Quantitative and Qualitative Aspects of Influence of the Investments on Economic Growth

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ABSTRACT

The problem of ensuring a steady economic growth is critical for successful development of the economy, and inflow of investments is one of the most important indicators of the economic advance. The modern conditions of development of economic systems have necessitated more precise directions of investment process for the economic growth to accelerate. With regard to this, the relevance of a comprehensive analysis and evaluation of connection between the investment activity and the economic growth increases. This paper presents a comparative analysis of notions and approaches to evaluation of the role of investments in achieving a steady economic advance. In order to evaluate the quantitative and qualitative factors of the investment activity influencing the buoyancy of economy, index methods and correlation and regression analysis ones were used. The authors suggest applying the indices of "input" and "return" of the investments. The quality of investments is characterized by directions of the investment activity. The quantitative aspect is characterized by a "quick" and "deferred" return of investments. The dependence of economic growth on the indices elaborated was studied on the basis of indices of the economic development of Russia. The suggested approach of quantitative and qualitative evaluation of investment activity and the elaborated indices can be used as an auxiliary tool for forming the investment policy both at the level of the country and at that of regions.

Keywords: Economic Growth, Gross Domestic Product, Investments, Investment Activity
JEL Classifications: C54, C01, E22

1. INTRODUCTION

The volume and structure of investments are determined by the rates, efficiency and steadiness of economic development. A vast majority of empirical studies confirm there is a positive dependence between the rates of economic advance and the volume of investments in the fixed capital. The mechanism of interaction of the economic growth and investments worded as the "accelerator principle" implies that growth of the actual gross domestic product (GDP) brings about the growth of real investments (Samuelson, 2002). However, different countries have persistent distinctions in the levels of development and economic growth indices depending on investments (Table 1). Investments play a special part in ensuring buoyancy of the economy. Intensive investments are essential for:
- Systematic upgrade of the material and technical resources of the country;
- Development of high technology and knowledge-intensive industries;
- Development of human resources;
- Creation of the modern transport infrastructure;
- Development of manufacturing that uses the state-of-the-art technologies.

The modern science is still keen to study the problem of investments promotion and evaluation of their influence on economic advance. The economists ask themselves some questions. For instance, what are the limits of economic growth rate?

How can the difference of economic growth rates in various countries be explained? What factors or combinations thereof influence it most significantly? The search for economic advance factors is not complete yet. Studying the regularity of their effect on development of the economy is a topical scientific and applied problem, the former determining the dynamics of development of economic systems.

2. LITERATURE REVIEW

While analyzing the modern approaches to evaluation of the influence of investments on economic growth, the authors point out that the most economists believe the investments to have a principal part in ensuring a steady economic growth (Table 2). Yet the diversity of conclusions and variety of approaches to evaluation of significance of investments for achieving the economic advance confirm the complicated nature of the problem under consideration.

As controversial are the conclusions about cause-effect relations between investments and the economic growth rate. High economic growth rates are the cause of increased inflow of investments, and this is marked by all researchers. Nevertheless, recently some works have been published that mention this relation can also be negative in the reverse direction. For the first time, similar results were obtained by Blomstrom et al. (1996). Barro (1997) pointed out the reverse nature of dependence between investments and growth rate in his work too.

When studying the influence of various factors on the economic growth rate, econometric models are used frequently. For instance, proceeding from such a model, in the work of Sachs and Warner (1995), an attempt is made to answer the question about the "natural resources curse" effect which consists in the fact that rich in natural resources countries develop on average more slowly than ones having less resources. Borisov and Podkorytova (2006) study the influence of inequality of income on the economic growth

Table 1: Differences in the economic growth indices depending on investments in some countries (2014, %)

Indices	Countries		
	Russia	China	USA
GDP, USD bln	3666	18,083	17,348
The share of GDP in the world's GDP	3.3	16.6	15.9
Investments, % of GDP	19.5	84.2	15*
The share in GDP			
The share in GDP of mining of natural resources	8.8	2.6*	4.3
The share in GDP of manufacturing industries	13.4	12.1*	30.1
Education, healthcare, social services	6.1	12*	5.7
Distribution of investments:			
Distribution of investments in manufacturing industries	18.3	33.4	40.3*
Distribution of investments in mining industries	16.1	2.8	No data
Direct foreign investments, USD bln	21	129	92

*2013. Source: Kalabekov (2014), Zhan et al. (2015). GDP: Gross domestic product

Table 2: Approaches of research by the economists to the role of investments in attaining the economic growth

Researchers	Particularities of the approach, results of the research
The investments play a decisive positive part	
Korda et al., 2012	The economic advance can be supported by large scale investments at the expense of investment fund of the banks of development. Investments produce a positive effect on enhancing the stability of the economic system
Su and Liu, 2016; Hlavacek and Bal-Domanska, 2016; Ai and Zhang, 2013; Iamsiraroj, 2016; Rahman et al., 2016	Direct foreign investments foster a steady economic growth and social and economic development; they will help attract an even greater flow of capital. In raising the economic growth rates, private investments play a greater part than the state ones. The effect of buoyancy of the economy depending on the volume of direct foreign investments varies with regard to regions and over time
Smirnov, 2011	Investment activity and the financial system development level are fundamental factors influencing the economic advance
The investments play a negative part	
Bekbolotova, 2011	The negative impact of investments on the economic growth in less developed African countries is noted. "When comparing the international indices of the share of investments in the country's economy and economic growth rate, it was found out that in Ghana the level of investments reached 25% in the 1960s (to compare, it was 22.9% in the developed countries), yet the economy growth rates demonstrated not only low indices but also negative ones, i.e., there was an economic downturn."
The role of investments can change depending on certain conditions	
Misakyan, 2008	"Direct foreign investments promote … a higher GDP. … they can also produce a negative effect on the development of smaller transition economies."
Simionescu, 2016	"There are some countries for which large volumes of direct foreign investments do not generate economic advance – and meanwhile there are some other countries where the high economic growth rates do not depend on the volumes of direct foreign investments."
Abu and Karim, 2016	"Although there is a reverse causal relation between the domestic investments and economic growth, the effect of investments is negative in short terms and positive in the long run."
The investments play a neutral part	
Belov, 2013	There is no valid statistical relations of the federal investments and the economic growth rates
Simionescu, 2016	"… there are some countries for which large volumes of direct foreign investments have not brought about any economic advance."
Agbloyor et al., 2016	"No proofs have been found in the complete sampling … for a valid relation between the direct foreign investments and economic growth."

Source: Compiled by the authors. GDP: Gross domestic product

in a similar manner. The article by Uschev and Chirkova (2008) deals with the dependence of growth rates on the investment rate.

3. RESEARCH METHODS

In the modern economic science, a rather universal approach to construction of econometric models of the economic growth is described, and the following equation is formed in general terms (Barro and Sala-i-Martin, 1995):

$$G_k = a_0 + \sum a_i Ekon_i + \sum b_j ContolVar_j + \sum c_l Dum_l + \varepsilon_k \qquad (1)$$

Here:

G_k – Growth rate of the main indices of the national product in the country k;

$Ekon_i$ – Economic variables; $ControlVar_j$ – Additional control variables; Dum_l – Dummy variables reflecting the regional effect; a_0 – Constant; a_i, b_j, c_l – The respective regression coefficients; ε_k – random error.

The econometric approach is based on adding a set of variables describing the economy's structural parameters into the right part of the Equation (1). The authors are following this approach too when studying the influence of investments in the fixed capital on the economic growth rates.

The authors suggest considering the qualitative and quantitative aspects of the investments influence. The qualitative aspect will characterize the inputs (investment receipts), while the quantitative one – the returns. Depending on the investments payback period, the "quick" and "deferred" returns are distinguished.

In order to solve this problem, structural index variables are built that determine the directions of investment. The variables will then be introduced into the econometric model as exogenous factors.

The following designations are used: V^i_{HumRs} – The volume of investments in human resources in the year i; $V^i_{Science}$ – The volume of investments in science and scientific developments in the year i; V^i_{Manuf} – The volume of investments in manufacturing industries in the year i; V^i_{Mining} – The volume of investments in mining industries in the year i; GDP^i – Gross domestic product in the year i. Now the constituent components of the indices are discussed in more detail.

S_{qual} – structural index of quality (2)

$$S^i_{qual} = \frac{V^i_{Manuf} + V^i_{Science} + V^i_{HumRs}}{V^i_{Mining}} \qquad (2)$$

The quality of investments is determined by a higher economic growth rate and depends on the way investments are distributed in the kinds of economic activity. The more the value of structural index S_{qual} exceeds 1, the higher the quality of investments is.

$S1_{quan}$ – structural index of "quick" returns (3). In quantitative indices, the absolute increment of investment volumes is used

taking into account the mean lag of payback of investment projects in the relevant economic activity kinds.

$$S1^i_{quan} = \frac{V^i_{Mining} - V^{i-1}_{Mining}}{GDP^i} \qquad (3)$$

The payback of investments in mining industries is rather quick – it takes 1-2 years. Hence the absolute investments increment lag made 1 year.

$S2_{quan}$ – structural index of "deferred" returns (4)

$$S2^i_{quan} = \frac{(V^i_{Manuf} - V^{i-5}_{Manuf}) + (V^i_{Science} - V^{i-10}_{Science}) + (V^i_{HumRs} - V^{i-3}_{HumRs})}{GDP^i} \qquad (4)$$

Manufacturing industry is considered to be the most significant economic constituent in any country. In countries having a high economic advance speed, the largest investments volume falls on manufacturing industries (Table 1). Return on investments makes on average 3-7 years depending on the particular industry in manufacturing, so the model takes into account the absolute investments increment with a 5-year lag.

Human resources are one of the major factors of economic growth and enhancement of the economy competitiveness. By investments in human resources, the authors will mean the total volume of investments in education, healthcare, physical culture and social security. The process of investments in education and that of receiving the returns from the investments belong to different time spans, so a 3-year lag is taken into account when including the human resources investment returns into the model. It is this time that one needs on average to gain good professional skills and work experience.

Investments in science are increasing from year to year, both in the absolute and in the relative expression. On average, the investment projects in this area pay back within 7-12 years. The authors introduce the returns on investments in science, scientific research and development into the model with the investments volume increment taken into account with a lag of 10 years.

Endogenous variable G is the GDP growth rate (5):

$$G_i = GDP^i / GDP^{i-1} \qquad (5)$$

Now the econometric model can be built (6) reflecting the dependence of GDP growth rates on the structural indices:

$$G = f(S1_{quan}, S2_{quan}, S_{qual}) = a_0 + a_1 S1_{quan} + a_2 S2_{quan} + a_3 S_{qual} + \varepsilon \qquad (6)$$

Elasticity coefficients have to be calculated in order to compare the influence of the structural indices on the economic growth index.

4. RESULTS AND DISCUSSION

The model suggested was tested out on statistical data provided by the Russian Federal service of the state statistics for 1994-2016.

The preliminary analysis of the data enabled the authors to come to the following conclusions.

First, insufficient incoming of new fixed assets into the economy of Russia restrains their update considerably. Physical wear and obsolescence of the fixed assets render their use inefficient. Low rates of updating the fixed assets slow down the upgrade process of Russia's economy. The necessity of the fastest possible update of technologies and equipment in many of the major industries is evident, e.g., in power generation, chemical industry, wood processing industry. In its turn, the condition of the fixed assets depends on the size of investments allotted for the update thereof.

Second, in the time span analyzed, the reduction of the quantity of scientific and research, design organizations is observed. Investments in intellectual property objects and expenses for scientific and research, design and experimental, technological works make slightly over 1% for the period studied, with the share of high technology and knowledge-intensive industries production in the GDP being <22%. According to the data of UNESCO (http://creativecommons.org/licenses/by-nd/3.0/igo/), since 2007-2013, the growth of the world's expenses for science was 30.7% points (the global GDP growth was 20% points). Despite the risk of investments in scientific developments being not repaid, one of the main trends of the recent years is a surge of non-state investments. The share of Russia in the world's scientific budget is 1.7% (it was 2% in 2008). 2013 saw Russia's volume of investments in scientific developments make 1.13% GDP (which ranks 25th in the world according to this index).

Thirdly, the share of funds directed to manufacturing industries keeps being reduced, with the largest investment volumes (on average about 3%) falling to metals production while the specific weight of investments in engineering being quite minor. There was some change in the structure of investments according to the kinds of activity during the time span since 2005 up to 2014. While in 2005 the manufacturing industries were leaders among the industry sectors, occupying a large share in the gross volume of investments in the entire economy – 14%, commencing with 2010 the investments in natural resources mining started to exceed those in the manufacturing industries and reached 2.1 trillion rubles by 2014 (to compare, the investments in the manufacturing industry made 1.9 trillion rubles). Moreover, by 2012 the investments in generation and distribution of electric power, gas and water increased significantly. Since 2013 the index started to go down (reaching 1.1 trillion rubles in 2014), which is explained by the growth of the production capacities being put into operation in 2014. Over quarter II of 2009, gross investments in the fixed capital decreased considerably, from 100% to 80% as compared to the average level of 2008, with a moderate growth being observed before that. During the current recession, there have been no abrupt change in dynamics yet in the recent 2.5 years the investments volume went down by 0.11% points (from 107% to 96%). That is, during the crisis of 2008-2009 the investments volume suffered a quick slump while the reduction of 2014-2015 was slow and prolonged.

The influence of investments behavior on the current economy growth rates is relatively low (the share of investments being

about 20% in the Russian GDP) but it is hard to overestimate their influence on the upgrade and consequently on the prospective GDP growth rates. In 2012-2013, the actual increment of investments was lower than their calculated dynamics determined by the macroeconomic factors. As experts believe, the proportion of investments increment and GDP increment will not have come back to the prior to crisis level for the nearest 3 years. And this means Russia is not to expect the capital expansion and accelerated upgrade of economy so far.

Figure 1 describes the behavior of Russia's GDP growth rates. The speed drops in 1998, 2008-2009 and in 2014-2015 due to the economic downturn are clearly shown in the Figure 1.

In this time, a marked reduction of investments inflow into the development of human resources was observed. Neither are the investors interested in providing funds for implementation of long-term projects, such as scientific research, construction, development of manufacturing enterprises. The GDP growth rates dynamics (Figure 1) is an endogenous variable in the regression model (6). In order to calculate the coefficients of the econometric model (6) and elasticity coefficients, the data were previously brought to USD billions according to the average annual exchange rate. The quantity of observations decreased due to the use of lag variables. Table 3 lists the regression statistics. The model is valid according to Fisher's test. The standardized R^2 is rather high, i.e., in Russia, the economic growth of 67% depends on the factors considered. The index of deferred returns is the most significant of all the structural indices discussed according to Student's test. All regression coefficients are positive, therefore, their increase enhances the economic growth. How much exactly?

In order to evaluate the influence of structural indices on the economic growth, t-statistics is supplemented with elasticity coefficients (Table 4) that show by how many per cent the growth rate will increase.

The quality index has the highest elasticity coefficient. Therefore, the economic advance is first of all influenced by the increment of investments in mining industries, support of scientific developments and investment in human resources. The investments in mining industries yield a brief and insignificant rise of the economic growth rates. In Russia, in order to ensure a steady economic upturn, the total investments in manufacturing
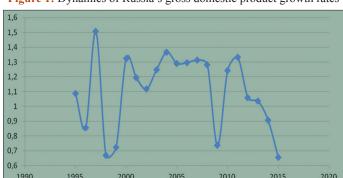
Figure 1: Dynamics of Russia's gross domestic product growth rates

Table 3: Results of regression modeling

Regression statistics			
Multiple R	0.859		
R^2	0.737		
Standardized R^2	0.671		
Standard error	0.125		
Observations	16		
Dispersion analysis			

	df	SS	MS	F
Regression	3	0.526605835	0.175535278	0.000852472
Remainder	12	0.187845492	0.015653791	
Total	15	0.714451327		

	Regression coefficients	Standard error	t-statistics	P value
Y-crossing	0.5214	0.3416	1.5262	0.1529
S2 deferred returns	2.0318	0.4183	4.8574	0.0004
S1 quick returns	0.3306	0.4379	0.7549	0.4649
S of quality	0.2683	0.2641	1.0161	0.3296

SS: Sum of square, MS: Mean square

Table 4: Correlation and elasticity of structural indices

Structural indices	Correlation with G	Elasticity, %
S2 deferred returns	0.84	20.96
S1 quick returns	0.16	3.98
S quality of investments input	0.40	29.73

industries, human resources, science and scientific developments have to markedly exceed those in mining industries.

5. CONCLUSION

The intensity of development of the economy is determined by active investing. A poor inflow of both Russian and foreign investments is the basis for the economic growth rates to increase. Russia has got all the main factors determining the attractiveness for investors:
- A high level of the potential demand both in the foreign and the domestic markets;
- Extensive deposits of raw materials and fuel and energy resources;
- A formed structure of enterprises management, availability of the own production and social infrastructure;
- A favorable geographical location of North-Eastern and South-Western regions, availability of land and marine transportation routes, an opportunity of round-the-year supply of the products.

The indices developed allow determining the directions of investment, evaluating the result of investment returns in order to maximize the economic growth rate. The suggested approach of quantitative and qualitative evaluation of investment activity can be used as an auxiliary tool when forming the investment policy both at the level of the country and at that of regions. Proceeding from the analysis of statistical data and model coefficients, the following practical recommendations in the main directions of investment policy can be suggested.
1. Development of structures (investment agencies) has to ensure:

- The scientific, engineering, financial and legal development of the priority investment projects;
- Targeted development of the investment resources and granting of risk reduction warranties for the investors.
2. State support of manufacturing enterprises and organizations has to be granted proceeding from the following principles observed:
- State support is provided exclusively for the priority activity directions;
- Indirect allowances have to be discontinued for inefficiently operating enterprises.
3. The guarantee of long-term supply of raw materials at the required volume and proportional sharing of expenses for creation of the service infrastructure with the investors.
4. Improvement of the mechanism of co-financing by the state of creating the infrastructure for a dynamic development of raw materials processing enterprises.
5. Improvement of the investment climate. The state support in overcoming the inflation processes, actual and not only formal creation of advanced development areas are essential for that.

All these measures would foster the promotion of investments essential for increasing the economic growth rates.

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