A Quantitative Assessment of the Impact of Credit on Economic Growth in Russia

Byvshev Victor and Brovkina Natalya*

Financial University under the Government of Russia, Moscow, Russia

Abstract: The Russian credit market reflects the significant range of problems faced by the national economy. Among them are structural and regional imbalances; restrictions that prevent the free movement of funds in the interbank market; uncertainty that leads to a slowdown in the rates of attraction and placement of credit resources. As a result, the question arises as to how effective the credit market in Russia is and whether it has a stimulating effect on the national economy. The purpose of this article is to assess the impact of credit on economic growth as one of the criteria for the effectiveness of the credit market in the national economy. Growth rates of real quarterly GDP levels cleared of seasonality as well as quarterly growth rates of real household consumption in Russia cleared of seasonality are viewed as indicators of economic growth. Indicators of the credit market include quarterly growth rates of real loans to households and quarterly growth rates of real loans to non-financial organizations. In addition, such events as the global economic crisis of 2008 – 2009 and its impact, Western sanctions and the increase of crude oil prices were taken into account. As a result of the study conducted by the authors using an open econometric model of vector autoregression, the conclusion was drawn that loans to households and non-financial organizations in the long term have a stimulating effect on the Russian economy.

Keywords: Credit market, loans to households, loans to non-financial organizations, gross domestic product (GDP), vector autoregression model.

I. INTRODUCTION

Currently, the Russian economy has not yet reached the path of sustainable growth. The chart of quarterly growth rates of Russia's real GDP cleared of seasonality and the rate of increase of real quarterly values of final household expenditures cleared of seasonality indicates that approximately from the third quarter of 2014 (after the introduction of sanctions of Western countries) there has been a negative trend in the rate of growth of real GDP and values of final household expenditures (Figure **1**).

This raises the question about the availability of mechanisms that stimulate the growth of the Russian economy. Models of such mechanisms have been known since the appearance of the static Keynesian model of aggregate demand ISLM in the famous work of John R. Hicks (1937). This model reflects the mechanism of monetary transmission, according to which the increase in the supply of money in the economy in the short term (when the overall price level is fixed) leads to an increase in the real volume of production of goods and services. This model is still an important part of the monetary theory, which studies the impact of money supply on real output and the general price level. There are factors that form the value of money supply: this is the level of the monetary base and the value of the money multiplier, which is in inverse dependence with the excess reserves ratio. The value of the coefficient is essentially formed by the banks within the framework of the lending process, and the higher the volume of loans issued, the lower the multiplier becomes and, consequently, the higher the level of money supply. Thus, bank lending can be considered one of the channels of monetary transmission.

The authors have already assessed the impact of the credit market on the country's GDP using the econometric model (Byvshev, Brovkina 2017). The model discussed in this article reflects the changes in the Russian credit market in recent years. In particular, the driver of growth of the national credit market was mortgage lending. Besides, the econometric model has undergone qualitative changes, which allowed an increase in the adequacy of assessments due to the inclusion of the quarterly growth rate values of the prices of crude oil into the list of exogenous factors. As a result, using this econometric model it is possible not only to assess the impact of credit on GDP and final consumption of households, but also to compare the impact of credit and oil prices on economic growth in Russia.

II. ECONOMIC GROWTH INDICATORS AND THE MACROECONOMIC VARIABLES THAT EXPLAIN THEM

Two macroeconomic variables are taken as indicators of economic growth, which are explained in the model in question (current endogenous variables):

*Address correspondence to this author at the Department of Financial Markets and Banks of the Financial University under the Government of RF, Moscow, Russia; Tel/ Fax: +7(495) 615-72-75; E-mail: nbrobkina@inbox.ru

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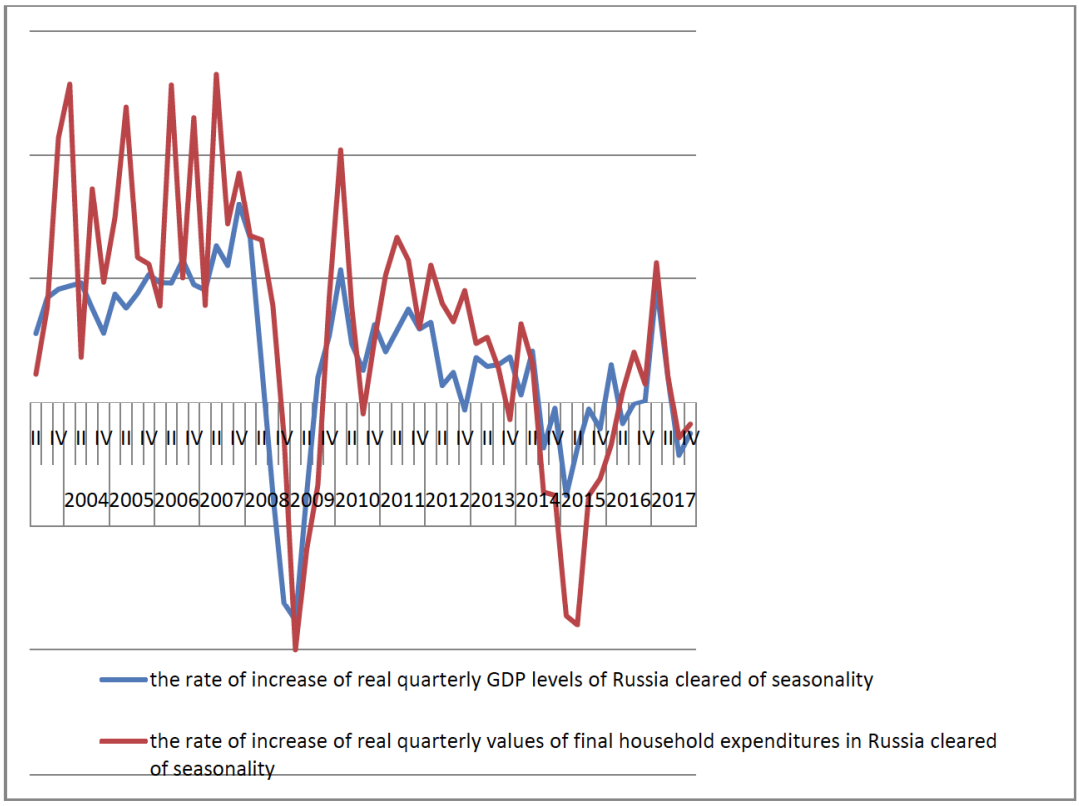

Figure 1: The rate of increase of the quarterly levels of real GDP of Russia cleared of seasonality (%), the rate of increase of real quarterly values of final household expenditures in Russia cleared of seasonality (%).

y_{1t} - the rate of increase of real quarterly GDP levels of Russia cleared of seasonality;

y_{2t} - the rate of increase of real quarterly values of final household expenditure in Russia cleared of seasonality.

The quarterly values of the real GDP of Russia cleared of the seasonal factor $Y_t^{\backslash s}$ and the values of the growth rate y_{1t} calculated from them, as well as the values of the real expenditure on final consumption of households in Russia cleared of the seasonal factor $C_t^{\backslash s}$ and the values of their growth rate y_{2t} are placed in Table **1**.

Next, we form the vector of current endogenous variables:

$$y_t = (y_{1t}, y_{2t})^T \quad (1)$$

Quarterly growth rates of real loans to households, non-financial organizations, quarterly values of the rate of growth of crude oil prices, as well as binary variables of the presence of Western sanctions and the world economic crisis of 2008-2009 were adopted as exogenous (explanatory) variables in the model, based on the results of experiments:

x_{1t} - quarterly growth rates of real loans to households;

x_{2t} - quarterly growth rates of real loans to non-financial organizations;

x_{3t} - binary variable for the presence of Western sanctions;

x_{4t} - binary variable of the world economic crisis of 2008-2009;

x_{5t} - quarterly values of crude oil price growth rate.

Quarterly values of real loans to households, non-financial organizations, crude oil prices, as well as their growth rates are given in Table **2**.

From exogenous variables we form the vector of current exogenous variables:

$$x_t = (x_{1t}, x_{2t}, x_{3t}, x_{4t}, x_{5t})^T \quad (2)$$

Variables y_{1t}, y_{2t}, x_{1t}, x_{2t}, x_{5t} can be interpreted as stationary time series, which is not the case for dummy variables x_{3t}, x_{4t} that take discrete values of 0 or 1.

Table 1: The Quarterly Values of the Real GDP of Russia $Y_t^{\backslash s}$, their Growth Rate y_{1t}, Values of the Real Expenditure on Final Consumption of Households in Russia Cleared of the Seasonal Factor $C_t^{\backslash s}$ and their Growth Rate y_{2t}

Year	Quarter	$Y_t^{\backslash s}$	y_{1t}	$C_t^{\backslash s}$	y_{2t}
2003	I	6567,4		2546,7	
	II	7052,3	1,12	2661,6	0,46
	III	7742,7	1,69	2843,5	1,54
	IV	7942,6	1,82	3108,0	4,27
2004	I	7042,9	1,88	2848,7	5,14
	II	7618,6	1,93	2981,9	0,73
	III	8309,8	1,52	3248,7	3,45
	IV	8436,6	1,12	3471,4	1,94
2005	I	7435,6	1,75	3116,8	2,99
	II	8076,7	1,52	3394,1	4,77
	III	8805,1	1,76	3656,8	2,34
	IV	9093,0	2,06	3919,7	2,23
2006	I	7978,3	1,93	3468,6	1,56
	II	8729,5	1,93	3793,2	5,12
	III	9526,3	2,30	4072,6	2,01
	IV	9900,5	1,90	4465,3	4,60
2007	I	8622,1	1,81	3951,6	1,57
	II	9481,8	2,52	4328,5	5,30
	III	10304,9	2,21	4687,0	2,88
	IV	10809,9	3,19	5093,7	3,71
2008	I	9413,2	2,65	4521,2	2,68
	II	10231,0	0,62	4843,2	2,62
	III	10965,6	-1,49	5200,5	1,56
	IV	10667,0	-3,25	5402,1	-0,57
2009	I	8547,0	-3,53	4498,4	-4,00
	II	9090,1	-1,46	4584,7	-2,36
	III	10020,5	0,41	4782,5	-1,34
	IV	10391,0	1,08	5081,0	1,70
2010	I	8894,9	2,14	4587,1	4,08
	II	9544,6	0,95	4862,1	1,55
	III	10403,9	0,52	5130,7	-0,19
	IV	10918,8	1,26	5413,9	1,01
2011	I	9186,1	0,82	4792,5	2,05
	II	9859,0	1,16	5135,5	2,66
	III	10930,5	1,51	5554,2	2,29
	IV	11482,2	1,19	5874,0	1,21
2012	I	9703,7	1,29	5283,7	2,21
	II	10402,2	0,28	5568,0	1,60
	III	11192,2	0,49	5925,5	1,31
	IV	11660,8	-0,13	6259,5	1,80

(Table 1). Continued.

Year	Quarter	$Y_t^{\backslash s}$	y_{1t}	$C_t^{\backslash s}$	y_{2t}
2013	I	9825,6	0,73	5571,8	0,95
	II	10577,3	0,58	5889,2	1,05
	III	11374,3	0,61	6276,8	0,55
	IV	11948,8	0,74	6507,5	-0,28
2014	I	9871,5	0,13	5765,8	1,27
	II	10715,0	0,83	6000,6	0,64
	III	11474,4	-0,74	6344,5	-1,45
	IV	11987,9	-0,10	6607,0	-1,50
2015	I	9727,7	-1,50	5342,6	-3,45
	II	10363,9	-0,75	5439,5	-3,60
	III	11179,7	-0,12	5737,8	-1,51
	IV	11659,4	-0,44	5882,0	-1,23
2016	I	9677,8	0,61	5168,0	-0,68
	II	10324,7	-0,35	5173,2	0,18
	III	11152,4	-0,02	5631,3	0,81
	IV	11701,7	0,02	5792,1	0,30
2017	I	9811,8	1,89	5249,9	2,25
	II	10576,5	0,41	5428,9	0,43
	III	11321,8	-0,86	5799,9	-0,58
	IV	11798,9	-0,51	6010,5	-0,36

Table 2: Quarterly Values of Real Loans to Households, Non-Financial Organizations, Crude Oil Prices, as well as their Growth Rates

Year	Quarter	Quarterly values of real loans to households	x_{1t}	Quarterly values of real loans to non-financial organizations	x_{2t}	Crude oil prices	x_{5t}
2003	I	262,1	1,89	2894,0	2,47	183,6	8,8
	II	313,4	19,59	3041,1	5,08	152,6	-16,9
	III	392,8	25,31	3359,1	10,46	177,3	16,2
	IV	454,8	15,81	3603,3	7,27	182,1	2,7
2004	I	516,6	13,58	3726,7	3,43	188,1	3,3
	II	612,0	18,47	3910,8	4,94	211,5	12,4
	III	727,9	18,93	4189,5	7,13	248,3	17,4
	IV	836,5	14,92	4443,4	6,06	256,3	3,2
2005	I	901,0	7,71	4527,4	1,89	261,7	2,1
	II	1004,2	11,46	4698,0	3,77	311,8	19,2
	III	1205,8	20,08	4997,8	6,38	380,1	21,9
	IV	1430,4	18,63	5257,5	5,20	364,8	-4,0
2006	I	1561,7	9,18	5350,9	1,78	380,3	4,2
	II	1759,7	12,68	5678,1	6,11	431,3	13,4
	III	2058,8	16,99	6126,1	7,89	449,6	4,3
	IV	2355,7	14,43	6597,7	7,70	383,9	-14,6

(Table 2). Continued.

Year	Quarter	Quarterly values of real loans to households	x_{1t}	Quarterly values of real loans to non-financial organizations	x_{2t}	Crude oil prices	x_{5t}
2007	I	2538,9	7,77	6992,9	5,99	370,6	-3,5
	II	2770,4	9,12	7520,6	7,55	438,2	18,3
	III	3103,1	12,01	8283,8	10,15	494,1	12,8
	IV	3207,0	3,35	9037,3	9,10	573,7	16,1
2008	I	3211,3	0,13	9606,9	6,30	631,1	10,0
	II	3404,3	6,01	10101,8	5,15	765,5	21,3
	III	3751,9	10,21	10766,9	6,58	803,5	5,0
	IV	3867,4	3,08	11123,7	3,31	454,3	-43,5
2009	I	3601,0	-6,89	11032,1	-0,82	295,3	-35,0
	II	3391,5	-5,82	11002,6	-0,27	366,6	24,2
	III	3258,9	-3,91	10783,5	-1,99	463,3	26,4
	IV	3181,6	-2,37	10543,2	-2,23	497,6	7,4
2010	I	3048,2	-4,19	10069,7	-4,49	517,2	3,9
	II	3053,6	0,18	10115,4	0,45	543,3	5,0
	III	3140,3	2,84	10318,2	2,01	526,3	-3,1
	IV	3234,2	2,99	10357,9	0,38	578,8	10,0
2011	I	3243,1	0,28	10201,2	-1,51	675,5	16,7
	II	3390,1	4,53	10456,8	2,51	776,4	14,9
	III	3739,2	10,30	11240,5	7,49	763,0	-1,7
	IV	4072,2	8,91	11894,1	5,81	756,7	-0,8
2012	I	4327,8	6,28	12056,8	1,37	784,6	3,7
	II	4633,0	7,05	12264,6	1,72	759,2	-3,2
	III	5013,8	8,22	12672,6	3,33	722,3	-4,9
	IV	5367,1	7,05	12896,7	1,77	749,7	3,8
2013	I	5593,7	4,22	12913,2	0,13	753,4	0,5
	II	5873,8	5,01	13082,0	1,31	697,6	-7,4
	III	6252,8	6,45	13520,3	3,35	737,0	5,6
	IV	6543,2	4,64	13701,0	1,34	746,5	1,3
2014	I	6667,8	1,90	13749,1	0,35	738,3	-1,1
	II	6728,6	0,91	13818,0	0,50	738,8	0,1
	III	6912,2	2,73	14152,3	2,42	710,8	-3,8
	IV	6805,6	-1,54	14763,6	4,32	570,3	-19,8
2015	I	6290,5	-7,57	14584,5	-1,21	383,3	-32,8
	II	6060,0	-3,66	14457,1	-0,87	415,1	8,3
	III	5908,4	-2,50	14724,4	1,85	361,4	-12,9
	IV	5762,8	-2,46	15168,3	3,01	309,4	-14,4
2016	I	5591,3	-2,98	14932,1	-1,56	227,3	-26,5
	II	5498,4	-1,66	14253,9	-4,54	286,3	25,9
	III	5505,9	0,14	13774,6	-3,36	310,9	8,6
	IV	5494,1	-0,21	13380,7	-2,86	330,9	6,4
2017	I	5475,8	-0,33	12958,8	-3,15	371,6	12,3
	II	5500,4	0,45	12796,4	-1,25	349,3	-6,0
	III	5732,6	4,22	13053,1	2,01	351,6	0,7
	IV	5930,9	3,46	12964,9	-0,68	406,7	15,7

III. SPECIFICATION OF THE MODEL OF THE IMPACT OF LOANS ON THE RUSSIAN ECONOMY

To assess the impact of the credit market on the Russian economy, the $VARX(p,q)$ model has been applied, which is an open vector autoregression (VAR) model or, in other words, vector autoregression – distributed lags (ADL – models). In these models, lagged endogenous variables and current and lagged exogenous variables are presented as predefined variables (Nosko 2011:394). Such models were promoted by the Nobel prize in Economics laureate Christopher A. Sims (1980, 1982) for economic research.

The impact of credit on GDP should be assessed using a model $VARX(1,4)$. This means that current levels of the model-driven growth variables (1) are influenced by exogenous variables with a maximum lag of 4 quarters or 1 year.

Taking into account (1) and (2) the specification of the model $VARX(1,4)$ compactly has the following form:

$$y_t = a_0 + Ay_{t-1} + B^{(0)}x_t + B^{(1)}x_{t-1} + B^{(2)}x_{t-2} + B^{(3)}x_{t-3} + B^{(4)}x_{t-4} + B^{(5)}x_{5-4} + u_t \quad (3)$$

Here

$a_0 = (a_{10}, a_{20})^T$ - is the vector of required constants; (4)

the symbol $A = (a_{ij})$ denotes the square 2×2 matrix of required coefficients for lag endogenous variables y_{t-1}:

$y_{t-1} = (y_{1t-1}, y_{2t-1})^T$; (5)

the symbol $B^{(s)} = (b^{(s)}_{ij})$, where s = 0, 1, 2, 3, 4, 5 denotes 2×5 matrices of required coefficients for current (2) and lag (6) exogenous variables

$$x_{t-s} = (x_{1t-s}, x_{2t-s}, x_{3t-s}, x_{4t-s}, x_{5t-s})^T; \quad (6)$$

finally,

$$u_t = (u_{1t}, u_{2t})^T \quad (7)$$

vector of random perturbations reflecting the influence on the levels of (1) by unaccounted factors.

Note the detailed specification entry (3):

$$\begin{cases} y_{it} = a_{i0} + a_{i1}\cdot y_{1t-1} + a_{i2}\cdot y_{2t-1} + \sum_{j=1}^{j=5} b_{ij}^{(0)}\cdot x_{jt} + \sum_{j=1}^{j=5} b_{ij}^{(1)}\cdot x_{jt-1} + \\ \sum_{j=1}^{j=5} b_{ij}^{(2)}\cdot x_{jt-2} + \sum_{j=1}^{j=5} b_{ij}^{(3)}\cdot x_{jt-3} + \sum_{j=1}^{j=5} b_{ij}^{(4)}\cdot x_{jt-4} + u_{it}; \\ i = 1,2. \end{cases} \quad (3)'$$

It is known that if in model (3) the components of all vector variables y_t and x_{1t} are stationary time series, and in our case this is true for the variables $y_{1t}, y_{2t}, x_{1t}, x_{2t}, x_{5t}$ then the well-founded estimates of all parameters of this model are calculated by the least squares method, and all standard tests are correct. In this case, each equation of the model can be evaluated in isolation from others (Verbeek 2004).

IV. EVALUATION OF THE MODEL OF THE IMPACT OF CREDIT ON GDP GROWTH AND HOUSEHOLD FINAL CONSUMPTION EXPENDITURE

Estimates of the equations in model (3) include quality characteristics of the equation specification: determination coefficients R^2 and standard deviations of random perturbations. We emphasize that at the level of significance α=0.10 all explanatory variables stored in the following estimates of the equations are recognized as significant. The random residue tests allow us to assert that each random perturbation vector (7) is white noise.

The first equation (real GDP growth rate) has the following form:

$$\begin{cases} y_{1t} = 0,5 + 0,45\cdot y_{1t-1} - 0,03\cdot x_{1t} + 0,086\cdot x_{2t} - 1,2\cdot x_{4t} + \\ 0,026\cdot x_{5t} - 1,6\cdot x_{3t-1} + \\ +1,1\cdot x_{3t-2} + 0,055\cdot x_{1t-3} - 0,084\cdot x_{2t-3} - \\ -0,025\cdot x_{5t-4} + u_{1,t}; \\ \sigma_{u1} = 0,52\%; \qquad R^2 = 0,88. \end{cases} \quad (8)$$

The use of the econometric model has allowed to reveal a positive impact in the current period of real loans to non-financial organizations on the first of the indicators of economic growth - the rate of growth of real GDP. Thus, the increase in the current period of real loans to non-financial organizations by 1% increases the growth of real GDP by 0.086%. On the contrary, an increase in the current period of real loans to households by 1% reduces the GDP growth by 0.03% in the same period. The growth of real loans to households in the current period has a positive impact on the growth rate of real GDP with a lag of three quarters. The increase in real loans to households by 1% leads to an increase in real GDP by 0.055% in three quarters.

The global economic crisis of 2008-2009 had a strong negative impact on the growth rate of real GDP in the current period. GDP fell by 1.2%. Similarly, a large negative impact with a lag of one quarter on real GDP was caused by Western sanctions: GDP in the current period is 1.6% lower. However, the impact of the sanctions imposed six months ago on the growth rate of real GDP in the current period was positive. GDP grew by 1.1%.

The second equation (the rate of growth of real household expenditure on final consumption) is as follows:

$$\begin{cases} y_{2t} = 0,6 \cdot y_{1t-1} + 0,03 \cdot x_{5t} - 1,4 \cdot x_{3t-1} + 0,04 \cdot x_{5t-1} + \\ +0,08 \cdot x_{1t-2} + +0,02 \cdot x_{5t-3} + 1,3 \cdot x_{3t-4} - 0,02 \cdot x_{5t-4} + u_{2,t} \\ \sigma_{u2} = 1,1\%; \qquad R^2 = 0,82. \end{cases} \quad (9)$$

The evaluation of the second equation (9) of the model (3) revealed the positive impact of real loans to households on the second indicator of economic growth in the country - the rate of growth of real household expenditure on final consumption. The increase in real loans to households by 1% increases their real final consumption by 0.08% in two quarters.

Western sanctions have a negative impact on the current real level of household final consumption. Their presence reduces the level of real household expenditure on final consumption by 1.4% in the course of one quarter. However, a year later, the impact of sanctions on the level of real household spending was positive: spending increased by 1.3%.

A significant positive impact on the rate of growth of real spending on final consumption of households in the current period is provided by the growth of real GDP in the previous period. The increase in GDP by 1% in the previous period results in a 0.6% increase in household expenditure in the current period. This confirms Clive W. J. Granger's claim (1969) that the rate of growth of real GDP is the reason for the rate of growth of household expenditure on final consumption.

Let us compose from the coefficients of the equations (8) and (9) the matrix $a_0, A = (a_{ij})$ and $B^{(s)} = (b^{(s)}_{ij})$ of the compact model (3). These matrices are necessary to calculate the impulse multipliers characterizing the influence of the current values of the economic growth indicators in the country (1) only the current (2) and lag (6) values of the exogenous variables of the model.

Matrix of the coefficient estimates of model (3)

$$\begin{aligned} a_0 &= \begin{pmatrix} 0,50 \\ 0 \end{pmatrix}, A = \begin{pmatrix} 0,45 & 0 \\ 0,6 & 0 \end{pmatrix}, \\ B^{(0)} &= \begin{pmatrix} -0,03; & 0,09; & 0; & -1,2 & 0,03 \\ 0; & 0; & 0; & 0; & 0,03 \end{pmatrix}, \\ B^{(1)} &= \begin{pmatrix} 0; & 0; & -1,6; & 0; & 0 \\ 0; & 0; & -1,4; & 0; & 0,04 \end{pmatrix}, \\ B^{(2)} &= \begin{pmatrix} 0; & 0; & 1,1; & 0; & 0 \\ 0,08; & 0; & 0; & 0; & 0 \end{pmatrix}, \\ B^{(3)} &= \begin{pmatrix} 0,06; & -0,08; & 0; & 0; & 0 \\ 0; & 0; & 0; & 0; & 0,02 \end{pmatrix}, \\ B^{(4)} &= \begin{pmatrix} 0; & 0; & 0; & 0; & -0,02 \\ 0; & 0; & 1,3; & 0; & -0,02 \end{pmatrix}. \end{aligned} \quad (10)$$

Let's go back to the specification of (3) model and rewrite it by involving the lag operator L:

$$A_1(L) \cdot y_t = a_0 + B_4(L) \cdot x_t + u_t, \quad (11)$$

where characters $A_1(L)$ and $B_4(L)$ denote the following lag operators:

$$\begin{aligned} A_1(L) &= I - A \cdot L, \\ B_4(L) &= B^{(0)} + B^{(1)} \cdot L + B^{(2)} \cdot L^2 + B^{(3)} \cdot L^3 + B^{(4)} \cdot L^4. \end{aligned} \quad (12)$$

If there is an inverse operator $A_1^{-1}(L)$, the equation (11) can be represented as

$$y_t = \mu + C(L) \cdot x_t + v_t. \quad (13)$$

Here the lag operator is referred to as a transfer function (Nosko 2011: 394):

$$\begin{aligned} C(L) &= A_1^{-1}(L) \cdot B_4(L) \\ &= \sum_{i=0}^{\infty} C_i \cdot L^i = C_0 + C_1 \cdot L + C_2 \cdot L_2 + \cdots \end{aligned} \quad (14)$$

This function determines the effect of single changes in exogenous model variables on current endogenous variables. The entry (13) of the model (3) allows to study the impact on the current values of economic growth indicators in the country (1) only the current and lag values of exogenous variables (2) and (6) of the model. To do this, you need to calculate matrices that have the meaning of the limit values of the current endogenous variable y_t by predefined variables respectively $(x_t, x_{t-1}, \ldots, x_{t-s}, \ldots)$:

$$C_0 = \frac{\partial y_t}{\partial x_t}, C_1 = \frac{\partial y_t}{\partial x_{t-1}}, \cdots C_s = \frac{\partial y_t}{\partial x_{t-s}}, \cdots \quad (15)$$

These matrices are called pulse multipliers. Note the meaning of the elements $C_s(i,j)$ of the pulse multiplier $C_s(i,j)$. Namely, $C_s(i,j) -$ is the expected change of Δy_{it} component of y_{it} variable y in response to a single change of $\Delta x_{jt-s} = 1$ component x_{jt-s} variable x_{t-s}, so that C_s is a measure of the absolute strength of the relationship between variables x_{t-s} and y_t. The long-term multiplier is denoted by the symbol $\frac{\partial y}{\partial x}$ and is calculated by the rule:

$$\frac{\partial y}{\partial x} = \sum_{s=0}^{\infty} \frac{\partial y_t}{\partial x_{t-s}} = C_0 + C_1 + \cdots + C_s + \cdots \quad (16)$$

Let us return to the matrix (10) of the model coefficients (8)-(9) and consider matrix A. It can be verified that for such matrix the autoregressive operator $A_1(L) = I - A \cdot L$ is a stationary operator, the inverse operator $A_1^{-1}(L)$ exists and has the equation $A_1^{-1}(L) = I - \sum_{i=1}^{\infty} A^i \cdot L^i$. In turn, pulse multipliers are calculated according to the following recurrent rule:

$$C_0 = B^{(0)}, C_s = B^{(s)} + A \cdot C_{s-1} \text{ at}$$

$$s = 1,2,3,4; C_s = A^{s-4} \cdot C_4$$

at $s > 4$. (17)

First, we calculate the rule (17) pulse multipliers at $s = 1,2,3,4$:

$$C_0 = \begin{pmatrix} -0,03; & 0,09; & 0; & -1,2; & 0,03 \\ 0; & 0; & 0; & 0; & 0,03 \end{pmatrix},$$

$$C_1 = \begin{pmatrix} -0,0135; & 0,0405; & -1,6; & -0,54; & 0,0135 \\ -0,018; & 0,054; & -1,4; & -0,72; & 0,058 \end{pmatrix},$$

$$C_2 = \begin{pmatrix} -0,0061; & 0,0182; & 0,38; & -0,243; & 0,0061 \\ 0,072; & 0,0243; & -0,96; & -0,324; & 0,0081 \end{pmatrix}, \quad (18)$$

$$C_3 = \begin{pmatrix} 0,0533; & -0,072; & 0,171; & -0,109; & 0,0027 \\ -0,00365; & 0,011; & 0,228; & -0,146; & 0,0236 \end{pmatrix},$$

$$C_4 = \begin{pmatrix} 0,026; & -0,032; & 0,077; & -0,049; & -0,019 \\ 0,034; & -0,043; & 1,4; & -0,066; & -0,018 \end{pmatrix},$$

The first two columns in each pulsed multiplier (18) are changes in economic growth indicators (1) in response to a 1% increase in the corresponding real loans. The third and fourth columns refer to binary dummy variables (sanctions, global economic crisis). The fifth column contains changes in the values of indicators (1) of economic growth in response to the increase in the price of crude oil by 1%.

Then, having in mind (10) and (17), note that

$$\sum_{s=5}^{\infty} C_s = \sum_{s=5}^{\infty} A^{s-4} \cdot C_4 = (\sum_{i=1}^{\infty} A^i) \cdot C_4 = \begin{pmatrix} 0,8 & 0 \\ 1,1 & 0 \end{pmatrix} \cdot C_4 \quad (19)$$

Finally, using (18) and (19), we calculate by rule (16) a long-term multiplier that characterizes the impact on the growth rates of real GDP in Russia and the final consumption of households of exogenous variables of the model:

$$\frac{\partial y}{\partial x} = \sum_{s=0}^{\infty} C_s = \begin{pmatrix} \mathbf{0,054;} & \mathbf{0,019;} & -0,091; & -2,18; & 0,019 \\ \mathbf{0,11;} & \mathbf{0,011;} & -0,64; & -1,31; & 0,081 \end{pmatrix} \quad (20)$$

Thus, the following results were obtained. The increase in real loans to households in the long-term period by 1% leads to the growth of real GDP in Russia by more than 0.05% in the current period. The increase in real loans to non-financial organizations by 1% leads to the growth of real GDP of Russia by about 0.02% in the current period.

The increase in real loans to the population in the long-term period by 1% leads to an increase of real final consumption of households by 0.11% in the current period. The increase in real loans to non-financial organizations by 1% leads to an increase in the real final consumption of households by 0.01% in the current period.

The increase in the price of crude oil by 1% in the long-term period leads to an increase in Russia's real GDP by 0.02% in the current period and households ' real expenditure on final consumption by about 0.08%.

V. CONCLUSIONS

Loans to households and non-financial organisations, have a positive impact on economic growth in Russia. At the same time, in the long term, the positive impact of real loans on economic growth is not less significant than the impact of oil prices.

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