Econometric Model of the Impact of the Interest Rate on the Economic Development

Industrial Engineering
& Management Systems
Vol 19, No 1, March 2020, pp.254-265
ISSN 1598-7248 | EISSN 2234-6473 |
https://doi.org/10.7232/iems.2020.19.1.254

Econometric Model of the Impact of the Interest Rate on the Economic Development

Larisa Yuzvovich*
Ural Federal University named after the first President of Russia B. N. Yeltsin,
Ural State University of Economics, Yekaterinburg, Russian Federation

Elena Razumovskaya
Ural Federal University named after the first President of Russia B. N. Yeltsin,
Ural State University of Economics, Yekaterinburg, Russian Federation

Maksim Maramygin
Ural State University of Economics, Yekaterinburg, Russian Federation

Vadim Ponkratov
Financial University under the Government of the Russian Federation, Moscow, Russian Federation

Nikolay Kuznetsov
State University of Management, Moscow, Russian Federation

Nadezhda Bashkirova
Lomonosov Moscow State University, Moscow, Russian Federation

(Received: October 18, 2019 / Revised: December 9, 2019 / Accepted: December 20, 2019)

ABSTRACT

In the context of the implementation of the inflation targeting policy in the Russian Federation (RF), undertaking a comprehensive study of the transmission mechanism and its consequences for the economy is becoming increasingly relevant. Against this backdrop, the purpose of the present study is to develop an econometric model for determining the correlation between the interest rate and economic growth in prevailing conditions of the Russian market. To that end, the authors used the Granger test in order to determine the causal relations between the indicators of economic development and the key rate level of Central Bank of the Russian Federation (CBR) from 2006 to 2018. There were determined to be dominant indicators which provide the transmission mechanism of the influence of the key rate on the actual GDP of the Russian Federation. A model of the key rate influence on the pace of economic growth was developed. For this purpose, the authors used the vector autoregression method by taking the interdependence between the national economy components into consideration. The findings of this study confirmed the positive character of the interaction of the CBR key rate and the country's economic growth. An analysis of the econometric model contributed to the determination of changes in the nation's economic activity indicators due to the changes occurring in the key rate of the Central Bank. The developed econometric model can be applied as a tool that helps monetary authorities to better understand the determining internal forces in the economy. Moreover, this model helps formulate monetary policy decisions, emit alternatives, and increase the element of consistency in debates about the transmission mechanism. Finally, the Central Bank can use this model to identify the objectives of the monetary policy.

Keywords: Russia, interest rate, transmission mechanism, monetary policy, economic growth, Central Bank, inflation targeting

* Corresponding Author, E-mail: larisayuzvovich@yandex.ru

1. INTRODUCTION

Interest rates are considered to be key indicators for financial markets, which is why they have a strong impact on the economy as a whole. The central bank tends to maintain price stability, thus influencing the dynamics of domestic demand and, consequently, the effectiveness of production factors (Segura-Ubiergo, 2012; Eddelani *et al.*, 2019; Fabus *et al.*, 2019; Fedulova *et al.*, 2019; Balynskaya *et al.*, 2017). Thus, it can be inferred that the monetary policy affects the deviation of the economic growth rate from the potential one, albeit not the economic potential itself (Abuka, 2019; Odhianmbo, 2009; Bykanova *et al.*, 2017; Muda *et al.*, 2019). According to this factor, on the one hand, the attempts to stimulate economic growth in the current environment by means of key rate cut can have significant negative consequences (Kudrin *et al.*, 2017; Thornton and Vasilakis, 2019; Barmuta *et al.*, 2019). On the other hand, high interest rates tend to stymie the economic recovery and development (Balynskaya and Ponomarev, 2018; Yanchuk, 2013). Tight monetary policy, which is characterized by an increase in nominal interest rates, makes borrowed funds less accessible to economic agents (Lin, 2011; Neri and Ropele, 2019). As a result, it discourages direct foreign investment and, consequently, it has a negative impact on economic growth (Andrieş *et al.*, 2016; Ding and Kim, 2017; Zeibote *et al.*, 2019; Merjo, 2014). Therefore, the mechanisms and tendencies of interaction between interest rates and economic activity, as well as the functioning of the transmission mechanism, are extremely difficult to study because they are characterized by contradictory interinfluence over the short-term. In this regard, the management of short-term interest rates is an important element of monetary policy in any country, including Russia.

The CBR maintains price stability in the Russian economy through its monetary policy (The Central Bank of the Russian Federation, 2018). The key rate was declared as the primary instrument of monetary policy since September 13, 2013. From this date until the end of 2013, it was 5.50% per annum (The Central Bank of the Russian Federation, 2019). In 2014, the key rate was raised 6 times by the CBR, and Russia ended 2014 with a key Central Bank rate of 17.00%. A sharp increase in the key rate to 17.00% per annum occurred on December 16, 2014 (The Central Bank of the Russian Federation, 2019). Russia implemented an inflation targeting policy that reduced the key rate within the framework of expectations of slowing inflation and the current inflation rate, which remained below the level of 4% for a long time. Thus, on September 6, 2019, the CBR decided to cut the key rate to 7.00% per annum (The Central Bank of the Russian Federation, 2019).

Nevertheless, the growth rate of the Russian economy still does not satisfy the expectations of the CBR, despite the reduction in inflation and the level of inflation expectations in the country. This is due to the reduction of the external demand for Russian exports in the context of the slowdown in the global economy, as well as the weak dynamics of investment activity in Russia, including government investment (Takhumova *et al.*, 2018). Since then, the question of key rate reduction has become a most urgent subject of discussion in Russia. Some differences in the results of scientific research regarding the transmission mechanisms in Russia have been observed. However, the basic statements formulated in previously conducted studies correlated in many aspects, and they were generally focused on transitioning to an active stimulating monetary policy implemented by the CBR (Abramova, 2016; Kudrin *et al.*, 2017; Mirkin, 2009; Moiseev and Pantina, 2016). The researchers' critical assessments of the current economic policy coincide to a certain extent. Some of them considered the policy to be unnecessarily restrictive and acting as a constraint on economic growth, which can potentially range from 4% to 8% (Kudrin *et al.*, 2017).

It is important to note that, in a modern economy, one of the most significant issues is analyzing the state of the country's economic development, which makes it necessary for the CBR to take the most rational measures when implementing the transmission mechanism. National economy regulation is significantly influenced by external economic processes. As a result, the goals of the implemented measures may be distorted. The authors point out that the regulation policy of the CBR should focus not only on the interconnectivity within the global economy, but also consider the interdependence of certain national economic elements. In this regard, the goal of this study was to develop an econometric model to determine the correlation between interest rates and economic growth rates using the Russian Federation as the example case. The results of this study substantiated the interaction of the CBR's key rate and the main macroeconomic indicators that influence and determine the health an economy. The authors developed a model for assessing the synergistic effect of the transmission mechanism on Russian economic development, taking into account the correlation of elements associated with the national economy. The researchers were able to determine the variability of economic indicators influenced by the change of the CBR's key rate.

The remainder of this paper has been organized in the following manner:

- Section 2 presents a review of the relevant literature;
- Section 3 presents an outline of the factors and hypotheses of this study, along with a description of the research methodology;
- The data collection is described in Section 4;
- Section 5 contains the data analysis and a discussion of the results;
- Section 6 comprises the conclusions of this study; and

- Recommendations are then presented in Section 7.

2. LITERATURE REVIEW

The theory and practice of the interest rate and economic growth correlation in developed countries has significant theoretical and empirical foundations. Theoretical concepts differ significantly in their approaches to the analysis of the interest rates impact on the economic development. Most schools accept one hypothesis, namely: interest rates are negatively correlated with economic growth. It means that higher interest contributes to lower growth rate and lower interest lead to higher growth rate (Lee and Werner, 2018). This hypothesis is critical as it forms the basis of modern monetary policy provided by central banks around the world. For example, Tobin's Monetary Growth Theory (Tobin, 1965) suggests that a higher real return of money as an alternative asset affects capital demand in the medium term, but it says nothing about the short-term period. Equilibrium theories of the business cycle by Lucas (1975), Tobin and Brainard (1977), and Fischer (1979) show that the increase of anticipated inflation lowers the expected real interest rate, and triggers a shift in the investment portfolio, which is also detrimental to output. Modern empirical studies, devoted to the analysis of monetary policy target for the long-term dynamics, are based on the hypothesis of the negative impact of the interest rate. The authors came to the general conclusion that the positive effect of the transition to inflation targeting is predominant (Honda and Inoue, 2019; Thornton and Vasilakis, 2019; Ding and Kim, 2017). The transition to inflation targeting reduces inflation expectations, as well as the level and volatility of inflation (Ayres *et al.*, 2014; Neri and Ropele, 2019). Price stability, in its turn, contributes to a decrease in real interest rates, as well as to a decrease in the general level of uncertainty. These two factors have a positive effect on the dynamics of real investments and ultimately provide the GDP increase (Saleh *et al.,* 2020).

Some studies proved a positive and significant impact of interest rate on economic development (Campos *et al.*, 2012; Odhianmbo, 2009).

The authors based their study on the models of empirical assessment of the relations. Thus, they declared that the interest rate has a mixed effect on gross output. On the one hand, the theory of Irreversible Investments (Arrow, 1968; Bertola and Caballero, 1994) argues that the increase of the interest rate affects the output due to costs rise (the cost of borrowed capital increases). On the other hand, it has a positive effect on overall production due to the investment activity increase in the current period (Dore *et al.*, 2013). The economic agents, expecting the interest rates increase, want to reduce costs contributed by the increase of the borrowings cost in case of the investment decision delay. Approaches of McKinnon (1973) and Shaw (1973) are also based on the positive impact of interest rates on the economy in the short and medium term in the case of financial liberalization. Financial liberalization means keeping interest rates rising until they reach equilibrium level that is appropriate for a competitive free market. Financial liberalization comes after a period of financial repression, when interest rates are maintained at an artificially low equilibrium level, thus having an adverse effect on the accumulation of savings and on setting the stage for further investment. However, the "neo-structural" approach (Lin, 2011) predicts stagflation, that is, accelerated inflation and slow economic growth caused by a short-term financial liberalization. In the medium term, the savings rate may reach level, sufficient to compensate the adjustment of the assets portfolio.

Economic scientific literature introduces different views regarding interest rates as a tool for economic growth stimulation. Some researchers argued that interest rate lowering for the aggregate demand increase has a limited effect due to credit markets unrest (Kelly, 2019; Abuka *et al.*, 2019). In addition, the impact of the global financial crisis on economic activity in general and the banking sector in particular is rather ambiguous (Andrieş *et al.*, 2016; Uribe *et al*., 2017; Bhimjee *et al*., 2016).

Thus, the representatives of classical economics, as well as modern researchers, are unanimous in their opinion that a change in the interest rate contributes to change in real and nominal interest rate. Therefore, an understanding of the correlation between economic growth and the interest rate is significant for the forecast of all types of interest rates, and consequently, for identification of economic development character. However, the mechanisms and courses of relations between interest rates and economic activity are extremely difficult to investigate (Odhianmbo, 2009; Lee and Werner, 2018). It is worth noting that existing approaches to the assessment of the impact of the interest rate on the economy and the character of their interaction are based on the interest rate endogeneity. It means that its value depends on the shocks of nominal or real variables of the model and their distribution to other components of the economic system (Lee and Werner, 2018). In addition, actual markets are constantly unbalanced. So, non-monetary factors prevail, such as the amount of money and credit (Lee and Werner, 2018). Therefore, the impact of the interest rate on the economy depends on the type of market. In other words, interest rates influence economic growth rates, depending on the level of economic development, institutional environment features, macroeconomic situation, etc. The authors consider the conditions and mechanisms of the interest rates influence on the economic growth using the example of Russia and some foreign countries. In the framework of the study, the following restrictions were established:

- the percentage channel of the monetary policy transmission in Russia is investigated;
- the key rate of the Central Bank of Russia is considered as an instrument of the transmission mechanism of monetary policy;
- the impact of the key rate on economic development is assessed through the real, financial and budget sectors.

3. METHODS AND MATERIALS

The procedure for the development of the empirical model of the influence of the Central Bank key rate on economic growth in Russia was based on the null hypothesis. It declares that all indicators, such as: the growth of actual GDP and indicators of the transmission mechanisms of monetary policy (indicators that depend on the key rate and affect the level of actual GDP) are endogenous variables. The research algorithm was based on the implementation of the following steps:

1) The study of the time series in terms of structural shifts using the Chow test. The implementation of the stage provides for the development of linear regression models for the entire set of values and for presumably heterogeneous subsamples of the values. Linear one-factor regression models of the refinance rate dynamics and the key rate of the Central Bank are developed in the Statistica 12.0:

$$y = 10.45 - 0.04 \times t \quad (1)$$

$$y_1 = 11.76 - 0.14 \times t \quad (2)$$

$$y_2 = 9.85 - 0.05 \times t \quad (3)$$

where

y: the dynamics model for the combined indicator of the refinance rate and the key rate of the Central Bank (from the 1st quarter of 2006 to the 4th quarter of 2018);

y_1: the dynamics model of the refinance rate of the Central Bank (from the 1st quarter of 2006 to the 3rd quarter of 2013);

y_2: the dynamics model of the Central Bank key rate (from the 4th quarter of 2013 to the 4th quarter of 2018).

Statistical significance of the models is confirmed by the following:

- the value of the determination coefficients: 0.84, 0.94, 0.88 (for functions (1) - (3), respectively);
- the calculated values of Fisher criterion: 5.17, 60.03, 5.56 for the table values: 4.03, 4.18, 4.39;
- the calculated values of Student *t*-test for the variable *t*: -2.25, -7.75, -2.46 for table values 2.01, 2.04, 2.09 and $p = 0.05$.

The analysis of the residuals of the model using F-statistics showed that $F > F_{table}$ (6.17> 3.19). It means that the differences between SS and ($SS_1 + SS_2$) are statistically significant. Thus, the hypothesis of the structural shifts in the data sets is confirmed. The researchers provided data uniformity to the study of the key rate of the Central Bank impact on economic growth. For this purpose the authors used quarterly detailed values for the period from the 4th quarter of 2013 to the 4th quarter of 2018.

2) The study of the time series for the stationarity of socio-economic indicators and their integration. The authors tried to avoid the illusory associations in the development of the model of the key rate influence on economic development. For this purpose a preliminary assessment of the time series' stationarity was carried out. The researchers used the augmented Dickey – Fuller method and the Phillips – Perron test in the EViews 10.0 software package. In terms of identification of the non-stationary character of the time series of the socio-economic development of the Russian Federation, they were integrated by the 1st (formula 4) and 2nd order (formula 5) (de Lizardi, 2014):

$$\overline{y}(t) = y(t) - y\ (t-1) \quad (4)$$

$$\overline{\overline{y}}(t) = \overline{y}(t) - \overline{y}(t-1) \quad (5)$$

where

$y(t)$: the time series level of the indicators of socio-economic development;

$\overline{y}(t)$: integrated time series of the 1st order;

$\overline{\overline{y}}(t)$: integrated time series of the 2nd order.

3) Implementation of the Granger test for the causality of instruments of the transmission mechanism of monetary policy (key rate) and indicators of socio-economic development. The matter of the test is the assessment of the regression (formula 6) and null hypothesis test of $\beta_1 = ... = \beta_p = 0$ (Ruan *et al.*, 2018).

$$\begin{cases} y_t = \alpha_0 + \sum \alpha_j \cdot y_{t-j} + \sum \beta_j \cdot x_{t-j} + \varepsilon_t \\ x_t = \alpha_0 + \sum \alpha_j \cdot x_{t-j} + \sum \beta_j \cdot y_{t-j} + u_t \end{cases} \quad (6)$$

where

y, x : dependent and independent variables;

$\alpha_0,\ \alpha_j,\ \beta_j$: regression coefficients;

$t - j$: time lag;

$\varepsilon_t,\ u_t$: error.

4) The development of the model of the key rate influence on economic development using the vector autoregressive model, which is widely applied for the transmission mechanisms analysis (Hou *et*

al., 2016; Brancaccio *et al*., 2019; Auer, 2019; Chen *et al*., 2017; Potjagailo, 2017). The resulting indicator (level of actual GDP) is autocorrelated. Thus, the authors used the autoregressive model. This eliminates the possibility to use the regression analysis. In addition, the autoregressive model allows us to consider the lag factor when modeling the impact of endogenous and exogenous variables on the resulting indicator. According to the vector autoregressive model, the authors determined the percentage change of the indicators X2, X10, X3, X4, X13, X14 with an increase in the key rate of the Central Bank by 1% of their actual level in 4th quarter of 2018.

4. Data

The authors used quarterly values for the period from 2006 to 2018 for the development of a model of the influence of the Central Bank key rate on the economic development (The Central Bank of the Russian Federation, 2019; The Russian Federal State Statistics Service, 2019; The Ministry of Finance of the Russian Federation, 2019; Knoema, 2019). The use of index values provides the values commensurability, which increases the accuracy of the modeling results.

According to the restrictions of the survey, the following system of indicators was used to develop a model of the influence of the Central Bank key rate on the economic development (Table 1).

The representativeness of the proposed list of indicators (Table 1), characterizing the economic development level of the country and describing the transmission mechanism of the influence of the key rate on economic development, is confirmed by the expert assessment. As part of the assessment, 40 specialists representing the Central Bank of the Russian Federation and banking institutions were asked to assess the representativeness of indicators based on a 10-point scale (the higher the score, the higher the degree of representativeness). According to the results of the survey, it was determined that the sample is representative at the level of 89%, which is a sufficient percentage of factorization (the percentage of the description of the studied object). Statistical confirmation is the cumulative percentage of variance of the specified system of indicators, obtained from the results of a factor analysis of indicators X1-X17 based on quarterly data for 2006-2013. The calculated factorization percentage is 91%. The results of expert and statistical analysis attest to the representativeness of the proposed system of indicators at the level of 89-91%.

As a resulting indicator of the economic development level of the country, the authors used the indicator of real GDP growth rates compared to the same period of the previous year.

The key rate was introduced by the Central Bank of Russian Federation on 13th of September 2013. Before 2013, refinance rate served as a key rate. Since the indicator X1 combines two indicators, namely, the growth rate

Table 1. The system of assessment indicators for the impact of the Central Bank key rate on the economic development

Indicator	Abbreviation
Growth rate of a weighted key rate as an instrument of the transmission mechanism of monetary policy	(X1)
The growth rate of actual GDP over the same period of the previous year as an effective indicator characterizing the economic development of the country	(X2)
The growth rate of industrial products, calculated for the indicator (million USD)	(X3)
Export growth rate, calculated for the indicator (million USD)	(X4)
Import growth rate, calculated for the indicator (million USD)	(X5)
Growth rate of foreign exchange reserves, calculated for the indicator (million USD)	(X6)
The growth rate of the balance of payments, calculated for the indicator (million USD)	(X7)
Growth rate of the average nominal exchange rate of the USD to the ruble	(X8)
Growth rate of final consumption expenditures, calculated for the indicator (million USD)	(X9)
Growth rate of direct foreign investment, calculated for the indicator (million USD)	(X10)
Growth rate of foreign portfolio investment, calculated for the indicator (million USD)	(X11)
GDP deflator, to the previous period	(X12)
Consumer price index, to the previous period	(X13)
Producer price index, to the previous period	(X14)
The growth rate of unemployment (in the age of 15 years and older)	(X15)
Growth rate of the consolidated budget income, calculated for the indicator (million USD)	(X16)
Growth rate of consolidated budget expenses, calculated for the indicator (million USD)	(X17)

of the refinance rate (from the 1st quarter of 2006 to the 3rd quarter of 2013) and the growth rate of the key rate (from the 4th quarter of 2013 to the 4th quarter of 2018), this time series were tested for uniformity. For this purpose, the authors used the Chow test. As a result, the structural shifts were determined (formulas (1) - (3)).

5. RESULTS

The results of the analysis of the dynamic series stationarity of the indicators of socio-economic development of the Russian Federation are introduced in Table 2.

The analysis showed that the levels of the time series for indicators *X*5*, X*6*, X*10*, X*11*, X*14 are stationary according to both criteria. For the specification (*I,* 0), the probability of accepting the null hypothesis about the nonstationarity of the time series does not exceed 5%. The indicators *X*2, *X*3, *X*7, *X*8, *X*12, *X*13 are stationary for (*I,* 1); *X*1, *X*4, *X*9, *X*15-*X*17). This means that in order to reduce the time series to stationarity, which allows the validity of the modeling results to be increased, they needed to be integrated by means of formulas (4) - (5). In this case, the first-order integration was used for indicators that are stationary at the 1st difference in the series (*X*2, *X*3, *X*7, *X*8, *X*12, *X*13), and the second-order integration was used for indicators *X*1, *X*4, *X*9, *X*15-*X*17. The probability of accepting the null hypothesis about the nonstationarity of the time series according to all indicators does not exceed 5%. Thus, we can confirm the stationarity of the time series with a probability of 95%. The reliability is confirmed by the identity of the evaluation results according to two criteria.

The authors carried out the Granger causality test to determine the cause-and-effect relations reflecting the influence of the Central Bank key rate on the country's economic growth. The choice of lag (L = 1, ... 4) is caused by the use of quarterly data in the study. Table 3 introduces statistically significant cause-and-effect relations reflecting the influence of the Central Bank key rate on the economic development in the Russian Federation. The indicators that have a significant impact on the GDP,

Table 2. The results of the analysis of the dynamic series stationarity of the indicators of socio-economic development of the Russian Federation

Indicator	ADF - statistics			PP- statistics		The result of the stationarity analysis
	Specification	t-Statistic	Prob.	Adj. t-Stat	Prob.	
X1	*I, 2*	-3.48	0.0232	-9.91	0.0000	Stationary
X2	*I, 1*	-3.57	0.0206	-5.82	0.0002	Stationary
X3	*I, 1*	-5.37	0.0004	-5.37	0.0004	Stationary
X4	*I, 2*	-6.74	0.0001	-4.64	0.0019	Stationary
X5	*I, 0*	-9.22	0.0000	-5.05	0.0008	Stationary
X6	*I, 0*	-6.76	0.0000	-14.25	0.0000	Stationary
X7	*I, 1*	-5.22	0.0006	-7.49	0.0000	Stationary
X8	*I, 1*	-4.75	0.0015	-4.75	0.0015	Stationary
X9	*I, 2*	-10.77	0.0000	-10.03	0.0000	Stationary
X10	*I, 0*	-3.94	0.0076	-3.93	0.0077	Stationary
X11	*I, 0*	-3.44	0.0215	-3.39	0.0239	Stationary
X12	*I, 1*	-4.31	0.0037	-4.31	0.0037	Stationary
X13	*I, 1*	-3.35	0.0284	-10.91	0.0000	Stationary
X14	*I, 0*	-5.18	0.0005	-6.72	0.0000	Stationary
X15	*I, 2*	-9.20	0.0000	-3.27	0.0045	Stationary
X16	*I, 2*	-108.53	0.0000	-3.94	0.0076	Stationary
X17	*I, 2*	-193.33	0.0000	-4.95	0.0009	Stationary

Explanation of Symbols:
ADF – statistics - the augmented Dickey-Fuller method;
PP- statistics – - Phillips-Perron stationarity criterion;
t-Statistic – Augmented Dickey-Fuller test statistic;
Adj. t-Stat - Phillips-Perron test statistic;
Prob. – the probability of accepting the null hypothesis about the nonstationarity of the time series;
I – Intersep – time series specification according to the constant;
0 – level; 1 – 1st difference of the series; 2 – 2nd difference of the series

but do not depend on the key rate are not considered in Table 3. They also were not used in development of the model of the Central Bank key rate influence on the economic growth.

The results of the Granger test indicate that with a probability of 5%, we can reject the hypotheses about the non-statistical significance of the influence of the indicator *X*1 on *X*2 (lag = 1, 2), *X*3 (lag = 1, 2), *X*4 (lag = 1, 2), *X*10 (lag = 1-3), *X*13 (lag = 1), *X*14 (lag = 1), *X*3 on *X*2 (lag = 1), *X*4 (lag = 1), *X*4 on *X*2 (lag = 1), *X*10 on *X*2 (lag = 1), *X*13 on *X*2 (lag = 1), *X*14 on *X*2 (lag = 1). This is proved by Fisher F-Statistic and *p*-level (*Prob*.).

The dynamics of the key rate has a statistically significant effect on the growth rate of the following aspects: actual GDP, industrial products, exports, direct investment, and price index (consumer and producer prices).

The key rate is an instrument of monetary policy that regulates money supply and price level. The test results confirmed the significance of this effect: the consumer and producer prices reflect the changes of the key rate with 1 quarter "delay".

Actual gross domestic product (GDP), industrial products, and direct investment respond to changes in the key rate with a time lag of one or two quarters. Relevant indicator change (as measured by the key rate tool) is possible through the effectiveness of the credit channel of the monetary policy transmission mechanism. The key rate affects the volume of loans issued as a result of changes in demand for credit resources and offers. With the key rate increase, the costs of loans rises which, in turn, negatively affects demand. On the other hand, as a result of key rate augmentation, deposit interest increases, resulting in an enlargement of banks' deposits and credit resources (supply). The volume of issued loans serves as the finance source, affecting the amount of investment and industrial production, and is reflected in GDP dynamics. The mechanism of the key rate influence on export dynamics can be seen in changes in the real sector (the growth of the industrial production index) and monetary sector (for example, changes in the exchange rate). The devaluation of national currency contributes to export increases. However, according to the data from Table 3, the key rate does not significantly affect the exchange rate. Therefore, the influence of the key rate on export dynamics is caused by changes in production volume ($X3 \rightarrow X4$, $p = 0.0095$).

The key rate has an insignificant impact on import dynamics, foreign exchange reserves, currency exchange rates, balance of payment, portfolio investment, consumer expenses, unemployment, GDP deflator, and income and expenses of the consolidated budget. The insignificant effect of the key rate on import dynamics can be explained by the fact that, if we consider the real sector, the dominant part of GDP accounts for the oil and gas sector, which is not import-dependent. Production stimulation with the key rate decrease will not contribute to a significant increase in imports of raw materials and means of production. The key rate affects the dynamics of exports and direct investments, which are included in the balance of payments calculation. However, as it was shown by the Granger test, the influence of the key rate on the balance is statistically insignificant. It can be explained by the fact that the key rate does not impact such components of the balance of payments as: the growth of goods and services

Table 3. Statistical indicators of the Granger causality test, reflecting the influence of the Central Bank of Russia key rate on economic growth

Null Hypothesis	*L* = 1		*L* = 2		*L* = 3		*L* = 4		Cause-and-effect relations line
	F-Statistic	Prob.	F-Statistic	Prob.	F-Statistic	Prob.	F-Statistic	Prob.	
X1 does not Granger Cause X2	**5.7730**	**0.0280**	**4.1636**	**0.0381**	1.2939	0.3251	0.6465	0.6449	X1 → X2
X1 does not Granger Cause X3	**6.5217**	**0.0206**	**4.2755**	**0.0355**	1.7701	0.2108	0.4298	0.7838	X1 → X3
X1 does not Granger Cause X4	**5.1785**	**0.0361**	**4.0889**	**0.0399**	1.6696	0.2306	0.6408	0.6483	X1 → X4
X1 does not Granger Cause X10	**24.383**	**0.0001**	**4.8234**	**0.0255**	**4.1674**	**0.0337**	0.9860	0.4671	X1 → X10
X1 does not Granger Cause X13	**4.6339**	**0.0460**	1.0656	0.3709	0.7801	0.5293	0.1157	0.9732	X1 → X13
X1 does not Granger Cause X14	**5.4284**	**0.0324**	1.8298	0.1968	1.5183	0.2644	0.9393	0.4884	X1 → X14
X3 does not Granger Cause X2	**4.7265**	**0.0441**	1.9485	0.1792	1.3896	0.2975	0.7316	0.5953	X3 → X2
X3 does not Granger Cause X4	**8.5367**	**0.0095**	1.3700	0.2862	1.3035	0.3222	0.9221	0.4964	X3 → X4
X4 does not Granger Cause X2	**8.5562**	**0.0094**	3.4477	0.0606	1.3833	0.2992	0.6321	0.6536	X4 → X2
X10 does not Granger Cause X2	**5.8989**	**0.0265**	3.4394	0.0609	1.1649	0.3669	0.3194	0.8574	X10 → X2
X13 does not Granger Cause X2	**5.0781**	**0.0377**	2.7933	0.0953	1.7154	0.2213	0.4351	0.7803	X13 → X2
X14 does not Granger Cause X2	**10.397**	**0.0050**	2.0566	0.1648	1.1284	0.3798	0.5779	0.6872	X14 → X2

Explanation of Symbols:
- significant statistics at $p = 0.05$

import, net transfers, portfolio investments, capital flow, and official reserves. Changes in the key rate affect the exchange rate by means of the unattractiveness of investment conditions and savings. But to a greater extent, the exchange rate and foreign exchange reserves depend on foreign exchange earnings and payments in foreign currency, as well as the tendency to invest and save in foreign currency.

Consumer spending is mainly financed from proprietory resources. The change in the key rate is aimed at borrowed capital regulation (for example, through direct investment). This confirms the high probability of the null hypothesis that the key rate does not affect the dynamics of consumer spending.

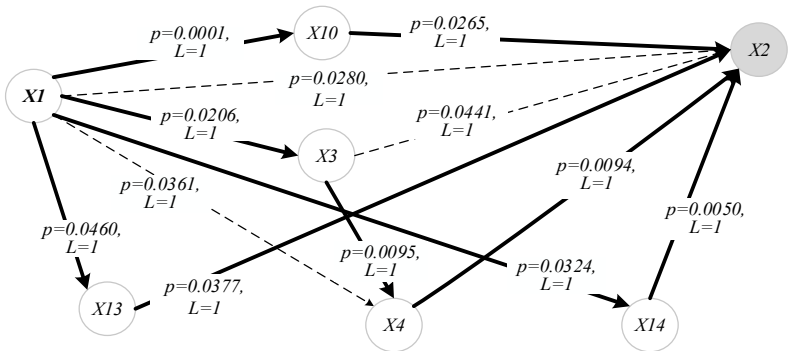
Among the indicators that depend on the key rate of the Central Bank, the authors distinguish *X3*, *X4*, *X10*, *X13*, and *X14* as factors that significantly affect the actual GDP. According to the results of the Granger causality test, the researchers constructed a diagram (Figure 1) that contains only those indicators that influence the key rate on actual GDP growth.

As a result of the calculations, the authors determined that the influence of the Central Bank key rate on economic growth in the Russian Federation is reflected through a change in the following indicators with a one-quarter lag: the industrial production growth rate, amount of exports, rate of direct investment, consumer price index, and producer price index. The empirical model of the influence of the key rate of the Central Bank on economic growth is represented by the following system of equations:

$$\begin{cases} X2 = -0.1480\times X2(-1)+0.0440\times X4(-1)+0.0069\times X10(-10) \\ \quad -0.0537\times X13(-1)-0.1192\times X14(-1)+1.0534 \\ X10 = 1.2474\times X1(-1)-0.5173\times X10(-1)+1.6404 \\ X3 = 0.1135\times X1(-1)-0.4496\times X3(-1)+1.5723 \\ X4 = 0.0166\times X3(-1)-0.1354\times X4(-1)+1.1585 \\ X13 = 0.0044\times X1(-1)-0.3006\times X13(-1)+1.2959 \\ X14 = 0.0034\times X1(-1)-0.2643\times X14(-1)+1.2696 \end{cases} \quad (7)$$

The vector of endogenous variables is written as $Y_t = [X1_t, X2_t, X3_t, X4_t, X10_t, X13_t, X14_t]$, which was confirmed by the results of a lag exclusion test. For all the defined indicators, there observed a lag that corresponds to a statistically significant coefficient of the lag variable. The statistical significance of the coefficients is estimated by *p-value*. Thus, it was determined that the impact of the key rate of the Central Bank of Russia on the economy for all these indicators is statistically significant when *L=1 quarter*. The statistical significance of the constructed models of vector autoregression is confirmed by the deviation of the predicted indicators from the actual ones by no more than 5%. For the prediction model of indicator *X*2, the deviation is 2.4%, for *X10* – 3.3%, for *X3* – 1.8%, for *X4* – 4.0%, for *X14* – 2.7%, for *X13* – 3.1%.

As a result of the analysis of the system of equations of the autoregressive model, it can be argued that the increase in the key rate by 1% provides the actual GDP growth by 0.8% through the increase production volume by 1.1%, export by 0.7%, and direct investment by 2.1%. The actual GDP is negatively affected by an increase in the consumer price index (by 0.2%) and producer price index (by 0.7%).



Explanation of Symbols:

p – significant p-levels (error level 0.05);

L – lag of the statistically significant effect. In the case of the significant cause-and-effect relations between indicators with more than one lag p = min, L is a lag at which p = min;

X2 - GDP growth rate - the resulting indicator reflecting the influence of the key rate on the economic development;

→ - chain of cause-and-effect relations reflecting the most significant relationships (if there is more than one option to reflect the influence of the key rate on the actual GDP);

- - → - a chain of cause-and-effect relations that is not taken into account when developing the model, since there is a statistically more significant chain of influence of the key rate on the actual GDP.

Figure 1. A diagram of cause-and-effect relations reflecting the influence of the key rate of the Central Bank of Russia on economic development.

6. DISCUSSION

The authors of this study developed an empirical model of the transmission mechanism of the influence of monetary policy on economic development by means of a key rate. It was determined that in Russia, the key rate increase has a primarily synergistic positive effect on economic growth in the short-term period. The negative effect of the key rate increase is observed in the following:

- The increase of consumer and producer prices, which reduces buying capacity; and
- The GDP level adjusted for the GDP deflator.

On the other hand, the increase of the key rate of the Central Bank exerts a positive influence on economic growth through industrial products, exports, and especially, direct investment. The results of our study disprove the claim about the exclusively negative impact of interest rate growth on economic development (Lucas, 1975; Tobin and Brainard, 1977). However, this study confirms the hypothesis about the mixed and positive effects of the interest rate on production volume in the country (McKinnon, 1973; Shaw, 1973; Bertola and Caballero, 1994). This effect can be explained by the fact that the Russian economy is unbalanced, which is characterized by a limited supply of borrowed capital. Credit providers have market power and decide who to make transactions with. Therefore, for this kind of market, a decrease in interest rates does not always lead to economic growth. It also provides an explanation of high-nominal interest rates and inflation in developing countries compared to developed ones. The results of this study show that a significant factor determining the growth of Russia's GDP with an increase of the key rate of the Central Bank is direct-investment increase. It contributes to the increase of the production and export of goods and services. Thus, the hypothesis of irreversible investment is confirmed (Arrow, 1968). Under the conditions of the unbalanced Russian market, this effect is explained by the fact that economic agents expecting the increase of the interest rate want to level out the costs caused by the future rise of the cost of the borrowed capital, in case there is investment decision delay. This effect is also confirmed by the international examples of interest rates having a positive effect on economic growth. The practices of some countries, particularly of Brazil (2000-2008) (Segura-Ubiergo, 2012), Turkey (2002-2007) (Macovei, 2009), and India (1980-2013) (The World Bank, 2018), show that economic growth occurs in environments with high real interest rates The authors declare that the rejection of inflation targeting and the responsibility of the CBR to support economic growth will be a great mistake. The unavailability of loans in the Russian economy will contribute to greater damage in the long-term perspective.

The Central Bank of Russia officially started the inflation-targeting policy at the end of 2014 (Inflation Targeting, 2019). The main benefit that any economy gets from inflation targeting is price stability and low interest rates. Low inflation provides confidence in macroeconomic stability for businesses, investors, and society as a whole. If inflation is low, the planning horizon is broadened, credit volumes grow, more long-term money appears in the economy, businesses and the public have more investment possibilities, and the economy starts to grow. The effective implementation of the interest rate policy and the effectiveness of the interest rate channel of the monetary policy transfer are important for a successful transition to the inflation-targeting.

According to the results of this study, the effective implementation of the inflation-targeting policy in Russia can be ensured only if the market situation changes. Capital borrowers, whose income will be reduced by the interest rate increase, should prevail in the economy. This can be achieved by providing the conditions for competition to increase in the Russian market using borrowed capital. These conditions will provide the possibility to achieve a negative correlation between the interest rate and economic growth. This is the key to the successful implementation of targeting policies in any country, and in Russia in particular.

The constructed autoregressive model allows for assessing the influence of the key rate on the dynamics of economic development in Russia, which can be diametrically opposite under different environmental conditions. The advantages of the constructed model, for example, compared with the cognitive and regression ones, is that the proposed model allows for assessing the impact of the key rate on the economic development level, taking into account the time lag of dependent and independent variables. The advantages compared to existing autoregressive models are the maximum accuracy of the simulation results, which is due to the maximum possible sampling (for the entire period of the key rate existence), the stationarity of the analyzed time series, which is confirmed by the deviation of the predicted indicators from the actual by no more than 5%.

The model developed in this study demonstrates the implementation of the transmission mechanism of the monetary policy influence, which is conducted by means of a key rate impact on the economic development of Russia. To provide the changes in the monetary and real sectors of the economy, the specifics of their functioning should be considered. This model can be used to form an intellectual basis for understanding economic trends and making decisions to determine the course of monetary policy. The proposed econometric model can be used for various purposes in central banks. It helps to develop the relations between the specific variables. In addition, it provides compliance with resource limitations and contributes to the complex process of macroeconomic forecast-

ing of the transmission mechanism. It may also be useful for the analysis of monetary policy. But it is worth noting that in the framework of this study, the effectiveness of a single channel of the monetary transmission was analyzed, namely, the interest rate. The authors evaluated the consequences of its interaction through the relations of various parts of the Russian economy. This does not help us explain temporal change in the central bank policy, as well as the differences of monetary policy measures in different countries. These aspects determine the issues of the further scientific works.

7. CONCLUSION

The empirical study results and the development of an econometric model of the transmission mechanism show that the interest rate and economic activity in Russia are characterized by a positive relation in the short-term period. The developed econometric model can be applied as a tool that helps monetary authorities to better understand the determining internal forces in the economy. An increase in the key rate by 1% contributes to an increase in actual GDP by 0.8% due to an increase in production by 1.1%, exports by 0.7%, and direct investment by 2.1%. The identified positive relations between the key rate of the Central Bank of Russia and economic effectiveness makes the implementation of the inflation-targeting policy difficult due to market imbalance, namely, the dominance of the lenders' conditions over those of the borrowed capital consumers. Therefore, the diversification and intensification of borrowed capital in the financial market of Russia should be the main factor for easing the monetary policy. This will lead to disinflation and an increase in economic activity. Therefore, before making decisions on monetary policy, the Central Bank should evaluate the relations between the key rate and the business cycle, taking into account the specifics of the market.

REFERENCES

Abramova, M., Dubova, S., Krasavina, L., Lavrushin, O., and Maslennikov, V. (2016), Key aspects of modern monetary policy in Russia: Experts views, *Ekonomy. Taxes. Law*. **1**, 6-15.

Abuka, C., Alinda, R. K., Minoiu, C., Peydró, J. L., and Presbitero, A. F. (2019), Monetary policy and bank lending in developing countries: Loan applications, rates, and real effects. *Journal of Development Economics,* **139**, 185-202.

Andrieş, A. M., Căpraru, B., Ieşan-Muntean, F., and Ihnatov, I. (2016), The impact of international financial crisis on bank performance in eastern and central european countries, *EuroEconomica*, **35**(1), Retrieved September 8, 2019, Available from: http://journals.univ-anubius.ro/index.php/euroeconomica/article/view/3378/3567.

Arrow, K. J. (1968), Optimal capital policy with irreversible investment, *Capital and Growth, Papers in Honor of Sir John Hicks*, 1-19.

Auer, S. (2019), Monetary policy shocks and foreign investment income: Evidence from a large Bayesian VAR, *Journal of International Money and Finance*, **93**, 142-166.

Ayres, K., Belasen, A. R., and Kutan, A. M. (2014), Does inflation targeting lower inflation and spur growth? *Journal of Policy Modeling*, **36**(2), 373-388.

Balynskaya, N. R. and Ponomarev, A. V. (2018), Current issues in the development of modern political and economic processes in Russia and Europe, *Economics and Politics,* **2**(12), 5-7.

Balynskaya, N. R., Vasil'yeva, A. G., Gafurova, V. M., Kuznetsova, N. V., and Rakhimova, L. M. (2017), Effective management of the financial sustainability of subjects of the Russian Federation as the factor of social and economic welfare of the modern territory: An empirical, *The European Proceedings of Social & Behavioural Sciences*, pp. 985-992, cited 2019 September 18, Available from: http://dx.doi.org/10.15405/epsbs.2017.07.02.127.

Barmuta, K., Ponkratov, V., Maramygin, M., Kuznetsov, N., Ivlev, V., and Ivleva, M. (2019), Mathematical model of optimizing the balance sheet structure of the Russian banking system with allowance for the foreign exchange risk levels, *Entrepreneurship and Sustainability Issues*, **7**(1), 484-497.

Bertola, G. and Caballero, R. J. (1994), Irreversibility and aggregate investment, *The Review of Economic Studies*, **61**(2), 223-246.

Bhimjee, D. C., Ramos, S. B., and Dias, J. G. (2016), Banking industry performance in the wake of the global financial crisis, *International Review of Financial Analysis*, **48**, 376-387.

Brancaccio, E., Giammetti, R., Lopreite, M., and Puliga, M. (2019), Monetary policy, crisis and capital centralization in corporate ownership and control networks: A B-Var analysis, *Structural Change and Economic Dynamics*, **51**, 55-66.

Bykanova, O. A., Akhmadeev, R. G., Kosov, M. E., Ponkratov, V. V., Osipov, V. S., and Ragulina, Y. V. (2017), Assessment of the economic potential of sovereign wealth funds, *Journal of Applied Economic Sciences,* **12**(1), 70-84.

Campos, N. F., Karanasos, M. G., and Tan, B. (2012), Two to tangle: Financial Development, political instability and Economic Growth in Argentina, *Journal of Banking and Finance,* **36**(1), 290-304.

Chen, H., Chow, K., and Tillmann, P. (2017), The effectiveness of monetary policy in China: Evidence from

a Qual VAR, *China Economic Review*, **43**, 216-231.
de Lizardi, C. G. (2014), A computer program to run a monte carlo experiment: A dickey-fuller distribution, *Economía Informa*, **387**, 68-75.
Ding, H. and Kim, J. (2017), Inflation-targeting and real interest rate parity: A bias correction approach, *Economic Modelling*, **60**, 132-137.
Dore, M., Makken, R., and Eastman, E. (2013), The monetary transmission mechanism, non-residential fixed investment and housing, *Atlantic Economic Journal, International Atlantic Economic,* **41**, 215-224.
Eddelani, O., El Idrissi, N. E., and Monni, S. (2019), Territorialized forms of production in Morocco: Provisional assessment for an own model in gestation, *Insights into Regional Development,* **1**(1), 6-18.
Fabus, M., Dubrovina, N., Guryanova, L., Chernova, N., and Zyma, O. (2019), Strengthening financial decentralization: Driver or risk factor for sustainable socio-economic development of territories, *Entrepreneurship and Sustainability Issues*, **7**(2), 875-890.
Fedulova, I., Voronkova, O., Zhuravlev, P., Gerasimova, P., Glyzina, M., and Alekhina, N. (2019), Labor productivity and its role in the sustainable development of economy: On the example of a region, *Entrepreneurship and Sustainability Issues*, **7**(2), 1059-1073.
Fischer, S. (1979), Anticipations and the nonneutrality of money, *The Journal of Political Economy*, **87**(2), 225-252.
Honda, Y. and Inoue, H. (2019), The effectiveness of the negative interest rate policy in Japan: An early assessment, *Journal of the Japanese and International Economies*, **52**, 142-153.
Hou, K., Mountain, D. C., and Wu, T. (2016), Oil price shocks and their transmission mechanism in an oil-exporting economy: A VAR analysis informed by a DSGE model, *Journal of International Money and Finance*, **68**, 21-49.
Inflation Targeting (2019), Yango.Pro. cited 2019 September 10, Available from: https://yango.pro/blog/inflyatsionnoe-targetirovanie/.
Kelly, D. (2019), More easing will make the world weaker rather than stronger, cited 2019 September 10, Available from: https://www.ft.com/content/1825c342-d39e-11e9-8367-807ebd53ab77.
Knoema (2019), cited 2019 September 12, Available from: https://knoema.ru/.
Kudrin, A, Goryunov, E., and Trunin, P. (2017), Stimulating monetary policy: Myths and reality, cited 2019 September 7, Available from: https://www.csr.ru/news/stimuliruyushhaya-denezhno-kreditnaya-politika-mify-i-realnost/.
Lee, K. S. and Werner, R. A. (2018), Reconsidering monetary policy: An empirical examination of the relationship between interest rates and nominal GDP growth in the U.S., U.K., Germany and Japan, *Ecological Economics*, **146**, 26-34.
Lin, J. Y. (2011), New structural economics: A framework for rethinking development, *The World Bank Research Observer*, **26**(2), 193-221.
Lucas, R. E. (1975), An equilibrium model of the business cycle, *The Journal of Political Economy*, **83**(6), 1113-1144.
Macovei, M. (2009), Growth and economic crises in Turkey: Leaving behind a turbulent past? *European Economy*, *Economic Papers* 386.
McKinnon, R. I. (1973), *Money and Capital in Economic Development*, Brookings Institution Press.
Merjo, M. (2014), Influence of investments on social and economic development of the Republic of Ingushetia, *Journal of Contemporary Economics Issues,* **1**, cited 2019 September 22, Available from: https://doi.org/10.24194/11404.
Mirkin, Y. M. (2009), A long-term strategy for the Russian financial sector: challenges of the post-crisis period, *Journal of the New Economic Association*, **1-2**, 1-5.
Moiseev, S. and Pantina, I. (2016), Real exchange rate targeting, *Voprosy Ekonomiki*, **5**, 44-65.
Muda, I., Erlina, Omar, N. H., Said, J., and Kholis, A. (2019), The constraints and barriers for loan distribution by financing institutions to cooperant members, *Journal of Southwest Jiaotong University,* **54**(3), cited 2019 September 22, Available from: http://jsju.org/index.php/journal/article/view/280.
Neri, S. and Ropele, T. (2019), Disinflationary shocks and inflation target uncertainty, *Economics Letters*, **181**, 77-80.
Odhianmbo, N. M. (2009), Interest rate liberalization, financial deepening, and economic Growth in Zambia: A dynamic linkage, *African Development Review*, **21**(3), 541-557.
Potjagailo, G. (2017), Spillover effects from Euro area monetary policy across Europe: A factor-augmented VAR approach, *Journal of International Money and Finance*, **72**, 127-147.
Ruan, Q., Zhang, M., Lv, D., and Yang, H. (2018), SAD and stock returns revisited: Nonlinear analysis based on MF-DCCA and Granger test, *Physica A: Statistical Mechanics and its Applications*, **509**, 1009-1022.
Saleh, H., Abubakar, H., and Suriani, S. (2020), Determining factors affecting the interest in investment in Bulukumba Area of South Sulawesi, *Journal of Southwest Jiaotong University,* **55**(1), cited 2020 Jan 15, Available from: http://jsju.org/index.php/journal/article/view/499.
Segura-Ubiergo, A. (2012), The puzzle of brazil's high interest rates, *IMF Working Paper* WP/12/62, cited 2019 September 7 Available from: https://www.imf.org/external/pubs/ft/wp/2012/wp1262.pdf

Shaw, E. S. (1973), *Financial Deepening in Economic Development*, Oxford University Press, New York.

Takhumova, O. V., Kasatkina, E. V., Maslikhova, E. A., Yumashev, A. V., and Yumasheva, M. V. (2018), The main directions of increasing the investment attractiveness of the Russian regions in the conditions of institutional transformations, *Espacios*, **39**(37), 6.

The Central Bank of the Russian Federation (2018), Single state monetary policy in 2019 and for 2020-2021, cited 2019 September 14, Available from: http://www.cbr.ru/content/document/file/48125/on_2019(2020-2021).pdf.

The Central Bank of the Russian Federation (2019), cited 2019 September 14, Available from: http://www.cbr.ru/statistics/.

The Ministry of Finance of the Russian Federation (2019), cited 2019 September 12, Available from: https://www.minfin.ru/ru/statistics/conbud/.

The World Bank (2018), India development update, cited 2019 September 10, Available from: http://documents.worldbank.org/curated/pt/814101517840592525/pdf/India-development-update-Indias-growth-story.pdf.

The Russian Federal State Statistics Service (2019), cited 2019 September 13, Available from: https://www.gks.ru/folder/10705.

Thornton, J. and Vasilakis, C. (2019), Negative policy interest rates and exchange rate behavior: Further results, *Finance Research Letters*, **29**, 61-67.

Tobin, J. (1965), Money and economic growth, *Journal of the Econometric Society*, **33**(4), 671-684.

Tobin, J. and Brainard, W. C. (1977), Asset markets and the cost of capital. In Balassa, B., Nelson, R. (Eds.), *Economic Progress, Private Values, and Public Policy*, NorthHolland, Amsterdam, 235-262.

Uribe, J. M., Chuliá, H., and Guillén, M. (2017), Uncertainty, systemic shocks and the global banking sector: Has the crisis modified their relationship? *Journal of International Financial Markets, Institutions and Money*, **50**, 52-68.

Yanchuk, M. (2013), Application of theory of spiral dynamics in management of integrative development of economic systems, *Journal of Contemporary Economics*, **3**, cited 2019 September 24, Available from: https://doi.org/10.24194/31308.

Zeibote, Z., Volkova, T., and Todorov, K. (2019), The impact of globalization on regional development and competitiveness: Cases of selected regions, *Insights into Regional Development,* **1**(1), 33-47.

Larisa Yuzvovich is a Doctor of Economic Sciences, Professor, Honorary Worker of Higher Professional Education of the Russian Federation. Scientific interests: investment financing, concession policy, public-private partnership. She is an author of more than 160 scientific works.

Elena Razumovskaya is a Doctor of Economic Sciences, Professor, Expert of the Ministry of Finance of the Russian Federation in the field of financial literacy. Scientific interests: financial and investment decisions, behavioral finance. She is an author of over 170 scientific and educational publications.

Maksim Maramygin is a Doctor of Economic Sciences, Professor, Director of the Institute of Finance and Law, Honorary Worker of Higher Professional Education of the Russian Federation. Scientific interests: banking, monetary policy, investment activity. He is an author of more than 170 scientific works.

Vadim Ponkratov is a Candidate of Economic Sciences. Scientific interests: state financial policy, evaluation of its effectiveness; management of oil and gas budget revenues, strategies for the formation and use of sovereign funds resources; natural rent and instruments of its withdrawal; tools of state financial incentives for economic development. He is an author of more than 150 scientific works.

Nikolay Kuznetsov is a Doctor of Economic Sciences. Scientific interests: building systems of financial and economic management of enterprises; financial and strategic management, financial analysis, economic and mathematical modeling and forecasting. He is an author of more than 200 scientific works.

Nadezhda Bashkirova is a Candidate of Economic Sciences, Associate Professor. Scientific interests: tax audit; state financial stimulation of economic development; tax risks estimation and management. She is an author of more than 50 scientific works.