS, 2020), (Gambacorta & Murcia, 2020), (Kim & Oh, 2020).

Moreover, the following specification is used [2]:

$$Y_{it} = \sum_{k=0}^{K} \theta_k \cdot MaP_{t-k} + X_{i,t-1}\mathrm{B}_i + \varepsilon_{it}, \qquad [2]$$

where Y_{it} is the lending growth rate (d_log_loans); i is the bank's indicator, t is the quarters counter, $X_{i,t-1}$ is the matrix of bank control characteristics (for example, SIZE is the bank's size; CAP is the capital adequacy requirements, LIQ is the share of liquid assets in total assets, DEP is the share of deposits in all liabilities according to the recommendations (BIS, 2020)), ε_{it} is the model balances.

This approach suffers three fundamental disadvantages.

First, it does not take into account many factors that could affect the growth of lending. Moreover, it does not compare the situation with what could have been without the introduction of measures. For example, the implementation of macro add-ons according to the definition [1] restricts disbursement of risky loans for which they are intended. The probable growth observed could be caused by faster capital accumulation, including through profit generation with low reserves or from high-yield strategies while transforming business in the context of the regulatory burden increase (Gospodarchuk & Suchkova, 2019). Therefore, a reasonable assessment of the effect can be obtained only if comparable control observations are available. To take this into account, it is necessary to implement the difference-in-differences method (Wooldridge, 2009). For the author's information, this approach is implemented only in one paper (Behncke, 2020) for Switzerland. Therefore, in this study we will try to assess the effectiveness of macroprudential measures for Russia based on the same data set as in Kozlovtceva, Penikas, Petreneva, & Ushakova (2020), but using a modified difference-in-differences method.

Secondly, the index use is a significantly averaged approach. It does not take into account that the measures are aimed at different lending segments and have different 'mechanics' of impact. Therefore, we will consider one type of measures that we have studied thoroughly – they are macro add-ons to risk weights in relation to unsecured consumer loans.

Third, taking into account only the fact of implementing a measure does not take into consideration the fact that measures can have various scopes. For example, in terms of the implemented macro add-ons. Therefore, we shall follow the recommendation of Budnik (2020) where, on top of the fact itself, the sensitivity, S of the measure implementation should be taken

into account. This sensitivity was first taken into account for Russia in the paper by Kozlovtceva, Penikas, Petreneva, & Ushakova (2020).

It should be noted in advance that all studies on macroprudential measures can be divided into two groups. Some prove their effectiveness, while others refute it. The first group includes papers for both an aggregate of dozens of countries (Bruno, Shimb, & Shin, 2017), (Cerutti, Claessens, & Laeven, 2017), (Dautović, 2019), (Morgan, Regis, & Salike, 2019), (BIS, 2020), (Gambacorta & Murcia, 2020), (Meuleman & Vennet, 2020), (Revelo, Lucotte, & Pradines-Jobet, 2020), and for individual countries. Gauthier, Lehar, & Souissi (2010) and, Duprey & Ueberfeldt (2020) studied Canada; Gómez, Murcia, Lizarazo, & Mendoza (2020) focused on Colombia; Yarba & Güner (2020) considered Turkey. However, even these papers contain indications of macroprudential measures to be ineffective. In particular, Cerutti, Claessens, & Laeven (2017) indicate that the effectiveness decreases in periods of economic recovery. Meuleman & Vennet (2020) argue that such measures are more effective when applied to problem banks.

The second group of researchers is less numerous. They say that macroprudential policy measures are not so effective. Such conclusions were obtained both for many countries (Cerutti, Correa, Fiorentino, & Segalla, 2017), (Budnik, 2020), and for individual ones. For example, McCann & O'Toole (2019) study Ireland; Basten (2020) observes the neighbouring Great Britain; Kim & Oh (2020) are focused on South Korea. McCann & O'Toole (2019) and Basten (2020) discuss the effects of substitution, where banks start lending in another segment (or another country), and banks that have not previously lent in it replace highly specialised banks of the segment.

There are a number of other papers discussing macroprudential measures for Russia. For example, Olkhovka & Adaskevich (2016), Danilova & Elizarova (2017), Danilova & Morozov (2017), Sinyakov & Khotulev (2017), Dyachkov (2018), Gospodarchuk (Capital Reserve Buffer as a tool of macroprudential policy, 2019), Andreev, Peiris, Shirobokov, & Tsomokos (2019), Ivanova, Andreev, Sinyakov, & Shevchuk (2019), Evstafyev (2020), Ipatiev (2020).

However, none of them implements the above-mentioned difference-in-differences method for the macro add-ons implemented to limit the risks of unsecured consumer lending. Besides, even disregarding the recent progress in difference-in-differences method – see (Card and Krueger, 1994), (Yagan, 2015), (Goodman-Bacon, 2018), (Berger, Turner, and Zwick, 2019) – do not account for the dual treatment of periods that are same time an 'after' period for past measure and a 'before' measure – for the future measure.

To explain why this obvious method is not so easy to apply, a closer look should be taken first at the data available. Thereafter, the necessary modifications will be explained for implementing the method in the context of such data.

3. Data

We are repeating that the task of this paper is to cross-check the results obtained in the preprint by Kozlovtceva, Penikas, Petreneva, & Ushakova (2020) and described in the analytical note by Kozlovtseva, Penikas, Petreneva, & Ushakova (2020). Therefore, a completely similar set of data will be used for objects and for the covered time period. Thus, we have quarterly data for 793 Russian banks from 2015 to 2019 at our disposal.

First, we will focus in more detail on the adopted disincentive macroprudential measures to limit the growth of unsecured consumer loans, see *Fig. 3*. The fact corresponds to the upper charts in *Fig. 3*, the lower ones reflect the sensitivity.

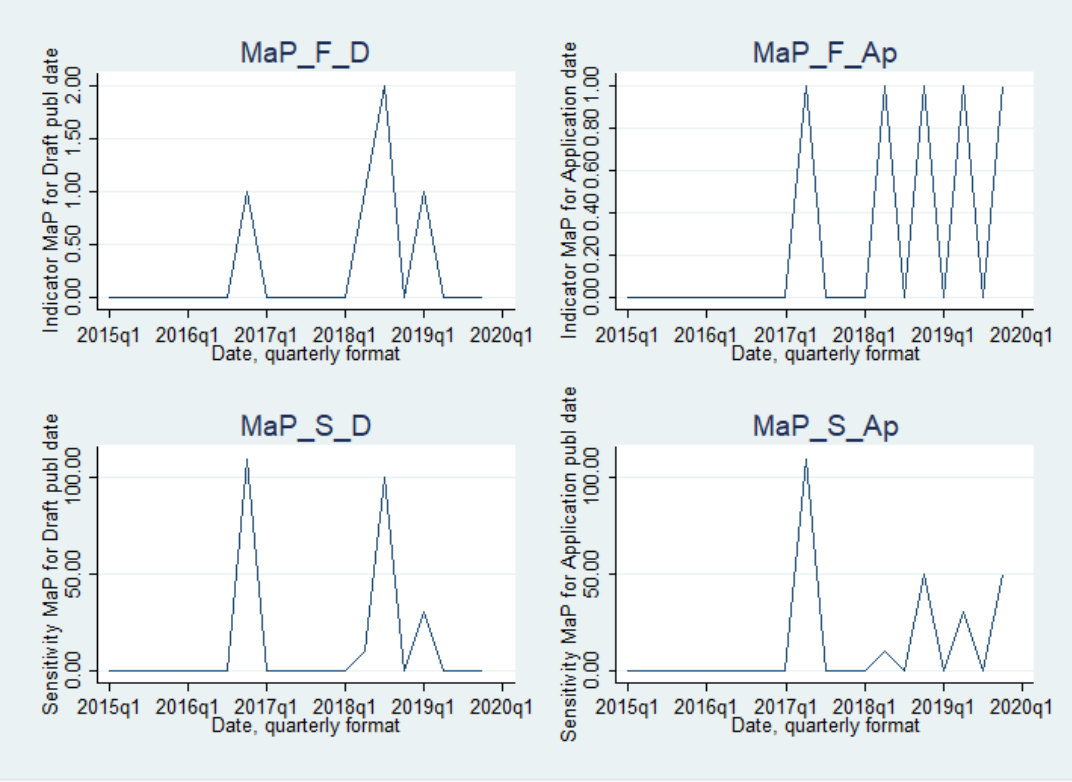


Fig. 3. Visual representation of indicators of macroprudential measures

Note: F is the fact of measure implementation (the number of measures implemented during these periods is shown on the vertical axis in the upper charts), S is the sensitivity of the measure (shown on the vertical axis in the lower charts, represented in units of risk weights), D is the date of publishing of the draft document on the measures implementation, Ap is the time when the measure was applied.

The charts in the left column in Fig. 3 correspond to the dates of the draft document publishing (announcement) of the implementation of measures (D is draft), the charts in the right column correspond to the dates when the measure was applied (Ap is Application). Accounting for this difference is necessary, since banks could start changing their strategies after information about such measures became available and not only when everything has already been decided and becomes effective. Probably, banks begin to adapt to the forthcoming situation earlier, focusing on rumours and information from friends, but this cannot be checked objectively. Therefore, the two dates will be checked: the announcement date and the date of entry into force.

It is worth looking at individual cases of banks in advance to get the first idea about the probable effect of measures. Next, the dynamics of the share of consumer loans in the assets of individual banks will be presented (the blue line, made on the left vertical axis) against the dynamics of the announced measures, taking into account their sensitivity (the red line, made on the right vertical axis; it corresponds to the line from the lower left chart in Fig. 3).

The following two figures show the dynamics, which can be conditionally named as follows: *Fig. 4* is the desirable for the regulator (target); *Fig. 5* is the undesirable for the regulator. For example, *Fig. 4* shows the situation for a particular bank (for simplicity we call it 'Bank 1', where No. 1 is not the banking license number). One can see that the progressive implementation of measures was associated with an equally progressive decrease in the share of consumer loans on this bank balance sheet. The share dynamics is desirable, since the disincentive macroprudential measures are probably reflected in the decrease of the consumer loans share, and that is exactly what the regulator would like to see.

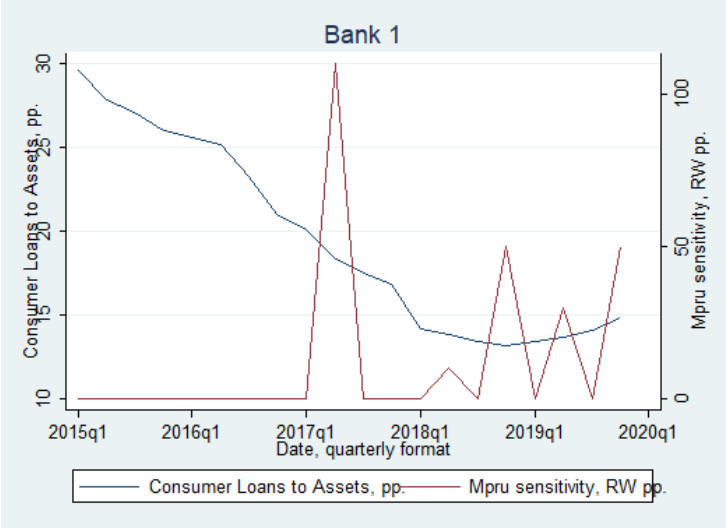


Fig. 4. An example of the share dynamics of consumer loans in the bank's assets, desired by the regulator in response to the measures implemented

Note: Consumer Loans to Assets, pp is the share of consumer loans in the bank's assets, percentage (blue line, made on the left vertical axis); Mpru sensitivity, RW pp. is the dynamics of the implemented macroprudential measures by their sensitivity as of the announcement date (red line, made on the right vertical axis). The figure title shows bank's general licence number and name thereof.

In *Fig. 5*, on the contrary, the dynamics is almost exactly the opposite. There are other four bank cases here – Bank 2 – 5, where numbers from two to five do not stand for the banking license numbers. For two banks on the upper charts, Banks 1 and 2, the announcement of the disincentive measures implementation is comparable to the beginning of a significant increase in the share of consumer loans on the balance sheet. For two lower charts, Banks 3 and 4, the situation is slightly better. The implementation of measures is associated with a decrease in the share of consumer loans, but after the announcement of the latest measures, perhaps due to banks' expectations that there will be no further disincentives, the share of consumer loans in banks begins to grow

significantly. Since in all the cases shown in *Fig. 5*, the share of consumer loans in banks is growing (with the beginning of the implementation of measures or after completion thereof), such dynamics can be named undesirable for the regulator, because the goal was to limit such loans.

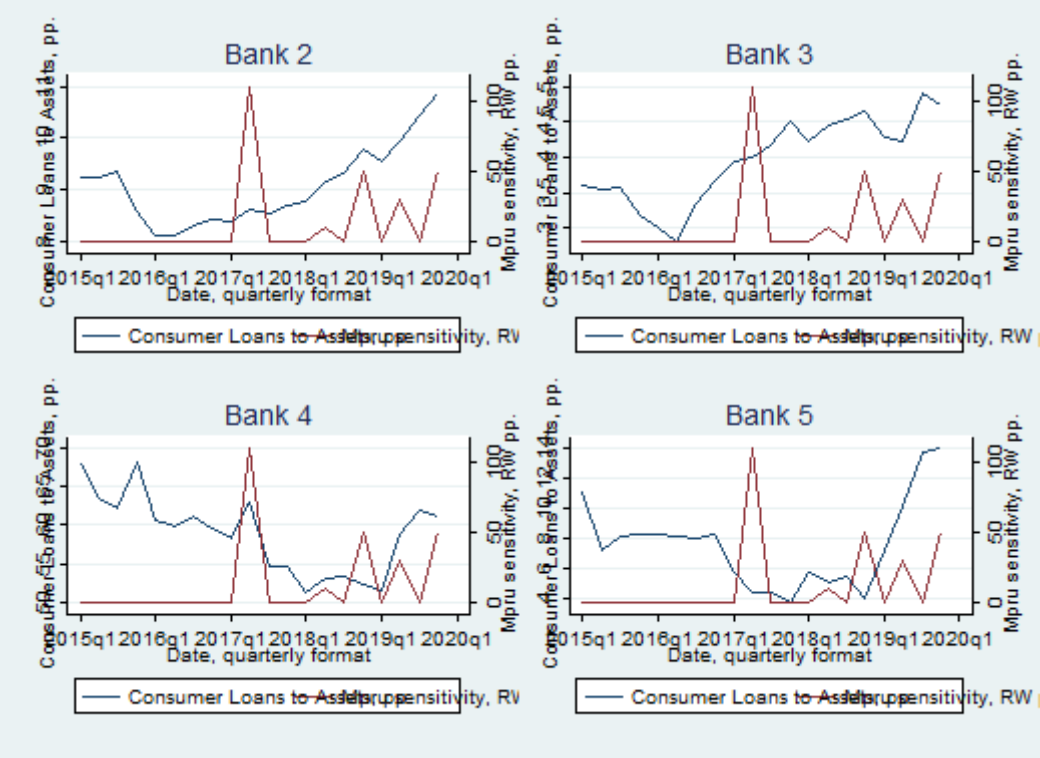


Fig. 5. Examples of undesirable dynamics for the regulator in relation to the share of consumer loans in the assets of banks, in response to the measures implemented

Note: Consumer Loans to Assets, pp is the share of consumer loans in the bank's assets, percentage (blue line, made on the left vertical axis); Mpru sensitivity, RW pp. is the dynamics of the implemented macroprudential measures by their sensitivity as of the announcement date (red line, made on the right vertical axis). The figure title shows bank's general licence number and name thereof.

It is fair to note that we name the dynamics of the above consumer loans share *conditionally* desirable or *conditionally* undesirable, since the regulator does not specify an explicit goal to reduce the consumer loans' share on the balance sheet. The regulator's website states a more general goal of 'limiting the risks associated with an increased debt burden of households' (Bank of Russia, 2021). Since we do not have access to either bank data on non-performing consumer loans, or household data on loans taken, we are not able to assess how the risks of the households' debt burden have actually changed.

Therefore, in we will consider three indicators as a dependent variable in our regression model (Y_{it}) to assess the effect of measures:

1) The share of consumer loans in the banks' assets (CtA);
2) The quarterly increase in the number of consumer loans (d_log_cl);
3) The quarterly increase in the number of all loans on the bank's balance sheet (d_log_loans).

Now the methodology for assessing the effect of the measures implemented on these indicators will be considered.

4. Methodology

Traditionally, the difference-in-differences method assumes availability of a 2 x 2 matrix, where there are two time periods (D_time): before and after the application of the measure (exposure, treatment); and two groups of observations: control one (to which the measure was not applied) and pilot (treatment) one (to which it was applied) (D_treat). We need to have the product of these variables: $D\_TT = D\_time \cdot D\_treat$. The effect of the measure will be clear by the significance of the coefficient θ_3 for a variable D_TT, i.e.:

$$Y_{it} = \theta_1 \cdot D\_time + \theta_2 \cdot D\_treat + \theta_3 \cdot D\_TT + X_{i,t-1}\mathrm{B}_i + \varepsilon_{it}. \quad [3]$$

The description of the variables used and statistics thereof see in Appendix 1. To take into account the sensitivity of the measure, D_treat will be multiplied by the degree of sensitivity, see Fig. 3. For more details on the justification of the sensitivity estimate, see Appendix 6.2 of the paper by Kozlovtceva, Penikas, Petreneva, & Ushakova (2020, pp. 20–23). In our case, we do not divide the samples into training and examination, following the Professor Diebolt's recommendation that if uploaded (static) data is available, it is worth giving preference to more accurate descriptive models based on the full sample, rather than to more accurate predictive models based on the training part of the sample and selected as the best ones on the examination sample (Diebolt, 2015, p. 4).

The essence of the method will be explained on the first example. We will move from the basic case to the real one. First, the percentage of consumer loans on the balance sheet of two banks (C – control bank and P – pilot bank) is indicated in the cells of Fig. 6. Since after applying the measure in the pilot bank, the share of its consumer loans reduced from 100% to 0% in this example, and the share of consumer loans did not increase in the control bank, it can be assumed that the effect of the measure equalled 100%. Then, if the purpose of the measure was to limit consumer lending, this measure can be named effective, since the share of such loans dropped to zero.

		Sample	
		Control (C)	**Pilot (P)**
time	**BEFORE**	0%	100%
	AFTER	0%	0%

Fig. 6. Basic information for applying the difference-in-differences method (Example 1)

Let us take at least a small extension of the example above, see Fig. 7 (Example 2). Let us assume that there are not two but three banks (B1, B2, B3), and there are not two, but three periods. Moreover, the measure was implemented twice: in the second and third periods. Despite the complication applied, we need to find an answer to the question: what is the effect of the measure or the measures in this case? How much more effective are they than in the example above?

		Banks		
time	**measure**	**B1**	**B2**	**B3**
1	0	0%	100%	100%
2	1	0%	0%	100%
3	2	0%	0%	100%

Fig. 7. An extended example for applying the difference-in-differences method (Example 2)

The difficulty of answering the question in the second example arises from the fact that the second bank (B2) dynamics of the consumer loans share is different from those of the first and third banks. Therefore, the question arises: is it a control or a pilot observation? At the same time, another question arises: what is to be done with the second stage of the measure? We might assign the status of control and pilot observations to the first period. There will be two pilot banks (second and third). We might forget about the second period and say that the first period is the situation 'before' the implementation of measures, and the third period is the final situation 'after'. Then we can calculate in our simplified example the average shares of consumer loans on the balance sheet of banks in the control and pilot groups. For the 'after' stage and the pilot group we get (0% + 100%) / 2 = 50%. The effect of the measure will be a decrease in the share of consumer loans by 50%, see *Fig. 8*.

Avg	**C (1x)**	**P (2x)**
BEFORE	0%	100%
AFTER	0%	50%

Fig. 8. Assessment of the effect for Example 2, if banks 2 and 3 are considered pilot; period 1 as BEFORE, and period 3 as AFTER

The problem with the approach described is that we did not take into account the information about what occurred in the second period. First, the second bank has already reduced the share of consumer loans in the second period. This means that it is incorrect to consider it the pilot bank after the second period. Secondly, the peculiarity of the second period is also such that it is both the 'after' period for the first measure and the 'before' period for the second measure. The simplified calculation in *Fig. 8* does not take this into account. Therefore, the assessment of the effect with this approach could be distorted. To correct the situation, it is necessary to replicate data in a special way, see *Fig. 9*.

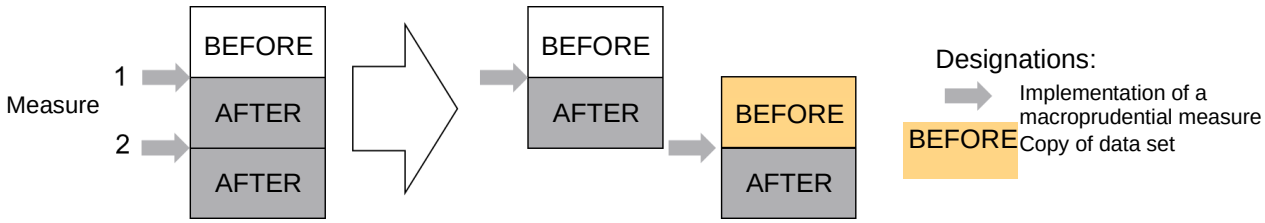
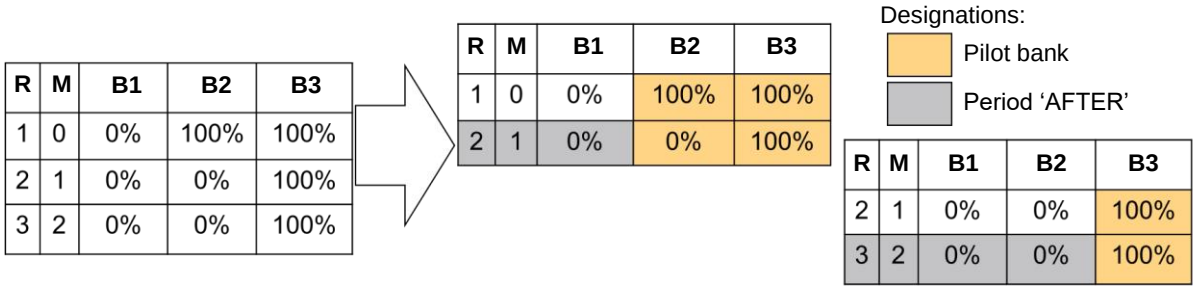


Fig. 9. An illustrative scheme of data replication to reflect several stages of the measure introduction

It is necessary to take into account all internal time periods (after implementing the first measure and before implementing the last measure). We will create identical duplicates for these periods' data. For Example 2, this means creating a fourth line using the data of the second period, see *Fig. 10*.



R	M	B1	B2	B3
1	0	0%	100%	100%
2	1	0%	0%	100%
3	2	0%	0%	100%

R	M	B1	B2	B3
1	0	0%	100%	100%
2	1	0%	0%	100%

R	M	B1	B2	B3
2	1	0%	0%	100%
3	2	0%	0%	100%

Fig. 10. An example of replicating data from example 2

A pilot bank in Example 2 will be the bank with consumer loans before the implementation of measures. It is easy to give such a definition, since in our example the share takes only two values: all or nothing. Then we similarly calculate average shares of consumer loans for each cell of the difference-in-differences method matrix. In this case (after replication), the result is that for pilot banks in the 'after' period, the average share is (0% + 100% + 100%) / 3 = 66%. Then the effect will be equal to -34%, but not -50%, as we presumed above, see Fig. 11. Thus, failure to take into account information about all stages of the implementation of measures can lead to distortion of the effect assessment.

Avg	C (3x)	P (3x)
BEFORE	0%	100%
AFTER	0%	66%

Fig. 11. Assessment of the effect of measures for Example 2 on replicated data

We showed above a general scheme for replicating data to assess the effect when a measure (exposure, treatment) was applied sequentially several times. It would seem that the scheme is quite simple. Nevertheless, we will draw attention to some peculiarities of the data available:

1) There are about 10,000 lines of data in the original data set. Manual checking and marking of each line requires much more time than demonstrating an example on three

lines. Therefore, it is necessary to automate the replication process for the system processing of all lines.

2) We have two types of macroprudential measures by dates (publishing of the project and entry into force thereof). Therefore, we need to be able to carry out replication automatically, to determine the periods for replication by dates of a specific type of measure.
3) Unlike the simple example, we do not have an unambiguous indicator that makes it possible to classify banks as pilot banks and control ones. All we can do is take a variable that will indicate the exposure to the measure. For example, the share of consumer loans in assets or the capital stock. Then, once the replication is completed, we need to extend the values of the selected indicator to the 'after' period in such a way that a bank will be uniformly attributed to the pilot bank or control one at the 'before' and 'after' stages. To do this, it is necessary to create the average value of the indicator in question and have it stored in the computer memory in the 'before' period. This value should be assigned to the data of the same bank in the 'after' stage next to each measure.

Therefore, an equally important innovation of this study, in addition to the very idea of replicating data to account for input of macroprudential measures in many periods, is the automation of this replication process that takes into consideration different requirements to account for the type of measure by date, and the indicator for determining the category of observation (pilot observation or control one).

For example, we will demonstrate the steps of preparing data to evaluate regression using the modified difference-in-differences method on the source data. Initially, we divide all observations into two groups: before the first measure implementation and after it. Thereafter, the 'before' and 'after' stages will be separated by the dummy variable D_time, and the type of observation (control or pilot) – by the variable D_treat. The result of the first division for measures with the date of the project publishing (D) is shown in Table 1. It is only natural that most of the observations relate to the period 'after'. Herewith, none of the observations belongs to the 'pilot' category (a column with a one for the D_treat variable). We observed the similar problem, but exactly the opposite (when no control observations are available) when studying the transition of Greek banks to statistical credit risk assessment models (internal rating-based model (IRB)) in the paper (Merika, Merikas, Penikas, & Surkov, 2020).

Table 1. Incoming data (step 1)

		D_treat		
		0	1	Total
D_time	0	3,721		3,721
	1	5,810		5,810
	Total	9,531		9,531

After replicating the internal periods (after the first measure and before the last one), the number of observations in the 'before' category became dominant in the new sample, see Table 2. As we can see, the number of observations in the 'after' category did not change, since we replicated observations from them to the 'before' category.

Table 2. Data replication for the 'BEFORE' stage (step 2)

		D_treat		
		0	1	Total
D_time	0	8,373		8,373
	1	**5,810**		**5,810**
	Total	14,183		14,183

In this example we will divide the observations into control and pilot ones according to the median value of the consumer loans share on the balance sheet. This gave us approximately equal shares of control and pilot observations, see Table 3. It is obvious that the total number of observations, including those divided into 'before' and 'after' periods, have remained unchanged.

Table 3. Assignments of pilot and control observations (step 3)

		D_treat		
		0	1	Total
D_time	0	4,652	3,721	**8,373**
	1	2,854	2,956	**5,810**
	Total	7,506	6,677	**14,183**

We will consider in our study two variables that may indicate the exposure to the measures under consideration: the share of consumer loans in the bank's assets (CtA) and the capital buffer (capital stock) above the minimum level (Kb). The peculiarity and limitation of our study is that it is retrospective, which means that we are thinking about how to evaluate the effect after the impact (measure, treatment) is applied. That is why we do not have a perfect control sample. We are trying to create it by replicating data. Moreover, by choosing a variable-indicator of exposure, we do not know whether we really chose it correctly. Then all we can do is consider different situations and try to draw a conclusion about the effectiveness of measures based on the prevailing patterns. To do this, we are building nine regressions for each case, gradually increasing the share of pilot observations from one to nine deciles for the capital buffer (Kb), and up to eight deciles for the

share of consumer loans on the balance sheet (CtA), see Table 4. In the latter case, we do not take one decile, since the sample has more than 10% of banks without such loans.

Table 4. Thresholds of the distribution deciles of selected indicators for determining pilot and control observations

Decile	CtA	Kb
MAX	93.9	-401.0
1	19.0	0.3
2	11.6	1.6
3	7.9	2.9
4	5.3	4.9
5	3.6	7.9
6	2.4	11.7
7	1.4	17.2
8	0.4	26.2
9	0.0	41.7
MIN	0.0	467.7

Note: MIN and MAX are the extreme values in the distributions of the selected variables.

Thereafter, in *Fig. 12*, *Fig. 13* and in *Appendix 3* we will specify deciles, the values of which are taken from this table.

We should remark that bank studies often underline the benefits of taking into account dependent variable lags in regression models (BIS, 2020). The benefit is that the bank's financial indicators dynamics are really not the results of algorithmic trading with radically opposite values from period to period. As a rule, the bank's indicators are closely related to past values. Therefore, it may be useful to take into account the dependent variable lags. However, this benefit immediately creates difficulties in the econometric estimation of regression coefficients, since it can generate the endogeneity. Instrumental variables are used to correct the situation. However, the choice of instrumental variables is a separate art. On the one hand, there are tests for the endogeneity and suitability of the selected tools, and there are recommendations as to which tools are to be taken. On the other hand, each econometric study is a somewhat unique search for tools to be applied for an individual case. In particular, a lot of effort was taken to select the most appropriate tools for the model of the increase dynamics in all loans on the balance sheet (d_log_loans) in the study by Kozlovtceva, Penikas, Petreneva, & Ushakova (2020). This tools selection is a painstaking process that deserves respect and high appreciation. Nevertheless, the author believes that from the point of view of regular effectiveness evaluation of various measures, this selection seems to be strange. Each situation has its best set of tools different from other situations. Thus, when using tools the researcher can distort the answer 'adjusting it to some desired statement', if applicable. Therefore, we evaluate in this paper two groups of models: by

the ordinary least squares method (OLS) and by the two-step least squares method using instrumental variables (IV). We define endogenous lags for one quarter of the dependent variable and bank characteristics. We are choosing the lags of the second quarter of data variables to be used as tools. We checked the feasibility of including the third quarter lag. We did not find that including of the third lag as a tool brought about a significant improvement in the models, compared to including of the second lag. We use the Hausman test to check whether there is endogeneity, and the Sargan test to check whether the selected tools are suitable (valid). For self-verification, we are looking at the correlation of the model balances with endogenous variables and tools.

Table 5. The share of consumer loans on the balance sheet estimated by IV method, taking into account the sensitivity of the measure on the date of announcement thereof, when 10% of observations with the largest share of consumer loans on the balance sheet are named pilot observations

Y	Coef.	Std. Err.	z	P>|z|	[95% CI]	
Y_L1	0.9872	0.0020	491.92	0.000	0.9833	0.9912
SIZE_L1	0.0257	0.0081	3.19	0.001	0.0099	0.0414
LIQ_L1	0.0007	0.0008	0.96	0.336	-0.0008	0.0023
DEP_L1	-0.0012	0.0007	-1.64	0.102	-0.0026	0.0002
CAP_L1	-0.0008	0.0006	-1.40	0.160	-0.0020	0.0003
D_time	0.0004	0.0003	1.27	0.206	-0.0002	0.0011
D_treat	0.3115	0.0856	3.64	0.000	0.1438	0.4792
D_TT	-0.0025	0.0010	-2.59	0.010	-0.0044	-0.0006
key_rate_L1	-0.0091	0.0131	-0.70	0.487	-0.0348	0.0165
GDP_L1	7.8762	1.7849	4.41	0.000	4.3779	11.3745
REER_L1	0.0009	0.0007	1.28	0.199	-0.0005	0.0022
oil_gr_L1	0.0012	0.0010	1.22	0.223	-0.0007	0.0032
IRB	0.0340	0.4017	0.08	0.932	-0.7532	0.8213
Q1	-0.1063	0.0429	-2.48	0.013	-0.1903	-0.0223
Q2	0.0829	0.0410	2.02	0.043	0.0025	0.1633
Q3	-0.0158	0.0419	-0.38	0.705	-0.0978	0.0662
_cons	-0.3126	0.1227	-2.55	0.011	-0.5531	-0.0721

Let us explain the research procedure using the most vivid example. Table 5 shows estimates of the consumer loans share in the bank's assets. We consider the effect of the announcements of measures, taking into account their sensitivity. The coefficient in question for D_TT is statistically significant by 1% and is equal to -0.0025. Taking into account the sensitivity of the measure means that this coefficient refers to an increase in macro add-ons by 1 pp. For the sake of comparison, the average risk weight in the sample for all Russian banks decreased from 95 pp in 2015 to 85 pp in 2019. As we have seen in *Fig. 3*, the largest macro add-ons were up to 100 pp. Taking into account the estimated coefficient, we are concluding that **the increase in macro add-ons by 100 pp corresponded to the fact that 10% of Russian banks with the**

largest share of consumer loans on the balance sheet reduced them by 0.25 pp per quarter compared to other banks, starting from the date of such measure announcement, on average with other things being equal. Now let's check how reliable this conclusion is (taking into account the endogeneity and the validity of tools).

Table 6. The Hausman test to check availability of the endogeneity

	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
Indep. Var.	IV_1	AR_1	Difference	S.E.
Y_L1	0.9872	0.9820	0.0052	0.0005
SIZE_L1	0.0257	0.0287	-0.0031	0.0017
LIQ_L1	0.0007	0.0020	-0.0012	0.0003
DEP_L1	-0.0012	-0.0002	-0.0010	0.0002
CAP_L1	-0.0008	-0.0008	-0.0001	0.0003
D_time	0.0004	0.0003	0.0001	.
D_treat	0.3115	0.4162	-0.1047	0.0189
D_TT	-0.0025	-0.0019	-0.0006	.
key_rate_L1	-0.0091	0.0011	-0.0102	0.0082
GDP_L1	7.8762	5.8219	2.0542	1.4172
REER_L1	0.0009	0.0008	0.0000	.
oil_gr_L1	0.0012	0.0007	0.0006	0.0004
IRB	0.0340	0.0567	-0.0226	.
Q1	-0.1063	-0.1177	0.0114	.
Q2	0.0829	0.0765	0.0064	.
Q3	-0.0158	-0.0095	-0.0063	.

Table 6 shows the estimates of the Hausman test. Formally, the null hypothesis about the significance of the discrepancy in the estimates of the models' coefficients is tested: with instrumental variables (IV_1) and without them (AR_1). It is assumed that the estimates of the model with IV_1 are consistent with the null and alternative hypotheses, whereas the model where the endogeneity (AR_1) is available has effective estimates with the null hypothesis, but is not consistent with the alternative one. Simply put, under the null hypothesis we understand the situation where there is no endogeneity in the model; and under the alternative hypothesis the endogeneity is in place. According to the test results at the bottom of Table 6, we see that the null hypothesis is rejected. Therefore, endogeneity may be available in the model if we have chosen suitable tools. It should be remarked in advance, that the problem with the Hausman test applied to econometrics is that it is tending to indicate availability of the endogeneity.

After evaluating the IV model it is advisable to check the basic requirement for tools. They should correlate with the endogenous variable, but not correlate with the balances. For verification, we will create a variable of the balances of the estimated model (e_iv). Let us estimate the correlation of the balances with the variables in question. The results are available in *Appendix 2*.

We are using the tool (Y_L2) for the dependent variable lag. Its correlation with the endogenous variable (Y_L1) is 99%, just as we wanted it. Its correlation with the balances is -1%, which is also desirable and acceptable. Additionally, we will check our tools.

Table 7 shows the results of testing the null hypothesis of the suitability of tools with an alternative hypothesis of unsuitability thereof. Statistics exceed 80% indicating that the tools we have chosen are suitable. Thereafter, we will use the IV results if the given set of tools is suitable; otherwise (with J-statistic close to zero, i.e. less than a reasonably acceptable level of significance) – OLS will be applied.

Table 7. Checking the suitability of tools

Sargan N*R-sq test	1.539	Chi-sq(4)	P-value	=	0.8197
Basmann test	1.537	Chi-sq(4)	P-value	=	0.8200

We will consider the status of an IRB bank as an additional control characteristic. This means that the organisation uses its own statistics of losses (defaults) for loans and its own models for the forecast thereof. As of the beginning of 2020, only two Russian banks use these approaches: Sberbank and Raiffeisenbank. The expediency of taking into account such a characteristic is caused by a special procedure for calculating macro add-ons provided for IRB banks. It is fixed in Bank of Russia Instruction No. 5072-U (Bank of Russia, 2019). Simply put, the logic of this document is to compare the estimates of risk weights obtained by the bank itself using the IRB model, and risk weights, as if the bank did not use the IRB model (and operated according to the standard approach), but would include macro add-ons. Once comparison is made, the IRB bank should (to calculate its ratios) use its risk weights increased in proportion to the macro add-ons to the risk weights without using the IRB model.

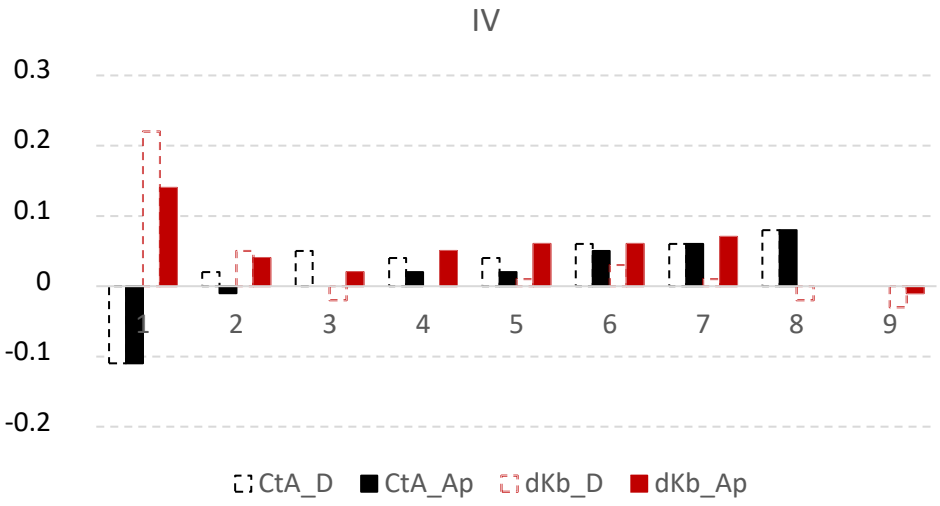
5. Discussion of empirical results

To assess the effectiveness of disincentive macroprudential measures, we will take into account three dependent variables, four types of measures (two categories by date and two by type: for the fact and for the sensitivity), two definitions of the pilot group (by the share of consumer loans and by the capital buffer), nine sizes of pilot groups, two evaluation methods (OLS and IV). Thus, we will consider a total of 3 x 4 x 2 x 9 x 2 = 432 regression models.

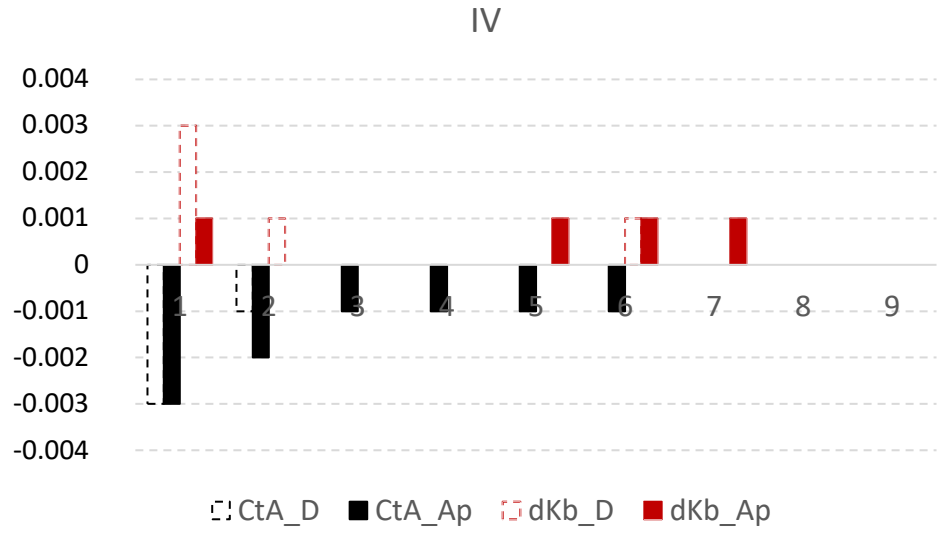
We noted that our goal is to consider the coefficient for the time indicator and belonging to the impact group, i.e. for D_TT. We have described the rule above, according to which we will choose between two methods: OLS and IV. So, let us successively consider two dependent variables on the charts below (the share of consumer loans on the balance sheet – *Fig. 12*, and the increase in all loans – *Fig. 13*; we do not show the increase in loan disbursements, since no significant effects have been revealed). For each of them, we will distinguish the effects of the measure implementation (part ‘a’ of the figures below) and of its intensity (part ‘b’ of the figures

below). Since we are considering the deciles of the sample to determine the pilot group, we will examine the effects collectively (on the same chart) with the same increase in deciles in the pilot group horizontally. Deciles are taken from Table 4. Thus, the results should be read as the mean coefficients per the entire decile. Alternative specifications with all the deciles at a single specification are available in Appendixes 7-20. The general findings hold.

We will visually distinguish the definitions by the share of consumer loans (black on the figures below) and by the buffer (red on the figures below). We will also distinguish the dates of the announcement (dotted lines on the figures below) and the entry into force of the measures (solid fill on the figures below).



(a) Measure implementation fact



(b) Intensity of the measure implemented

Fig. 12. The share of consumer loans in all assets of the bank (CtA)

Note: The deciles of the pilot group definition variable are set horizontally. The number means that at least such a share of banks belongs to the pilot group. For example, 3 means that 30% of banks are a pilot group. The values of the variable corresponding to deciles are given in Table *4*.

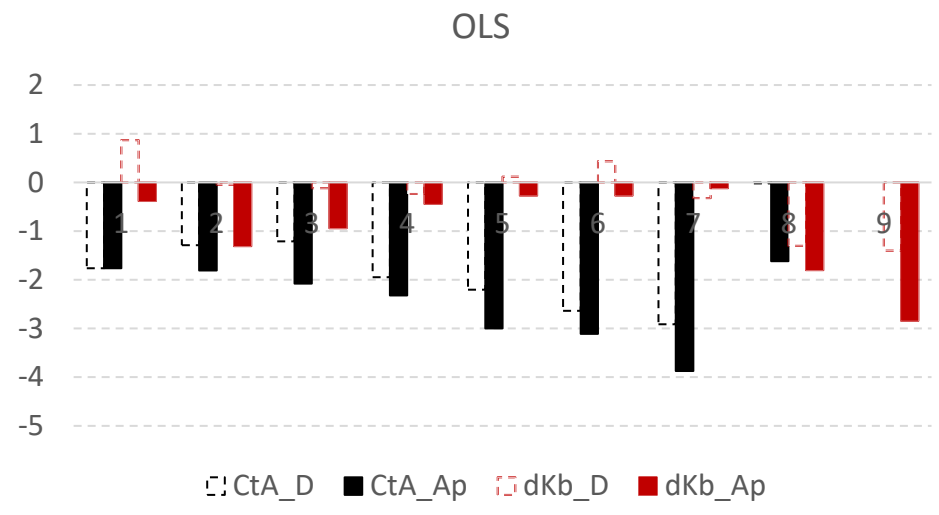
Each column on the figures below corresponds to the estimated coefficient. For more detailed estimation of regression, where significant coefficients were obtained for the dominant method (OLS or IV), see Appendix (for the share of consumer loans on the balance sheet: *Appendix 3 – Appendix 4*; for the increase in all loans on the balance sheet: *Appendix 5 – Appendix 6*). There have been no significant estimates from the measures implemented revealed for the increase in consumer credit disbursements.

Let us consider the significant results more closely. *Fig. 12* contains the results for the share of consumer loans on the balance sheet. For both types of measures, the IV estimates are the best. The interesting thing is that there is a long-lasting effect for banks with the lowest capital stock both in terms of the measure implementation and the intensity thereof.

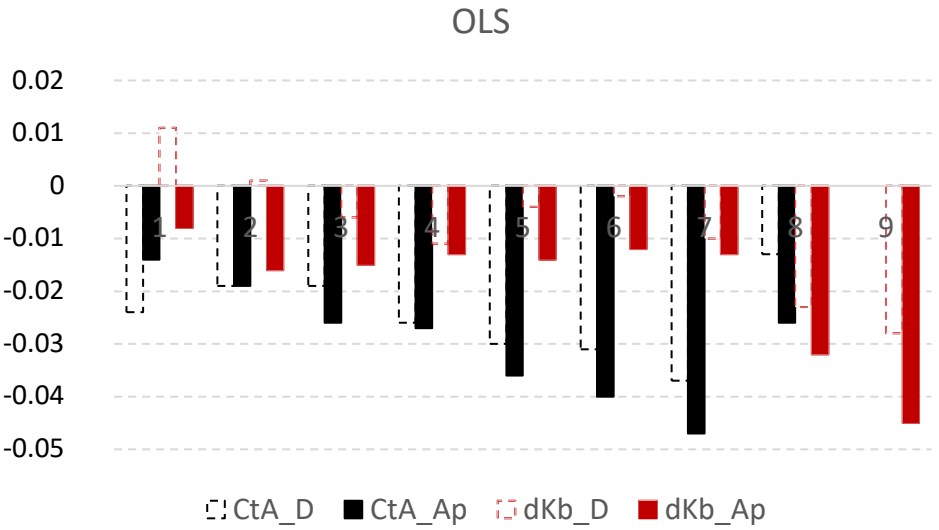
In 10% of banks with the lowest capital stock, the very fact of announcement of the measure implementation is associated with an increase in the share of consumer loans by 0.22 pp. per quarter; every 100 pp., the measures are associated with an increase in the share of consumer loans in such banks by 0.3 pp. per quarter, see the red columns in the first decile on *Fig. 12*. For such a category of banks, the measures implemented can be described as ineffective.

Capital-constrained banks are likely to seek to increase risky lending in order to compensate for the increasing burden on capital from these measures. The low capital stock may not be caused by the specialisation in consumer loans. It is an established fact that the larger the bank, the lower its capital stock, other things being equal. It can largely achieve this due to the high granularity of the loan portfolio, i.e. due to the large number of borrowers, where each individual loan has a small impact on the capital adequacy requirements. As to capital stocks larger than those that only 10% of banks have, there are no stable results.

At the same time, if we look at the indicator of the share of consumer loans on the balance sheet – namely, this indicator is more consistent with the focus of the policy of disincentive macroprudential measures, we see the following. The very fact of measures implementation is not significant, but the intensity of the measure matters. Moreover, **following the announcement of the measure, every 100 pp., macro add-ons correspond to a decrease in consumer loans in 10% of banks with the highest share of consumer loans by 0.3 pp. per quarter. Following the implementation, 30% of banks respond to the measure by the size of such a share. Moreover, by expanding to each additional decile the share is reduced on average less and less: banks with a share of consumer loans of more than 19% in assets reduce by 0.3 pp. per quarter from 100 pp. of macro add-ons, banks with a share above 12% reduce by 0.2 pp.; banks with a share in excess of 8% – by -0.1% per quarter.**



(a) Measure implementation fact



(b) Intensity of the measure implemented

Fig. 13. The growth rate of all loans on the bank's balance sheet per quarter

Note: The deciles of the pilot group definition variable are set horizontally. The number means that at least such a share of banks belongs to the pilot group. For example, 3 means that 30% of banks are a pilot group. The values of the variable corresponding to deciles are given in Table *4*.

For example, 100 pp. of macro add-ons means that with the effect of -0.3 pp. per quarter, the bank can reduce consumer loans by one percentage point per year. These effects can be described as desirable. In banks with a large share of consumer loans, this share decreases after the implementation of measures. Therefore, in this part, macroprudential measures can be described as effective.

Let us consider the conclusions regarding the growth rate of all loans, see *Fig. 13*. In this case, the tools have not proven suitable. Therefore, we use OLS estimates. Firstly, both the fact and the intensity of the measure indicate a significant negative effect for the pilot banks. This means that **following the implementation of the measures, the pilot banks had lower lending growth rates than the control ones by about 2–4% per quarter. Provided that every 100 pp.**

of macro add-ons correspond to a reduction by 2–6% per quarter, depending on the size of the pilot group. This is typical of 70% of banks by the amount of consumer loans on the balance sheet (with the share of consumer loans above 1.4% of all bank assets). Secondly, the effect itself increases in absolute terms, with a decrease in the share of consumer loans on the balance sheet. Thirdly, the effect is more significant from the dates of entry into force than from the date of the announcement of measures. Thus, the implementation of measures to limit the risks associated with consumer loans significantly reduces the growth rate of loans in banks with a high share of such loans (in fact, in banks where they just exist). This is an attractive result for the regulator in terms of overall financial stability.

Let us discuss an additional result related to the verification of the effect for IRB banks. In most models, the coefficients for the IRB variable are insignificant. Nevertheless, they are positive for the share of consumer loans and the growth rate of all loans; and negative – for the rate of issuance of consumer loans. Moreover, the positive coefficient for the growth rate of loans is statistically significant and is about 2% per quarter (*Appendix 5*), if we consider extreme situations (when only 10% or 90% of banks are referred to as pilot). This means that IRB banks have more relative volumes of consumer loans, other things being equal, they increase them more slowly (since they are already larger than other banks have), and they issue loans at a significantly faster rate (this is largely why banks had incentives to switch to IBR to get opportunities for such an increase in lending, other things being equal).

Additional robustness checks are available in Appendixes 7-13. We consider all three dependent variables: the share of consumer loans in total book (CtA), the growth rate of consumer loans (d_log_cl) and that of total loans (d_log_loans). We break down the sample by bank categories: look at the entire sample and at the SIFIs (SZKO) only. Alternatively we look at the entire sample by time and exclude the period of 2015-2017Q2 when the risk-weight add-ons were the largest. We also incorporate all the deciles by the exposure indicator into a single regression to see comparison between the deciles without the above discussed the effect of deciles expanding in the number of covered banks.

According to the results of our study, we see two interesting results when combining different conclusions. Firstly, the use of the modified difference-in-differences method with the replication of a part of the sample allows us to more accurately assess the effect of economic policy measures. In particular, the methodology of the Bank for international settlements is used in the paper by Kozlovtceva, Penikas, Petreneva, & Ushakova (2020). The result is that the growth rate of loans on the balance sheet of banks (d_log_loans) increases on average a year after the implementation of measures. It is indicated that the same conclusion was for Thailand. It does not meet the expectations of the regulator. The justification given is that we do not consider the

situation without the implementation of measures. In this paper, we have seen that the effect is the reduction of the share of consumer loans on the balance sheet for 30% of banks with their share of more than 8%, and the growth rate of all loans on the balance sheet is reduced by 70% of banks with such a share of more than 1.4%. When we expanded the sample beyond the identified thresholds, we did not see the policy effect. Thus, with the sample consolidated as much as possible, we obtain the same result as in Kozlovtceva, Penikas, Petreneva, & Ushakova (2020). Therefore, we emphasise once again that the use of the modified difference-in-differences method allows us to identify categories of banks for whom measures can be considered effective; and for whom – ineffective.

Secondly, let us correlate the three conclusions obtained. First of all, the implementation of disincentive measures is associated with a decrease in the share of consumer loans on the balance sheets of banks, where such a share is large. However, the rate of decline is economically slow. It is rather caused by a faster growth of all the bank's assets than by a deliberate reduction in the consumer loan portfolio. Second, there was no significant relationship between the growth rate of consumer loans disbursements and the measures implemented. This confirms the previous statement that there is no reduction in the issuance of consumer loans, but rather banks are just increasing other assets. Third, the implementation of measures is significantly associated with a reduction in the growth rate of all loans. Thus, here is what we have. The announcement of the measures affects the most 'aggressive' banks in the segment. They may be starting to adjust their strategies to a greater extent, although the rest are probably also reviewing their credit policies. Such adjustments and revisions are reflected in the fact that by the time the measures come into force, banks reduce the growth rate of other loans, but not unsecured consumer loans, in order to preserve the existing portfolio of the latter.

The effect of the measure turns to be more complicated than it was expected. On the one hand, the measures generally reduce the risks taken by banks, judging by the reduction in the growth rate of all loans on the balance sheet. On the other hand, the loan portfolios targeted by the measures do not radically decrease in most banks. Here we can create a linkage between the effect of disincentive macroprudential measures and the 'Giffen effect'. The latter is associated with the fact that the increase in prices of basic goods during crisis periods results in these goods only remained in the household budget. We have basically the same situation with consumer loans. The growth of their 'price' through the implementation of disincentive macroprudential measures leads to the fact that banks reduce (or slow down) other forms of lending, but not unsecured consumer loans. It cannot be excluded that the considered growth of such lending in the first quarter of 2021 (Bank of Russia, 2021) is a consequence of this effect.

6. Conclusion

In 2015–2019, Russia saw an active growth in unsecured consumer lending. Following the pandemic period in 2020, the pace returned to the previous dynamics. Before the pandemic, the Bank of Russia applied a number of disincentive macroprudential measures to limit the risks associated with such lending for financial stability. During the pandemic, these measures were cancelled to create incentives for banks to activate lending and boost the economy. Given the observed pace of economic recovery, the Bank of Russia not only indicated a return to the application of disincentive measures from mid-2021, but also planned to create a new restrictive tool for such loans from 2022. Therefore, there is a question: which of the two types of measures should be applied and with what intensity? And moreover, how to optimally combine the use of both measures?

To a great extent, we can answer these questions only in terms of disincentive measures, since they have already been applied and statistics is available. For restrictive measures, it is only possible to use foreign experience. However, even the availability of data on the measures applied does not make it easy to answer the question. For example, the paper by Kozlovtceva, Penikas, Petreneva, & Ushakova (2020) shows that about a year after the implementation of such measures, the overall growth rate of lending increased. It may appear that this indicates the ineffectiveness of the measures. It seems that only restrictive measures should be applied. This is not the case. There are two arguments here. We have found one in the current study, and we will note the second one for the reader to think about.

The first argument involves the revealed efficiency of disincentive measures. Through modification of the difference-in-differences method on the same data that were used in paper by Kozlovtceva, Penikas, Petreneva, & Ushakova (2020), we have identified that it is certainly incorrect to judge the effect by the total population without dividing it into a control and a pilot one. The current study has revealed that there are two channels of influence of disincentive measures.

First of all, banks with a share of consumer loans of more than about 20% of all assets already respond to the announcement of the implementation of such measures. For every 100 pp. of macro add-ons, they reduce the share of such loans by 0.3% per quarter. Let us take as an example macro add-ons of 600% (we did not consider them in the paper). They came into force in January 2014 and were applied to rate loans (with the effective interest rate on credit) of more than 60% per annum. Macro add-ons of this size are likely to reduce the share of the consumer loan portfolio in the bank's assets for one year by 7 pp., if the bank's share of such loans was more than 20%, i.e. from 20% to 13% in this example.

Secondly, after the disincentive measures come into force, almost all banks with consumer loans on the balance sheet (about 70% of all banks) reduce the growth rate of all loans on the balance sheet. Given that they do not reduce the share of consumer loans (except for the banks with the largest share), it means that they are changing their strategies, without fundamentally abandoning unsecured consumer lending.

Thus, both channels of disincentive macroprudential measures can be described as effective in terms of limiting the aggregate risks to financial stability. The first channel is implemented through direct exposure to the most risky loans in the most highly specialised banks. The second channel is implemented indirectly through a decrease in lending in other segments. Therefore, it is not advisable to abandon these disincentive measures. It is important to use the sensitivity estimates obtained (-0.3 pp. per quarter for the share of consumer loans and -2–6 pp. of the rate of decline in lending per quarter by 100 pp. of macro add-ons). If the regulator formulates the goal in terms of these indicators (how much they need to be reduced), the estimates obtained can be used to obtain the values of macro add-ons to be applied.

The second argument is that we need to remember about the procedure for implementing restrictive measures. We cannot exclude the possibility of establishing subsidiaries by the banks that, like microfinance organisations, will focus on unsecured consumer lending. The current rules of consolidation and recognition of subsidiaries in the capital allow, with some ownership interests, not to completely consolidate the organisation, but, in fact, to recognise it as an asset with market risk. As the draft legislation of (Bank of Russia, 2021) includes the mentioned microfinance entities, we do not expect material arbitrage opportunities to appear.

Nevertheless, after the macroprudential limits introduction in 2022 and the accumulation of statistics, a similar study can be conducted to answer the question of the efficiency of new limits operating in combination with the macroprudential risk-weight add-ons.

APPENDICES

Appendix 1. Descriptive statistics of the variables under examination

No.	Variable	Description	UoM	Obs	Mean	Std.Dev.	Min	Max
1	CtA	share of consumer loans on the balance sheet	pp.	11,623	7.71	11.83	0.00	93.92
2	d_log_cl	growth rate of consumer loans per quarter	pp.	8132	-6.51	135.85	-923.05	889.02
3	d_log_loans	the growth rate of all loans on the balance sheet per quarter	pp.	9,531	-4.15	22.63	-158.61	158.23
4	SIZE	bank's size, logarithm of thousand rubles	ln (RUB, thous.)	11,623	10.97	2.10	3.49	19.25
5	LIQ	share of liquid assets on the balance sheet	pp.	11,623	39.06	23.57	0.00	100.00
6	DEP	share of deposits on the balance sheet	pp.	11,623	55.81	23.32	0.00	100.00
7	CAP	capital adequacy requirements (N1.0)	pp.	11,276	32.60	34.67	0.00	854.12
8	kb	capital stock above the minimum, calculated according to three standards	pp.	11,759	16.40	26.38	-22.19	844.12
9	key_rate	average daily real key rate per quarter (adjusted for inflation, CPI)	pp.	15,700	3.57	2.28	-2.55	7.06
10	GDP	GDP growth	%	15,700	0.01	0.02	-0.03	0.03
11	REER	real exchange rate increase	%	15,700	-11.97	30.06	-125.82	6.00
12	oil_gr	increase in the average monthly prices of Brent oil	pp.	14,911	1.99	18.21	-33.71	34.14
13	IRB	status of the bank's use of the internal ratings-based (IRB) approach when calculating the capital adequacy ratio N1.0 in accordance with the requirements of Regulation No. 483-P[1]	unit	15,700	0.00	0.03	0.00	1.00
14	Q1	dummy variable for the 1st quarter	unit	15,700	0.25	0.43	0.00	1.00
15	Q2	dummy variable for the 2nd quarter	unit	15,700	0.25	0.43	0.00	1.00
16	Q3	dummy variable for the 3rd quarter	unit	15,700	0.25	0.43	0.00	1.00

[1]Source: For the period 2015–2019, two banks in Russia began to use IRB approach: Sberbank (1481) – from 01 January 2018 (https://bosfera.ru/press-release/sberbank-pervym-v-rossii-poluchil-razreshenie-na-primenenie-pvr), Raiffeisenbank (3292) – from 01 February 2019 (https://www.raiffeisen.ru/about/press/releases/128190/).

Appendix 2. Checking the correlation of endogenous regressors, balances and tools

	Y_L1	SIZE_L1	LIQ_L1	DEP_L1	CAP_L1	e_iv	Y_L2	Y_L3	SIZE_L2	LIQ_L2	DEP_L2	CAP_L2	SIZE_L3	LIQ_L3	DEP_L3
Y_L1	1.00														
SIZE_L1	0.08	1.00													
LIQ_L1	-0.32	-0.33	1.00												
DEP_L1	0.09	0.20	-0.11	1.00											
CAP_L1	-0.13	-0.33	0.32	-0.26	1.00										
e_iv	-0.01	0.00	0.02	0.01	0.01	1.00									
Y_L2	0.99	0.08	-0.32	0.10	-0.13	-0.01	1.00								
Y_L3	0.98	0.07	-0.31	0.10	-0.13	-0.02	0.99	1.00							
SIZE_L2	0.08	1.00	-0.34	0.20	-0.33	0.00	0.08	0.07	1.00						
LIQ_L2	-0.32	-0.33	0.94	-0.12	0.32	0.01	-0.32	-0.31	-0.33	1.00					
DEP_L2	0.10	0.20	-0.13	0.96	-0.27	-0.01	0.10	0.10	0.20	-0.11	1.00				
CAP_L2	-0.12	-0.31	0.30	-0.24	0.87	0.01	-0.12	-0.12	-0.32	0.30	-0.25	1.00			
SIZE_L3	0.08	0.99	-0.34	0.19	-0.34	-0.01	0.08	0.07	1.00	-0.33	0.19	-0.32	1.00		
LIQ_L3	-0.31	-0.32	0.91	-0.12	0.31	0.01	-0.31	-0.32	-0.33	0.94	-0.12	0.30	-0.32	1.00	
DEP_L3	0.10	0.19	-0.14	0.94	-0.27	-0.01	0.10	0.10	0.19	-0.13	0.96	-0.25	0.19	-0.11	1.00
CAP_L3	-0.02	-0.05	0.06	-0.03	0.13	0.00	-0.02	-0.02	-0.05	0.06	-0.04	0.13	-0.06	0.06	-0.05

Note: the description of the variables is given in Appendix *1*; L1, L2, L3 are the lags for 1–3 quarters of the specified variables, respectively; e_iv are the balances from the model with instrumental variables (detailed estimates of the model are given in Table *5*).

Appendix 3. *The share of consumer loans on the balance sheet* for the date of the **announcement** of the measure, deciles for the share of consumer loans on the balance sheet, the intensity of the measure

Variable	**IV_1**	**IV_2**	**IV_3**	**IV_4**	**IV_5**	**IV_6**	**IV_7**	**IV_8**	**IV_9**
D_time	0	0	0	0	0	0	0	0	0
D_treat	0.312***	0.098	-0.014	-0.053	-0.039	-0.049	-0.03	-0.021	(omitted)
D_TT	-0.003***	-0.001	0	0	0	0	0	0	(omitted)
Y_L1	0.987***	0.990***	0.992***	0.993***	0.993***	0.992***	0.992***	0.992***	0.992***
SIZE_L1	0.026***	0.026***	0.025***	0.024***	0.024***	0.024***	0.025***	0.025***	0.026***
LIQ_L1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
DEP_L1	-0.001	-0.001*	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001*
CAP_L1	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
key_rate_L1	-0.009	-0.009	-0.009	-0.009	-0.009	-0.009	-0.01	-0.01	-0.01
GDP_L1	7.876***	7.820***	7.783***	7.679***	7.728***	7.755***	7.812***	7.816***	7.815***
REER_L1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
oil_gr_L1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
IRB	0.034	-0.005	0.02	0.04	0.025	0.022	0.01	0.005	0.002
Q1	-0.106**	-0.107**	-0.107**	-0.107**	-0.107**	-0.107**	-0.107**	-0.107**	-0.107**
Q2	0.083**	0.083**	0.084**	0.085**	0.084**	0.084**	0.084**	0.084**	0.083**
Q3	-0.016	-0.015	-0.014	-0.014	-0.014	-0.014	-0.014	-0.014	-0.014
N	14132	14132	14132	14132	14132	14132	14132	14132	14132
r2c	0.979	0.979	0.979	0.979	0.979	0.979	0.979	0.979	0.979
idstat	1.10E+04	1.10E+04	1.10E+04	1.10E+04	1.10E+04	1.10E+04	1.10E+04	1.10E+04	1.10E+04
jp	0.82	0.813	0.823	0.84	0.839	0.846	0.836	0.829	0.819

Note: levels of significance: * p<.1; ** p<.05; *** p<.01; N – number of observations, r2_c – centred coefficient of determination, idstat – Anderson canonical statistics of Lagrange multiplier test (high value indicates that there are no underdetermined tools in the equation), jp – Sargan J test of tools feasibility (high rates show that there are no overdetermined tools in the equation, i.e. that the specified tools are feasible). The deciles of the pilot group definition variable are indicated in the column headers after the '_' sign. The number means that at least such a share of banks belongs to the pilot group. For example, 3 means that 30% of banks are a pilot group. The values of the variable corresponding to deciles are given in Table *4*.

Appendix 4. *The share of consumer loans on the balance sheet* for the **effective date** of the measure, deciles for the share of consumer loans on the balance sheet, the intensity of the measure

Variable	IV_1	IV_2	IV_3	IV_4	IV_5	IV_6	IV_7	IV_8	IV_9
D_time	0	0	0	0	0	0	0	0	0
D_treat	0.180***	0.074	0.051	0.001	-0.003	-0.005	0.004	0.021	(omitted)
D_TT	-0.003**	-0.002**	-0.001*	-0.001	-0.001	-0.001	0	0	(omitted)
Y_L1	0.991***	0.992***	0.992***	0.993***	0.993***	0.993***	0.993***	0.993***	0.993***
SIZE_L1	0.028***	0.028***	0.028***	0.028***	0.028***	0.028***	0.028***	0.029***	0.028***
LIQ_L1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
DEP_L1	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
CAP_L1	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
key_rate_L1	-0.004	-0.006	-0.007	-0.007	-0.008	-0.008	-0.008	-0.008	-0.008
GDP_L1	6.859***	7.228***	7.325***	7.380***	7.396***	7.403***	7.411***	7.396***	7.410***
REER_L1	0.001	0.001	0.001	0.001*	0.001*	0.001*	0.001*	0.001*	0.001*
oil_gr_L1	0.001	0	0	0	0	0	0	0	0
IRB	0.062	0.051	0.043	0.067	0.065	0.064	0.059	0.056	0.059
Q1	-0.073	-0.094**	-0.099**	-0.106**	-0.106**	-0.107**	-0.106**	-0.105**	-0.106**
Q2	0.138***	0.115***	0.111***	0.102***	0.102***	0.102***	0.102***	0.103***	0.102***
Q3	0.044	0.021	0.017	0.009	0.008	0.008	0.009	0.009	0.009
N	14285	14285	14285	14285	14285	14285	14285	14285	14285
r2c	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
idstat	1.10E+04	1.10E+04	1.10E+04	1.10E+04	1.10E+04	1.10E+04	1.10E+04	1.10E+04	1.10E+04
jp	0.801	0.797	0.79	0.796	0.795	0.796	0.79	0.776	0.787

Note: levels of significance: * p<.1; ** p<.05; *** p<.01; N – number of observations, r2_c – centred coefficient of determination, idstat – Anderson canonical statistics of Lagrange multiplier test (high value indicates that there are no underdetermined tools in the equation), jp – Sargan J test of tools feasibility (high rates show that there are no overdetermined tools in the equation, i.e. that the specified tools are feasible). The deciles of the pilot group definition variable are indicated in the column headers after the '_' sign. The number means that at least such a share of banks belongs to the pilot group. For example, 3 means that 30% of banks are a pilot group. The values of the variable corresponding to deciles are given in Table *4*.

Appendix 5. *The increase in all loans on the balance sheet* for the date of the **announcement** of the measure, deciles for the share of consumer loans on the balance sheet, the intensity of the measure

Variable	OLS2_1	OLS2_2	OLS2_3	OLS2_4	OLS2_5	OLS2_6	OLS2_7	OLS2_8	OLS2_9
D_time	0.001	0.002	0.004	0.011**	0.016***	0.019***	0.028**	0.009	-0.001
D_treat	2.784***	2.496***	2.244***	2.011***	2.421***	2.812***	4.704***	6.052***	(omitted)
D_TT	-0.024***	-0.019***	-0.019***	-0.026***	-0.030***	-0.031***	-0.037***	-0.013	(omitted)
SIZE_L1	0.511***	0.538***	0.537***	0.537***	0.550***	0.569***	0.626***	0.649***	0.501***
LIQ_L1	-0.038*	-0.037	-0.036	-0.038*	-0.036	-0.036	-0.033	-0.03	-0.045**
DEP_L1	0.056**	0.054**	0.052**	0.052**	0.051**	0.049**	0.041*	0.031	0.056**
CAP_L1	0	0.001	0.001	0	0.001	0.002	0.004	0.001	0
key_rate_L1	0.379**	0.387**	0.385**	0.379**	0.384**	0.381**	0.379**	0.370**	0.372**
GDP_L1	41.131**	41.428**	42.355**	42.464**	42.996**	42.376**	41.504**	41.203**	40.278**
REER_L1	-0.016	-0.016	-0.016	-0.016	-0.016	-0.016	-0.016	-0.016	-0.016
oil_gr_L1	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
IRB	2.185*	1.682	0.767	1.167	1.134	1.096	0.807	1.004	1.943*
Q1	-3.171***	-3.191***	-3.178***	-3.160***	-3.162***	-3.171***	-3.177***	-3.199***	-3.184***
Q2	-4.543***	-4.549***	-4.553***	-4.543***	-4.543***	-4.552***	-4.579***	-4.574***	-4.542***
Q3	-1.173*	-1.192*	-1.195*	-1.182*	-1.196*	-1.185*	-1.192*	-1.164*	-1.154
_cons	-11.081***	-11.570***	-11.703***	-11.790***	-12.418***	-13.062***	-15.236***	-16.686***	-10.412***
N	13235	13235	13235	13235	13235	13235	13235	13235	13235
r2	0.016	0.017	0.017	0.017	0.017	0.018	0.02	0.02	0.016
r2_a	0.015	0.016	0.016	0.016	0.016	0.017	0.019	0.019	0.015

Note: levels of significance: * p<.1; ** p<.05; *** p<.01; N – number of observations, r2 – coefficient of determination, r2_a – adjusted coefficient of determination, _cons – constant. The deciles of the pilot group definition variable are indicated in the column headers after the '_' sign. The number means that at least such a share of banks belongs to the pilot group. For example, 3 means that 30% of banks are a pilot group. The values of the variable corresponding to deciles are given in Table *4*.

Appendix 6. *The increase in all loans on the balance sheet* for the **effective date** of the measure, deciles for the share of consumer loans on the balance sheet, the intensity of the measure

Variable	OLS2_1	OLS2_2	OLS2_3	OLS2_4	OLS2_5	OLS2_6	OLS2_7	OLS2_8	OLS2_9
D_time	0.010***	0.013***	0.017***	0.021***	0.029***	0.036***	0.046***	0.031	0.008**
D_treat	1.636**	1.755***	2.078***	1.481**	1.919***	2.592***	4.168***	5.984***	(omitted)
D_TT	-0.014	-0.019**	-0.026***	-0.027***	-0.036***	-0.040***	-0.047***	-0.026	(omitted)
SIZE_L1	0.508***	0.524***	0.532***	0.527***	0.539***	0.559***	0.600***	0.639***	0.507***
LIQ_L1	-0.040*	-0.039*	-0.036	-0.039*	-0.038	-0.037	-0.034	-0.031	-0.044*
DEP_L1	0.054**	0.053**	0.051**	0.052**	0.051**	0.048**	0.042*	0.033	0.055**
CAP_L1	0.001	0.001	0.001	0.001	0.001	0.002	0.004	0.003	0.001
key_rate_L1	0.22	0.227	0.229	0.221	0.223	0.223	0.223	0.21	0.201
GDP_L1	32.600*	33.355*	34.742**	35.898**	36.169**	36.395**	35.420**	35.398**	35.362**
REER_L1	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.003	-0.003
oil_gr_L1	-0.002	-0.003	-0.003	-0.004	-0.004	-0.004	-0.004	-0.005	-0.006
IRB	1.887	1.602	0.843	1.294	1.259	1.137	0.977	1.027	1.852
Q1	-2.368***	-2.392***	-2.387***	-2.500***	-2.502***	-2.506***	-2.520***	-2.569***	-2.674***
Q2	-3.970***	-3.983***	-3.959***	-4.082***	-4.083***	-4.078***	-4.092***	-4.148***	-4.299***
Q3	-0.46	-0.478	-0.464	-0.577	-0.577	-0.571	-0.579	-0.623	-0.761
_cons	-10.471***	-10.843***	-11.244***	-10.973***	-11.549***	-12.346***	-14.149***	-16.145***	-9.781***
N	13342	13342	13342	13342	13342	13342	13342	13342	13342
r2	0.015	0.016	0.016	0.016	0.016	0.017	0.019	0.019	0.015
r2_a	0.014	0.015	0.015	0.015	0.015	0.016	0.018	0.018	0.014

Note: levels of significance: * p<.1; ** p<.05; *** p<.01; N – number of observations, r2 – coefficient of determination, r2_a – adjusted coefficient of determination, _cons – constant. The deciles of the pilot group definition variable are indicated in the column headers after the '_' sign. The number means that at least such a share of banks belongs to the pilot group. For example, 3 means that 30% of banks are a pilot group. The values of the variable corresponding to deciles are given in Table *4*.

Appendix 7. Impact for the proportion of consumer loans (CtA). Measure (MaP) – signal at enforcement date (F_Ap). Treatment dimension by CtA.

	All Banks.		All Banks.		SIFIs		SIFIs	
	2015-2019		2017Q3 - 2019		2015-2019		2017Q3 - 2019	
Variable	**OLS**	**IV**	**OLS**	**IV**	**OLS**	**IV**	**OLS**	**IV**
IRB	-2.565*	0.067	-1.698	-0.166	2.186	-0.19	0.938	-0.467*
D_time	-1.468***	-0.038	-0.039	0.048	-0.12	-0.023	-0.065	0
p1	21.165***	0.149*	32.301***	0.623***	29.158***	0.326	47.367***	1.308
p2	8.521***	-0.087	11.210***	0.439***	4.246	0.277	10.570***	0.044
p3	2.942***	-0.015	6.342***	0.222**	8.296**	0.058	8.629***	0.226
p4	(omitted)	-0.088	3.348***	0.170*	9.102**	-0.006	7.077***	0.316
p5	-1.877***	-0.011	1.889***	0.13	7.170**	0.089	6.576***	0.292
p6	-3.114***	-0.034	0.942***	0.09	5.982	0.007	4.200***	-0.231
p7	-4.124***	0.015	(omitted)	0.084	1.777	-0.07	2.526**	-0.304
p8	-5.069***	0.016	-1.049***	0.047	0.611	-0.052	3.569**	-1.192
p9	-4.756***	(omitted)	-1.752***	(omitted)	-0.492	0.137	2.499**	-0.584
p1_TT	-2.836***	-0.032	-0.116	-0.361***	-4.152***	0.12	4.44	0.123
p2_TT	(omitted)	0.167	0.135	-0.202	-0.321	-0.02	0.196	0.017
p3_TT	0.382	0.08	0.041	-0.054	-0.464	0.336	1.483***	0.187
p4_TT	0.578*	0.103	-0.015	-0.056	-0.211	0.162	0.624	-0.178
p5_TT	0.979***	0.087	0.117	0.049	0.691	0.207	-0.015	0.054
p6_TT	1.374***	0.129	0.132	0.036	-0.863	-0.138	-0.153	0.028
p7_TT	1.444***	0.059	(omitted)	0.051	-1.006	0.115	0.56	-0.151
p8_TT	1.381***	0.06	0.099	0.058	2.727	0.039	-0.165	0.275
p9_TT	1.357***	(omitted)	0	(omitted)	1.191	0.048	0.486	0.149
N	15049	14285	7373	6330	329	314	187	164
r2_a	53.2%	98.0%	70.3%	98.8%	69.6%	99.3%	94.5%	99.6%
r2c		98.0%		98.8%		99.4%		99.7%
idstat		1.10E+04		5193.917		90.372		37.01
jp		0.795		0.113		0.52		0.488

Appendix 8. Impact for the proportion of consumer loans (CtA). Measure (MaP) – signal at enforcement date (F_Ap). Treatment dimension by KB.

	All Banks.		All Banks.		SIFIs		SIFIs	
	2015-2019		2017Q3 - 2019		2015-2019		2017Q3 - 2019	
Variable	OLS	IV	OLS	IV	OLS	IV	OLS	IV
IRB	2.345	0.097	0.826	-0.106	4.397	-0.158	8.116	-0.43
D_time	0.329	0.036	0.221*	0.059	3.425	-0.352	1.378	-0.368
p1	0.462	-0.088	-1.313	-0.252*	8.835	-0.168	7.661	0.104
p2	4.782**	0.189**	4.553*	0.038	-2.976	-0.131	(omitted)	(omitted)
p3	3.372**	0.043	3.22	0.114	6.252	-0.229	-0.227	0.173
p4	2.815**	0.043	2.743	0.026	4.6	-0.168	5.554	0.058
p5	0.151	-0.016	0.631	0.131	10.534	-0.089	6.509	-0.478
p6	0.005	0.118	-2.132**	0.088	1.251	0.021	5.33	0.299
p7	0.271	-0.007	-1.555	0.03	12.119	-0.456	-2.881	0.384
p8	-0.392	-0.062	-1.920**	-0.02	14.944*	-0.045	5.865	0.225
p9	-0.476	-0.096	-1.417	0.017	3.951	-0.495	15.744**	-0.786
p1_TT	-0.374	0.11	-0.142	0.227	-3.288	0.522	-1.157	0.34
p2_TT	0.827	-0.061	0.398	-0.014	-4.542	0.341	(omitted)	(omitted)
p3_TT	-0.599	-0.029	-1.140***	-0.146	-4.844	0.401	-0.935	0.268
p4_TT	-0.146	0.059	-0.142	-0.062	-2.412	0.318	-0.644	0.359
p5_TT	-0.393	0.02	-0.157	-0.186	-8.155	0.262	-12.217	0.644
p6_TT	-0.205	-0.019	-0.337	-0.09	-4.009	0.351	-3.164	-0.122
p7_TT	-0.684**	-0.011	-0.288	-0.151	-6.015	0.109	-3.163	0.484
p8_TT	-0.548	-0.144	-0.467**	-0.076	-4.859	0.404	-1.472	0.252
p9_TT	-0.663**	-0.033	-0.104	0.018	-1.236	1.596**	1.193	2.153***
N	15049	14285	7373	6330	329	314	187	164
r2_a	12.2%	98.0%	14.0%	98.8%	49.8%	99.3%	50.3%	99.6%
r2c		98.0%		98.8%		99.4%		99.7%
idstat		1.10E+04		4824.358		84.529		59.332
jp		0.796		0.135		0.495		0.397

Appendix 9. Impact for the proportion of consumer loans (CtA). Measure (MaP) – sensitivity at draft date (S_D). Treatment dimension by CtA.

	All Banks.		All Banks.		SIFIs		SIFIs	
	2015-2019		2017Q3 - 2019		2015-2019		2017Q3 - 2019	
Variable	OLS	IV	OLS	IV	OLS	IV	OLS	IV
IRB	-1.36	0.061	-1.093	-0.213	-8.53	-0.264	-0.928***	-0.740**
D_time	-0.006	-0.001	0.001	0	0.014	0.002	0.006*	0.003
p1	19.600***	0.163	33.212***	0.217	47.478***	0.724	54.228***	20.800***
p2	(omitted)	-0.06	12.214***	0.259***	11.197***	0.295	12.901***	4.801***
p3	-5.226***	-0.081	7.263***	0.164*	9.606***	0.382	10.346***	3.990***
p4	-8.139***	-0.065	4.273***	0.069	8.798***	0.203	7.759***	2.850***
p5	-10.002***	0.005	2.851***	0.054	7.216***	0.132	6.754***	2.433***
p6	-11.225***	-0.028	2.089***	0.150*	4.236***	0.011	4.038***	1.210**
p7	-12.234***	0.013	0.987***	0.066	3.046**	0.019	3.377***	0.975*
p8	-13.294***	0.002	(omitted)	0.075	4.127*	0.248	3.207***	0.331
p9	-14.058***	(omitted)	-0.846**	(omitted)	2.364*	0.143	2.019***	0.171
p1_TT	0.024	0	0.015*	-0.004	-0.017	-0.004	-0.025***	-0.020*
p2_TT	0.001	0.007**	0.005	0	0.009	0.007	0.007	0.005
p3_TT	0.002	0.002	0.001	-0.003	-0.018	-0.002	-0.010*	-0.005
p4_TT	(omitted)	0	0.002	0	0.068	0	-0.002	-0.001
p5_TT	0.004	0.001	0.001	0	-0.008	0	-0.001	0
p6_TT	0.007**	0.001	-0.001	0	0.049	-0.01	-0.004	0.001
p7_TT	0.007*	0.001	-0.001	0.001	-0.005	-0.002	-0.001	0.002
p8_TT	0.006*	0.001	(omitted)	0	-0.006	-0.001	-0.008	-0.001
p9_TT	0.005	(omitted)	0	(omitted)	0.022	0.005	0.005***	0.001
N	14900	14132	6085	5042	315	300	151	128
r2_a	71.1%	97.9%	70.6%	98.8%	86.4%	99.4%	99.3%	99.7%
r2c		97.9%		98.8%		99.4%		99.7%
idstat		1.10E+04		4163.576		71.448		29.458
jp		0.831		0.143		0.623		0.77

Appendix 10. Impact for the proportion of consumer loans (CtA). Measure (MaP) – sensitivity at enforcement date (S_Ap). Treatment dimension by CtA.

	All Banks.		All Banks.		SIFIs		SIFIs	
	2015-2019		2017Q3 - 2019		2015-2019		2017Q3 - 2019	
Variable	OLS	IV	OLS	IV	OLS	IV	OLS	IV
IRB	-2.577**	0.043	-1.7	-0.162	1.852	-0.224	0.892	-0.448
D_time	0.006	-0.001	-0.001	0.001	0.019***	0.004	0.005	0.003
p1	22.527***	0.135*	32.217***	0.605***	31.605***	0.301	47.536***	1.426
p2	8.304***	-0.083	11.183***	0.382***	4.718	0.278	10.510***	0.021
p3	2.808***	-0.021	6.351***	0.221**	7.953**	0.144	8.811***	0.263
p4	(omitted)	-0.085	3.314***	0.125	8.906**	0.005	7.305***	0.3
p5	-1.784***	0.003	1.894***	0.152*	7.055**	0.139	6.639***	0.297
p6	-3.014***	-0.032	0.937***	0.083	6.072	-0.014	4.326***	-0.165
p7	-3.957***	0.025	(omitted)	0.103	1.7	-0.059	2.617**	-0.238
p8	-4.866***	0.027	-1.034***	0.058	1.064	-0.015	3.352*	-0.958
p9	-4.644***	(omitted)	-1.755***	(omitted)	-0.329	0.154	2.597**	-0.375
p1_TT	-0.213***	0	0.002	-0.009***	-0.234***	0.002	0.104	-0.012
p2_TT	0.002	0.007*	0.005	-0.002	0	-0.001	0.004	0.002
p3_TT	0.009	0.004	0	-0.001	0.032	0.004	0.025***	0.001
p4_TT	(omitted)	0.004	0.002	0.001	-0.001	0.005	0.005	-0.006
p5_TT	0.003	0.002	0.003	0	0.023	0	-0.004	-0.001
p6_TT	0.017***	0.005	0.004	0.001	-0.103**	-0.005	-0.015	-0.002
p7_TT	0.011*	0.001	(omitted)	0	-0.015	0.002	0.004	-0.005
p8_TT	0.004	0.001	0.002	0.001	0.062	-0.002	-0.003	0.001
p9_TT	0.004	(omitted)	0	(omitted)	0.052	-0.001	0.004	-0.003
N	15049	14285	7373	6330	329	314	187	164
r2_a	54.7%	98.0%	70.3%	98.8%	71.2%	99.3%	94.5%	99.6%
r2c		98.0%		98.8%		99.4%		99.7%
idstat		1.10E+04		5195.027		99.185		41.323
jp		0.794		0.112		0.532		0.475

Appendix 11. Impact for the consumer loans growth rate (d_log_cl). Measure (MaP) – sensitivity at draft date (S_D). Treatment dimension by CtA.

	All Banks.		All Banks.		SIFIs		SIFIs	
	2015-2019		2017Q3 - 2019		2015-2019		2017Q3 - 2019	
Variable	OLS	IV	OLS	IV	OLS	IV	OLS	IV
IRB	-5.919*	-5.502	-8.703*	-18.389	1.455	0.621	2.397	8.556
D_time	-0.124	-0.554	-0.707**	-0.792**	-0.099**	-0.032	-0.193***	-0.137
p1	18.315***	12.671	(omitted)	-8.698	-0.984	12.168	9.320*	19.283
p2	15.266**	11.041	-2.205	-2.262	-3.367	5.02	-13.116**	-2.426
p3	16.439***	12.749	1.784	1.159	0.585	4.13	-2.59	4.903
p4	15.182**	13.552	-1.504	-7.686	0.986	1.686	-1.104	-3.779
p5	15.307**	9.82	-4.188	-5.012	-1.195	-4.586	-3.628	-7.475
p6	13.827**	13.546	-0.184	-4.045	0.102	-2.308	-4.949	3.824
p7	12.812**	13.326	-3.781	-2.634	-8.556***	-1.152	-12.343*	7.58
p8	7.685	5.804	-11.527	-11.632	8.926	15.383	-4.284	33.429**
p9	(omitted)	(omitted)	-8.425	(omitted)	3.183	8.4	-15.54	13.154
p1_TT	-0.096	0.357	0.5	0.648	0.233***	0.019	0.178***	0.071
p2_TT	0.119	0.593	0.807**	0.877**	0.076***	0.086	0.185***	0.141
p3_TT	0.205	0.665*	0.664*	0.694	0.209***	0.079	0.263***	0.103
p4_TT	(omitted)	0.398	0.509	0.635	0.141	-0.076	0.07	0.005
p5_TT	0.106	0.629	0.957**	1.069**	0.146***	0.092	0.243***	0.152
p6_TT	0.34	0.786**	0.744*	0.853**	-0.315	0.166	-0.009	-0.113
p7_TT	0.125	0.581	0.736*	0.798*	0.054	-0.09	0.082	-0.131
p8_TT	0.400*	0.812**	0.867*	0.963**	0.064	-0.013	0.147	0.141
p9_TT	-0.351	(omitted)	(omitted)	(omitted)	0.835***	0.647	0.974***	0.977***
N	11336	10250	4513	3537	315	300	151	128
r2_a	3.0%	-6.5%	2.5%	-3.4%	28.4%	-12.1%	35.5%	26.9%
r2c		-6.2%		-2.5%		-0.1%		44.7%
idstat		1.97E+03		740.045		50.535		25.79
jp		0.436		0.035		0.006		0.145

Appendix 12. Impact for the total loans growth rate (d_log_loans). Measure (MaP) – signal at enforcement date (F_Ap). Treatment dimension by CtA. All Banks.

	All Banks.		All Banks.		SIFIs		SIFIs	
	2015-2019		2017Q3 - 2019		2015-2019		2017Q3 - 2019	
Variable	OLS	IV	OLS	IV	OLS	IV	OLS	IV
IRB	0.611	-0.235	-3.058**	-3.505	-0.732	-0.366	-1.756	-1.306
D_time	-0.354	3.445**	-2.165**	1.218	-0.217	0.211	-0.197	0
p1	0.442	10.219***	(omitted)	10.359***	2.585*	0.192	1.707	0.982
p2	(omitted)	9.619***	0.13	11.435***	-0.48	-0.657	-2.964**	-3.427**
p3	0.002	9.454***	-0.152	10.195***	-0.132	-0.755	-1.249	-1.779
p4	-2.153**	7.512***	-1.88	9.952***	-1.646***	-1.254	-1.283	-1.557
p5	-0.47	8.559***	-1.157	10.417***	-0.462	-0.594	-1.956	-2.699
p6	-0.797	8.439***	-2.412*	8.807***	0.158	-0.533	-4.402	-3.496**
p7	-0.778	8.998***	-1.878	9.482***	-4.893***	-2.820***	-7.117***	-5.869***
p8	-3.777***	4.919***	-5.855***	4.551**	-0.56	-1.387	-7.528**	-9.438***
p9	-6.973***	(omitted)	-11.637***	(omitted)	-3.004*	-0.463	-5.146	-5.163**
p1_TT	-0.37	-4.403**	0.662	-2.143	0.636	-0.09	1.184**	0.413
p2_TT	-0.024	-3.975*	0.405	-3.027	0.733	0.004	-0.077	0.048
p3_TT	-0.075	-4.021**	(omitted)	-2.478	2.851*	0.893	0.88	0.583
p4_TT	(omitted)	-4.629**	0.224	-3.344	2.137	0.138	-0.918	-1.152
p5_TT	-0.079	-3.768*	0.564	-2.838	0.721	-0.089	1.284	1.642
p6_TT	1.776	-1.81	2.408	-0.691	-3.408*	-1.531	-0.994**	-0.855
p7_TT	1.759	-2.523	2.025	-0.89	1.943	1.686	1.393	0.398
p8_TT	5.552***	2.781	6.781***	4.569*	0.295	-0.216	0.506	1.353
p9_TT	2.607	(omitted)	3.617**	(omitted)	2.539	-0.825	0.379	-0.242
N	13342	12628	6475	5542	329	314	187	164
r2_a	1.9%	-6.8%	2.8%	4.3%	48.1%	66.8%	39.0%	54.0%
r2c		-6.6%		4.8%		70.2%		62.8%
idstat		9.96E+01		66.981		91.405		28.429
jp		0		0		0.218		0.007

Appendix 13. Impact for the total loans growth rate (d_log_loans). Measure (MaP) – sensitivity at draft date (S_D). Treatment dimension by CtA.

	All Banks.		All Banks.		SIFIs		SIFIs	
	2015-2019		2017Q3 - 2019		2015-2019		2017Q3 - 2019	
Variable	OLS	IV	OLS	IV	OLS	IV	OLS	IV
IRB	0.714	-0.045	-3.164*	-4.08	-0.215	-0.259	-2.228	-1.35
D_time	0.022	-0.025	0	0.016	-0.008	-0.012	-0.007	0.003
p1	7.061***	9.302***	(omitted)	10.127***	1.543	-0.43	3.605**	3.619*
p2	6.143***	8.225***	-0.126	10.753***	-1.885	-1.817*	-1.072	-0.579
p3	5.455***	7.176***	-0.903	9.235***	0.736	0.355	1.798**	2.659*
p4	4.704**	6.533***	-2.451*	8.849***	-0.567	-0.406	-0.233	0.293
p5	5.708***	7.292***	-2.718**	7.957***	-0.838	-0.793	-1.082	-0.687
p6	5.424***	7.218***	-1.442	9.521***	-0.13	-0.293	-5.599***	-4.614***
p7	5.861***	8.077***	-2.722**	8.061***	-4.919***	-3.151***	-4.751***	-2.216
p8	3.12	4.808***	-3.001	6.935***	1.457	0.27	-1.471	3.062
p9	(omitted)	(omitted)	-10.735***	(omitted)	-2.971**	-1.552	-2.248	3.106
p1_TT	-0.055**	-0.008	-0.032	-0.045	-0.019**	0	-0.023***	-0.043
p2_TT	(omitted)	0.046	0	-0.016	0.036***	0.024	0.018***	0.013
p3_TT	-0.02	0.03	-0.014	-0.016	0.033***	0.01	0.014	-0.009
p4_TT	-0.067*	-0.027	-0.033	-0.051	0.025	0.022	0.017*	0.002
p5_TT	-0.049*	-0.004	-0.027	-0.028	0.012	0.012	0.008	0
p6_TT	-0.031	0.013	-0.012	-0.025	-0.303*	-0.149	-0.012	-0.02
p7_TT	0.002	0.04	0.019	0.013	-0.021	0.004	0.017	-0.023
p8_TT	0.073*	0.122***	0.034	0.035	-0.025	-0.013	0.008	0.017
p9_TT	-0.06	(omitted)	(omitted)	(omitted)	0.071***	0.062	0.022	0.008
N	13235	12519	5348	4420	315	300	151	128
r2_a	2.0%	-3.3%	2.5%	4.2%	53.5%	68.3%	45.3%	44.5%
r2c		-3.1%		4.9%		71.7%		58.1%
idstat		9.77E+01		55.753		71.586		20.026
jp		0		0		0.122		0.044

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