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INVESTMENT APPEAL OF A REGION AND ITS IMPACT ON INVESTMENT INFLOWS

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Abstract. The study is aimed at assessing the impact of several indicators of investment appeal, namely, domestic research and development expenditure and the rate of employment, on the inflow of investment to a region. The Russian regions' data were used to run factorial analysis of variance of investment in fixed assets against the variance of R&D expenditure and rate of employment: factors' influence was estimated significant with a greater impact from domestic R&D expenditure on the capital expenditure. The study proves that investors, when making decisions about investing their funds, pay attention primarily to the extent of intellectual potential development in a region, rather than to labor availability. Consequently, the strong influence of this factor on the inflow of investment makes it possible to conclude that regions that have reached the greatest level of intellectual potential development have every reason to be the most attractive for investors.

Keywords: investment; investment appeal; innovation; scientific and technological development; region, regional development

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1. Introduction

Investment problems have always been the focus of economics studies. This is since investment affects the deepest foundations of economic activity, determining the process of economic growth in general. Investment process activation is one of the most effective mechanisms of socio-economic transformation. In modern conditions, investment is the most important factor influencing technical progress, providing favorable conditions

to recover from economic crises, enabling structural changes in an economy and the growth of qualitative indicators of economic activity and development.

Currently, the increasing globalization of the world economy and the attendant factors of the deeper international division of labor, free movement of goods and services have led to an increase in the requirements for the investment appeal of territories competing for resource mobilization. The output performance, fixed assets availability and capacity, as well as their modernization status, structural shift in the economy, social and ecologic problems resolution depend on investment policy efficiency.

Lack of foreign investment in the economy, as a rule, is the result of its low investment appeal. Institutional and legislative insecurity of investment activity, low informational transparency of companies' financial statements, substantial tax burden, lack of required qualifications of personnel, political instability, weak infrastructure development - all these can limit the amount of potential investment and reduce capital expenditure.

When considering the problem of investment appeal, particular attention should be paid to the methods used for its assessment. The prospective state of a country's socio-economic system and its social and political stability depend on effective solution of such an important problem. In modern conditions, the center of gravity of socio-economic processes' management is quite actively and consistently moving from the federal to the regional level. The tendency to expand the powers of the regions covers the sphere of their cooperation with investors. Many regions already use this skillfully, developing their own investment policies and shaping the investment culture.

2. Literature review and methodology background

2.1. The conceptual framework for investment appeal studies

The problem of investment appeal assessment has a sufficient theoretical basis. Investment in conjunction with regional development issues is discussed in Doussard et al. (2017), Mas-Verdu et al. (2010), Takhumova et al. (2018), Samygin et al. (2017), Galanina et al. (2017), Ohotina et al. (2018), Baltgailis (2019), Tvaronavičienė (2019), Selivanova-Fyodorova et al. (2019).

Investment appeal is a generalized characteristic of a set of social, economic, organizational, political, socio-cultural preconditions that determine the attractiveness and expediency of investing in one or another economic system.

The impact of innovation on the regional system is studied in research by Gordon & McCann (2005), Hansen & Winther (2011), Sánchez-Carreira et al. (2018), Scott & Storper (2003), Prodani et al. (2019). A series of works reveals the functioning of the economic mechanism of a region and presents the influence of various indicators on economic space relatedness (Simmie & Martin 2010). The role of individual factors (cultural, historical, industrial, etc.) or their combination on regional development is shown in studies by Barca et al. (2012), Nikiforov et al. (2018), Putri & Sudaryanto (2018), Yeung (2005).

However, the need for comprehensive research, which will be based on the analysis of advanced world experience and its constructive adaptation to individual regional systems, remains.

Currently, there is no uniform approach to investment appeal definition among the economists. It is advisable to consider investment appeal as a combination of investment appeal and investment activity. Investment activity is the real extent of capital expenditure development in a region. Investment appeal is commonly understood as an integral characteristic of enterprises, industries, regions, countries as a whole from the perspective of potential gains, returns and risks.

Investment appeal is determined simultaneously by the influence of two groups of factors, one of which forms the investment potential (a set of conditions and factors attracting or repelling the investor), and the other – investment risks (a set of factors that influence the likelihood of unforeseen financial losses under uncertainty of investment outcomes or probability of total or partial failure to achieve investment objective).

There are various approaches to investment appeal assessment. They vary in purpose, the number of analyzed indicators and conceptual characteristics, the choice of indicators themselves. In business practice, there are three most widely recognized approaches to assessing the investment appeal of a region, a country or some other territory.

The first approach is based on an assessment of GDP dynamics, national income and industrial output. It considers the dynamics of the national income distribution, IS/LM proportions, quality of investment regulation, development of financial markets, including the stock market and the money market. Proponents of this approach consider the level of asset utilization to be the main indicator of investment appeal: earnings before interest and tax to total assets, or alternatively – retained earnings to total assets.

The second approach is based on the compilation of enlarged groups that consist of indicators that are close in meaning and are called factors. Indicators are not analyzed separately, but as an enlarged group - a factor affecting the investment appeal. These include: characteristics of economic potential, general economic conditions, maturity of the market environment in a region, political, social and socio-cultural, organizational, legal and financial factors. The main advantages of a multifactor approach to assessing the investment appeal are the use of statistical data that exclude subjectivity assessment, a differentiated approach to various levels of an economy, and the drive to provide the widest possible overview of all possible sources of investment.

The third approach is the risk-based. Its supporters consider two basic concepts as components of investment appeal: investment potential and investment risks. The risk method of analysis and assessment of investment appeal allows an investor not only to assess investment attractiveness of a territory, but also to compare the level of risk inherent in the new investment object.

It is crucial not only to ensure events that contribute to increasing the investment appeal of a region, but also to correctly assess the effect of their implementation. There are still gaps in regional systems of statistical indicators, methodological aspects of statistical analysis of regions' investment appeal are underdeveloped, the issues of improving regional statistics need to be resolved, methods for assessing the effect of investment on regional development are not in place, the risks arising not only from lenders, but also from borrowers and guarantors are far from being evaluated and mitigated. The lack of reliable assessment of investment potential, of risk factors and their impact on investment, low information transparency etc. indicate the insufficiency of research conducted in this field.

2.2. Methodology of modelling investment appeal indicators' influence on investment inflow to a region

The research objective was to assess the impact of investment appeal indicators (rate of employment; domestic research and development expenditure) on the inflow of investment to a region. The Russian regions' data were used for the empiric study.

The methodological basis of the study was multi-factor analysis of variance - a method for studying the differences between mean values of two or more samples. Variance analysis is used to analyze objects that have dependent indicators measured on an interval or relative scale, and one or more independent factors that should be categorical. Variance analysis is used as a test of statistical significance of differences in sample means between

two or more sets. The null hypothesis states that all sample means are equal. This test is carried out by disintegrating the sum of squares into components, that is, by splitting the total variance into parts, one of which is due to random error (that is, intragroup variability), and the second is related to the difference in mean values. The latter component of variance is then used to analyze statistical significance of differences between mean values. If this difference is significant, the null hypothesis is rejected, and an alternative hypothesis about the existence of difference between the means is accepted.

In our case, to assess the impact of investment appeal development in a region on amount of investment in fixed assets, it is rational to use multifactor (factorial) analysis of variance using the following algorithm:

1. Determine the dependent (Y) and independent (X) variables.
2. Divide the Xs data into groups according to their values. For each group of X, there are m_i observations of Y. Sample size across the groups can be different.
3. Find the common and intra-group mean values of influencing factors in each group.
4. Examine the difference between means of an independent variable in different groups using multivariate analysis of variance, that is, by splitting the total variance into parts, one of which is due to random error – intragroup variability, and the other – is related to the difference of factor means.
5. Determine the degree of the two factors combined influence (multiple correlation).
6. Check the significance of factors’ influence on Y using the F-test.
7. Estimate the effect significance of each factor.
8. Determine the relative importance (degree of influence) of each factor on the Y. Calculate the ω^2 criterion for the factor.

To perform the analysis, the following factors determining the investment appeal were chosen:

- X1 – domestic research and development expenditure, thousand rubles;
- X2 – rate of employment, %.

The dependent variable (Y) was set to be the volume of fixed capital investment of a region. 81 regions’ data were used, see table 1 for reference and example.

Table 1. Function and argument values for selected regions

	Region	Fixed capital investment (in current prices), mln. rub.	Domestic research and development expenditure, mln. rub.	Rate of employment (15-72 years old),%
1	Belgorod oblast	143802	1779,9	67,3
2	Bryansk oblast	68320	704,3	64,3
3	Vladimir oblast	78456	4511,5	65,7
4	Voronezh oblast	270999	6436,1	63,0
5	Ivanovo oblast	22616	642,0	64,8
6	Kaluga oblast	80081	9283,7	67,8
7	Kostroma oblast	26474	137,1	63,6
...
81	Sakhalin oblast	247986	1182,5	68,6

Next, a binary scale of independent variables was introduced to divide respective data into four groups according to the levels of independent variables (table 2). Variable means were used as a criterion for sampling, no censoring was applied to data.

Table 2. Independent variables’ sampling results

Rate of employment, %	Code marker	Total domestic R&D expenditure, millions of rubles	Code marker
Below 64.0	A	Below 11636.6	1
Above 64.0	B	Above 11636.6	2

Prior to analysis, the null hypothesis (H0) of research was proposed: means of fixed capital investment in groups that differ in the rate of employment and R&D expenditure are equal. Consequently, rate of employment and R&D expenditure do not affect fixed capital investment in a region. Alternatively, hypothesis H1 states, that indicators’ means are not equal across the groups, thus rate of employment and R&D expenditure do affect the total investment. The strategy is to find out whether regions with different rates of employment and R&D expenditure differ in the value of investment in fixed capital.

3. Results and discussion

Table 3 presents the results of factorial analysis of variance carried out to verify the group-wise differences of regions, broken down by indicators of domestic expenditure on research and development and the rate of employment, in relation to the resulting indicator – fixed capital investment in a region.

Table 3. Intergroup factors

Indicators	Groups	Number of regions
Rate of employment	A	37
	B	44
Total domestic R&D expenditure	1	68
	2	13

Total and intra-group means of fixed capital investment across the groups of regions presented in table 4.

Table 4. Intra-group and aggregate means of fixed capital investment

Rate of employment	Total domestic R&D expenditure	Mean Capex	Sample size
A	1	100410,0	34
A	2	208667,3	3
B	1	153870,8	34
B	2	514119,8	10
Total		177935,1	81

As can be seen from table 4, the highest average value of investment in fixed capital corresponds to the group with a high rate of employment and domestic expenditure on research and development, and the smallest - with a low level of both indicators. Moreover, the average value in the group with a high rate of employment and a low level of R&D expenditure (B1) is less than in a group with a low rate of employment and a high level of R&D expenditure (B2). Thus, we can conclude that the volume of investment in fixed capital in a region is directly related to the rate of employment and R&D expenditure, and the latter indicator has a greater impact on investment.

Next, we analyze the content of table 5 – “Intra-Subject Effects Test”. This table is central to the analysis of variance output since it indicates the presence or absence of significant differences between the categories of variables studied. Especially important here is the value of R², reflecting the proportion of the total variance in the dependent variable. In other words, this is the part of the function variance that can be explained by the variance of independent variables. The second point to be assessed is the actual significance of differences between groups

of the dependent variable. This conclusion about each of the variables can be made from the p-level column. The minimum value corresponds to the factor having the greatest impact.

Table 5. Intra-Subject Effects Test

Source	Factor variance Sum of Squares	df	Factor variance Mean Square	F	H0 probability p-level	ω^2
Intercept	1939750935 359	1	1939750935359	39,3	0,000	0,598
Rate of employment (Emp)	261743147953	1	261743147953	5,3	0,024	0,293
R&D Expenditure (RnDe)	445992338014	1	445992338014	9,0	0,004	0,387
Emp * RnDe	129023564410	1	129023564410	2,6	0,11	0,753
Error	3798919814229	77	49336620964			
Total	5155988529164	80				

$R^2 = 0,263$ (Adjusted $R^2 = 0,234$)

The calculated degree of the two factors influence – the multiple correlation indicator – is not high enough and amounts to 0.263. These results allow to conclude that the selected indicators (rate of employment and R&D expenditure in a region) together do not have a significant impact on fixed capital investment, and within each group of factors X_1 and X_2 there is no variability, yet there is some between groups.

The probability of the null hypothesis of 0.11 casts doubt on the joint influence of factors on fixed capital investment. Since the full effect of the influence of two factors is statistically significant, then in the next stage we will consider the significance of the interaction effect of these factors. To do this, F-statistics criterion is estimated. In our case, the interaction between the factors is statistically significant, since F-statistics value is 2.6 and exceeds the benchmark of 2.2.

The existence of interaction between factors suggests that the influence of any one factor depends on the value of another independent factor. The analysis showed that the rate of employment in a regional economy has an impact on the inflow of investment into a region, but this influence is stronger in combination with the level of expenditure on research and development. This is evidenced by the lower probability of the null hypothesis (0.11), the greater value of F-statistics (2.6) and the indicator ω^2 (0.753) compared with the values of these indicators for each of the factors separately. Thus, a high rate of employment in a region, combined with a high level of expenditure on research and development, leads to a high value of fixed capital investment in a region. In addition, we can mention the separate influence of each of the factors on the function (probability of null hypothesis, stating that these factors do not affect the investment, in both cases is under 0.05).

The degree of each factor influence on investment can be determined using the criterion of ω^2 . According to the estimates, the first factor (R&D expenditure) significance in terms of the influence on investment is quite high at 38.7%. The contribution of the second factor (rate of employment) to the full variance is also significant and amounts to 29.3%.

Thus, based on the analysis results, it can be concluded that fixed capital investment in a region is closely related to domestic expenditure on research and development and to the rate of employment. Investment inflow to a region is significantly dependent on domestic R&D expenditure: the factor contribution to total variance of investment amounts to 38.7%, compared to the less but still significant factor of relative employment in a region (29.3%). Low probability of the null hypothesis (presuming no influence of employment and R&D expenditure on investment) allows to reject it and consider the influence to be significant and verified.

5. Conclusion

The analysis results can be interpreted as follows. Investment inflow to a region, and consequently the region's investment appeal, is more dependent on domestic research and development expenditure rather than on the rate of employment. This means that when making decisions about investing their funds, investors first of all pay attention to the extent of intellectual potential development, not to the labor availability. The strong influence of the intellectual factor on the inflow of investment makes it possible to conclude that the regions that have reached higher level of intellectual potential development have every reason to be the most attractive for investors. Regional authorities' effort to support science and education affects the regional investment appeal significantly. However, it is not true that labor availability is ignored by investors.

Over the past decade, regional authorities have realized the importance of attracting investment and even included investment policies in strategic development plans. Investment policy cannot be implemented without properly linking it with the regional development strategy. However, some strategies have a number of flaws that need to be addressed before considering investment measures.

The process of developing an investment policy requires setting clear goals and objectives, as well as a detailed analysis and consideration of the results of regional development at a given level of investment inflows. The investment policy should identify priority sectors for the region and specific investment projects, the comparative advantages of which should be reported to the investor; develop measures to create mechanisms to protect the rights of investors; consider the possibility of creating, at the expense of the regional budget, insurance and pledge funds guaranteeing the observance of obligations to investors; develop a mechanism of individuals' funds raising in investment projects, etc.

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