Author's regional measurement of investment intensity of gross regional product of Irkutsk region

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Abstract. The leading industrial Asian countries (Japan, South Korea, China) had one drawback, which became their advantage – raw material poverty and a significant population. That is what helped to push them on the path of creating innovative material values, i.e. industrial products with world quality. Investing in the process of new industrialization is one of the most important aspects of financial activity. As a result, the process of measuring the investment intensity of the gross regional product and its impact on economic efficiency is most relevant. The article deals with the analysis of investment intensity of gross regional product. The author introduced into scientific circulation indicators: investment intensity of gross regional product, science intensity of gross regional product and science return of invested capital. The article reveals the influence of factors affecting the change in the investment intensity of the gross regional product and provides methodological approaches to its calculation. The article presents an analytical, systematic statistical material for the analysis of key indicators revealing the impact on the change of investment intensity of the gross regional product. Article executed within the framework of a research project of ISC SB RAS № XI.174.1.4 «Activation of internal potential of resource specialization regions development (on the example of the Baikal region)». 
1 Introduction

Investment conditions in the region are often determined not so much by its proximity to natural resources as by the economic infrastructure, the existing legal framework and the development of the communication system. In the context of globalization, the role of the investment component in the dynamics of economic development significantly increases (Drucker, P., 1985; Nelson, R., & Winter, S., 1982; Rahaev, B. M., 2000; Risin, I. E., & Hariton, S. V., 2004).

Investment activity is an important integral part of its overall economic activity. The issue of attracting investment in the economy is quite acute, as they are directly related to the pace of economic growth. Factor analysis of investment intensity of the region is the basis for rational financial decisions on the management of the region, so the subject is extremely relevant and has great practical importance (Filatov, E. A., 2018a).

2 Research questions

The questions of investment as a general economic category were studied in the works of the classics of economic theory: M. Keynes, John. Sachs, G. N. Mankiw, R. K. McConnell, W. Sharpe, J. Schumpeter, P. Samuelson, L. Mises, George Clark, M. Porter and others.

Researchers who consider investment as a factor of economic growth can be divided into those who traditionally determine the decisive role of investment in achieving sustainable economic growth (E. Domar, R. Harrod, W. Solow, J. M. Keynes, L. Erhard, W. sharp, I. Lipsitz, A. Bulatov, A. Shakhnazarov, A. Andrianov and others), as well as scientists who assign a minimal role to investments (R. King, S. Kuznets, E. Denison, and others).

Studies of theoretical and applied aspects of investment, the role of the state in the development of this process are devoted to the works of foreign scientists: E. Atkinson, T. Veblen, J. Keynes, John Neumann, R. Solow, R. Stiglitz, S. Fisher, J. Hicks and others.

The development of the conceptual foundations of the investment policy, its implementation mechanisms at the regional level of the Russian economy was carried out by domestic economists, including V. Leksin, B. Preobrazhensky, I. Rysin, A. Shvetsov and others.

Analysis of the conditions and factors determining the investment potential, investment attractiveness, investment activity of territories, development of methods for assessing their status and dynamics of changes
are reflected in the works of A. Anikeeva, N. Buryma, L. Zhukov, I. Roizman, L. Ryazanova, M. Samogorodskaya, V. Sadkova, Yu. Treschevsky, I. Skopina, A. Shakhnazarov, E. Yasin and others.

At the same time, a number of theoretical and applied issues on the research topic still do not have an adequate scientific solution.

3 Materials and methods

Three indicators were used for factor analysis of investment intensity of gross regional product: gross regional product (GRP), domestic current expenditure on research and development, and investment in fixed capital.

Further, based on the methods of deterministic (functional) factor analysis developed by the author (Filatov, E. A., 2018b), we estimate the degree of influence of two factors on the change in the investment intensity of GRP of the Irkutsk region of the Russian Federation.

Initial data for alternative factor analysis (according to the Ministry of Finance of the Irkutsk region and the Federal state statistics service for the Irkutsk region) of the GRP investment intensity of the Irkutsk region of the Russian Federation are presented in Table 1. Data on GRP of the Irkutsk region are taken from the website of the Ministry of Finance of the Irkutsk region – the Open budget of the Irkutsk region (http://openbudget.gfu.ru).

Table 1. Initial data for factor analysis.

| No. | Indicators | No. factor's | 2016 year (0) | 2017 year (I) | Deviation (Δ) |
|-----|------------|--------------|--------------|--------------|--------------|
| 1   | VRP – gross regional product (GRP), billion rubles | 1 128 | 1 169 | 41 |
| 2   | VTZN – internal current expenses for research and development, billion rubles | 4.2 | 5.1 | 0.9 |
| 3   | IOK – investments in fixed capital, billion rubles | 264 | 270 | 6 |
| 4   | IEVRP = investment intensity GRP (3 / 1) = (5 * 6) | 0.23404/3 | 0.230967 | -0.003076 |
where: * 0 - past (basic) period (year), taken as reference base; ** I – reported (current) period (year); *** Δ – change for the period, calculated as the difference between the fact and the plan (I - 0).

The author introduced the indicator of GRP investment intensity \( (IE_{VRP}) \), which is calculated as the ratio of investments in fixed capital \( (IOK) \) to the size of GRP \( (VRP) \).

GRP investment intensity indicator consists of the product of two factors: the knowledge intensity of GRP and the science return of invested capital.

The initial formula for factor analysis of GRP investment intensity \( (IE_{VRP}) \) will be as follows (formula 1):

\[
IE_{VRP} = \frac{VTZN}{VRP} \cdot \frac{IOK}{VTZN} = F_1 \cdot F_2
\]  

The author introduced into scientific use the indicator of knowledge intensity of GRP \( (NE_{VRP}) \), which is calculated as the ratio of domestic current expenditures on research and development \( (VTZN) \) to the size of the gross regional product \( (VRP) \). If in 2016 the science intensity of GRP of the Irkutsk region of the Russian Federation was 0.37%, in 2017 it increased to 0.44%. Table 1 shows that the science intensity of GRP is negligible (less than half a percent). This indicator says that the Russian economy and in particular the economy of the Irkutsk region is not science-intensive. At the same time, the knowledge-based economy is formed as a result of transformation into a diversified economy based on the production of high-tech and highly intelligent products. Therefore, we can partly agree with the statement of the late American Senator and longtime enemy of Russia John McCain: «Russia is a gas station that pretends to be a country».

The author introduced the indicator of scientific return on invested capital \( (NO_{IK}) \), which is calculated as the ratio of investment in fixed capital \( (IOK) \) to the amount of domestic current expenditure on research and development \( (VTZN) \). If in 2016 the scientific return of the invested capital of the Irkutsk region of the Russian Federation was 62.86, in 2017 it decreased to 52.94.

The total deviation of the resulting indicator \( (\Delta IE_{VRP}) \) is determined by the formula 2:

\[
\Delta IE_{VRP} = \sum_{n=1}^{2} \Delta IE_{VRP} (F_n) = \Delta IE_{VRP} (F_1) + \Delta IE_{VRP} (F_2)
\]
Auxiliary data on comparative coefficients for the factor analysis are presented in table 2.

Table 2. Multiple comparative coefficients of one factor.

| Comparison of factors | Comparison of factors | Comparison of factors | Comparison of factors |
|-----------------------|-----------------------|-----------------------|-----------------------|
| $F_1(0) / F_1(1)$    | $A_1$                 | 1.171697              | 1.00                  |
| $F_1(0) / F_1(1)$    | $A_2$                 | 0.853463              |                       |
| $F_2(1) / F_2(0)$    | $A_3$                 | 0.842246              |                       |
| $F_2(0) / F_2(1)$    | $A_4$                 | 1.187302              | 1.00                  |

The author's (alternative) methods of factor analysis are presented in the table 3.

Method No. 1.1 (formulas 1.1-1.3 in the table 3) is based on the difference between the effective planned indicators, which are adjusted on the comparative coefficients ($A_1$).

Method No. 1.2 (formulas 1.1-1.3 in the table 3) is based on the difference between the effective actual indicators, which is adjusted on the comparative coefficients ($A_4$).

Method No. 2.1 (formulas 3.1-3.3 in the table 3) is based on the ratio of the departure of the original factor to the original plan factor multiplied by the planned performance indicator, which is adjusted on the comparative coefficient ($A_1$).

Method No. 2.2 (formulas 4.1-4.3, in the table 3) is based on the ratio of the departure of the original factor to the original actual factor multiplied by the actual performance indicator, which is adjusted on the comparative coefficient ($A_4$).

Method No. 3.1 (formulas 5.1-5.3 in the table 3) is based on the difference between the effective actual and planned indicators, which is adjusted on the comparative coefficients ($A_1$).

Method No. 3.2 (formulas 6.1-6.3 in the table 3) is based on the difference between the effective actual and planned indicators, which is adjusted on the comparative coefficients ($A_4$).

Method No. 4.1 (formulas 7.1-7.3 in the table 3) is based on the ratio of deviation of the effective factor to the difference between the effective actual and planned factors, which is adjusted on the comparative coefficient ($A_1$).

Method No. 4.2 (formulas 8.1-8.3 in the table 3) is based on the ratio of deviation of the effective factor to the difference between the effective actual and planned factors, which is adjusted on the comparative coefficients ($A_4$).
Method No. 5.1 (formulas 9.1-9.3 in the table 3) is based on the ratio of deviation of the effective factor to the difference between the actual performance factors, which is adjusted on the comparative coefficients ($A_1$).

Method No. 5.2 (formulas 10.1-10.3 in the table 3) is based on the ratio of deviation of the effective factor to the difference between the planned performance factors, which is adjusted on the comparative coefficients ($A_4$).

| Table 3. Methods of alternative factor analysis using comparative coefficients. |
|---|
| **Formula number** | **Formulas / calculations** | **Main part of the formula** | **Correction factors** |
| 1.1 | $\Delta IE_{VRP} (F_1) = IE_{VRP0} \cdot (A_1) - IE_{VRP0}$ | – | – |
| 1.2 | $\Delta IE_{VRP} (F_2) = (IE_{VRP0} \cdot (A_3) - IE_{VRP0})^*$ | $A_1$ | – |
| 2.1 | $\Delta IE_{VRP} (F_1) = (IE_{VRP1} - IE_{VRP1} \cdot (A_2))^*$ | – | $A_4$ |
| 2.2 | $\Delta IE_{VRP} (F_2) = (IE_{VRP1} - IE_{VRP1} \cdot (A_4))^*$ | – | – |
| 3.1 | $\Delta IE_{VRP} (F_1) = (\Delta F_1 / F_1) \cdot IE_{VRP0}$ | – | – |
| 3.2 | $\Delta IE_{VRP} (F_2) = (\Delta F_2 / F_2) \cdot IE_{VRP0}$ | – | – |
| 4.1 | $\Delta IE_{VRP} (F_1) = ((\Delta F_1 / F_1) \cdot IE_{VRP1})$ | – | $A_4$ |
| 4.2 | $\Delta IE_{VRP} (F_2) = (\Delta F_2 / F_2) \cdot IE_{VRP1}$ | – | – |
| 5.1 | $\Delta IE_{VRP} (F_1) = (IE_{VRP1} \cdot A_3) - IE_{VRP0}$ | – | – |
| 5.2 | $\Delta IE_{VRP} (F_2) = (IE_{VRP1} \cdot A_2) - IE_{VRP0}$ | – | – |
| 6.1 | $\Delta IE_{VRP} (F_1) = (IE_{VRP1} - (IE_{VRP0} \cdot A_3))^*$ | – | $A_4$ |
| 6.2 | $\Delta IE_{VRP} (F_2) = IE_{VRP1} - (IE_{VRP0} \cdot A_4)$ | – | – |
| 7.1 | $\Delta IE_{VRP} (F_1) = \Delta IE_{VRP} - (IE_{VRP1} - (IE_{VRP0} \cdot A_3))^*$ | – | $A_1$ |
| 7.2 | $\Delta IE_{VRP} (F_2) = \Delta IE_{VRP} - (IE_{VRP1} - (IE_{VRP0} \cdot A_1))^*$ | – | $A_4$ |

4 Results
The result by the methods 1.1, 2.1, 3.1, 4.1, 5.1 is presented in the table 4, the result by the methods 1.2, 2.2, 3.2, 4.2, 5.2 is presented in the table 5.

**Table 4.** Result on methods 1.1, 2.1, 3.1, 4.1, 5.1

| No. | Main part of the formula | Correction coefficients | Result   |
|-----|--------------------------|-------------------------|----------|
| 1   | $\Delta IE_{VRP} (F_1) = 0.040185$ | $-0.040185$ | 0.040185 |
| 2   | $\Delta IE_{VRP} (F_2) =-0.036921$  | 1.171697 $A_1$ | -0.043260 |
|     | $-0.003263$              |                         | -0.003076 |

**Table 5.** Result on methods 1.2, 2.2, 3.2, 4.2, 5.2.

| No. | Main part of the formula | Correction coefficients | Result   |
|-----|--------------------------|-------------------------|----------|
| 1   | $\Delta IE_{VRP} (F_1) = 0.033845$ | 1.187302 $A_4$ | 0.040185 |
| 2   | $\Delta IE_{VRP} (F_2) =-0.043260$  | $-0.043260$   | -0.009415 |
|     | $-0.009415$              |                         | -0.003076 |

As can be seen from the final result of tables 1, 4, 5, the purpose of the analysis is achieved – the determination of the influence of factors is disclosed without deviations.

According to the results of the analysis on the change of investitionskosten GRP ($\Delta IE_{VRP}$) in Irkutsk region of the Russian Federation in the amount of -0.3076% was influenced by the following factors:

- increase the research intensity of the GRP in Irkutsk region of the Russian Federation ($F_1$) on 0.000639 increased study rate +4.0185%;
- reduced newcottage invested capital of Irkutsk region of the Russian Federation ($F_2$) on reduced 9.915966 studied figure -4.3260%.

The data on the investment intensity of GRP of the Irkutsk region is about 23%. Therefore, about a quarter of one ruble of GRP is occupied by investments in fixed capital. According to the results of the analysis, it is clear that in 2017, compared to 2016, there was a decrease in the investment intensity of the economy of the Irkutsk region of the Russian Federation by 0.31%, that is, less than a third of a percent or otherwise, the investment intensity of the economy of this subject of the Russian Federation remained virtually unchanged. The investment intensity of the economy of the Irkutsk region increased by 4% due to an increase in the science intensity of GRP and decreased by 4 % due to a decrease in the science return of invested capital.

On the basis of the law of the Irkutsk region of december 17, 2018 № 131-OZ «On the regional budget for 2019 and the planning period 2020 and 2021» the author made a forecast of the key indicators of investment capacity of the GRP of the Irkutsk region of the Russian Federation for 2019-2021 in table 6.
Data on GRP of the Irkutsk region are taken from the website of the Ministry of Finance of the Irkutsk region – the Open budget of the Irkutsk region (http://openbudget.gfu.ru)

Table 6. Forecast of key indicators of GRP investment capacity of the Irkutsk region of the Russian Federation for 2019-2021.

| No. | Indicators | 2019 year | 2020 year | 2021 year | Growth rate, % |
|-----|------------|-----------|-----------|-----------|----------------|
| 1   | VRP – gross regional product (GRP), billion rubles | 1 287.4 | 1 398.5 | 1 443.0 | 8.63 3.18 |
| 2   | IOK – investments in fixed capital, billion rubles | 311.5 | 352.2 | 403.7 | 13.07 14.62 |
| 3   | IEVRP – investment intensity GRP (2 / 1)*100%, % | 24.20 | 25.18 | 27.98 | 4.05 11.12 |

Table 6 shows that based on the forecast of the Ministry of Finance of the Irkutsk region, the GRP investment intensity of the studied region should grow steadily in the next 3 years. If in 2016-2017 the investment intensity of the GRP of the Irkutsk region was 23%, by 2021 this figure will grow to 28%.

5 Discussion

Investing is one of the most important aspects of financial activity (Basovsky, L. E., & Basovskaya, E. N., 2008; Blau, S. L., 2018; Igoshin, N. V., 2017; Kolmykova, T. S., 2009; Lakhmetkina, N. I., 2012; Melnikov, R. M., 2014; Rimer, M. I., 2010; Teplova, T. V., 2012; Teplova, T. V., 2015; Yankovsky, K. P., 2010).

Recovery from stagnation is immeasurably more difficult than after the usual financial crisis. According to RAS academician A. G. Aganbegyan:
without an increase in investment by 8-10% per year, it will not be possible to return the Russian economy to growth (Aganbegyan, A. G., 2016).

The low investment intensity of GRP contributes to the continuation of stagnation and recession, and this in turn reduces the competitiveness of the Russian economy. In the Irkutsk region there are all necessary prerequisites for further development of industrial production (Tarakanov, M. A., 2018). Financial stabilization and growth of industrial production will be achieved only if there is an increase in investment in the real sector. The success of any event largely depends on timely and effective investment decisions.

The paradigm of the development of the region as a complex economic system shows that it is impossible to achieve sustainable growth rates of various sectors of the economy without measures to accumulate funds that are planned to be used for particularly important strategic and infrastructure projects, and microfinance. It shows the influence of investment processes on all economic levels of management of the region from the most large-scale, affecting significant industries, to the primary links in the form of specific enterprises (Krutskih, D. B., 2011; Pchelincev, O. S., & Minchenko, M. M., 2005).

6 Conclusion

Today, due to the development of global communication systems, there is a process of universal integration. The simplification of procedures for the transfer and flow of financial resources, the ability to control financial flows in real time allows different organizations to invest regardless of the distance. In this regard, the main factors affecting the investment process are the economic and legal conditions that make up the external environment of the investment objec (Chub, B. A., 1998).

Attracting investment to the region gives it additional competitive advantages and is often the most powerful means of growth. The main and most common purpose of attracting investment is to improve the efficiency of the business entity (Filatov, E. A., 2018a).

The main brake in the development of the Russian economy is not Western sanctions, but the Russian collaborationist government and the Bank of Russia (which is essentially a division of the US Federal reserve), spending trillions: to build an electronic concentration camp, the formation of offshore assets, financing worthless and predatory RUSNANO, conducting ruinous world Championships, Olympics, Universiade, but not forming the investment of industrialization.
The Central Bank of Russia is also the main source of inflation in Russia. Inflation for the comprador leadership of the Central Bank of the Russian Federation is the main argument for maintaining a high key rate. The high key rate is a sign of the colonial economy. Under the guise of fighting inflation CBR squeezing money reduces the monetization of the Russian economy (an indicator numerically equal to the ratio of the unit M2 – money supply, including cash and cash in the accounts of enterprises and deposits in banks to the volume of gross domestic product). If inflation in 2018 in Russia, according to the final data of Rosstat, amounted to 4.3 %, in reality it is 4.5 times more.

According to the Ministry of Finance of Russia, the budget surplus in 2018 amounted to about 2 746 billion rubles, or 2.7% of GDP. Budget revenues of the Russian Federation amounted to 19 455 billion rubles (the Revenues of the Federal budget of the Russian Federation was provided: the Federal tax service in the amount of 11 927 billion rubles, the Federal customs service – in the amount of 6 063 billion rubles, other Federal bodies – in the amount of 1 465 billion rubles), the expenditures of the budget of the Russian Federation – 16 709 billion rubles. This surplus of the Russian budget was formed due to the increase in world prices for hydrocarbons. But this surplus of the budget of the Russian Federation in modern conditions of government will not be directed to the investment support of the Russian economy.

References

[1] Aganbegyan, A. G. (2016) From recession and stagnation through financial forcing to economic growth. Money and credit. No. 12. 46-52 (In Russian).
[2] Basovsky, L. E., & Basovskaya E. N. (2008) Economic evaluation of investments: Textbook. Moscow: INFRA-M (In Russian).
[3] Blau, S. L. (2018) Investment analysis: Textbook. Moscow: Dashkov and Company (In Russian).
[4] Chub, B. A. (1998) Methodology of corporate investment management in the region: Dissertation of candidate of economic sciences. Moscow: Higher school of privatization and entrepreneurship (In Russian).
[5] Drucker, P. (1985) Innovation and entrepreneurship. N.Y., Harper Row.
[6] Filatov, E. A. (2018a) Alternative factor analysis of the investment intensity of the gross regional product of the Baikal region. MATEC Web of Conferences. 2/2. 08017. DOI:
[7] Filatov, E. A. (2018b) Methodology of analysis of effective indicators of commercial organizations: Monograph. Irkutsk: Publishing house of ESIEL (In Russian).

[8] Igoshin, N. V. (2017) Investments. Organization, management, financing: Textbook. Moscow: Unity Dana-M (In Russian).

[9] Kolmykova, T. S. (2009) Investment analysis: Textbook. Moscow: INFRA-M (In Russian).

[10] Krutskih, D. B. (2011) Investment activity of the region: economic content and development management mechanism: Dissertation of candidate of economic sciences. Kursk: South-West state university (In Russian).

[11] Lakhmetkina, N. I. (2012) Investment strategy of the enterprise: Textbook. Moscow: KNORUS (In Russian).

[12] Melnikov, R. M. (2014) Economic evaluation of investments: Textbook. Moscow: Prospect (In Russian).

[13] Nelson, R., & Winter, S. (1982) An evolutionary theory of economic change. Cambridge, Massachusetts, Belknap Press of Harvard University Press.

[14] Pchelincev, O. S., & Minchenko, M. M. (2005) Regional policy at the stage of economic growth: from current transfers to infrastructure investments. Spatial economics. No. 2. 7-26 (In Russian).

[15] Rahaev, B. M. (2000) Investment policy as a factor of regional economy growt. Federal relations and regional socio-economic policy. No. 1. 88-93 (In Russian).

[16] Rimer, M. I. (2010) Economic evaluation of investments: Textbook. Saint-Petersburg: Peter (In Russian).

[17] Risin, I. E., & Hariton, S. V. (2004) Content of regional investment policy. Energy XXI century. No. 4. 90-91 (In Russian).

[18] Tarakanov, M. A. (2018) Problems of manufacturing products for final consumption in the industry of Irkutsk oblast. Geography and natural resources, Vol. 39, No. 2. 168-174. DOI: 10.21782/GiPR0206-1619-2018-2(137-144)

[19] Teplova, T. V. (2012) Investments: Textbook. Moscow: Yurayt (In Russian).

[20] Teplova, T. V. (2015) Effective financial director: Textbook. Moscow: Yurayt-M (In Russian).

[21] Yankovsky, K. P. (2010) Investments: Textbook. Saint-Petersburg: Peter (In Russian).