Banks as the Actors of a Modern Monetary Policy in Russia: Effects of Exposure on the Econom

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Abstract: The article's relevance is determined by the fact that in the conditions of a bank-oriented financial system the "signals" from the central bank regarding decisions about the monetary policy go to the economy via banks, through which the main channels of the transmission mechanism of the monetary policy are implemented. The analysis of the effects of banks as the actors of the monetary policy is therefore relevant. The article, based on a study of the elements of investment potential for their impact on GDP, contains conclusions about the possibility of achieving economic growth as one of the strategic goals the monetary policy through the main channels of the transmission mechanism using its standard tools. The article is to identify and quantify the factors that have significant effects on economic growth through the impact on investment potential. The change in the Bank of Russia's key interest affects only some of the investment potential elements such as deposits of legal entities in rubles. Such impact can slightly improve GDP. The use of monetary policy tools will enable the influence on the change of the nominal interest rate and, therefore, the adjustment of real rates, and it may also affect aggregate demand (consumption and investment potential).

Keywords: Investment potential, monetary policy, interest rate, economic growth.

INTRODUCTION

Russia is one of the countries with a bank-oriented system, therefore, the "signals" from the central bank regarding decisions about the monetary policy go to the economy via banks, through which the main channels of the transmission mechanism of the monetary policy are implemented (Abramova *et al*. 2016, 2017, 2018, Maslennikov 2015, Eskindarov 2017, Sokolov *et al*. 1996). Today, the efficiency of the interest and credit channels of the transmission mechanism plays a primary role in the monetary policy of the Bank of Russia, aiming at regulating inflation, optimizing the level of business activity, and stabilizing the state of the national economy. A change in the nominal interest rate may affect the adjustment of real rates, and, therefore, it also affects aggregate demand which is consumption and investment potential (Abramova and Igonina 2018, Dubova 2017). The need for a consistent decrease of rates, as well as fundamental changes in the ways to combat inflation from the suppression of demand to measures that can stimulate demand and supply were repeatedly pointed out in the studies. [11,12]. In this regard, the analysis of the effects of banks as actors of the monetary policy through the main tools of investment potential, which has a significant impact on GDP, is relevant.

METHODS

For conducting statistical, economic, and mathematical modeling, it is important to define the concept of investment potential in mathematical form. Those means, that can be directed to investments (Abramova and Igonina 2018), can be understood as investment potential.

The elements of investment potential are as follows:

- Total amount of bank deposits and other attracted funds of legal entities and individuals in rubles (total in Russia), billion RUR, EViews – DRUR.
- Total amount of bank deposits and other attracted funds of legal entities and individuals a foreign currency and precious metals (total in Russia, billion RUR, EViews – DUSD.
- Deposits of legal entities in rubles, billion rubles, EViews – DJLRUR.
- Deposits of legal entities in a foreign currency and precious metals, billion RUR, EViews – DJUSD.
- Deposits of individuals in rubles, billion RUR, EViews – DFLRUR.
- Deposits of individuals in a foreign currency and precious metals, billion RUR, EViews– DFLUSD.
- The volume of debt securities issued in rubles, billion RUR, EViews - CBRUR.
- The volume of debt securities issued in a foreign currency, billion RUR, EViews – CBNONRUR.

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- Deposits of credit institutions within the Bank of Russia, billion rubles, EVIEWS – DKOBR.
- The volume of loans provided to legal entities, i.e. residents and individual entrepreneurs in rubles, billion rubles, EViews – TC (Abramova and Igonina 2018).
- The factors that significantly influence the indicators of investment potential are the following:
- The refinance rate, which was the key rate of the Bank of Russia until 09/13/2013, EViews – IR.
- Inflation, %, month against previous month, EViews – INF.
- USD/RUR exchange rate, EViews – KURS.
- Monetary base in general terms, billion RUR, EViews – DB.
- A part of income directed to savings in total income distribution, %, EViews – DS (Abramova and Igonina 2018).

Research Methodology

Study period: 01/2010 through 02/2018, monthly.

The following computer programs were used for the research:

- Microsoft Office Excel, which enables organizing large amounts of data.
- EViews, an statistical package, which provides the necessary data processing and the analysis of correlation and regression.

The sequence of work with the mentioned software in this study is the following:

1. Search, selection, and systematization of input data. The Excel sheet is based on the data provided by the Bank of Russia's website, Russian Federal Statistics Service website, and regulatory legal acts
2. Calculation of missing parameters and determination of assumptions:
   - The key rate of the Bank of Russia. If established before the 15th day, then its value is taken into account in the analysis of the current month. Otherwise, it will occur in the next month due to the pending impact factors.
   - Inflation: CPI (month / previous month) – 100.
   - USD/RUR rate. The data are published daily, therefore calculated by a formula of a simple average for the month (interim).
3. GDP. The data are published quarterly. GDP growth rates (current prices) are calculated by the following formula: the value of the current month / the value of the previous month *100% - 100%.
4. Preparing the systematized data for uploading to EViews.
5. Transferring data from Excel to EViews.
6. Conducting correlation and regression analysis in EViews.
7. Building BVAR-models.
8. Conclusions.

Identification of Investment Potential Elements, Factors, Including those Affecting GDP, and Evaluation

At the first stage, it is important to identify:

1) Investment potential elements that affect GDP the most.
2) Investment potential factors, including the key rate of the Bank of Russia, that have the greatest impact on the identified elements.
3) Investment potential factors, significantly affecting GDP.

Thus, the study is to determine the role of the change in the key rate of the Bank of Russia in the elements of investment potential, that may subsequently influence GDP, and if there is a connection between the values of the key rate as a factor of investment potential and GDP.

Economic and mathematical modeling is based on finding a relationship between variables by creating correlation matrices and performing regression analysis using BVAR-models and parametric models, testing them for autocorrelation and heteroscedasticity.

Table 1: The GDP and Investment Potential Elements Correlation Matrix

	GDP	DRUR	DUSD	DFLRUR	DFLUSD	DJLRUR	DJLUSD	DKOBR	CBRUR	CBNONRUR	TC
GDP	1	0.71815029...	0.27065475...	0.70675595...	0.44020133...	0.80287839...	0.37803573...	0.56442900...	0.68494042...	0.63215515...	0.71959671...
DRUR	0.71815029...	1	0.48776730...	0.99292255...	0.66467839...	0.93342003...	0.54530288...	0.54145964...	0.97278598...	0.95738633...	0.15535907...
DUSD	0.27065475...	0.48776730...	1	0.42020530...	0.97094037...	0.40744816...	0.96441069...	-0.0289936...	0.55179165...	0.45567221...	-0.1570899...
DFLRUR	0.70675595...	0.99292255...	0.42020530...	1	0.60739885...	0.90744569...	0.47862889...	0.53748173...	0.95468952...	0.95834265...	0.16558956...
DFLUSD	0.44020133...	0.66467839...	0.97094037...	0.60739885...	1	0.58434534...	0.95137663...	0.08881126...	0.71032659...	0.62752086...	-0.0590781...
DJLRUR	0.80287839...	0.93342003...	0.40744816...	0.90744569...	0.58434534...	1	0.48639131...	0.55385743...	0.91344725...	0.87188040...	0.27011862...
DJLUSD	0.37803573...	0.54530288...	0.96441069...	0.47862889...	0.95137663...	0.48639131...	1	0.12033706...	0.62559275...	0.45643126...	-0.0565504...
DKOBR	0.56442900...	0.54145964...	-0.0289936...	0.53748173...	0.08881126...	0.55385743...	0.12033706...	1	0.55591635...	0.40435453...	0.39199142...
CBRUR	0.68494042...	0.97278598...	0.55179165...	0.95468952...	0.71032659...	0.91344725...	0.62559275...	0.55591635...	1	0.90544759...	0.06913993...
CBNONRUR	0.63215515...	0.95738633...	0.45567221...	0.95834265...	0.62752086...	0.87188040...	0.45643126...	0.40435453...	0.90544759...	1	0.07210699...
TC	0.71959671...	0.15535907...	-0.1570899...	0.16558956...	-0.0590781...	0.27011862...	-0.0565504...	0.39199142...	0.06913993...	0.07210699...	1

Source: created by authors using EViews

The Influence of Elements of Investment Potential on GDP

It is important to create a correlation matrix (Table **1**). If there are coefficients greater than 0.5, there is a noticeable link between the elements of the investment potential and GDP. These variables are: total amount of bank deposits in rubles (DRUR), deposits of individuals in rubles (DFLRUR), deposits of legal entities in rubles (DJLRUR), deposits of credit institutions in rubles in the Bank of Russia (DKOBR), the volume of debt securities issued in rubles (CBRUR), the volume of debt securities issued in a foreign currency (CBNONRUR), and the volume of loans granted to legal entities in rubles, i.e. residents and individual entrepreneurs (TC).

It is noticeable that the correlation does not show a cause-effect relationship, only reflecting the presence-absence relationship between the parameters. The regression model (Table **2**) shows the elements of investment potential that have the greatest impact on GDP.

Table 2: "GDP – Investment Potential" Regression Model

Dependent Variable: GDP
Method: Least Squares
Date: 04/26/18 Time: 02:28
Sample (adjusted): 2013M10 2017M12
Included observations: 51 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	19119.50	3739.911	5.112287	0.0000
CBNONRUR	3.870156	2.416276	1.601703	0.1171
CBRUR	0.650297	0.219657	2.960514	0.0051
DRUR	-0.968769	0.435295	-2.225546	0.0317
DUSD	-0.401474	0.379966	-1.056603	0.2970
DFLRUR	0.583126	0.601868	0.968859	0.3384
DFLUSD	1.342236	0.928074	1.446260	0.1559
DJLRUR	1.283820	0.395927	3.242570	0.0024
DJLUSD	0.235663	0.535768	0.439860	0.6624
DKOBR	7.33E-05	0.000314	0.233263	0.8167
TC	0.136945	0.013975	9.799020	0.0000

R-squared	0.954983	Mean dependent var	21181.16
Adjusted R-squared	0.943729	S.D. dependent var	2166.862
S.E. of regression	514.0117	Akaike info criterion	15.51080
Sum squared resid	10568320	Schwarz criterion	15.92746
Log likelihood	-384.5253	Hannan-Quinn criter.	15.67002
F-statistic	84.85598	Durbin-Watson stat	0.998985
Prob(F-statistic)	0.000000		

Source: created by authors using EViews.

The regression equation is as follows: GDP = 19119.50 + 3.87*CBNONRUR + **0.65*CBRUR + (-0.97)*DRUR** + (-0.40)*DUSD + 0.58*DFLRUR + 1.34*DFLUSD + **1.28*DJLRUR +** 1.24*DJLUSD + 7.33*DKOBR **+ 0.14*TC.**

The most significant Prob-level coefficients (much less than 0.5) of the model can be observed for the following elements: CBRUR, DRUR, DJLRUR, and TC.

Then, it is necessary to conduct a regression analysis of the model, except insignificant variables, that are: CBNONRUR, DUSD, DFLRUR, DLUSD, DJLUSD, DKOBR). The results are presented in Table **3**. The determination coefficient (R2) exceeds 0.5 and is equal to 0.94, which indicates a strong relationship between GDP and individual investment potential elements.

The regression equation is: GDP = 11222.55 + + 0.59*CBRUR + (-0.22)*DRUR + 0.94*DJLRUR + 0.14*TC. Thus, the statistical significance of all coefficients was confirmed, the p-level is much lower than 0.05.

The obtained model must be tested for autocorrelation. The probability of Obs*R-squared (=0.026) does not exceed 5%, which indicates the presence of autocorrelation. The next step is to perform the White test for heteroscedasticity in order to determine the model's efficiency using EViews.

The probability of Obs*R-squared is 0.0815. The remaining probabilities are also higher than the significance level (more than 5%). Hence, the null

Table 3: "GDP – Investment Potential" (Significant Elements) Regression Model

Dependent Variable: GDP
Method: Least Squares
Date: 05/17/18 Time: 21:27
Sample (adjusted): 2013M10 2017M12
Included observations: 51 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	11222.55	1103.840	10.16682	0.0000
CBRUR	0.592763	0.151093	3.923165	0.0003
DRUR	-0.216960	0.098981	-2.191933	0.0335
DJLRUR	0.944094	0.264988	3.562783	0.0009
TC	0.139111	0.009401	14.79778	0.0000

R-squared	0.940827	Mean dependent var	21181.16
Adjusted R-squared	0.935682	S.D. dependent var	2166.862
S.E. of regression	549.5380	Akaike info criterion	15.54893
Sum squared resid	13891630	Schwarz criterion	15.73832
Log likelihood	-391.4976	Hannan-Quinn criter.	15.62130
F-statistic	182.8467	Durbin-Watson stat	1.163009
Prob(F-statistic)	0.000000		

Source: created by authors using EViews.

hypothesis about the absence of heteroscedasticity is not rejected. If the heteroscedasticity is absent, the estimates obtained are effective. To confirm correct the results obtained with the model, it is possible to apply the Bayesian' approach, since the test revealed autocorrection (Table **4**).

The closer the determination coefficient (R2) to 1, the more the regression approximates the statistical data. Table **3** shows that the determination coefficient turned out to be equal to 0.96, which indicates that there is a strong connection between the explanatory variables and the dependent variable and also describes the created model as adequate. To check the statistical significance, the obtained t-statistics data (the Student's t-criterion is indicated opposite each parameter in square parentheses). For these purposes, it is important to compare the value of t-statistics with the critical value of the Student's coefficient (2,021) for a reliable probability and the number of degrees of freedom (40).

For four parameters' t-statistics is higher than the critical value, presented in the table. Therefore, they are significant. These are: CBRUR, DRUR, DJLRUR, and TC (by types of economic activity and individual areas of fund use). Thus, the initial data obtained in the parametric model were confirmed.

The Influence of Investment Potential Factors on Various Investment Potential Elements

After identifying the investment potential elements that have the greatest impact on GDP (CBRUR, DRUR, DJLRUR, and TC), it is necessary to identify

Table 4: "GDP – Investment Potential" BVAR-Model

Bayesian VAR Estimates
Date: 04/26/18 Time: 02:15
Sample (adjusted): 2013M10 2017M12
Included observations: 51 after adjustments
Prior type: Litterman/Minnesota
Initial residual covariance: Full VAR
Hyper-parameters: Mu: 0, L1: 0.1, L2: 0.99, L3: 1
Standard errors in ( ) & t-statistics in [ ]

	GDP
GDP(-1)	0.084516 (0.05897) [1.43332]
GDP(-2)	0.003826 (0.04002) [0.09560]
C	17253.49 (3925.38) [4.39537]
CBNONRUR	3.115089 (2.45057) [1.27117]
CBRUR	0.646246 (0.21597) [2.99231]
DRUR	-1.034802 (0.42985) [-2.40736]
DUSD	-0.329524 (0.37673) [-0.87470]
DFLRUR	0.723051 (0.59852) [1.20807]
DFLUSD	1.197190 (0.91672) [1.30595]
DJLRUR	1.341916 (0.39223) [3.42127]
DJLUSD	0.112545 (0.53781) [0.20927]
DKOBR	5.34E-06 (0.00031) [0.01705]
TC	0.128728 (0.01475) [8.72787]
R-squared	0.958290
Adj. R-squared	0.945118
Sum sq. resids	9792041.
S.E. equation	507.6271
F-statistic	72.75431
Mean dependent	21181.16
S.D. dependent	2166.862

Source: created by authors using EViews.

investment potential factors that have a significant impact on these elements (Table **5**). For this purpose, several models were created to determine the

investment factors that have the greatest impact on each of the four elements.

Table 5: "CBRUR – Investment Potential Factors" Regression Model

Dependent Variable: CBRUR
Method: Least Squares
Date: 04/26/18 Time: 02:31
Sample (adjusted): 2013M10 2017M09
Included observations: 48 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3024.864	1612.459	-1.875932	0.0676
DB	1.109825	0.171633	6.466280	0.0000
DS	-38.14531	25.12298	-1.518344	0.1364
IR	110.5493	103.7743	1.065286	0.2928
INF	-902.0217	274.0395	-3.291576	0.0020
KURS	69.98318	17.44131	4.012496	0.0002

R-squared	0.849822	Mean dependent var	12512.03
Adjusted R-squared	0.831944	S.D. dependent var	2214.781
S.E. of regression	907.9419	Akaike info criterion	16.57671
Sum squared resid	34623056	Schwarz criterion	16.81061
Log likelihood	-391.8410	Hannan-Quinn criter.	16.66510
F-statistic	47.53366	Durbin-Watson stat	1.053234
Prob(F-statistic)	0.000000		

Source: created by authors using EViews.

The regression equation: CBRUR = (-3024.86) +**1.11*DB +** (-38.15)*DS +110.55*IR **+** (**-902.02)*INF +69.98*KURS.** The most significant factors (p-level is much lower than 0.05) affecting the volume of debt securities issued in rubles, are the monetary base, inflation, and the USD/RUR rate. The coefficient of determination (R2) is equal to 0.85, which is extremely high. It also confirms the adequacy of the model and the presence of a strong relationship between the variables. The importance of "monetary base", "inflation", and "exchange rate" is high since the Student's t-criterium is equal to 6.47 (-3.29), 4.01 which is bigger than the critical value in the table (2.018, the number of degrees of freedom equals 42).

Nevertheless, in order to create an effective model, it is imortant to eliminate insignificant parameters and conduct andconduct an addition regression on the updated model (Table **6**).

The updated regression equation is as follows: CBRUR = (-4236.45) +1.26*DB + (-688.52)*INF +74.27*KURS. The obtained probabilities for all variables do not exceed 5%, which confirms the significance of these factors. Additionally, the coefficient of determination (R2) is equal to 0.89. Therefore, there is a strong relationship between the parameters and the model is adequate.

Table 6: "CBRUR – Significant Investment Potential Factors" Regression Model

Dependent Variable: CBRUR
Method: Least Squares
Date: 05/17/18 Time: 21:37
Sample (adjusted): 2013M10 2018M02
Included observations: 53 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4236.447	1077.761	-3.930784	0.0003
DB	1.263680	0.104100	12.13905	0.0000
INF	-688.5186	203.9386	-3.376108	0.0014
KURS	74.27023	11.00772	6.747102	0.0000

R-squared	0.887070	Mean dependent var	13018.31
Adjusted R-squared	0.880156	S.D. dependent var	2641.970
S.E. of regression	914.6108	Akaike info criterion	16.54735
Sum squared resid	40989135	Schwarz criterion	16.69605
Log likelihood	-434.5047	Hannan-Quinn criter.	16.60453
F-statistic	128.2990	Durbin-Watson stat	1.267965
Prob(F-statistic)	0.000000		

Source: created by authors using EViews.

Table 7: "CBRUR – Investment Potential Factors" BVAR-Model

Bayesian VAR Estimates
Date: 04/26/18 Time: 02:33
Sample (adjusted): 2013M12 2017M09
Included observations: 46 after adjustments
Prior type: Litterman/Minnesota
Initial residual covariance: Full VAR
Hyper-parameters: Mu: 0, L1: 0.1, L2: 0.99, L3: 1
Standard errors in ( ) & t-statistics in [ ]

	CBRUR
CBRUR(-1)	0.731420 (0.05467) [13.3800]
CBRUR(-2)	0.179052 (0.04378) [4.08997]
C	-604.0806 (520.949) [-1.15958]
DB	0.133757 (0.07294) [1.83377]
DS	-18.77885 (7.54449) [-2.48908]
IR	-11.81421 (32.6474) [-0.36187]
INF	192.5671 (100.016) [1.92535]
KURS	12.17227 (5.98538) [2.03367]
R-squared	0.981424
Adj. R-squared	0.978002
Sum sq. resids	3840954.
S.E. equation	317.9273
F-statistic	286.8021
Mean dependent	12658.80
S.D. dependent	2143.549

Source: created by authors using EViews.

To ensure the correctness of the obtained coefficients, it is possible to carry out the Breusch-Godfrey serial correlation LM-test. The obtained probabilities (0.0159 and 0.0138) do not exceed 5%. Therefore, autocorrelation is present. Using EViews, it is important to perfotm the White test.

The probability of Obs*R-squared is 0.0207, which means it is below the significance level of 5%. Consequently, the heteroscedasticity takes place, which is why the model may not be efficient enough. Due to the presence of autocorrelation and heteroscedasticity, it is necessary to refer to the BVAR-model (Table **7**).

R2 is equal to 0.98. There is a strong relationship between the explanatory variables and the dependent variable, which also describes the created model as adequate. Comparing the value of t-statistics with the critical value of the Student's coefficient (which is 2.021 for the reliable probability of 95% and the number of degree of freedom of 40), there are two parameters (DS and KURS) that have higher t-statistics and, consequently, they are significant.

Table 8: "DRUR – Investment Potential Factors" Regression Model

Dependent Variable: DRUR
Method: Least Squares
Date: 04/26/18 Time: 02:35
Sample (adjusted): 2010M12 2017M09
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5688.981	1264.934	-4.497452	0.0000
DB	3.042412	0.179025	16.99435	0.0000
DS	-102.6293	30.33021	-3.383731	0.0011
IR	201.4396	125.5378	1.604614	0.1127
INF	-1300.928	313.2588	-4.152885	0.0001
KURS	76.09159	24.67023	3.084349	0.0028

R-squared	0.951711	Mean dependent var	26308.74
Adjusted R-squared	0.948534	S.D. dependent var	6051.187
S.E. of regression	1372.779	Akaike info criterion	17.35742
Sum squared resid	1.43E+08	Schwarz criterion	17.53352
Log likelihood	-705.6541	Hannan-Quinn criter.	17.42812
F-statistic	299.5712	Durbin-Watson stat	1.048789
Prob(F-statistic)	0.000000		

Source: created by authors using EViews.

The new equation is: DRUR = (-5688.98) + 3.04***DB +(-102.63)*DS** + 201.45*IR **+(-1300.93)*INF +76.09*KURS.** The most significant factors (with the p-level lower than 0.05) that affect DRUR are: monetary base, the share of income directed to savings, inflation, and USD/RUR exchange rate.

The regression analysis with the elimination of insignificant parameters is presented in Table **9**. The coefficient of determination (R2), which is equal to 0.95, indicates a strong connection and the adequacy of the created regression.

Table 9: "DRUD – Significant Investment Potential Factors" Regression Model

Dependent Variable: DRUR
Method: Least Squares
Date: 05/17/18 Time: 21:45
Sample (adjusted): 2010M12 2017M09
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5884.284	1271.875	-4.626464	0.0000
DB	3.069879	0.180018	17.05319	0.0000
DS	-94.45931	30.20400	-3.127377	0.0025
INF	-1022.097	263.2965	-3.881923	0.0002
KURS	105.2059	16.88563	6.230503	0.0000

R-squared	0.950075	Mean dependent var	26308.74
Adjusted R-squared	0.947481	S.D. dependent var	6051.187
S.E. of regression	1386.746	Akaike info criterion	17.36634
Sum squared resid	1.48E+08	Schwarz criterion	17.51310
Log likelihood	-707.0201	Hannan-Quinn criter.	17.42526
F-statistic	366.3282	Durbin-Watson stat	0.913467
Prob(F-statistic)	0.000000		

Source: created by authors using EViews.

The equation is: DRUR = (-5884.28) + 3.07*DB + (-94.46)*DS + (-1022.097)*INF + 105.21*KURS. It is necessary to check the model for autocorrelation and heteroscedasticity.

The probabilities (0.0000 and 0.0000), obtained by the Breusch-Godfrey test, exceeded 5%, which means the autocorrelation is present. However, heteroscedasticity is absent as the probability of Obs*R-squared is 0.051. The null hypothesis about the absence of heteroscedasticity is not rejected and the model is effective. Thus, it is necessary to create the Bayesian' regression (Table **10**).

R2 is 0.99, which indicates a very strong relationship between the explanatory and dependent variables. T-statistics was used to check the statistical significance. There are two parameters with the t-statistics higher than the critical value obtained (1.993 with a reliable probability of 95% and the number of degrees of freedom of 74). Hence, they are significant. Those are DB (monetary base) and DC (income directed to savings).

The adjusted equation (Table **11**): DJLRUR = (-141.68)+**0.599*DB + (-31.76)*DS +132.11*IR + (-465.23)*INF +**3.27*KURS. The most significant factors (with the p-level much lower than 0.05) that affect deposits of legal entities in rubles are: monetary base, the share of income directed to savings, key rate, and inflation.

The removal of insignificant variables from the regression proved the initial results. DB, DS, IR, and

INF are significant for DJLRUR, since the p-level exceeds 0.05 and R2 equals 0.88. The model is adequate.

Table 10: "DRUR – Significant Investment Potential Factors" BVAR-Model

Bayesian VAR Estimates
Date: 04/26/18 Time: 02:36
Sample (adjusted): 2011M02 2017M09
Included observations: 80 after adjustments
Prior type: Litterman/Minnesota
Initial residual covariance: Full VAR
Hyper-parameters: Mu: 0, L1: 0.1, L2: 0.99, L3: 1
Standard errors in ( ) & t-statistics in [ ]

	DRUR
DRUR(-1)	0.728396 (0.04418) [16.4858]
DRUR(-2)	0.163493 (0.04048) [4.03853]
C	-834.0641 (285.650) [-2.91989]
DB	0.374887 (0.07737) [4.84557]
DS	22.84855 (6.91468) [3.30435]
IR	-17.85690 (27.1859) [-0.65684]
INF	-99.51243 (74.7228) [-1.33175]
KURS	9.235570 (5.46069) [1.69128]
R-squared	0.997890
Adj. R-squared	0.997685
Sum sq. resids	5768851.
S.E. equation	283.0599
F-statistic	4864.414
Mean dependent	26574.59
S.D. dependent	5882.851

Source: created by authors using EViews.

The adjusted equation is as follows: DJLRUR = (-92.31)+0.61*DB + (-31.82)*DS +144.36*IR + (-476.79)*INF. The probabilities (0.0005 and 0.0006), obtained by the test for autocorrelation, do not exceed 5%. Therefore, autocorrelation is present. Concerning the White test, it is noticeable that one of the probabilities is 0.1004, which makes it possible to conclude that there is no heteroscedasticity in the model. In this case, it is important to consider that due to the presence of autocorrelation, the coefficients may be overestimated.

Table 11: "DJLRUR – Investment Potential Factors" Regression Model

Dependent Variable: DJLRUR
Method: Least Squares
Date: 04/26/18 Time: 02:37
Sample (adjusted): 2010M12 2017M09
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-141.6799	424.4234	-0.333817	0.7394
DB	0.598888	0.060068	9.970121	0.0000
DS	-31.75552	10.17670	-3.120416	0.0026
IR	132.1125	42.12168	3.136449	0.0024
INF	-465.2291	105.1077	-4.426213	0.0000
KURS	3.271534	8.277600	0.395227	0.6938

R-squared	0.882037	Mean dependent var	6136.596
Adjusted R-squared	0.874277	S.D. dependent var	1299.044
S.E. of regression	460.6085	Akaike info criterion	15.17333
Sum squared resid	16124173	Schwarz criterion	15.34943
Log likelihood	-616.1065	Hannan-Quinn criter.	15.24403
F-statistic	113.6544	Durbin-Watson stat	1.117293
Prob(F-statistic)	0.000000		

Source: created by authors using EViews.

Table 12: "DJLRUR – Significant Investment Potential Factors"

Dependent Variable: DJLRUR
Method: Least Squares
Date: 05/17/18 Time: 21:48
Sample (adjusted): 2010M12 2017M09
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-192.3145	402.4023	-0.477916	0.6341
DB	0.610156	0.052581	11.60422	0.0000
DS	-31.82149	10.11942	-3.144596	0.0024
IR	144.3563	28.38316	5.085984	0.0000
INF	-476.7877	100.4024	-4.748766	0.0000

R-squared	0.881795	Mean dependent var	6136.596
Adjusted R-squared	0.875654	S.D. dependent var	1299.044
S.E. of regression	458.0778	Akaike info criterion	15.15099
Sum squared resid	16157313	Schwarz criterion	15.29774
Log likelihood	-616.1907	Hannan-Quinn criter.	15.20991
F-statistic	143.6026	Durbin-Watson stat	1.148745
Prob(F-statistic)	0.000000		

Source: created by authors using EViews.

R2 is equal to 0.95, which indicates a strong relationship between the explanatory and dependent variables. It also describes the model as adequate. Four parameters have higher t-statistics than the obtained critical value (equals 1.993 with a reliable probability of 95% and the number of degrees of freedom of 74). The most significant factors are: monetary base (DB), share of income directed to savings (DS), key rate (IR), and inflation (INF).

Table 13: "DJLRUR – Investment Potential Factors"

Bayesian VAR Estimates
Date: 04/26/18 Time: 02:38
Sample (adjusted): 2011M02 2017M09
Included observations: 80 after adjustments
Prior type: Litterman/Minnesota
Initial residual covariance: Full VAR
Hyper-parameters: Mu: 0, L1: 0.1, L2: 0.99, L3: 1
Standard errors in ( ) & t-statistics in [ ]

	DJLRUR
DJLRUR(-1)	0.509069 (0.06154) [8.27194]
DJLRUR(-2)	0.047480 (0.04451) [1.06676]
C	150.1617 (255.369) [0.58802]
DB	0.248815 (0.05340) [4.65979]
DS	-14.63795 (6.41158) [-2.28305]
IR	61.11095 (27.0353) [2.26041]
INF	-230.0630 (71.8814) [-3.20059]
KURS	1.253539 (5.06968) [0.24726]
R-squared	0.945253
Adj. R-squared	0.939930
Sum sq. resids	6685060.
S.E. equation	304.7098
F-statistic	177.5908
Mean dependent	6202.993
S.D. dependent	1243.249

Source: created by authors using EViews.

The adjusted equation (Table **14**): TC = (15132.96)+**4.01*DB + 414.18*DS +**553.76*IR+(-2253.34)*INF **+(-337.41)*KURS**. The most significant factors (with the p-level lower than 0.05) that affect the volume of loans are: monetary base, the share of income directed to savings, and the exchange rate. The Breusch-Godfrey test confirms that the model has an autocorrelation.

After excluding insignificant factors, the important of the remaining parameters was confirmed (Table **15**).

Table 14: "TC – Investment Potential Factors"

Dependent Variable: TC
Method: Least Squares
Date: 04/26/18 Time: 02:39
Sample (adjusted): 2010M01 2017M09
Included observations: 93 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-15132.96	6110.886	-2.476393	0.0152
DB	4.006728	0.873404	4.587485	0.0000
DS	414.1809	162.4128	2.550174	0.0125
IR	553.7595	687.5719	0.805384	0.4228
INF	-2253.339	1704.243	-1.322194	0.1896
KURS	-337.4116	132.8849	-2.539126	0.0129

R-squared	0.279677	Mean dependent var	14008.63
Adjusted R-squared	0.238279	S.D. dependent var	8746.723
S.E. of regression	7633.846	Akaike info criterion	20.78091
Sum squared resid	5.07E+09	Schwarz criterion	20.94431
Log likelihood	-960.3124	Hannan-Quinn criter.	20.84689
F-statistic	6.755818	Durbin-Watson stat	0.486736
Prob(F-statistic)	0.000023		

Source: created by authors using EViews.

The p-level is lower that 5% and is equal to 0.000, 0.007, and 0.001 respectively. The updated regression equation is as follows: TC = (17935.25) + 4.34*DB + 441.05*DS + (-281.66)*KURS. The probabilities (0.0000 and 0.0000) are less than 5%, which is why autocorrelation is present. On the other hand, heteroscedasticity is absent, as all the error probabilities greater than 5% are equal to 0.3021, 0.2940, and 0.6027 respectively. The zero hypothesis about the absence of heteroscedasticity is not rejected.

Table 15: "TC – Significant Investment Potential Factors"

Dependent Variable: TC
Method: Least Squares
Date: 05/17/18 Time: 21:50
Sample (adjusted): 2010M01 2017M09
Included observations: 93 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-17935.25	5717.043	-3.137155	0.0023
DB	4.336382	0.835997	5.187077	0.0000
DS	441.0511	160.0027	2.756524	0.0071
KURS	-281.6621	87.59122	-3.215643	0.0018

R-squared	0.265137	Mean dependent var	14008.63
Adjusted R-squared	0.240366	S.D. dependent var	8746.723
S.E. of regression	7623.378	Akaike info criterion	20.75789
Sum squared resid	5.17E+09	Schwarz criterion	20.86681
Log likelihood	-961.2417	Hannan-Quinn criter.	20.80187
F-statistic	10.70367	Durbin-Watson stat	0.494531
Prob(F-statistic)	0.000004		

Source: created by authors using EViews.

The next step is to create the BVAR-model to refine the cefficients of the linear regression model, since there is autocorrelation, thanks to which the coefficients could be overestimated (Table **16**).

The coefficient of determination (R2) is equal to 0.58, which is why there is a connection among the average force between the variables. To calculate the significance, it is important to identify parameters in which t-statistics is higher than the obtained critical

value (= 1.9900 with the reliable probability of 95% and the number of degrees of freedom of 85). Therefore, they are significant. Those are: DB, DS, INF, and KURS.

Table 16: "TC – Investment Potential Factors"

Bayesian VAR Estimates
Date: 04/26/18 Time: 02:40
Sample (adjusted): 2010M03 2017M09
Included observations: 91 after adjustments
Prior type: Litterman/Minnesota
Initial residual covariance: Full VAR
Hyper-parameters: Mu: 0, L1: 0.1, L2: 0.99, L3: 1
Standard errors in ( ) & t-statistics in [ ]

	TC
TC(-1)	0.447963 (0.06193) [7.23302]
TC(-2)	0.013376 (0.04254) [0.31444]
C	-11871.68 (4482.82) [-2.64826]
DB	2.552154 (0.66709) [3.82580]
DS	601.5009 (118.004) [5.09729]
IR	882.7832 (490.506) [1.79974]
INF	-4379.998 (1269.53) [-3.45009]
KURS	-323.7873 (94.8510) [-3.41364]
R-squared	0.580803
Adj. R-squared	0.545449
Sum sq. resids	2.81E+09
S.E. equation	5822.195
F-statistic	16.42824
Mean dependent	14286.28
S.D. dependent	8635.660

Source: created by authors using EViews.

The Influence of Investment Potential Factors on GDP

The final stage of the correlation and regression analysis is to evaluate the degree of investment potential factors' influence on GDP directly. The first step is to identify the relationship between the parameters (Table **17**).

As seen from the table, the closest connection can be seen between GDP and monetary base, as well as the USD/RUR exchange rate and the key rate of the Bank of Russia. The next step is to build the AR-model (Table **18**).

The regression equation is: GDP = 1082.93 +**1.84*DB +** (-57.80)*DS **+ 441.25*IR + (-1001.27)*INF +** (-47.27)*KURS. The most significant factors of investment potential, affecting GDP, are monetary base, the key rate, and inflation. At the same time, the coefficient of determination is equal to 0.84 and the strong connection between the variables was confirmed. The next step is to exclude insignificant parameters (Table **19**). The coefficient if determination is equal to 0.84, which means GDP depends on these factors by 84% and the model is adequate. The obtained probabilities do not exceed 5% (0.000, 0,004, and 0.013 respectively), which means the parameters are significant. The adjusted equation is as follows: GDP = 1053.61 +1.7*DB + 253.99*IR + (-838.27)*INF.

Nevertheless, autocorrelation is present. In this case, heteriscedasticity is absent as all probabilities do not exceed 5% (0.2717, 0.2647, 0.5128).

Since there is autocorrelation in the model, created by the method of least squares, it is necessary to create the BVAR-model (Table **20**).

Based on the results obtained, R2 is equal to 0.03. There is a strong relationship between the explanatory and dependent variables. Therefore, the model is adequate. The value of t-statistics in four parameters (DB, IR, INF, and KURS) is higher than the critical one (1.9900 with the number of degrees of freedom of 85).

CONCLUSIONS

1) Among the investment potential elements, the following ones have the largest impact on GDP:

Table 17: The Correlation Matrix for GDP and Investment Potential Factors

	GDP	DB	DS	IR	INF	KURS
GDP	1	0.90171165...	-0.1624965...	0.66552901...	-0.1227704...	0.72659797...
DB	0.90171165...	1	-0.1266621...	0.69166346...	-0.0774378...	0.79839542...
DS	-0.1624965...	-0.1266621...	1	0.08352181...	0.02861449...	0.03072917...
IR	0.66552901...	0.69166346...	0.08352181...	1	0.32888386...	0.87499716...
INF	-0.1227704...	-0.0774378...	0.02861449...	0.32888386...	1	0.08073987...
KURS	0.72659797...	0.79839542...	0.03072917...	0.87499716...	0.08073987...	1

Source: created by authors using EViews.

Table 18: "GDP – Investment Potential Factors"

Dependent Variable: GDP
Method: Least Squares
Date: 04/26/18 Time: 02:41
Sample (adjusted): 2010M01 2017M09
Included observations: 93 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1082.924	1241.755	0.872091	0.3856
DB	1.838136	0.177479	10.35692	0.0000
DS	-57.80048	33.00290	-1.751376	0.0834
IR	441.2541	139.7172	3.158194	0.0022
INF	-1001.273	346.3086	-2.891275	0.0048
KURS	-47.26631	27.00272	-1.750428	0.0836

R-squared	0.838035	Mean dependent var	18030.97
Adjusted R-squared	0.828727	S.D. dependent var	3748.265
S.E. of regression	1551.226	Akaike info criterion	17.59382
Sum squared resid	2.09E+08	Schwarz criterion	17.75721
Log likelihood	-812.1126	Hannan-Quinn criter.	17.65979
F-statistic	90.03062	Durbin-Watson stat	0.732048
Prob(F-statistic)	0.000000		

Source: created by authors using EViews.

Table 19: "GDP – Significant Investment Potential Factors"

Dependent Variable: GDP
Method: Least Squares
Date: 05/17/18 Time: 21:54
Sample (adjusted): 2010M01 2017M12
Included observations: 96 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1053.612	949.5067	1.109641	0.2700
DB	1.699910	0.131030	12.97347	0.0000
IR	253.9853	86.38838	2.940040	0.0041
INF	-838.2706	332.5656	-2.520617	0.0134

R-squared	0.841176	Mean dependent var	18264.49
Adjusted R-squared	0.835996	S.D. dependent var	3913.311
S.E. of regression	1584.787	Akaike info criterion	17.61506
Sum squared resid	2.31E+08	Schwarz criterion	17.72191
Log likelihood	-841.5230	Hannan-Quinn criter.	17.65825
F-statistic	162.4186	Durbin-Watson stat	0.621492
Prob(F-statistic)	0.000000		

Source: created by authors using EViews.

- The volume of debt securities issued in rubles, which is most influenced by all factors: the total share of income directed to savings and the USD/RUR rate.
- The total amounts of deposits of individuals and legal entities in rubles is mostly influenced by monetary base and the share of income directed to savings.
- Deposits of legal entities in rubles (bn), that are influenced by monetary base, the share of income directed to savings, the key rate of the Bank of Russia, and inflation.
- The volume of loans granted to legal entities (residents and individual entrepreneurs) in rubles, which is affected by monetary base and the income share directed to savings, as well as inflation and USR/RUR exchange rate.

Table 20: "GDP – Investment Potential Factors" BVAR-Model

Bayesian VAR Estimates
Date: 04/26/18 Time: 02:42
Sample (adjusted): 2010M03 2017M09
Included observations: 91 after adjustments
Prior type: Litterman/Minnesota
Initial residual covariance: Full VAR
Hyper-parameters: Mu: 0, L1: 0.1, L2: 0.99, L3: 1
Standard errors in ( ) & t-statistics in [ ]

	GDP
GDP(-1)	0.549025 (0.06118) [8.97360]
GDP(-2)	0.082684 (0.04320) [1.91410]
C	446.0799 (767.823) [0.58097]
DB	0.689319 (0.15189) [4.53839]
DS	23.70786 (21.0700) [1.12519]
IR	261.2960 (84.7178) [3.08431]
INF	-852.7532 (209.228) [-4.07570]
KURS	-39.74147 (16.1768) [-2.45670]
R-squared	0.928248
Adj. R-squared	0.922196
Sum sq. resids	83274889
S.E. equation	1001.655
F-statistic	153.3938
Mean dependent	18207.57
S.D. dependent	3591.019

Source: created by authors using EViews.

2) Therefore, if the key rate of the bank of Russia is changed, it will be mostly effective to influence only deposits of legal entities in rubles. Nevertheless, this impact can slightly improve GDP Additionally, monetary base, the share of income directed to savings, inflation, and the USD/RUR rate have a significant impact on GDP and the key rate of the Bank of Russia.

3) Almost all the factors, that influence the investment potential, can affect GDP (as shown in the AR-model), namely, monetary base, the

key rate of the Bank of Russia, inflation and the USD/RUR rate. This point must be taken into account while conducting state monetary policy.

4) Thus, the impact of banks as subjects of monetary policy on the economy can be improved in the following ways:

- To lend to economic projects rather than economic entities.
- To make certain priority sectoral and regional lending areas within a limited number of megaprojects transparent.
- To stimulate the development of specialized institutions (primarily development banks) to ensure the stable credit selection
- To make credits for small and medium-sized businesses significantly more affordable.

To support these measures and incentives for credit activity, it is critical to maintain for the next five years and expand the range of special refinancing tools of the Bank of Russia, as well as to intensify the implementation of incentive banking regulation mechanisms based on differentiated regulation of the banking sector.

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