

Investments in fixed assets in Russia: analysis and forecast

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Abstract. The relevance of the study is that investment activities associated with investments in fixed assets relate to the "system-forming" activity of the state and are articulated in a number of federal documents and national projects. As it is noted in the Decree of the President of Russia "On National Development Goals of the Russian Federation for the Period until 2030" the sustained economic growth is associated with a high level of investment activity. It is planned to increase capital investment in fixed assets by 2030 by at least 70 percent compared to 2020. The author's version of blocks of factors of investment in fixed assets is formed according to a content criterion. Hierarchical classification of Russian regions into qualitatively homogeneous groups according to factor indicators of regional promotion of investments in fixed assets by the method of cluster analysis based on interregional comparisons was performed. A federal approach to the analysis of trends of indicators of investments in fixed assets has been implemented and their forecasting for 2021-2022 has been carried out. The proposed analytical and methodological support for the executive authorities of the federal and regional levels serves as the basis for the development of the appropriate measures to ensure the conditions for growth of investments in fixed assets and sustainable economic growth.

1 Introduction

The purpose of national projects implementation is to ensure sustainable growth of investments in fixed assets. This course of action is directly related to the high level of investment activity and the evolution of socio-economic development of the regions. A number of authors consider the essence of investments as acquired assets and as the process of investing in such assets Nosov et al. [1], Safiullin and Abdullina [2], Hakimov and Fasikhov [3], Surzhikov [4], Pinkovetskaya [5], Arsenieva et al. [6]. A number of authors consider investments as an incentive for enterprises to compete Stupnikova and. Sukhadolets [7], Demina et al. [8]. The connection between economic and legal nature of investments from theoretical perspective has been investigated Spinev [9], Lotorev et al. [10]. The structure of investments Singireva and Ioda Yu.V. [11] is studied in detail. Investments in

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fixed assets are being investigated Yalyalieva et al. [12], Vyakina [13] as a resource of import substitution and a guarantee of economic security. We have formed blocks of factor indicators according to a content criterion, allowing us to deepen the analysis of investments in fixed assets in the regional context, highlighting qualitatively homogeneous groups of regions according to the nature of investments. The method of studying the dynamics of indicators of investments in fixed assets has been implemented and the forecast for 2021-2022 has been carried out. The results can be used by federal and regional government bodies to resolve issues related to the regulation of investment activities.

2 Materials and methods

The dialectic method and the comparison method were used as research methods in a time-series analysis of fixed capital investments. Statistical tools included: a method of classification of factors by their content assessment [14], a method of time-series analysis [15], a Chow test for hypothesis testing that there is a structural gap in the trend [16]. The methods of cluster analysis [17] and ranking of regional units according to the nature of investment activity were used [18], as well as the method of constructing statistical tables for calculation of general indicators and the graphical method of presenting the results of the study [19].

Information processing is carried out on the basis of application packages: "Microsoft Excel", "STATISTICA" [20], Gretl.

3 Results

Our study, based on official information from Rosstat [21] and statistical methodology, should provide an insight of the state of investment activities related to fixed capital investments, the processes and trends in it, the relationships and features of regional functioning. The study of territorial differentiation of investment activities is related to the definition of a range of specific statistical indicators. Moreover, they should be presented in a regional context. Such indicators include the following:

- 1) investments in fixed capital per capita, rub.,
- 2) index of physical volume of investments, %.

We will consider the factors of regional development of fixed capital investments from a statistical point of view. Factors are grouped according to a content criterion; the following groups are highlighted:

- 1) Factors of economic development of the region.

A prominent representative of this group is the "gross regional product per capita." In this group we also consider: consumer activity of the population, inflation rate, state of the labor market. These indicators create the economic background for investment activities to take place.

- 2) Demographic factors.

a. Investment activities are eventually connected with people, so the influence of demographic conditions cannot be ignored.

The demographic factor is the "total fertility rate." The demographic situation is directly related to the level of human capital development.

- 3) Social factors.

a. This is a group of indicators of the standard of living and development of the social sphere of the region. As an example: "monetary income of the population." Higher living standards correlate with higher incomes, which can also be considered as a potential source of investment.

4) Structural and production factors.

a. The factors of this group characterize the structure of the economy, the level of labor productivity, innovative activity, the state of fixed assets, and environmental conditions. This variety of factors allows us to cover various aspects of the state of the industrial and infrastructural segments of the region. This includes, for example, "the share of mining in the gross value added (GVA) structure of the region."

5) Factors of digital development.

a. Investors cannot ignore the level of digital development of the region, because of it's great influence on business activity and the pace of economic development. An example of a factor sign is "the number of personal computers per 100 employees."

6) Financial factors.

a. This is a very important group. It reflects financial resources and financial conditions for investment activities. This group included, for example, the factor characteristic "proportion of loss-making organizations."

At the next stage with the aid of "Statistica" application we conducted a cluster analysis of factor indicators of fixed capital investments. The baseline data were pre-standardized, allowing them to be used as data sets for multidimensional grouping of fixed capital investment factors (conditions). The Ward method and the k-average method are used to perform cluster analysis of factor indicators. As a result, we came up with a multidimensional grouping of regions of the Russian Federation by factors (conditions) of investment activity. Following the results of cluster analysis, six clusters were singled out. Table 1 shows the results of a multidimensional grouping with a content-related interpretation of each single cluster.

Table 1. Multidimensional grouping of regions of the Russian Federation according to the investment climate for investments in fixed assets.

Investment climate for investments in fixed assets	Representative regions of the Russian Federation
Very favorable	Moscow
Favorable	St. Petersburg, Moscow, Murmansk, Yaroslavl, Udmurtia
Good	Arkhangelsk, Stavropol, Mari El, Perm, Tver, Samara
Medium	Crimea, Novosibirsk, Astrakhan, Sverdlovsk, Khabarovsk
Poor	Sakhalin, Khanty-Mansi autonomous district, Kamchatka territory, Magadan
Unfavorable	Chechen Republic, North Ossetia, Republic of Tuva, Kurgan, Jewish Autonomous Region

Moscow alone falls into a group with "very favourable conditions." The city of Moscow is an urban area with high socio-economic and financial standards. It is the leader in attracting foreign investments and one of the business centres in Eastern Europe. Moscow marks a very high level of incomes of the population, technologically advanced Internet infrastructure and high-tech industries.

The group with "favorable conditions" includes the regions of the European part of Russia ranging from Tambov to Murmansk region. Their distinctive feature is the rapid digitalization of business and economy as whole and the presence of high tech industries. For example, in the Chuvash Republic 68.7% of organizations have their own website - that is the maximum number for all subjects of the Federation.

"Good conditions" extend mostly in the regions of the European part of the Russian Federation. Samara is also in this cluster. Along with the average level of digitalization, the demographic situation is not the most favorable in these regions, but they do have an increase

in the physical volume of GRP and a positive dynamics when it comes to investments in digital technologies. Rosstat (Federal State Statistics Service), however, reports the absence of high-tech products and industries in the Stavropol Territory.

"Average conditions" are observed in regions spread over the entire territory of Russia - from Crimea to Primorye. With rare exceptions, the high costs of digitalization in these regions are combined with underdeveloped high tech sector. The Republic of Crimea has one of the largest in the country proportion of organizations (78.1%) with Internet communication speed of at least 2 Mbps. The majority of representatives of this group reach a high level of gross regional product - GRP (Khabarovsk Territory, Sverdlovsk Region).

The group with "poor conditions" included 4 regions with severe natural and climatic conditions. They feature high level of financial and production indicators, but lack of development of high-tech industries and Internet technologies.

"Unfavorable conditions" developed in the North Caucasus and a number of regions of the Asian part of the country. For example, in the Kurgan region, the average per capita income of residents is 21.3 thousand rubles, which is 32% less than the average value in Russia. The main advantage of this group representatives is a good demographic situation.

Based on the comparison of time series data, horizontal analysis (trend analysis) is at the core of the statistical assessment of the dynamics of phenomena. It is focused both: on the characteristic of the speed and intensity of the phenomenon process and on forecasting. Investment activities related to investments in fixed assets have fluctuations over time. They are caused by the seasonal factor as well as the phase of the economic cycle, changes in business activity in the economy, economic shocks (sanctions, etc.), the changing situation in the foreign market and other factors. In our study we will analyze the dynamics of volume, cost and relative indicators. Whenever the object of the study is a specific territory (for example, a region or the Russian Federation), there is no need to use level indicators, that is, to calculate them in terms of per capita.

Figure 1 shows a graph of the volume of investments in fixed assets in the Russian Federation as a whole with the calculation of chain growth rates. It makes no sense to calculate base indicators, since the volume of investments is a cost value, thus, it is highly subjected to inflation, what makes nominal values grow annually, but at the same time actual values do not always grow.

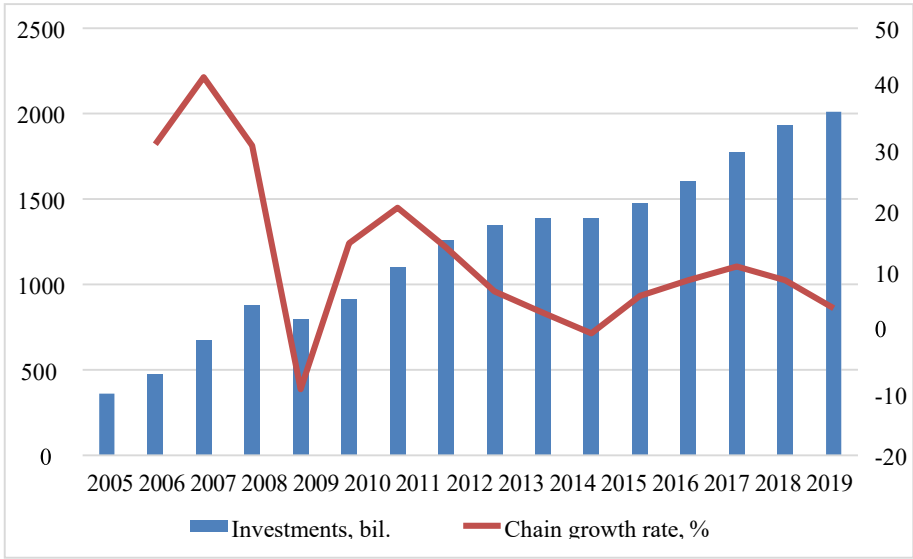


Fig. 1. Dynamics of investments in fixed assets in the Russian Federation.

Unlike base indicators, chain indicators give a clearer picture of what happens year after year. During the crisis years, investment activity in Russia faded to subsequently intensify, but the growth in activity over time became less significant. At the beginning of the 21st century chain growth rates reached 42% per year (2007), then after the crisis of 2008-2009 the largest chain rate growth was just 21% (2011), and after the crisis of 2014-2015 - only 10.9% (2018).

Table 2. Forecast of investments in fixed assets in the Russian Federation for 2021-2022 (billion rubles).

Forecast year	Point Forecast	Interval forecast (95% probability)	
		Lower limit	Upper limit
2021	20926,9	19139.0	22714.8
2022	21963,6	20139.0	23788.2

Despite a fairly stable development, investments time series indicators reveal fluctuations and a change in trend, so a logical scientific question arises - is this related to any qualitative shift? Such a shift could be any legislative change in the field of investment in fixed assets or the introduced measure of state regulation. Since 2014 the State Program "Economic Development and Innovative Economy" has been developed and implemented in Russia. It is designed for the period until the end of 2024 and concerns many issues of the economy and social sphere including the investment activities of enterprises. We will consider this program as a qualitative factor that could cause changes in the trend. We apply the Chow test to verify this thesis. The observed Chow test value was calculated in the Gretl program. The year 2015 was chosen as the time point for splitting the sample into 2 parts, since any major legislative and managerial change has a delayed effect, with a lag of at least 1 year. The observed value $F_{ob} = 5.57$; the p-value is 0.0195. This suggests that, with a probability of 95%, the hypothesis that there is a structural gap in the trend can be adopted. Therefore, the introduction of the State Program "Economic Development and Innovative Economy" had the expected effect at the federal level and influenced the investment activities.

Let's consider how the values of the index of physical volume of investments in fixed assets in Russia have changed (Figure 2).

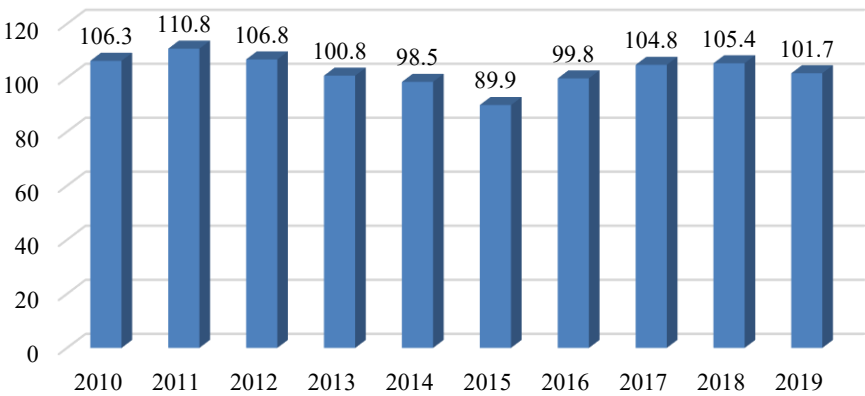


Fig. 2. The dynamics of the index of physical volume of investments in fixed assets in the Russian Federation.

The trend dynamics of the index generally correspond to the phases of the economic cycle. The crises of 2008-2009 and 2014-2015 influenced the physical volume of investments, although the second crisis was more severe. Currently, the Russian economy is

undergoing a period of investment activity, but index values are already beginning to slow down. Table 3 shows the forecast values of the index (according to the ARMA model).

Table 3. Forecast of physical volume index of investments in fixed assets in the Russian Federation for 2021-2022 (%).

Forecast year	Point forecast	Interval forecast (95% probability)	
		Lower limit	Upper limit
2021	99.5	91.6	107.5
2022	105.4	96.7	114.2

The model forecasts a possible slowdown in investment activity and subsequent recovery, which is generally consistent with current economic forecasts. For example, Pryazhnikov [22], notes "the current forecast for the development of Russia is not precisely formulated and has practically no connection with the actual indicators." A number of authors believe that "the main issue in the field of the economy now is the correct assessment of the timing of its full recovery and further reaching an accelerated pace of economic development. An important topic is the influence of the next wave of pandemic that can interrupt the economic recovery" [Karavaeva et al. [23]. Under these conditions, a certain decline in the values of economic indicators is almost inevitable. Let's check for structural changes in the time series of the index. Observed Chow test value $F_{obz} = 6.61$; p-value is 0.0395. This suggests that with a probability of 95%, a hypothesis about the presence of a structural gap in the trend can be adopted - this means that there is a positive effect after the introduction of the State Program "Economic Development and Innovative Economy."

4 Discussion

In the area of global economy there are a number of studies on specific investment issues. Chinese researchers have discovered a link between the environmental situation and the size of foreign investment. The results obtained indicate that tight environmental regulation results in a drop in production volumes of foreign companies in general and a decrease in polluting industries around cities, oriented, in particular, at emissions reduction Xu Y et al. [24]. Scientists studied the investment activities of family enterprises and concluded that family property is less sensitive to investment fluctuations, which indicates a more effective investment behavior of family firms Quarato et al. [25], Nosov et al. [26], Zhichkin et al. [27]. Scientists Amendolagine and Prota [28], using the Tobit model, put forward the argument that bilateral investment treaties can help countries with poor management and administration problems, like many countries in sub-Saharan Africa, develop their economies more efficiently.

Thus, a review of scientific literature and federal documents makes it possible to draw the following conclusions:

- 1) investment activity is recognized as one of the key in the modern innovative economy, and therefore the Russian government should place increased emphasis on this matter; (develop relevant programmes, create legal and regulatory framework);
- 2) the scientific community has conducted many diverse empirical studies on investment, but there are still unresolved issues in the theoretical understanding of this phenomenon.

We paid special attention to the informational and methodological aspect of the analysis of investments in fixed assets in Russia and in its regions.

5 Conclusion

The current priority direction of social and economic policy is aimed to ensure a stable trend of investment activity in the Russian Federation, which serves as the foundation for accelerated economic growth in the country. Investments, in turn, generate innovation, stimulate innovative activity in the economy. Investments in fixed capital (fixed assets) create a solid basis for sustained development of the enterprises. Their growing business activity acts as a financial source of new investments. This is a gradual process, a circular flow, and investment policy itself can be considered as part of strategic development.

The information-methodical approach is proposed:

- the author's version of blocks of factor indicators of regional development forming according to a content criterion: factors of economic development of the region; demographic factors; social factors; structural and production factors; digital development factors; financial factors;
- based on the application of the cluster analysis method, six qualitatively homogeneous groups of Russian regions according to factor indicators of the development of investments in fixed assets were recognized. Clusters with various formation conditions were identified: "very favorable," "favorable," "good," "medium," "poor," "unfavorable." A geographical feature was revealed - the first two clusters represent a city of federal status - Moscow and the regions of the European part of Russia; in the last two - the regions of the Far North, the Far East and the North Caucasus;
- the federal-scale approach to analyze the dynamics of indicators of investments in fixed assets, as well as their forecasting has been implemented.

An analysis of investment trends showed their relationship with economic cycles. During the years of crisis, investment activity in Russia slowed down to subsequently intensify, but the growth in activity over time became less substantial. The levels of investment time series are subject to fluctuations and a change of trend, which can be caused by the effect of structural shift (that is, the influence of a qualitative factor). We consider such a factor to be the adoption of the State Program "Economic Development and Innovative Economy" in 2014. Verification using the Chow test revealed that in general, a hypothesis of the presence of a structural gap in the trend is true, consequently the Program on investment activities in the Russian Federation proves to have a positive impact.

In the conclusion, it should be noted, that the results of the analysis are required for the government executive authorities in the process of state programs update for the development of specific regions in the direction of sustainable accelerated growth of real investments in fixed assets.

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