Bank of Russia

Domestic Macroprudential Policy and Inward Transmission of Foreign Monetary Shocks: The Case of Russia

WORKING PAPER SERIES

No. 63 / November 2020

Konstantin Styrin
Yulia Ushakova

Konstantin Styrin

Research and Forecasting Department, Bank of Russia. Email: styrinka@cbr.ru

Yulia Ushakova

Research and Forecasting Department, Bank of Russia. Email: ushakovayuv@cbr.ru

Bank of Russia Working Paper Series is anonymously refereed by members of the Bank of Russia Research Advisory Board and external reviewers.

Cover image: Shutterstock.com

Address: 12 Neglinnaya street, Moscow, 107016
Tel.: +7 495 771-91-00, +7 495 621-64-65 (fax)
Website: www.cbr.ru

Domestic Macroprudential Policy and Inward Transmission of Foreign Monetary Shocks: The Case of Russia*

Konstantin Styrin† Yulia Ushakova‡

12 November 2020

Abstract

This paper studies to what extent the domestic macroprudential policy stance affects the cross-border transmission of monetary policy shocks from the U.S. to a small open economy by estimating their effect on domestic lending using proprietary bank-level balance sheet data for internationally active Russian banks covering 2000-2017. To identify the causal effect at the bank level we exploit heterogeneity across banks in terms of their exposure to U.S. monetary policy and domestic prudential policy. We find evidence that expansionary monetary policy shocks in the US stimulate domestic lending by Russian banks, and the estimated effect has been statistically and economically significant. A more restrictive domestic macroprudential policy stance in Russia is found to attenuate the inward transmission of US monetary shocks to domestic bank lending.

Keywords: monetary policy, macroprudential policy, international spillovers, cross-border transmission

JEL Codes: E52, F34, G21

*This paper was written as the Bank of Russia's team contribution to the International Banking Research Network (IBRN) Macroprudential and Monetary Policy Interactions initiative. The views expressed in the paper are solely those of the authors and do not necessarily represent the official position of the Bank of Russia. The Bank of Russia is not responsible for the contents of the paper. Any reproduction of this paper shall be subject to the consent of the authors.

†Corresponding author: Bank of Russia, StyrinKA@mail.cbr.ru

‡Bank of Russia

1 Introduction

This paper studies empirically whether and, if so, to what extent domestic macropudential policy can insulate a small open emerging market economy from foreign monetary policy spillovers. To the extent that capital flows from systemic economies to emerging markets are triggered by monetary policy shifts in the former, as documented by Bruno and Shin (2015a) and Passari and Rey (2015), for example, this is related to the question of whether or not and by how much domestic macroprudential policy is able to reshape the inward transmission of foreign monetary shocks.

We do our empirical exercise using regulatory bank-level data for internationally active Russian banks. Russia is a small open emerging market economy, and, like other emerging market economies, it is influenced by the Global Financial Cycle. Recently, Russia experienced two major capital inflow episodes, one around 2007 and the other after 2012. In both cases, capital flows from abroad inspired credit growth viewed by policy makers as excessive. This motivated the Bank of Russia, which is in charge of both price and financial stability in Russia, to test various macroprudential policies. In 2007 and in the 2010s it experimented with raising reserve requirements on foreign borrowings. In 2013, the Bank of Russia increased capital charges (i.e. introduced a higher risk weight) on high-interest, and therefore perceived as high-risk, uncollateralised consumer loans.

In this study, we investigate how the domestic macroprudential policy stance transforms the dynamic effect of US monetary shocks on the growth of credit to private non-financial borrowers by internationally active Russian banks that supposedly works through the channel of the banks' external funding.

We employ a panel data set that covers 22 internationally active Russian banks and 18 years of quarterly observations, 2000 through 2017. The dependent variable is quarterly credit growth by bank i in quarter t. There are two effects of interest. The first is a four-quarter cumulative effect of monetary policy shocks in the US interacted with a lagged transmission channel variable, which is the ratio of external liabilities to total assets (the foreign funding ratio). We limit our analysis only to US monetary shocks since, historically, up to 80-90 percent of external borrowing by Russian banks tends to

be denominated in US dollars. The expected sign of the cumulative effect is negative: other things equal, lending by institutions that rely more heavily on external funding is expected to be more sensitive to monetary tightening in the US, and these institutions will cut their lending more aggressively.

The second effect of interest is a four-quarter cumulative dynamic effect of US monetary shocks interacted with the lagged transmission channel variable and a lagged indicator of macroprudential policy stance. If domestic macroprudential policy dampens the transmission of monetary shocks from abroad, the sign of this effect should be the opposite of the sign of the first effect of interest, i.e. positive.

In addition to the foreign funding ratio, we consider another channel variable that characterises the exposure of a bank to consumer credit, which was a target of prudential policy interventions in the 2010s.

Monetary policy shocks in the US are obtained through the so-called High-Frequency Identification procedure as suggested in Gertler and Karadi (2015). According to this approach, monetary policy surprises, which are increases in the price of a futures contract on the US federal funds rate within a tight window surrounding the time of a US monetary policy announcement, serve as external instruments in a Structural Vector Autoregression (SVAR) framework.

The proxy for the domestic macroprudential policy stance in Russia is based on a recently compiled IMF database (Cerutti et al. (2017)). As a baseline specification, it is a 2-year cumulative sum of +1s, 0s, and -1s, indicating, respectively, tightening, no change, and loosening of macroprudential policy in a given quarterly period. We use a 3-year cumulative as a robustness check.

As is standard in the literature, our regressions include a number of bank-level controls as well as bank and time fixed effects.

We find that U.S. monetary policy shocks affect domestic lending by Russian banks. The estimated effect is statistically and economically significant and is more pronounced for loans denominated in U.S. dollars than in rubles. An unanticipated monetary loosening in the U.S. is shown to stimulate growth in dollar-denominated loans extended

by Russian banks to domestic private non-financial borrowers. We also find that the domestic macroprudential policy stance in Russia considerably attenuates the inward transmission of U.S. shocks. Taken at face value, these findings suggest that domestic macroprudential policy is capable of limiting international monetary spillovers.

The remainder of the paper is organised as follows. 2 surveys related literature. Section 3 explains how we identify U.S. monetary shocks and set up our regressions. Section 4 describes the data we use. Section 5 reports empirical findings, and Section 6 concludes.

2 Related Literature

Our paper is related to four strands in the literature. The first is the literature on the Global Financial Cycle. Passari and Rey (2015) and Miranda-Agrippino and Rey (2020) show empirically that US monetary shocks are a major driving force behind the Global Financial Cycle that features comovements in international financial variables, such as asset prices, leverage of global financial intermediaries, and cross-border capital flows. Moreover, they show that a floating exchange rate regime does not insulate an economy from these spillovers. Gerko and Rey (2017) provide SVAR-based evidence that US monetary policy spills over to the UK by affecting mortgage and corporate spreads. Bruno and Shin (2015b) document that an appreciation of local currency is associated with a higher leverage of the domestic banking sector, a finding consistent with the risk taking channel of international monetary transmission. Avdjiev et al. (2020a) document that the sensitivity of international bank lending to the US monetary policy has varied over the past decade and explain this pattern by the degree of convergence in monetary policy among advanced economies. Rey (2016) shows that US monetary policy transmits internationally and affects monetary conditions even in inflation-targeting countries with freely floating exchange rates. Rey (2015) argues that the only way to regain the autonomy of domestic monetary policy and foster the resilience of financial sector is to impose capital controls and macroprudential policies.

The second strand in the literature deals with international monetary transmission through bank lending. Using bank-level data, Cetorelli and Goldberg (2012a) and Cetorelli and Goldberg (2012b) study the propagation of international liquidity shocks through the internal funding network of US global banks. Buch et al. (2019) survey a multi-country study of the IBRN initiative on international monetary policy transmission. The study provides evidence of the existence of the international bank lending channel and the portfolio rebalancing channel of international monetary policy transmission. The effect on an individual bank's lending is heterogeneous and depends on the bank's characteristics. Cao and Dinger (2018) document that the bank lending channel of domestic monetary policy in Norway can by impaired by the access of banks to foreign funding. Morais et al. (2019), using credit register data, find that loose monetary policy in Europe and the US stimulates lending growth and more risk-taking by Mexican subsidiaries of European and US banks; it also improves real economic outcomes of local borrowers.

The third strand in the literature deals with the effectiveness of macroprudential policy. Galati and Moessner (2018) is a recent survey of this literature with a focus on the effectiveness of macroprudential policy tools. Aiyar et al. (2014) document that raising bank-specific capital requirements for UK banks resulted in a contraction of their lending, which was partially offset by increased lending from unregulated UK-based subsidiaries of foreign banks. Based on credit register data for Spanish banks, Jiménez et al. (2017) find that dynamic provisioning, a macroprudential policy tool introduced in Spain in 2000 and revised four times, smooths credit cycle and improves economic outcomes for borrowing firms. In a cross-country study, Alam et al. (2019) find that tighter loan-to-value (LTV) limits have an economically significant negative effect on household credit. Using loan-level data, De Jonghe et al. (2020) demonstrate that tighter capital requirements disproportionally reduce lending of smaller, riskier, and less-profitable banks, which mainly affects credit to large, risky, and low-borrowing-cost firms. Buch and Goldberg (2017) survey a multi-country findings of the IBRN initiative on international spillovers of prudential policy. The findings suggest that the intensity of cross-border spillovers depends

on the type of prudential instruments and bank characteristics. Avdjiev et al. (2020b) decompose bilateral bank credit flows into global, home, and host components and find that the latter two are affected by prudential policies in the source and destination countries, respectively.

The fourth strand in the literature deals with interactions between monetary and macroprudential policies. From a domestic perspective, Gambacorta and Mistrulli (2004) is an early paper that studies interactions between domestic monetary and prudential policies. Using a sample of Italian banks, they find that the propagation of monetary shocks at the bank level depends on bank's excess capital. Using bank-level data of European banks, Budnik and Bochmann (2017) find an ameliorating effect of bank capitalization and liquidity buffers on lending during a period of financial distress. Using matched bank-firm data for UK small and medium enterprises (SME), De Marco and Wieladek (2015) show that higher capital requirements for banks worsen economic outcomes of borrowing firms and that tight monetary policy reinforces this effect. Using loan-level data, Dell'Ariccia et al. (2017) provide evidence that US banks tend to increase ex ante risk-taking in lending when interest rates are low, the relationship being less pronounced for banks with relatively low capital. Maddaloni and Peydró (2013) show that loose monetary policy encourages banks to soften lending standards and that this effect can be offset by macroprudential policy interventions such as an increase in bank capital requirements or a decrease in loan-to-value ratio. Gambacorta and Murcia (2020) summarize the findings of a recent study based on loan-level data for five Latin American countries. Policies that target the credit cycle are more effective than policies that are supposed to improve the resilience of the banking sector. Furthermore, monetary policy reinforces the effects of macroprudential policy.

From an international perspective, Baskaya et al. (2017), using credit register data for Turkey, find that international bank credit channel is more pronounced for better capitalized domestic banks that borrow abroad. Coman and Lloyd (2019) find that credit growth in emerging markets with tighter prudential policy stance is less affected by shifts in the US monetary policy, with loan-to-value ratio limits and reserve requirements being

the most effective prudential instruments. Giovanni et al. (2017) employ corporate credit data for Turkey to show that looser global financial conditions lead to an increase in domestic lending driven mainly by banks more exposed to cross-border borrowing. Epure et al. (2018) use credit register data for Romania to show that tighter macroprudential policy slows the growth of household credit, the effect being more pronounced for ax ante risky borrowers and domestic banks with greater exposure to cross-border borrowing. Takáts and Temesvary (2019b) find that a tighter macroprudential policy in a source country mitigates the effect of monetary policy of major currency issuers on cross-border lending. In a related study, Takáts and Temesvary (2019a) show that a tighter macroprudential policy in destination countries mitigated the effect of the taper tantrum of 2013 on cross-border credit outflows.

3 Methodology

In order to estimate the dynamic effect of shocks in U.S. monetary policy on credit growth in Russia and its dependence on the domestic macroprudential policy stance, we employ a panel data regression with bank and time fixed effects and bank controls. The regressors of interest are the distributed lag of U.S. monetary policy shock interacted with a bank-level variable that is related to a specific channel of transmission of U.S. monetary shocks to the Russian economy and a measure of the macroprudential policy stance. We consider two transmission channel variables. The first channel variable is the foreign funding ratio defined as the ratio of all foreign liabilities to total assets. It determines to what extent a bank relies on cross-border funding and hence its exposure to shifts in monetary policy abroad. The second channel variable is the share of consumer credit in total assets. It determines the exposure of a bank to domestic prudential policy interventions targeting consumer credit.

To measure the contemporaneous stance of domestic macroprudential policy we employ the simple approach to the quantification of prudential policy changes offered in Cerutti et al. (2017). These authors consider a quarterly panel of 64 countries covering

the period from 2000 to 2017 and splits all prudential policies into five categories: capital buffers, interbank exposure limits, concentration limits, loan-to-value (LTV) limits, and reserve requirements. Each individual prudential policy intervention in every quarterly time period is assigned a value of 1 if it was a tightening, –1 if it was an easing, and 0 if there was no change. For example, on 1 April 2011, the Bank of Russia raised the reserve requirement ratio on credit institutions' liabilities to non-resident banks in all currencies from 4.5% to 5.5%, the ratio on individual deposits in all currencies from 3.5% to 4%, and the ratio on credit institutions' other deposits in all currencies from 3.5% to 4%. This prudential action was coded as +1. Table A.1 in the Appendix lists all prudential actions undertaken in Russia between 2006 and 2016. Eventually, all individual prudential policy interventions quantified in this specific way are aggregated across five categories for every quarterly date. The aggregate measure of the overall stance of prudential policy on date t is then defined as a 2-year cumulative sum of quarterly aggregates, i.e. for quarterly dates from $t-7$ to t. As a robustness check, we also consider a 3-year cumulative sum. The time path of the stance of domestic macroprudential policy is shown in Figure 1.

U.S. monetary shock is identified in a structural vector autoregression framework (SVAR) using the high-frequency identification (HFI) procedure of Gertler and Karadi (2015). Subsection 3.1 lays out the details of this identification method. Subsection 3.2 describes the specification of our fixed-effect panel data regression.

3.1 Identification of U.S. Monetary Policy Shocks

U.S. monetary shocks are identified in a SVAR framework, which is similar to Gertler and Karadi (2015). Following Gertler and Karadi (2015), we consider two separate identifications, one using a 4-variable SVAR and the other using a 6-variable SVAR. The former model contains the following four variables for the U.S.: consumer price index, industrial production, one-year interest rate on government bonds, and the excess bond premium (EBP) developed by Gilchrist and Zakrajšek (2012). The EBP is a credit spread, the difference in the yield of corporate bonds and government bonds with the same term to maturity net of the probability of default on the corporate bond. As Gilchrist and

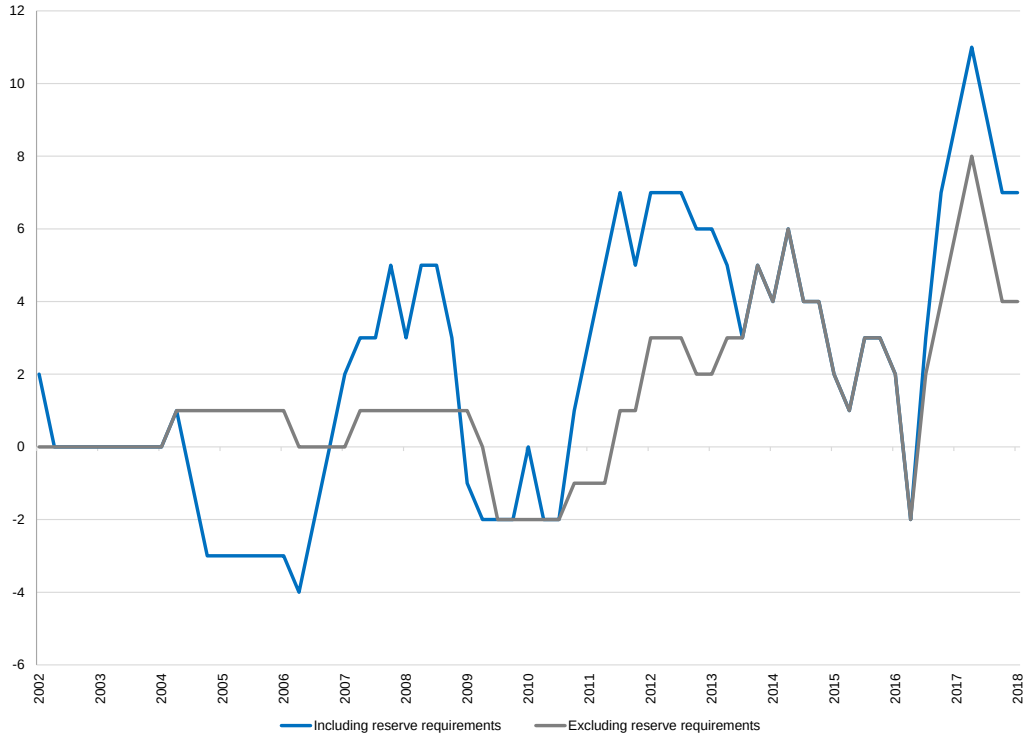

Figure 1: Aggregate prudential policy stance in Russia

Zakrajšek (2012) document, this variable displays a well-pronounced cyclical behaviour and is a good predictor of future economic activity. Together with the one-year rate on government bonds, the EBP characterises the cost of debt finance for private firms. The reduced-form four-variable VAR is estimated on monthly data. The order of the SVAR is set equal to 12, which is a conventional choice in the literature when data are monthly. Monthly time series of identified monetary shocks are then aggregated to the quarterly frequency to be used in regressions. The 6-variable SVAR additionally includes credit spreads for 3-month U.S. commercial paper and 10-year mortgage loans.

The high-frequency identification (HFI) method of Gertler and Karadi (2015) employs data on so-called monetary surprises (Gürkaynak et al. (2005)) as external instruments for the identification of monetary policy shocks. This is a special case of a more general external instrument approach developed by Mertens and Ravn (2013) and Stock and Watson (2012). The idea behind the external instrument method is simple and quite

appealing. Suppose that there is some imperfect proxy for a structural shock of interest. Gertler and Karadi (2015) use various series of monetary surprises as such a proxy. A monetary surprise is measured as a change in the price of a futures contract on the US federal funds rate within a narrow (30-minute) window surrounding the time of a monetary policy announcement by the U.S. Federal Open Market Committee or any other anticipated monetary policy event, e.g., a public speech of a Federal Reserve Governor. The identifying assumption is that, during this narrow window, the monetary policy announcement is the only development that occurs in the macroeconomic environment, with everything else remaining unchanged. It follows that a systematic component of the monetary surprise, i.e. one that is related to the exogenous change in monetary policy and is free of any noise due to market over- or underreaction, can be interpreted as a monetary policy shock. For each variable included in a VAR, its VAR innovation, which is the residual from the OLS regression of this variable on its own lags and the lags of all other variables, is a surprise change that cannot be forecast by past information contained in the VAR. Macroeconomic theory considers all unforeseeable developments in the environment as driven by structural shocks of different nature, i.e. exogenous shifts in preferences, technology, or economic policy, one of those disturbances being a monetary policy shock. It follows that a reduced-form VAR innovation should be a mixture of structural shocks. If a VAR contains a sufficient number of variables, then the space of VAR innovations should span the space of structural shocks. To the extent that a monetary shock is the only structural shock that gives rise to a monetary surprise, the OLS projection of a monetary surprise on the space of structural shocks or, equivalently, on the space of reduced-form VAR innovations should isolate the structural monetary shock by cutting off noise. The monetary surprise works exactly in the same way as an instrumental variable with respect to the VAR innovation of the monetary policy indicator, which is the one-year rate on government securities in Gertler and Karadi (2015). In practice, the monetary policy shock series is estimated as predicted values from the OLS regression of a monetary surprise on the reduced-form VAR innovations.

Following Gertler and Karadi (2015), we use monetary surprises on five different in-

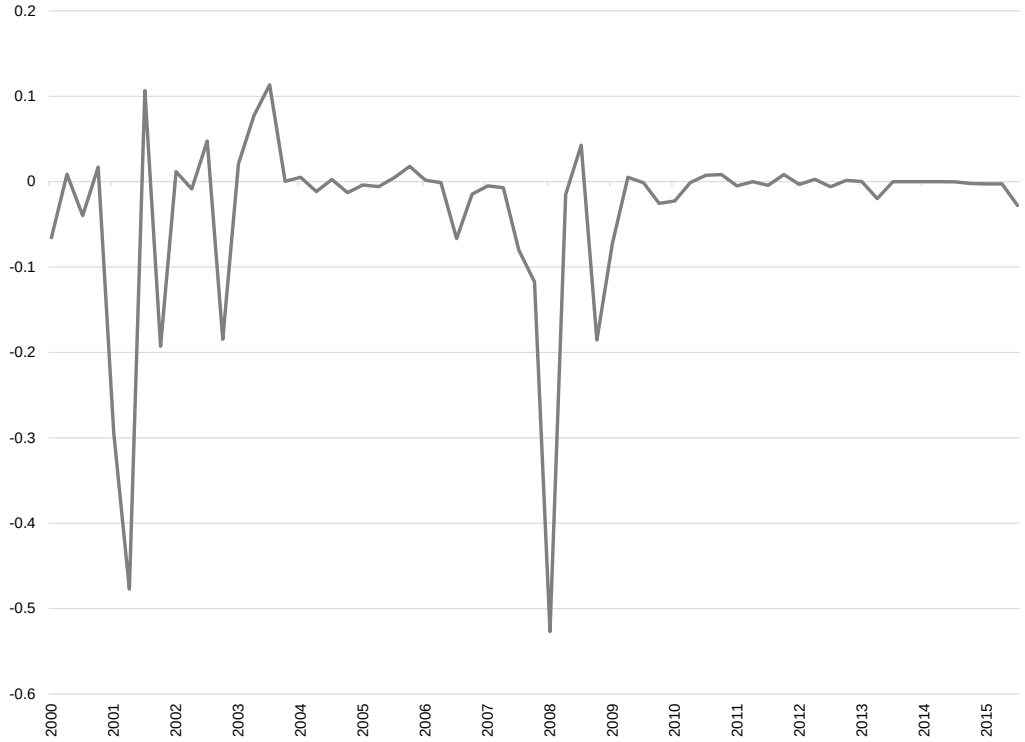

Figure 2: Monetary surprises derived from MP1 futures contracts, p.p.

terest rate derivatives: a current-month futures on the federal funds rate (labeled MP1), a three-month-ahead futures on the federal funds rate (FF4), and six-month, nine-month, and year-ahead futures on three-month Eurodollar deposits (ED2, ED3, and ED4, respectively). For each derivative contract, all individual monetary surprises are aggregated to a quarterly frequency. Figure 2 shows the time path of US monetary surprises derived from the MP1 futures contracts. Figure 3 shows the time path of US monetary policy shock identified in the 4-variable SVAR with MP1 surprises serving as external instruments.

In the language of instrumental variable estimation, the OLS regression of the interest rate innovation on a monetary surprise is called a first-stage regression of an endogenous regressor, the interest rate, on an instrumental variable, a monetary surprise. It is now well understood that standard methods of statistical inference cannot be applied when instruments are weakly correlated with the instrumented endogenous regressor. As a screening device, Stock et al. (2002) suggest using a threshold of 10 for the F-statistic

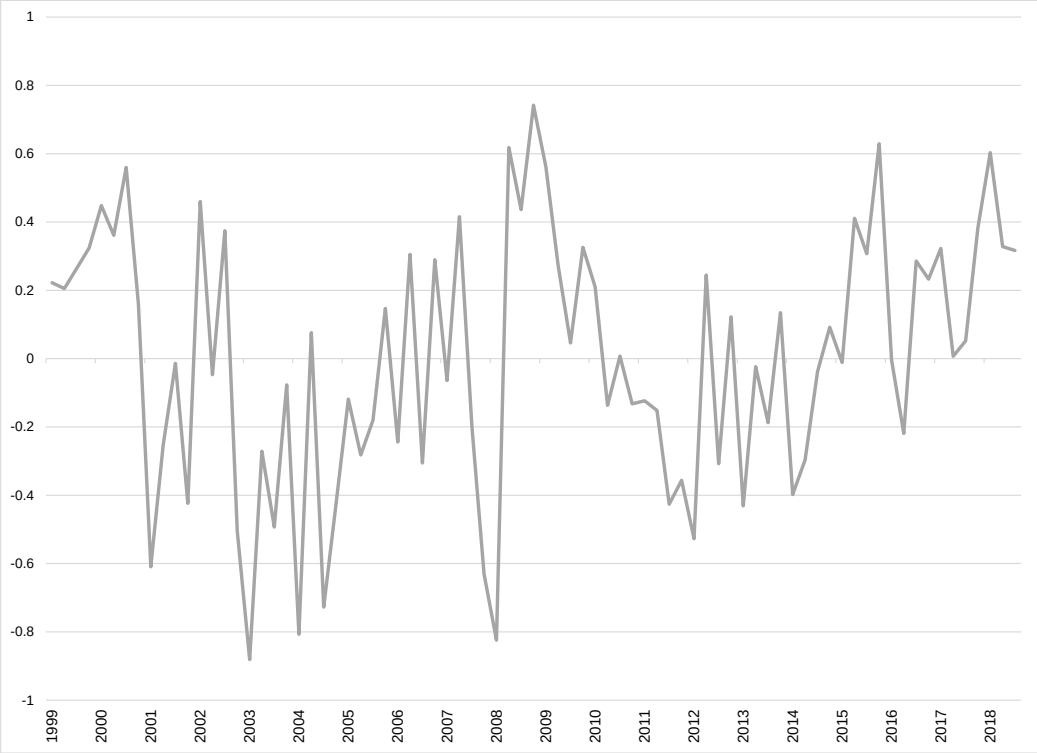

Figure 3: SVAR identified US monetary shock, p.p.

that tests the null hypothesis that, in population, all instrumental variables in the first-stage regression are jointly insignificant. We applied this method to the five candidate instrumental variables and found that only two of them were strong instruments, MP1 and FF4, with first-stage F-statistics being 18.75 and 23.11, respectively, for the 4-variable SVAR and 18.04 and 20.01, respectively, for the 6-variable SVAR. Our baseline regressions therefore employ U.S. monetary policy shocks identified with three different sets of external instruments: (i) MP1, (ii) FF4, and (iii) MP1 and FF4.

3.2 Econometric Specification

Our econometric specification is a fixed effects panel data regression. The dependent variable is the quarterly growth rate of loans granted by a bank to private non-financial borrowers. We run separate regressions for (i) ruble-denominated loans and (ii) dollar-denominated loans. The regressors of interest are a contemporaneous value of the identified U.S. monetary policy shock along with its three lags, all interacted with the fourth lag of the transmission channel variable, or the channel variable for brevity, and the fourth lag of the macroprudential policy stance. As was mentioned above, we consider two transmission channel variables, the foreign funding ratio and the share of consumer credit in total assets.

The specification also includes bank-level control variables: the log of total real assets, the ratio of core deposits to total assets, the liquid asset ratio, and (the reciprocal of) the leverage ratio defined as the ratio of a bank's tier 1 capital to its total assets.

The effect of time-invariant factors at the bank level is captured by bank fixed effects u_i. The effect of time-varying factors that affect all banks uniformly is captured by time fixed effects v_t. These factors potentially include domestic and foreign levels of economic activity, the risk appetite of international investors, etc. The interactions of contemporaneous and lagged foreign monetary policy shocks with the lagged channel variable and lagged macroprudential policy stance capture the idea that the dynamic effect of U.S. monetary policy can be heterogeneous across banks, depending on a bank's exposure to foreign monetary policy or domestic prudential policy, and can depend on the domestic

macroprudential policy stance. For example, institutions that rely on external funding to a greater extent than their peers are likely to cut their lending more aggressively in response to monetary tightening in the U.S., while higher reserve requirements on external borrowing are likely to discourage banks to borrow abroad and thus reduce the effect of future foreign monetary shocks on domestic lending.

The fixed-effects panel regression specification is thus given by

$$\begin{aligned}\Delta \ln Loans_{it} &= \sum_{k=0}^{3} \alpha_k Channel_{i,t-4} \times \Delta MP^{US}_{t-k} \\ &+ \sum_{k=0}^{3} \beta_k Channel_{i,t-4} \times Pru^{RU}_{t-4} \times \Delta MP^{US}_{t-k} \\ &+ \delta\, Channel_{i,t-4} \times Pru^{RU}_{t-4} + \lambda\, Channel_{i,t-4} + \gamma' X_{i,t-1} + u_i + v_t + e_{it}\end{aligned} \tag{1}$$

where $\Delta \ln Loans_{it}$ is the quarterly growth rate of loans denominated in all currencies, or in rubles, or in foreign currency for bank i on date t, $Channel_{i,t}$ is the channel variable for bank i on date t, and $X_{i,t}$ is a vector of bank controls for bank i on date t. As specification (1) implies, the channel variable is bank-specific and enters the regression with lag 4. This is motivated by the intention to estimate the dynamic effect of foreign monetary policy shocks given the exposure of the bank to cross-border financial liabilities, which is equivalent to exposure to US monetary policy, or consumer credit, which is equivalent to exposure to domestic prudential policies targeting consumer credit, just before the arrival of a shock. In general, the channel variable is endogenous, and it will therefore respond to a monetary shock in the U.S. Taking a predetermined, namely, date $t-4$, the values of this variable should make OLS estimates of the coefficients of interest – those on the distributed lag of the U.S. monetary policy shock, ΔMP^{US}_{t-k}, $k = 0, 1, 2, 3$, interacted with the lagged channel variable and the lagged stance of domestic macroprudential policy, Pru^{RU}_{t-4}, – less prone to simultaneity bias. A similar argument applies to the macroprudential policy stance variable, which appears in the equation at its fourth lag, to the extent that it is likely to endogenously respond to the loosening of monetary policy abroad in order to curb unwanted capital inflows and arrest excessive domestic credit growth, overall or in certain sectors.

When estimating regressions (1), the standard errors are clustered at the bank level in order to account for serial correlation in the idiosyncratic error term e_{it}.

3.3 Hypotheses of Interest

In this study, we investigate if

(i) U.S. monetary policy shocks are transmitted to the economy of Russia through the foreign borrowing channel and the consumer credit channel;

(ii) a tighter domestic macroprudential policy stance attenuates the transmission of foreign monetary shocks to domestic lending.

In the Section 5 we formally test statistical hypotheses related to research questions (i) and (ii).

To approach (i), we look at the statistical significance of the four-quarter cumulative effect of U.S. monetary shock interacted with the fourth lag of the channel variable, which is either the foreign funding ratio or the share of consumer credit in total assets. This cumulative effect equals the sum of the coefficients of the distributed lag of U.S. monetary policy shock interacted with a channel variable, i.e. $\alpha_0 + \alpha_1 + \alpha_2 + \alpha_3$ in the notation of equation (1). The expected sign of the effect is negative: an unanticipated tightening in the U.S. raises the cost of dollar funding and forces a bank dependent on it to cut its loans.

To approach (ii), we test the statistical significance of the cumulative effect of the triple interactions, the distributed lag of U.S. monetary shock interacted with the lagged channel variable and the domestic macroprudential policy stance. The expected sign of the effect is positive: a more restrictive macroprudential policy at home is likely to make the effect of foreign monetary shocks on domestic lending less pronounced. In the case of prudential policies targeting consumer credit, we expect to observe a more pronounced alleviating effect from those policies on banks that specialise in consumer credit, and hence are more exposed to consumer loans.

In all cases, when point estimates prove statistically significant, we pay attention to the sign of the estimated coefficient and check if it is consistent with theoretical predictions. We also make some simple calculations to figure out if the estimated effect is quantitatively substantial, i.e. economically significant.

4 Data

The dataset that we employ in this study consists of three parts: (i) a panel of supervisory bank-level data; (ii) U.S. macroeconomic time series for SVAR that serves to identify and estimate a time series of U.S. monetary policy shock; and (iii) a quarterly time series of the 2- or 3-year cumulative sum of increments in the macroprudential policy indicator that take values +1, 0, or -1, respectively, for tightening, no change, or loosening. The raw data are taken from the cross-country macroprudential policy database developed in Cerutti et al. (2017). The bank-level and macroprudential policy data are quarterly and cover the time period from the first quarter of 2000 through the fourth quarter of 2017. The SVARs are estimated on monthly data. Monthly time series of identified U.S. monetary shocks are then aggregated to quarterly.

The bank-level panel data come from the mandatory reports that all commercial banks with operations in Russia are required to submit to the Bank of Russia every month. There are 22 internationally active banks in our dataset. During the period of our analysis a few banks were reorganised via mergers and acquisitions. To deal with this issue we follow the traditional approach: if two banks merged at some point, we create a synthetic bank, as if both institutions had been a single entity for the entire sample period. More than that during the period under study the number of banks decreased because of the enhancement of supervision policy after 2013. We dropped the last four quarters of observations that a bank reported before its exit – due to licence withdrawal – to clean the dataset of idiosyncratic business decisions on the eve of bankruptcy that would otherwise be likely to distort our dataset.

Since 2015, the Bank of Russia has prepared a list of Domestic Systemically Important

Banks (DSIBs) on an annual basis, and has identified internationally active banks. This status applies to a credit institution if, at least, one of the following criteria is satisfied: (1) the credit institution is the parent organization of a banking group with a share of assets allocated to foreign jurisdictions exceeding 10%; (2) the foreign liabilities of the bank in question exceed 100 billion rubles, which was equivalent to 1.5 billion US dollars as of 2018; (3) the credit institution belongs to a banking group/a bank holding company with a headquarters located in a foreign jurisdiction. We applied these criteria to select a sub-sample of internationally active banks that satisfied one of the above criteria consistently over the entire sample period of 2000-2017, or over the time period the respective institution operated in the Russian market.[1]

The bank-level data include such variables as the growth rate of loans to resident private nonfinancial borrowers in rubles and in foreign currencies, liabilities to non-residents as a fraction of total assets, which we label as the foreign funding ratio, the share of consumer credit in total assets, total assets (*ta*), the inverse of the leverage ratio (*leverage*) defined as the ratio of tier-one capital to total assets, and core deposits as a fraction of total assets (*core*). Balance sheet characteristics, the foreign funding ratio, and the share of consumer credit in total assets are adjusted for outliers to ensure that large observations are not driving the results [2]. We eliminate valuation effects caused by exchange rate fluctuations from our bank-level variables. We do this in attempt to avoid substantial movements in our bank-level regressors that are uninformative from the perspective of our empirical exercise. For example, a sharp depreciation of the ruble, such as one that occurred in December 2014, will reduce the dollar value of ruble-denominated balance sheet items producing a spurious spike in the ratio of cross-border liabilities to assets, a key bank-level variable in our study, even if the dollar value of cross-border liabilities remains unchanged. This spike obviously has nothing to do with a change in the composition of banks' funding sources. From the point of view of estimation, noise in a

[1]When implementing the selection procedure, we adjusted the ruble value of the threshold for foreign liabilities for different dates to account for temporal changes in the ruble exchange rate to the US dollar. Eventually, we ended up with a list of 22 internationally active banks each satisfying, at least, one of the above-mentioned criteria over the time period covered by our study.

[2]We exclude observations where the value of the respective variable lies in the top 100 percentile or in the bottom 1 percentile of the sample distribution

Table 1: Summary statistics for the sample of 22 internationally active banks

	Mean	SD	Min	Max
Banking sector assets (MM USD)	586,868	410,584	31,345	1,292,969
Bank assets (MM USD)	26,708	66,301	0.5	532,138
Domestic lending (MM USD)	15,312	40,178	0,1	326,663
Non-financial lending (MM USD)	14,368	38,505	0,1	319,790
Δ Non-financial lending (%)	5.6	10.9	-19.8	34.3
Δ Commercial loans (%)	5.0	14.3	-43.7	45.9
Size ($ln(Assets)$)	15.4	2.3	7.0	20.4
Liquid asset ratio	23.2	10.8	9.1	60.1
Core deposits ratio	37.3	15.6	3.4	66.0
Tier 1 ratio	13.2	6.1	7.4	47.6

regressor of interest (interacted with the distributed lag of foreign monetary policy shock) is equivalent to measurement error in the regressor and, hence, bias the estimated effect toward zero. In fixed-effect panel regressions, this bias is magnified (Wooldridge (2010), p. 365). To solve this issue, we convert all ruble denominated asset and liability items involved into the construction of bank-level variables to U.S. dollars using the average exchange rate of the ruble against the U.S. dollar for the period under estimation. Items denominated in foreign currencies are expressed in rubles in banks' financial statements. We converted them to U.S. dollars using the contemporaneous exchange rate of the ruble against the U.S. dollar. Table 1 reports summary statistics of bank-level variables for the sample of 22 internationally active banks.

Figures 4 and 5 show the time path of the growth rate of, respectively, dollar- and ruble-denominated loans, and Figure 6 shows the time path of the foreign funding ratio in the cross-section of 22 internationally active banks.

Six U.S. macroeconomic time series employed in the SVAR are the index of industrial production (seasonally adjusted), the rate of CPI inflation (seasonally adjusted), the interest rate on one-year government bonds, Gilchrist and Zakrajšek's excess bond premium (EBP), and the credit spread on 3-month commercial paper and 10-year mort-

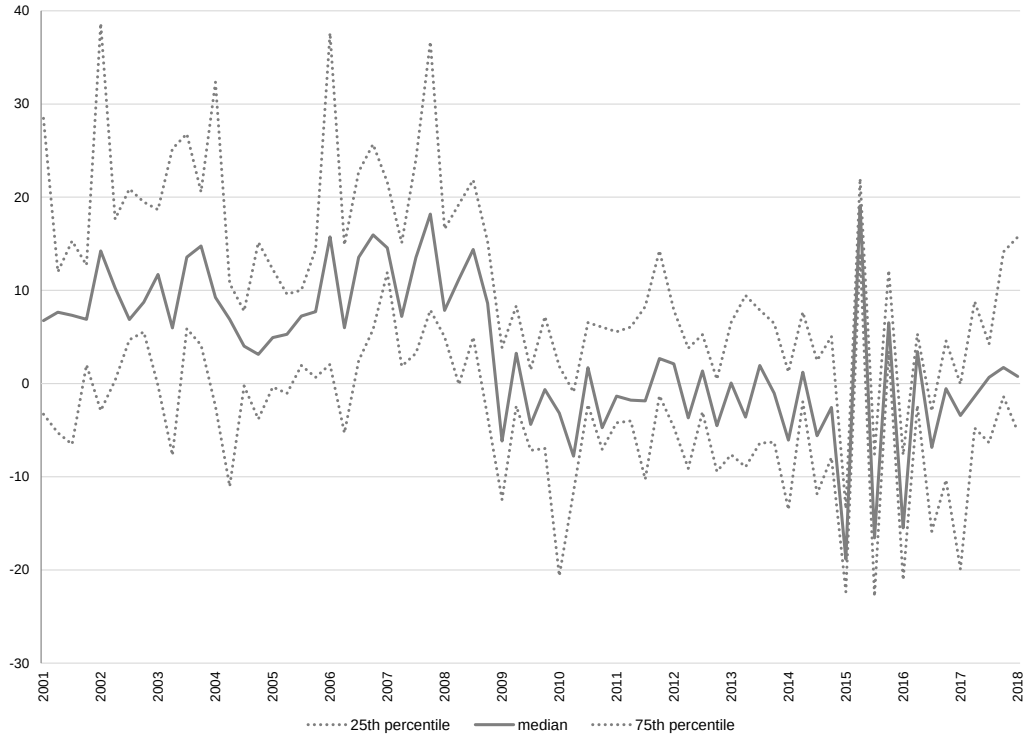

Figure 4: Dollar-denominated credit growth for 22 internationally active Russian banks, %

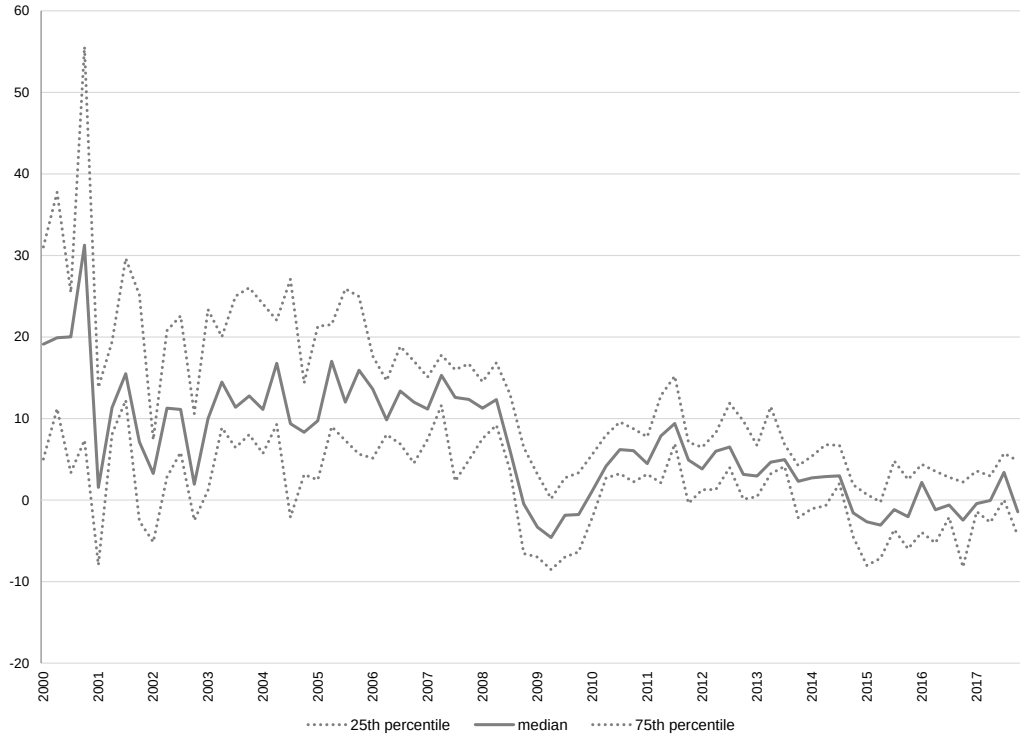

Figure 5: Ruble-denominated credit growth for 22 internationally active Russian banks, %

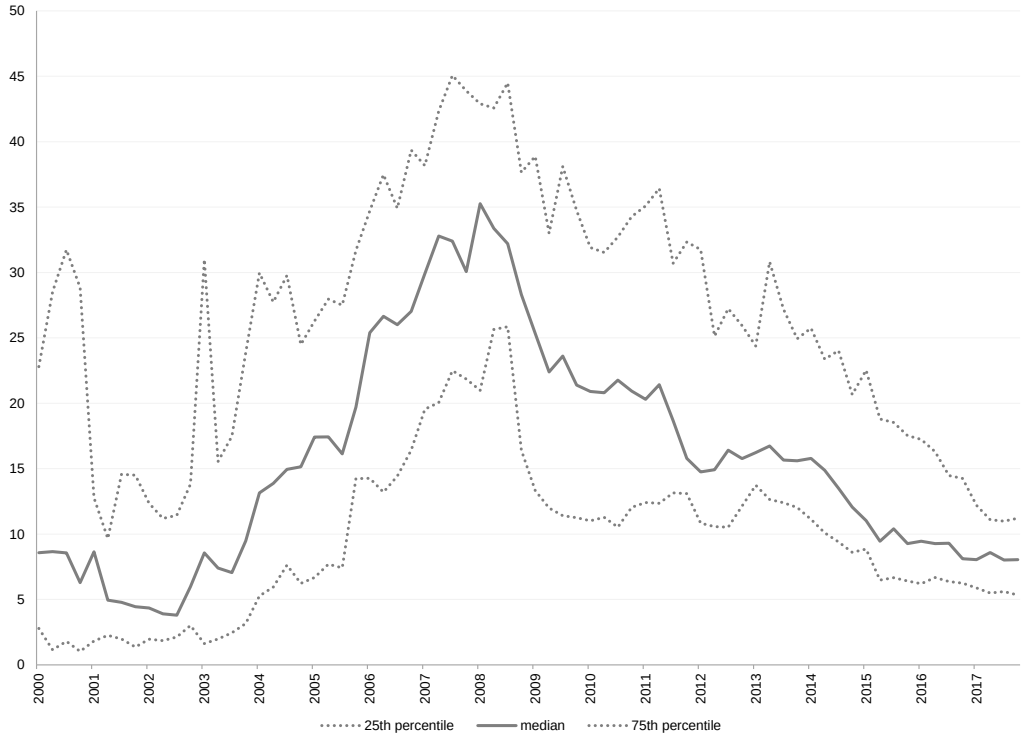

Figure 6: Cross-border funding ratio of 22 internationally active Russian banks, %

gage securities. All series except the EBP are taken from the online Federal Reserve Database (FRED – `www.fred.org`). The EBP data up to August 2016 are available from Simon Gilchrist's webpage. We extend the EBP series beyond August 2016 by recursively forecasting it one quarter ahead using the reduced-form VAR estimated on a subsample ending the third quarter of 2016.

Data on external instruments MP1, FF4, ED2, ED3, and ED4 up to October 2015 are kindly provided by the IBRN methodology team.

Table 2: Regressions with aggregate prudential policy index

The dependent variable, $\Delta \ln Loans_{i,t}$, is log-changes in loans to the domestic non-financial private sector denominated in all currencies (ALL), rubles (RUB), or foreign currency (FC). The measure of exposure, $Channel_{i,t}$, corresponds to non-residents liabilities to total liabilities (NRL/TL). The data are quarterly from 2000 Q1 to 2017 Q4 for a panel of 22 big internationally active banks. Standard errors are clustered by bank. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

ΔMP_t^{US}	SVAR shock			MP1			SVAR shock			MP1		
$Channel_{i,t}$	NRL/TL			NRL/TL			NRL/TL			NRL/TL		
Pru_t^{RU}	2-year cum overall			2-year cum overall			2-year cum without RR			2-year cum without RR		
$\Delta \ln Loans_{i,t}$	ALL	RUB	FC	ALL	RUB	FC	ALL	RUB	FC	ALL	RUB	FC
$\sum_{k=0}^{3} Channel_{i,t-4} \times \Delta MP_{t-k}^{US}$	−0.22*	−0.30*	−0.41**	0.39	1.78	−1.23	−0.15	−0.27*	−0.21	−0.76	0.04	−1.46
$\sum_{k=0}^{3} Channel_{i,t-4} \times Pru_{t-4}^{RU} \times \Delta MP_{t-k}^{US}$	0.07**	0.07*	0.08**	−0.15	−0.40*	0.16	0.07	0.11	−0.05	0.92	0.51	0.71
$Channel_{i,t-4} \times Pru_{t-4}^{RU}$	−0.01**	−0.02**	−0.02	−0.02***	−0.02***	−0.02*	−0.01	−0.01	−0.03*	−0.02**	−0.02	−0.04*
$Channel_{i,t-4}$	−0.05	−0.00	−0.06	−0.00	0.06	−0.04	−0.05	−0.01	−0.03	−0.01	0.06	−0.04
$\ln TotalAssets_{i,t-1}$	0.50	0.51	1.30	−1.16	−1.17	0.22	0.09	0.03	0.79	−1.44	−1.58	−0.01
$Liquid_{i,t-1}$	0.10	0.13	0.17*	0.16**	0.18*	0.14	0.10	0.12	0.18*	0.16**	0.17*	0.15
$Core_{i,t-1}$	−0.00	0.00	−0.01	−0.04	−0.03	−0.02	−0.01	−0.00	−0.01	−0.03	−0.02	−0.02
$Leverage_{i,t-1}$	0.21*	0.10	0.35	0.09	0.01	0.21	0.18	0.05	0.34	0.09	0.02	0.21
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1265	1265	1265	1054	1054	1054	1265	1265	1265	1054	1054	1054
No. of banks	22	22	22	22	22	22	22	22	22	22	22	22
R^2	0.33	0.27	0.21	0.32	0.26	0.24	0.32	0.26	0.25	0.32	0.26	0.24

5 Findings

5.1 The Role of the Aggregate Prudential Policy Index

Table 2 reports estimation results for regressions with a 2-year cumulative measure of macroprudential policy stance. As a baseline, we consider specifications with SVAR-identified US monetary policy shock (labeled as 'SVAR shock') and a version of the aggregate prudential index that includes changes in reserve requirements. Sometimes, it is argued that reserve requirements are more a monetary policy tool, rather than a prudential policy tool. In the case of Russia, though, this assertion is likely to be less accurate than perhaps in the case of some other countries. There were two major episodes when the Bank of Russia intervened by changing reserve requirements, one around 2006-2008 and the other in the middle of 2010s. In the first episode, the prudential intervention targeted mainly cross-border borrowing by Russian banks from foreign banks. The primary purpose was to curb massive capital inflows that were viewed as destabilising and therefore unwanted rather than manage the money supply. In the second episode, reserve requirements on foreign borrowing were raised in an attempt to promote the de-dollarisation of the liabilities of the banking sector and thus make it more resilient and less vulnerable to foreign exchange risk. It follows that, in the second episode, changes in reserve requirements, which affected mostly foreign-currency liabilities, could also be viewed as a form of prudential capital controls to the extent that borrowing in foreign currency both domestically and abroad became more expensive for Russian banks. We consider specifications with an aggregate prudential index that does not cover reserve requirements as a robustness check. We also try the monetary surprise series MP1 as a direct proxy of U.S. monetary policy shock. Compared with SVAR-identified shock, the advantage of MP1 as a proxy is due to the fact that it does not rely on the assumption that the SVAR is correctly specified, in particular, that the space of VAR innovations spans the space of structural shocks. If true, this is likely to produce poor estimates of U.S. monetary policy shock. An important shortcoming of monetary surprises as a proxy for U.S. monetary policy shock is that they potentially contain a non-trivial amount

of noise due to the market's under- or overreaction to news, and this is likely to make estimated coefficients of the distributed lag of U.S. monetary policy shock interacted with the lagged channel variable and the lagged stance of prudential policy in Russia subject to attenuation bias. Each specification is run for three different versions of the dependent variable, which differ in terms of currency denomination of loans: we consider, separately, loans to private non-financial borrowers denominated in all currencies (labeled ALL), in rubles (RUB), and in foreign currency (FC).

Results shown in Table 2 provide evidence supporting U.S. monetary policy spillovers to Russia and the insulating effect of domestic prudential policy. The estimated regressions in the first three columns, which correspond to the specification with SVAR-identified U.S. monetary policy shock and aggregate prudential index that covers reserve requirements, provide the strongest evidence. An unexpected monetary easing by 0.25 p.p. will raise the credit growth of a Russian bank with a 15% share of foreign liabilities in total liabilities, which is close to the sample mean, by approximately 1 p.p. over a one-year horizon for ruble-denominated loans and by 1.5 p.p. for foreign-currency-denominated loans, assuming zero prudential policy stance. Shifting the stance of domestic prudential policy from 0 to 3, which is roughly the sample average, would offset about 2/3 of the negative effect produced by U.S. monetary tightening for ruble-denominated loans and about 1/2 of it for foreign-currency denominated loans. The estimated effect is statistically significant for foreign-currency-denominated loans and marginally significant for ruble-denominated loans. For both types of loans, the estimated effect is economically significant.

The remaining specifications shown in Table 2 provide much less striking evidence in support of cross-border monetary policy spillovers and the insulating role of domestic prudential policy. Regressions with MP1 surprises serving as a proxy for U.S. monetary policy shock yield mostly insignificant effects and sometimes counterintuitive, i.e. wrongly signed, estimated effects of interest. Specifications with an aggregate prudential index that does not cover required reserves display insignificant offsetting effects from the domestic prudential policy stance. We interpret these inconclusive findings as follows.

First, the attractiveness of MP1 surprises as an alternative proxy for U.S. monetary policy shock is caused by its flexibility, and the independence of the imposed VAR structure is likely to be counter-veiled by its noisiness, which makes all point estimates but one statistically insignificant. Second, reserve requirements that targeted mostly cross-border borrowing and played the role of prudential capital controls proved to be perhaps the most powerful prudential intervention that shielded the domestic banking sector from inward monetary policy spillovers. As a result, the omission of this component from the aggregate prudential index is equivalent to removing a main character from a play, leading to insignificant estimated effects of interest.

In what follows, we analyse the effect of specific prudential policies, namely, reserve requirements on foreign liabilities and risk weights on consumer credit.

5.2 The Role of Prudential Policies Targeting Foreign-Currency Reserve Requirements

Table 3 shows the estimation results for regressions that discover the role of FX reserve requirements as a specific prudential policy. The foreign funding ratio described above, which serves as a transmission channel variable and differs across banks, measures the exposure of a bank both to shifts in U.S. monetary policy and to the stance of domestic prudential policy targeting cross-border borrowing. The SVAR-identified shock is the baseline proxy for US monetary policy shocks, with the monetary surprise MP1 being a supplementary proxy. We consider, separately, the effect of foreign monetary spillovers to domestic lending growth by currency of denomination, namely: (i) for loans denominated in all currencies (labeled ALL), (ii) in rubles (RUB), and (iii) in foreign currencies (FC). The regressors of interest are double and triple interactions of the distributed lag of U.S. monetary policy shock with, respectively, the fourth lag of the foreign funding ratio and the fourth lag of the foreign funding ratio cum the fourth lag of the prudential policy stance targeting cross-border funding, which is the 2-year cumulative index of reserve requirements on foreign currency deposits.

We observe that the estimated effect of SVAR-identified U.S. monetary shocks inter-

Table 3: Regressions with 2-year cumulative foreign-currency reserve requirement policy measures

The dependent variable, $\Delta \ln Loans_{i,t}$, is log-changes in loans to the domestic non-financial private sector denominated in all currencies (ALL), rubles (RUB), or foreign currencies (FC). The measure of exposure, $Channel_{i,t}$, corresponds to non-residents liabilities to total liabilities (NRL/TL). The data are quarterly from 2000 Q1 to 2017 Q4 for a panel of 22 big internationally active banks. Standard errors are clustered by bank. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

ΔMP_t^{US}	SVAR shock			MP1		
$Channel_{i,t}$	NRL/TL			NRL/TL		
Pru_t^{RU}	2-year cum RR foreign			2-year cum RR foreign		
$\Delta \ln Loans_{i,t}$	ALL	RUB	FC	ALL	RUB	FC
$\sum_{k=0}^{3} Channel_{i,t-4} \times \Delta MP_{t-k}^{US}$	−0.17*	−0.24**	−0.40***	0.21	1.62	−1.40
$\sum_{k=0}^{3} Channel_{i,t-4} \times Pru_{t-4}^{RU} \times \Delta MP_{t-k}^{US}$	0.12**	0.10	0.19***	−0.13	−0.80	0.81
$Channel_{i,t-4} \times Pru_{t-4}^{RU}$	−0.03	−0.04**	−0.03	−0.03*	−0.04***	−0.03
$Channel_{i,t-4}$	−0.04	0.00	−0.07	−0.01	0.05	−0.06
$\ln TotalAssets_{i,t-1}$	0.43	0.46	1.20	−1.27	−1.29	0.06
$Liquid_{i,t-1}$	0.09	0.12	0.16	0.15**	0.17*	0.12
$Core_{i,t-1}$	−0.00	0.00	−0.00	−0.03	−0.03	−0.01
$Leverage_{i,t-1}$	0.22*	0.11	0.37	0.10	0.02	0.23
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1265	1265	1265	1054	1054	1054
No. of banks	22	22	22	22	22	22
R^2	0.32	0.27	0.25	0.32	0.25	0.24

acted with the fourth lag of the foreign funding ratio, which is shown in the first row of Table 3, is negative and statistically significant, with the point estimates being very close to those in the specification with the aggregate prudential policy index, as reported in Table 2. An unexpected monetary loosening in the US by 0.25 p.p. will raise the lending growth of a Russian bank with a foreign funding ratio of 15% by 0.9 p.p. over a one-year horizon for ruble-denominated loans and by 1.5 p.p. for foreign-currency denominated loans. The estimated offsetting effect of domestic FX reserve requirements is more pronounced compared with that of the aggregate prudential policy index. For foreign-currency-denominated loans the point estimate suggests that a moderately tight – of 2 points according to the codification of Cerutti et al. (2017) – level of FX reserve requirements almost entirely offsets the stimulating effect of U.S. monetary policy on domestic lending growth, thus shielding the domestic economy from international monetary policy spillover through the bank lending channel. For ruble-denominated loans, the estimated effect is statistically insignificant, which is in contrast with the specification where the prudential policy stance is measured by the aggregate prudential index, as shown in Table 2.

The estimated regressions that use MP1 monetary surprise as a proxy for U.S. monetary policy shock are reported in the last three columns of Table 3. Similarly to those with the aggregate prudential policy index shown in Table 2, neither double nor triple interactions are statistically significant. This finding is consistent with the view that MP1 monetary surprises are crude proxies for U.S. monetary policy shock, such that the overwhelming amount of noise makes the estimated effects of interest prone to substantial attenuation bias.

5.3 The Role of Prudential Policies Targeting Consumer Credit

Table 4 reports results for changes in prudential policy targeting consumer credit implemented in Russia over the sample period. The dependent variable, as before, is the growth in loans denominated in all currencies, rubles, or foreign currency. The channel variable is the fourth lag of the share of consumer credit in total assets. Three alter-

Table 4: Regressions for policy targeting consumer credit

The dependent variable, $\Delta \ln Loans_{i,t}$, is log-changes in loans to the domestic non-financial private sector denominated in all currencies (ALL), rubles (RUB), or foreign currency (FC). The measure of exposure, $Channel_{i,t}$, corresponds to the ratio of consumer loans to total assets (Cons/TA). The data are quarterly from 2008 Q1 to 2017 Q4 for a panel of 22 big internationally active banks. Standard errors are clustered by bank. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

ΔMP_t^{US}	SVAR shock			SVAR shock			SVAR shock		
$Channel_{i,t}$	Cons/TA			Cons/TA			Cons/TA		
Pru_t^{RU}	2-year cum consumer			2-year cum overall			2-year cum overall without RR		
$\Delta \ln Loans_{i,t}$	ALL	RUB	FC	ALL	RUB	FC	ALL	RUB	FC
$\sum_{k=0}^{3} Channel_{i,t-4} \times \Delta MP_{t-k}^{US}$	−0.08	0.01	−0.02	−0.09	−0.09	−0.42	−0.22**	−0.19**	0.19
$\sum_{k=0}^{3} Channel_{i,t-4} \times Pru_{t-4}^{RU} \times \Delta MP_{t-k}^{US}$	0.29**	0.12	−0.16	0.01	0.02	0.14**	0.09***	0.11**	−0.07
$Channel_{i,t-4} \times Pru_{t-4}^{RU}$	−0.12***	−0.09***	0.12	0.01*	0.01***	−0.01	−0.02**	−0.01*	0.01
$Channel_{i,t-4}$	0.03	−0.00	0.12	−0.11	−0.16	0.31**	−0.00	−0.05	0.20
$\ln TotalAssets_{i,t-1}$	−0.99	−2.12	−0.08	−0.80	−1.90	−0.41	−0.50	−1.55	−0.74
$Liquid_{i,t-1}$	−0.04	−0.07	0.17	−0.04	−0.07	0.17	−0.04	−0.07	0.15
$Core_{i,t-1}$	0.00	−0.03	0.08	−0.01	−0.05	0.10	0.01	−0.03	0.12
$Leverage_{i,t-1}$	0.22*	−0.04	0.32	0.23*	−0.02	0.30	0.21*	−0.05	0.30
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	744	744	744	744	744	744	744	744	744
No. of banks	21	21	21	21	21	21	21	21	21
R^2	0.25	0.22	0.21	0.23	0.22	0.20	0.24	0.22	0.21

native indicators of the prudential policy stance are considered: (i) a 2-year cumulative index that covers only those prudential interventions that target consumer credit; (ii) a 2-year cumulative overall prudential policy index; and (iii) a 2-year cumulative overall prudential policy index excluding reserve requirement policies.

As can be seen from Table 4, estimated effects of interest vary substantially across different specifications. In the regressions with the consumer credit-related prudential policy index, as shown in the first three columns, the effect of US monetary policy shocks on lending does not depend on the exposure of a bank to consumer credit. The offsetting effect of domestic prudential policy is found to be statistically significant and of correct sign only for loans denominated in all currencies, but not for ruble-denominated loans or foreign-currency-denominated loans individually. In the regressions with a 2-year cumulative overall index, the broadest measure of prudential policy stance, the only statistically significant effect is a positive coefficient on the triple interactions in the case of foreign currency loans, indicating an insulating role for domestic prudential policy. In the regression with the overall prudential index excluding reserve requirement policies, on the contrary, the offsetting effect of domestic prudential policies is found to be statistically significant for ruble-denominated loans but not for foreign currency loans, with the primary negative effect of U.S. monetary policy on domestic lending growth in Russia also being statistically significant.

Bank-level data on consumer credit are available only since 2008 as before then consumer credit was not shown as a separate item in bank accounting. In attempt to obtain a longer sample of data, we employ as a proxy for consumer credit the share of household loans in total assets. This variable is far from perfect proxy as, in addition to consumer credit, household loans include car loans and mortgages loans. Unlike consumer credit, though, these data are available for the entire sample period, 2000Q1-2017Q4. We estimated a set of regressions with household loans as a fraction of total assets serving as a transmission channel variable with alternative proxies for the domestic prudential policy stance. The estimation results are shown in Table 5. If this evidence is combined with regressions where consumer credit as a fraction of total assets is employed as a channel

Table 5: Regressions for policy targeting consumer credit

The dependent variable, $\Delta \ln Loans_{i,t}$, is log-changes in loans to the domestic non-financial private sector denominated in all currencies (ALL), rubles (RUB), or foreign currency (FC). The measure of exposure, $Channel_{i,t}$, corresponds to the ratio of household loans to total assets (HH loans/TA). The data are quarterly from 2000 Q1 to 2017 Q4 for a panel of 22 big internationally active banks. Standard errors are clustered by bank. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

ΔMP_t^{US}	SVAR shock			SVAR shock			SVAR shock		
$Channel_{i,t}$	HH loans/TA			HH loans/TA			HH loans/TA		
Pru_t^{RU}	2-year cum consumer			2-year cum overall			2-year cum overall without RR		
$\Delta \ln Loans_{i,t}$	ALL	RUB	FC	ALL	RUB	FC	ALL	RUB	FC
$\sum_{k=0}^{3} Channel_{i,t-4} \times \Delta MP_{t-k}^{US}$	−0.08	0.04	−0.22	−0.16	−0.04	−0.46**	−0.17*	−0.06	−0.15
$\sum_{k=0}^{3} Channel_{i,t-4} \times Pru_{t-4}^{RU} \times \Delta MP_{t-k}^{US}$	0.16	0.01	0.17	0.01	0.01	0.13**	0.04	0.04	0.02
$Channel_{i,t-4} \times Pru_{t-4}^{RU}$	−0.10***	−0.07**	0.07	0.00	0.01	0.01	−0.01	−0.01	0.03*
$Channel_{i,t-4}$	−0.11	−0.15	−0.11	−0.16*	−0.21*	−0.06	−0.13	−0.17	−0.12
$\ln TotalAssets_{i,t-1}$	−0.29	−0.03	0.32	−0.18	0.06	0.60	−0.18	0.08	0.24
$Liquid_{i,t-1}$	0.09	0.08	0.14	0.08	0.08	0.16**	0.08	0.07	0.14
$Core_{i,t-1}$	0.05	0.03	0.03	0.04	0.03	0.03	0.04	0.03	0.03
$Leverage_{i,t-1}$	0.22**	0.06	0.36	0.21**	0.06	0.37	0.22**	0.06	0.35
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1260	1260	1260	1260	1260	1260	1260	1260	1260
No. of banks	22	22	22	22	22	22	22	22	22
R^2	0.32	0.26	0.24	0.31	0.26	0.25	0.32	0.26	0.24

variable with different alternative proxies for the prudential policy stance, as shown in Table 4, the 'big picture' seems to be the following. In the 'average' specification, the estimated one-year cumulative effect of foreign monetary shock conditional on bank exposure to consumer/household credit is negative, economically sizable, and, occasionally, statistically significant, although most often insignificant. The estimated effect of triple interactions that involve domestic prudential policy is positive and, occasionally, statistically significant, although most often insignificant. The size of the effect implies partial insulation from foreign monetary policy spillovers in some specifications and disproportionately greater effects in others. The only stable pattern is that the sign of the estimated cumulative effect of double interactions is almost uniformly negative, whereas the sign of the estimated cumulative effect of triple interactions is almost uniformly positive, which is consistent with the insulating effect of domestic prudential policy.

6 Conclusion

In this paper, we document that U.S. monetary policy shocks affect domestic lending in Russia. We also find that domestic macroprudential policy partially offsets the transmission of U.S. monetary policy into domestic lending. Both the direct effect of U.S. monetary policy and the offsetting effect of domestic prudential policy are more pronounced for loans denominated in foreign currency, which are mostly in U.S. dollars. The effects for ruble-denominated loans are also non-negligible. These empirical patterns are seen for the aggregate prudential policy stance as well as for prudential policies targeting specific items on the asset or liability sides of banks' balance sheets such as cross-border funding or consumer credit, the two areas that experienced active prudential interventions by the Bank of Russia. To the extent that a substantial part of the sample period is associated with a floating FX regime and inflation targeting preceded by a gradual transition phase, our findings are consistent with the view that floating exchange rates themselves do not insulate the economy from foreign monetary policy spillovers, whereas domestic prudential policy has a counter-balancing effect.

References

Aiyar, S., C. W. Calomiris, and T. Wieladek (2014): "Does macro-prudential regulation leak? Evidence from a UK policy experiment," *Journal of Money, Credit and Banking*, 46, 181–214.

Alam, Z., M. A. Alter, J. Eiseman, M. R. Gelos, M. H. Kang, M. M. Narita, E. Nier, and N. Wang (2019): "Digging deeper–Evidence on the effects of macro-prudential policies from a new database," Working Paper WP/19/66, International Monetary Fund.

Avdjiev, S., L. Gambacorta, L. S. Goldberg, and S. Schiaffi (2020a): "The shifting drivers of global liquidity," *Journal of International Economics*, 125.

Avdjiev, S., B. Hardy, P. McGuire, and G. von Peter (2020b): "Home sweet host: Prudential and monetary policy spillovers through global banks," Working Paper 853, Bank for International Settlements.

Baskaya, Y. S., J. Di Giovanni, Ş. Kalemli-Özcan, J.-L. Peydró, and M. F. Ulu (2017): "Capital flows and the international credit channel," *Journal of International Economics*, 108, S15–S22.

Bruno, V. and H. S. Shin (2015a): "Capital flows and the risk-taking channel of monetary policy," *Journal of Monetary Economics*, 71, 119–132.

——— (2015b): "Cross-border banking and global liquidity," *The Review of Economic Studies*, 82, 535–564.

Buch, C. M., M. Bussiere, L. Goldberg, and R. Hills (2019): "The International Transmission of Monetary Policy," *Journal of International Money and Finance*, 91, 29–48.

Buch, C. M. and L. S. Goldberg (2017): "Cross-Border Prudential Policy Spillovers: How Much? How Important? Evidence from the International Banking Research Network," *International Journal of Central Banking*, 13, 505–557.

Budnik, K. B. and P. Bochmann (2017): "Capital and liquidity buffers and the resilience of the banking system in the euro area," Working Paper 2120, European Central Bank.

Cao, J. and V. Dinger (2018): "Financial globalization and bank lending: the limits of domestic monetary policy?" Working Paper 4, Norges Bank.

Cerutti, E., R. Correa, E. Fiorentino, and E. Segalla (2017): "Changes in Prudential Policy Instruments – A New Cross-Country Database," *International Journal of Central Banking*, 13, 477–503.

Cetorelli, N. and L. Goldberg (2012a): "Banking Globalization and Monetary Transmission," *Journal of Finance*, LXZII, 1811–1843.

——— (2012b): "Liquidity Management of US Global Banks: Internal Capital Markets in the Great Recession," *Journal of International Economics*, 88, 299–311.

Coman, A. and S. Lloyd (2019): "In the face of spillovers: prudential policies in emerging economies," Working Paper No. 828, Bank of England.

Danilova, E. and M. Morozov (2017): "The macroprudential policy framework in Russia," *BIS Papers*, 305–319.

De Jonghe, O., H. Dewachter, and S. Ongena (2020): "Bank capital (requirements) and credit supply: Evidence from pillar 2 decisions," *Journal of Corporate Finance*, 60.

De Marco, F. and T. Wieladek (2015): "The real effects of capital requirements and monetary policy: Evidence from the United Kingdom," Working Paper No. 573, Bank of England.

Dell'Ariccia, G., L. Laeven, and G. A. Suarez (2017): "Bank leverage and monetary policy's risk-taking channel: evidence from the United States," *Journal of Finance*, 72, 613–654.

Epure, M., I. Mihai, C. Minoiu, and J.-L. Peydró (2018): "Household credit, global financial cycle, and macroprudential policies: credit register evidence from an emerging country," Working Paper WP/18/13, International Monetary Fund.

Galati, G. and R. Moessner (2018): "What do we know about the effects of macroprudential policy?" *Economica*, 85, 735–770.

Gambacorta, L. and P. E. Mistrulli (2004): "Does bank capital affect lending behavior?" *Journal of Financial Intermediation*, 13, 436–457.

Gambacorta, L. and A. Murcia (2020): "The impact of macroprudential policies in Latin America: An empirical analysis using credit registry data," *Journal of Financial Intermediation*, 42.

Gerko, E. and H. Rey (2017): "Monetary Policy in the Capitals of Capital," *Journal of the European Economic Association*, 15, 721–745.

Gertler, M. and P. Karadi (2015): "Monetary Policy Surprises, Credit Costs, and Economic Activity," *American Economic Journal: Macroeconomics 7*, 44–76.

Gilchrist, S. and E. Zakrajšek (2012): "Credit Spreads and Business Cycle Fluctuations," *American Economic Review 102*, 1692–1720.

Giovanni, J. d., S. Kalemli-Ozcan, M. F. Ulu, and Y. S. Baskaya (2017): "International spillovers and local credit cycles," Working Paper 23149, National Bureau of Economic Research.

Gürkaynak, R. S., B. Sack, and E. T. Swanson (2005): "Do Actions Speak Louder than Words? The Response of Asset Prices to Monetary Policy Actions and Statements," *International Journal of Central Banking 1*, 55–93.

Jiménez, G., S. Ongena, J.-L. Peydró, and J. Saurina (2017): "Macroprudential policy, countercyclical bank capital buffers, and credit supply: evidence from the Spanish dynamic provisioning experiments," *Journal of Political Economy*, 125, 2126–2177.

Maddaloni, A. and J.-L. Peydró (2013): "Monetary policy, macroprudential policy and banking stability: evidence from the euro area," *International Journal of Central Banking*, 9, 121–169.

Mertens, K. and M. O. Ravn (2013): "The Dynamic Effects of Personal and Corporate Income Tax Changes in the United States," *American Economic Review 103*, 1212–1247.

Miranda-Agrippino, S. and H. Rey (2020): "US Monetary Policy and the Global Financial Cycle," *Review of Economic Studies*.

Morais, B., J. Peydró, J. Roldán-Pena, and C. Ruiz-Ortega (2019): "The International Bank Lending Channel of Monetary Policy Rates and QE: Credit Supply, Reach for Yield, and Real Effects," *Journal of Finance*, LXXIV, 55–90.

Passari, E. and H. Rey (2015): "Financial Flows and the International Monetary System," *Economic Journal 125*, 675–698.

Rey, H. (2015): "Dilemma Not Trilemma: The Global Financial Cycle and Monetary Policy Independence," Working Paper 21162, National Bureau of Economic Research.

——— (2016): "International Channels of Transmission of Monetary Policy and the Mandellian Trilemma," *IMF Economic Review*, 64, 6–35.

Stock, J. H. and M. W. Watson (2012): "Disentangling the Channels of the 2007-2009 Recession," *Brookings Papers on Economic Activity*, 42, 81–135.

Stock, J. H., J. H. Wright, and M. Yogo (2002): "A Survey of Weak Instruments and Weak Identification in Generalized Method of Moments," *Journal of Business and Economic Statistics*, 20, 518–529.

Takáts, E. and J. Temesvary (2019a): "Can macroprudential measures make cross-border lending more resilient? Lessons from the taper tantrum," *International Journal of Central Banking*, 15, 61–105.

——— (2019b): "How does the interaction of macroprudential and monetary policies affect cross-border bank lending?" Working Paper No. 782, Bank for International Settlements.

Wooldridge, J. M. (2010): *Econometric Analysis of Cross Section and Panel Data*, Cambridge, Massachusetts: MIT Press, 2 ed.

Appendices

Table A.1: Timeline of macroprudential measures since 2006

Differentiated reserve requirement	
October 2006	The reserve requirement on liabilities to non-resident banks in all currencies was increased to 3.5% (from 2%). This instrument was introduced at 2% in August 2004
July 2007	The reserve requirement on liabilities to non-resident banks in all currencies was increased to 4.5% The reserve requirements on individual deposits in local currency and on other deposits were raised to 4% and 4.5%, respectively
October 2007	The reserve requirement on liabilities to non-resident banks in all currencies was reduced to 3.5% The reserve requirements on individual deposits in local currency and on other deposits were lowered to 3% and 3.5%, respectively
January 2008	The reserve requirement on liabilities to non-resident banks in all currencies was increased to 4.5% The reserve requirements on individual deposits in local currency and on other deposits were raised to 4% and 4.5%, respectively
March 2008	The reserve requirement on liabilities to non-resident banks in all currencies was increased to 5.5% The reserve requirements on individual deposits in local currency and on other deposits were raised to 4.5% and 5%, respectively
July 2008	The reserve requirement on liabilities to non-resident banks in all currencies was increased to 7% The reserve requirements on individual deposits in local currency and on other deposits were raised to 5% and 5.5%, respectively
September 2008 (1^{st})	The reserve requirement on liabilities to non-resident banks in all currencies was increased to 8.5%. The reserve requirements on individual deposits in local currency and on other deposits were raised to 5.5 and 6%, respectively
September 2008 (18^{th})	The reserve requirement on liabilities to non-resident banks in all currencies was reduced to 4.5%. The reserve requirements on individual deposits in local currency and on other deposits were lowered to 1.5% and 2%, respectively

October 2008	The reserve requirements were uniformly reduced to 0.5%. The reserve requirement was subsequently raised to 1% in May 2009, to 1.5% in June 2009, to 2% in July 2009, and to 2.5% in August 2009
February 2011	The reserve requirement on liabilities to non-resident legal entities in all currencies was increased to 3.5%. The reserve requirement on deposits was raised to 3%
March 2011	The reserve requirement on liabilities to non-resident legal entities in all currencies was increased to 4.5%. The reserve requirement on deposits was raised to 3.5%
April 2011	The reserve requirement on liabilities to non-resident legal entities in all currencies was increased to 5.5%. The reserve requirement on deposits was raised to 4%
March 2013	The reserve requirements were uniformly imposed at 4.25%
April 2016	The reserve requirement on liabilities in foreign currency, except individual deposits, was increased to 5.25%. The reserve requirement on other liabilities remained at 4.25%
July 2016	The reserve requirement on liabilities in foreign currency, except individual deposits, was increased to 6.25%. The reserve requirement on individual deposits in foreign currency was increased to 5.25%. The reserve requirement on liabilities in rubles remained at 4.25%
August 2016	The reserve requirement on liabilities in foreign currency was increased to 6% for individual deposits and 7% for other liabilities. The reserve requirement on liabilities in rubles was raised to 5%
January 2017	The structure of credit institutions' reservable liabilities included in the calculation of required reserves were updated. Differentiated reserve requirements were imposed on long-term liabilities to non-resident legal entities and other liabilities, which had been previously exempt from the rule. The reserve ratios for long-term liabilities equal the previously existing reserve ratios for the respective liabilities
Provisioning	
June 2009	The loan classification and the provisioning requirement were eased (in response to a banking crisis). Restructured loans were allowed to remain in the original classification

March 2013	The minimum provisions for newly extended unsecured consumer loans were increased to 2% for loans without payments overdue (from 1%) and to 6% for loans with payments overdue for no more than 30 days (from 3%). The tighter provision requirements were applicable only in the case that borrowers did not have deposit accounts with the banks. Unsecured consumer loans with payments overdue for more than 360 days must be fully provisioned (that is, 100%)
January 2014	The minimum provisions for newly extended unsecured consumer loans were increased to 3% for loans without payments overdue and to 8% for loans with overdue payments for no more than 30 days. The tighter provision requirements were applicable only in the case that borrowers did not have deposit accounts with the banks
December 2014	The loan classification and the provisioning requirement were eased (to increase flexibility in the management of credit risk)
Sectoral Capital Risk Weights	
May 2009	The risk weight for relatively low-risk newly extended mortgage loans in rubles was reduced to 0.7 (from 1). These mortgage loans meet the following requirements: - The size of loans is less than RUB 50 million - The LTV ratio is less than 70%; the DSTI ratio is less than 33% (for calculating the DSTI ratio, income of spouse and children is also included) - The property used as collateral must be insured for an amount of at least the size of loans
October 2011	The risk weight for relatively high-risk newly extended mortgage loans in rubles was increased to 1.5 (from 1). These mortgage loans meet the following requirements: - The size of loans is more than RUB 50 million - The LTV ratio is more than 80%
July 2013	The risk weights for newly extended unsecured consumer loans were increased based on risk profiles: Loans in local currency - Risk weight of 1.1 for loans with effective lending rates of 25-35% - Risk weight of 1.4 for loans with effective lending rates of 35-45% - Risk weight of 1.7 for loans with effective lending rates of 45-60% - Risk weight of 2 for loans with effective lending rates of more than 60% Loans in foreign currency

	- Risk weight of 1.7 for loans with effective lending rates of 20-25% - Risk weight of 2 for loans with effective lending rates of more than 25%
January 2014	The risk weights for newly extended unsecured consumer loans were increased based on risk profiles: Loans in local currency - Risk weight of 3 for loans with effective lending rates of 45-60% - Risk weight of 6 for loans with effective lending rates of more than 60% Loans in foreign currency - Risk weight of 3 for loans with effective lending rates of 20-25% - Risk weight of 6 for loans with effective lending rates of more than 25%
May 2014	The criteria for mortgage loans subject to a risk weight of 0.7 were changed: - The DSTI ratio is less than 50% (previously, 33%); other criteria remain unchanged
December 2014	The risk weight for relatively low-risk newly extended mortgage loans in rubles was further reduced to 0.5. These mortgage loans meet the following requirements: - The size of loans is less than RUB 50 million - The LTV ratio is less than 50%; the DSTI ratio is less than 40% - The property used as collateral must be insured for an amount of at least the size of loans
January 2015	The risk weight for relatively high-risk newly extended mortgage loans in rubles was increased to 1.5 (from 1). These mortgage loans meet the following requirement: - The LTV ratio is more than 90%
February 2015	The risk weight for newly extended unsecured consumer loans was reduced to 1. These loans must have the following risk profiles: - In local currency - With effective lending rates of 25-35%
April 2015	The risk weight for newly extended mortgage loans in foreign currency was increased to 3 (from 1)
August 2015	The risk weight for newly extended unsecured consumer loans was increased to 3. These loans must have the following risk profiles: - In foreign currency

	- With effective lending rates of less than 20%
January 2016	The risk weight for relatively low-risk newly extended mortgage loans in rubles was further reduced to 0.35. These mortgage loans meet the following requirements: - The size of loans is less than RUB 50 million - The LTV ratio is less than 50%; the DSTI ratio is less than 33% - The property used as collateral must be insured for an amount of at least the size of loans
May 2016	The risk weights for new exposures to legal entities in foreign currency were increased to 1.1-1.5 (from 1), depending on transaction types and investment purposes. Main features are: - Risk weight for the above-mentioned foreign-currency exposures (both loans and debt securities) would be at least 1.1, except for exposures to the corporate sector with sufficient foreign-currency earnings for debt servicing and exposures that are guaranteed - Risk weight for foreign-currency lending for purchasing commercial real estate would be 1.3 - Risk weight for foreign-currency debt securities held in certain securities depositories would be 1.5

Source: Danilova and Morozov (2017)

Table A.2: Sample of internationally active banks

No	Reg number	Name
1	1	Joint Stock Company UniCredit Bank
2	316	Home Credit & Finance Bank Limited Liability Company
3	354	Gazprombank (Joint Stock Company)
4	1000	VTB Bank (Public Joint-Stock Company)
5	1326	Joint Stock Company 'ALFA-BANK'
6	1481	Sberbank of Russia
7	1978	CREDIT BANK OF MOSCOW (public joint-stock company)
8	2209	Public Joint-Stock Company 'Bank Otkritie Financial Corporation'
9	2216	Banca Intesa
10	2268	Public Joint-Stock Company 'MTS Bank'
11	2272	Public joint-stock company ROSBANK
12	2557	Joint Stock Company Commercial Bank Citibank
13	2590	Joint-Stock Commercial Bank 'AK BARS' (Public Joint-Stock Company)
14	2748	BM-Bank Joint Stock Company
15	2867	Joint Stock Company ISBANK
16	3016	Joint Stock Company Nordea Bank
17	3251	Promsvyazbank Public Joint-Stock Company
18	3290	HSBC Bank (RR) (Limited Liability Company)
19	3292	Joint stock company Raiffeisenbank
20	3307	Danske Bank
21	3311	Credit Europe Bank (Russia) Ltd.
22	3349	Joint stock company Russian Agricultural Bank