Factor Analysis of Investment Returns of Gross Regional Product of Irkutsk Region

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Abstract. The development of the national economy is inextricably linked with the intensification of investment activities in the regions of the country. Such an important indicator for the state as the level of national security depends on the investment climate in the state, which explains the relevance of this topic. Investments are a necessary component of any modern economy, and especially their importance in the modernization and recovery period after the crisis. The article deals with the analysis of investment returns of gross regional product. The author introduced into scientific circulation indicators: investment return of gross regional product, science return of gross regional product and science intensity of invested capital. The article reveals the influence of factors affecting the change in the investment return 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 return of 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

Investments are not a goal, but a tool for solving strategic tasks facing society and the country.

The leading role of investments in the development of the region's economy is determined by the fact that thanks to them the introduction of science and technology is carried out, as a result of which the basis for expanding the production capabilities of the region's economy and its economic growth is created (Kapkanshchikov, S. G., 2018; Mel'nikov, V. V., 2017).

Irkutsk region of Russia has a number of attractive features for investors. Among them – a very capacious market, rich reserves of natural resources, relatively skilled and cheap labor, significant scientific and technical potential, the availability of unused production capacity, favorable geographical location and others.

2. Problem Statement

The most important factor contributing to the maintenance of sustainable economic growth in Russia is the development of an effective investment process. Negative trends in the investment sector have become a serious threat to Russia's economic security.

The current socio-economic situation in the Russian Federation, in the context of the global economic crisis, strongly dictates the need to consider the investment problems of the Russian economy.

3. Research Questions

Investments are one of the most important economic categories, one of the components of the gross national product, the most variable and at the same time determining the development of the economy (Arnold, G., 2002; Ball, D. A., McCulloch, W. H., Frantz, P. L., Geringer J. M., & Minor M. S., 2006; Brigham, E. F., & Houston J. F., 2004; Certo, S. C., 2003; Farnham, P. G., 2005; Ross, S. A., Westerfield, R. W., & Jordan, B. D., 2006; Trompenaars, F., & Woolliams, P., 2003; Zikmund, W. G., 2003). If the consumption is functionally related to income and government expenditures and net exports are fairly easy to predict, the amount of investment is very difficult to predict at the macro level (Brodskij, B. E., 2012; Gryaznova, A. G., & Dumnaya, N. N., 2006; Gusejnov, R. M., & Semenihina, V. A., 2017; Zolotarchuk, V. V., 2016; Il yashenko, V. V., 2019; Kapkanshchikov, S. G., 2018; Kireev, A. P., 2014; Kiseleva, E. A., 2018). They can sharply and suddenly increase or fall. During the great depression in the US, the volume of investments decreased by 100 %, in the Russian Federation for the period from 1992 to 1998, the volume of investments decreased by more than 3 times. This was due to a number of reasons, but the main one was the lack of economic motivation of the holders of savings to turn their funds into investments.

According to world statistics and forecasts of IMF experts, the average global ratio of gross savings (investment) to GDP in the last two decades has been at the level of 23-24 %.

4. Purpose of the Study

The problem of competitiveness is multidimensional and multilevel. Along with its macro - and micro-level assessments, a meso-level with sectoral and regional dimensions deserves attention. It is the latter that is especially important for Russia due to the vastness of its territory and the variety of conditions, as well as the lack of a sufficiently clear regional policy as a necessary prerequisite for improving the competitiveness of individual territories. As a result, the author proposes indicators and methods for assessing the return of investment in the region.

5. Research Methods

Three indicators were used for factor analysis of gross regional product return investment: 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., 2018; Filatov, E. A., 2019), we estimate the degree of influence of two factors on the change in the investment return 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 investment returns of GRP 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	№ factor's	2016 (0) *	2017 (I) **	Deviation (Δ) ***
1	*VRP* – gross regional product, billion rubles		1 128	1 169	+41
2	*VTZN* – internal current expenditure on research and development, billion rubles		4.2	5.1	+0.9
3	*IOK* – investments in the fixed assets, billion		264	270	+6

	rubles				
4	**IO_{VRP} – investment return of GRP** (1/3) = (5 * 6)		4.272727	4.329630	**0.056902**
5	NO_{VRP} – scientific output of GRP (1/2)	F_1	268.571429	229.215686	-39.355742
6	NE_{IK} – science intensity of the invested capital (2/3)	F_2	0.015909	0.018889	0.002980

where: * **0** – past (base) period (year) taken as a basis for comparison; ** I – reporting (current) year; * * * Δ – change for the period is calculated as the difference between the fact and the plan (I – 0).

The author introduced the indicator of GRP investment return (IO_{VRP}), which is calculated as the ratio of GRP (**VRP**) to the amount of investment in fixed capital (**IOK**). GRP investment return – an economic indicator that characterizes the efficiency of investment in fixed capital, shows the return in the form of GRP for each unit of investment in fixed capital. In 2016, the investment return of the GRP of the Irkutsk region was 4.27 (from 1 ruble of investment in fixed capital, 4 rubles 27 kopecks of GRP were obtained), then in 2017 it increased to 4.33. The increase in investments in the return of GRP of the Irkutsk region during the study period increased by almost 6 kopecks.

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

The initial formula for factor analysis of GRP return on investment (IO_{VRP}) will be as follows (formula 1):

$$IO_{VRP} = \frac{VRP}{VTZN} * \frac{VTZN}{IOK} = F_1 * F_2 \tag{1}$$

The author introduced the indicator of scientific output of GRP (NO_{VRP}), which is calculated as the ratio of the gross regional product (**VRP**) to the size of the internal current costs of research and development (**VTZN**). Newcottage GRP inverse measure of the research intensity of the GDP ($NE_{VRP} = 1 / NO_{VRP}$). Table 1 shows that the science output of GRP is of great importance, due to the fact that the science intensity of GRP is negligible (less than half a percent). The indicator of the GRP science intensity shows that the Russian economy and, in particular, the economy of the Irkutsk region is non-science intensive.

The author introduced into scientific circulation the indicator of science-intensive invested capital (NE_{IK}), which is calculated as the ratio of domestic current expenditure on research and development (**VTZN**) to the amount of investment in fixed capital (**IOK**). Knowledge intensity of invested capital reverse the rate of return on invested capital ($NE_{IK} = 1 / NO_{IK}$). If in 2016 the knowledge intensity of the invested capital of the Irkutsk region of the Russian Federation was 1.59 %, in 2017 it increased to 1.89 %.

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

$$\Delta IO_{VRP} = \sum_{n=1}^{2} \Delta IO_{VRP} (F_n) = \Delta IO_{VRP} (F_1) + \Delta IO_{VRP} (F_2) \tag{2}$$

Auxiliary data on comparative coefficients for the factor analysis are presented in table 2.

Table 2. Multiple comparative coefficients of one factor.

The designation of comparative coefficient	Comparison of factors	Value	The product of coefficients (value)
$F_{1\,(\mathrm{I})} / F_{1\,(0)}$	A_1	0.853463	1.00
$F_{1\,(0)} / F_{1\,(\mathrm{I})}$	A_2	1.171697	
$F_{2\,(\mathrm{I})} / F_{2\,(0)}$	A_3	1.187302	1.00
$F_{2\,(0)} / F_{2\,(\mathrm{I})}$	A_4	0.842246	

Author (alternative) methods of factor analysis are presented in table 3.

Method № 1.1 (formulas 1.1–1.3 in table 3) based on the difference between the performance targets, which is adjusted to the comparative coefficients (A_1).

Method № 1.2 (formulas 1.1–1.3 in table 3) based on the difference between the actual performance indicators, which is adjusted by comparative factors (A_4).

Method № 2.1 (formulas 3.1–3.3 in table 3) based on the ratio of the deviation of the initial factor to the initial planning factor multiplied by the planned performance indicator, which is adjusted by a comparative coefficient (A_1).

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

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

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

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

Method № 4.2 (formulas 8.1–8.3 in table 3) based on the ratio of the deviation of the effective factor to the difference between the effective actual and planned factors, which is adjusted for comparative coefficients (A_4).

Method № 5.1 (formulas 9.1–9.3 in table 3) based on the ratio of the deviation of the effective factor to the difference between the actual effective factors, which is adjusted for comparative coefficients (A_1).

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

Table 3. Methods of alternative factor analysis using comparative coefficients.

№ formulae	formulas / calculations — the main part of the formula	adjustment factors
1.1	$\Delta IO_{VRP}\,(F_1) = IO_{VRP\,0}*(A_1) - IO_{VRP\,0}$	–
1.2	$\Delta IO_{VRP}\,(F_2) = (IO_{VRP\,0}*(A_3) - IO_{VRP\,0})*$	A_1
2.1	$\Delta IO_{VRP}\,(F_1) = (IO_{VRP\,\mathrm{I}} - IO_{VRP\,\mathrm{I}} * (A_2))*$	A_4
2.2	$\Delta IO_{VRP}\,(F_2) = (IO_{VRP\,\mathrm{I}} - IO_{VRP\,\mathrm{I}} * (A_4))*$	–
3.1	$\Delta IO_{VRP}\,(F_1) = (\Delta F_1 / F_{1\,0}) * IO_{VRP\,0}$	–
3.2	$\Delta IO_{VRP}\,(F_2) = (\Delta F_2 / F_{2\,0}) * IO_{VRP\,0})*$	A_1
4.1	$\Delta IO_{VRP}\,(F_1) = ((\Delta F_1 / F_{1\,\mathrm{I}}) * IO_{VRP\,\mathrm{I}})*$	A_4
4.2	$\Delta IO_{VRP}\,(F_2) = (\Delta F_2 / F_{2\,\mathrm{I}}) * IO_{VRP\,\mathrm{I}}$	–

5.1	$\Delta IO_{VRP}(F_1) = (IO_{VRP\,1}*A_4) - IO_{VRP\,0}$	−
5.2	$\Delta IO_{VRP}(F_2) = ((IO_{VRP\,1}*A_2) - IO_{VRP\,0})*$	A_1
6.1	$\Delta IO_{VRP}(F_1) = (IO_{VRP\,1} - (IO_{VRP\,0}*A_3))*$	A_4
6.2	$\Delta IO_{VRP}(F_2) = IO_{VRP\,1} - (IO_{VRP\,0}*A_1)$	−
7.1	$\Delta IO_{VRP}(F_1) = \Delta IO_{VRP} - (IO_{VRP\,1} - (IO_{VRP\,0}*A_1)$	−
7.2	$\Delta IO_{VRP}(F_2) = \Delta IO_{VRP} - (IO_{VRP\,1} - (IO_{VRP\,0}*A_3))*$	A_1
8.1	$\Delta IO_{VRP}(F_1) = \Delta IO_{VRP} - ((IO_{VRP\,1}*A_2) - IO_{VRP\,0})*$	A_4
8.2	$\Delta IO_{VRP}(F_2) = \Delta IO_{VRP} - ((IO_{VRP\,1}*A_4) - IO_{VRP\,0})$	−
9.1	$\Delta IO_{VRP}(F_1) = \Delta IO_{VRP} - (IO_{VRP\,1} - (IO_{VRP\,1}*A_4))$	−
9.2	$\Delta IO_{VRP}(F_2) = \Delta IO_{VRP} - (IO_{VRP\,1} - (IO_{VRP\,1}*A_2))$	A_1
10.1	$\Delta IO_{VRP}(F_1) = \Delta IO_{VRP} - ((IO_{VRP\,0}*A_3) - IO_{VRP\,0})*$	A_4
10.2	$\Delta IO_{VRP}(F_2) = \Delta IO_{VRP} - ((IO_{VRP\,0}*A_1) - IO_{VRP\,0})$	−

6. Findings

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

Table 4. The result on methods 1.1, 2.1, 3.1, 4.1, 5.1.

No.	the main part of the formula	adjustment factors		result
1	$\Delta IO_{VRP}(F_1) = $ -0.626114	−		-0.626114
2	$\Delta IO_{VRP}(F_2) = $ 0.800289	0.853463	A_1	0.683016
	0.174175			**0.056902**

Table 5. The result on methods1.2, 2.2, 3.2, 4.2, 5.2.

No.	the main part of the formula	adjustment factors		result
1	$\Delta IO_{VRP}(F_1) = $ -0.743386	0.842246	A_4	-0.626114
2	$\Delta IO_{VRP}(F_2) = $ 0.683016	−		0.683016
	-0.060370			**0.056902**

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 in investment returns GRP (ΔIO_{VRP}) Irkutsk region of the Russian Federation in the amount of -5.6902 % influenced by the following factors:

- reduced newcottage GRP Irkutsk region of the Russian Federation (***F₁***) on 39.355742 reduced the analyzed indicator -62.6114 %;

- increasing knowledge-intensity of the invested capital of Irkutsk oblast of the Russian Federation (***F₂***) on 0.002980 increased study rate +68.3016 %.

According to the results of the analysis, it is clear that in 2017, compared to 2016, there was an increase in the investment return of the economy of the Irkutsk region of the Russian Federation by 5.7

%. Investment efficiency of the economy of the Irkutsk region increased by 68.3% due to an increase in the knowledge intensity of the invested capital and decreased by 62.6 % due to a decrease in the science productivity of GRP.

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 key indicators of investment return of 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 investment return of GRP of the Irkutsk region of the Russian Federation for 2019-2021.

No.	Indicators	2019 year	2020 year	2021 year	Growth rate, % 2020 / 2019	2021 / 2020
1	**VRP** – gross regional product, billion rubles	1 287.4	1 398.5	1 443.0	+8.63	+3.18
2	**IOK** – investments in the fixed assets, billion rubles	311.5	352.2	403.7	+13.07	+14.62
3	**IO$_{VRP}$** – **investment return of GRP** (1 / 2)*100%, %	413.29	397.08	357.44	–3.92	–9.98

Table 6 shows that on the basis of the forecast of the Ministry of Finance of the Irkutsk region, the GRP investment return of the studied region in the next 3 years should steadily decrease. Formally, this has a negative effect, since investments in fixed capital should grow faster than the gross regional product. But based on the plans of the Government of the Irkutsk region of the Russian Federation, the GRP investment capacity 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%. This is a positive trend for the development of the economy of the studied region.

7. Conclusion

According to the governor of the Irkutsk region: 2018 was the year of development for the Irkutsk region. In 2018, the majority of macroeconomic indicators showed positive dynamics. According to preliminary estimates, in 2018, GRP grew by more than 170 billion rubles and amounted to 1 trillion 365 billion rubles. The volume of attracted into the economy of the region investment at the end of 2018 amounted to 316 billion rubles, which is above the level of 2017 by 17 %. The growth of investments was achieved both through the extraction of minerals and through the sustainable operation of the manufacturing sector. For example, in the engineering industry, the volume of investments increased 7 times, in the chemical industry – 3.3 times, in the oil refining, food, wood processing – almost 2 times (Levchenko, S. G., 2019).

Irkutsk region takes the 2nd place in the Siberian Federal district on the growth of investments in fixed capital.

According to the author, the main reasons for the decline in investment activity in the Russian economy are as follows:

- Russia is one of the most corrupt countries where businessmen have to spend huge amounts of money on bribes to officials to overcome excessive administrative barriers;

- high dependence of the national economy, public Finance and balance of payments on the external economic situation with the existing structure of GDP of the Russian Federation;

- long-term economic downturn of the Russian economy;

- reduction of gross national savings (annually more than 10 % of GDP is withdrawn from Russia);

- inflationary processes and the decline in the stability of the national currency (quite a high price of commercial lending due to the policy of the Central Bank);

- structural deformation of the money supply due to the policy of the Central Bank;

- violation of the processes of formation of public capital, the ratio between the system of interest rates and the level of profitability of the real sector of the Russian economy;

- unstable financial position of Russian enterprises (investments depend on revenue, which in turn is determined by the state of General economic activity);

- preferences in obtaining income in the speculative stock market (fluctuations in stock prices, often created artificially by stockbrokers to cash in on speculative transactions with securities, cause instability in investment policy);

- the fallacy of the economic policy of the state, based on the liberal-monetarist model of market reforms, the lack of public investment strategies.

To increase the investment return of the country and separately different regions, it is necessary to solve the above reasons for the decline in investment activity.

The main event of the «Baikal Business Forum 2019» (Irkutsk, the Scientific library of the Irkutsk state university named after Rasputin V. G., may 16, 2019) was the Investment message of the governor of the Irkutsk region. In his message, Levchenko S. G. noted that the state plan provides for full-scale industrialization in the Irkutsk region. The development of gas and gas chemical industry, gold mining, deep processing of timber, pharmaceutical, construction industry, as well as processing of agricultural products were chosen as strategic directions. As part of industrialization, it is planned to create at least 100 new enterprises, invest at least 1 trillion rubles of investment, create 16 thousand new jobs. As a result, tax revenues to the consolidated budget of the region will increase to 250 billion rubles.

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