

Estimation for Optimum Investment Capacity of a Region (The Case of Amur Region)

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Abstract. The article investigates issues of the optimization of the investment capacity of a region.

The study utilizes economic and statistical methods and computational and constructive research methods as well as the method of comparative analysis.

The author proposes his definition of the concepts of the actual and optimal investment capacity of a region. The actual investment capacity of Amur Region is estimated for the period 2000 - 2016. The author designs an estimation model for the optimal investment capacity in a region and uses it to estimate the optimum investment capacity in Amur Region in 2000 - 2016.

A characteristic feature of investment processes in Amur Region is the implementation of large-scale investment projects. In 2000-07, the local economy suffered from a shortage of investment resources that are required for maximizing the gross regional product (GRP). Between 2010 and 2013 the actual investment capacity exceeded the optimum, which means that either the capital invested in the region was not put to effective use, failing to bring about GRP growth (within the investment actual capacity excess over the optimum), or the investments in major projects will produce GRP growth in the future.

The obtained results indicate that the investment capacity of Amur Region was 54.1% in 2016. In order to prevent inefficient investment spending and to maximize GRP in the region, it is necessary to reduce the actual investment capacity by 6.2 percentage points (to 47.9%).

Consequently, by determining the optimum investment capacity, it will be possible to execute a more consistent and rational approach to distribution of limited public investment resources and to prevent their inefficient spending.

1. Introduction

Investment is the foundation of sustainable development of companies, institutional sectors and national economies as a whole. Investments drive economic growth by increasing the production potential of economic entities [1]. Creating a favorable investment climate in Russia and increasing investment capacity in its regions will put it on the track of sustainable economic development.

The economies of individual regions have different degrees of susceptibility to investments and investing activity [2]. This calls for quantitative estimation of the optimum investment capacity of a region. Investment activity in a specific region of Russia has its limits that are determined by market demand for investment resources in the form of capital investments in various projects.

In the past few years, the Russian government has been implementing a policy aimed at the accelerated development of Russia's Far Eastern regions by "pumping investments" into the area [3]. In this

regard, it becomes timely and relevant to design a toolkit for estimating the optimum investment capacity in a region in order to avoid inefficient spending of public funds.

The subject of the study is Amur Region where a number of major investment projects are being implemented, such as the construction of the Amur Gaz Processing Plant, the second phase of the Vostochny Cosmodrome, the Power of Siberia gas pipeline and a cross border bridge over the River Amur that are entering the active phase of construction works; the second phase of a soybean processing plant and the upcoming launch of the Nizhne-Bureyskaya HPP. Incentives for business development and tax concessions are available to tenants of territories of advanced socio-economic development operating in the region.

The concept of "investment capacity" appears fairly rarely in applied economics. A survey by Expert RA Agency found that the term "investment capacity" is regarded as identical to "investment potential" and is defined as the sum total of objective prerequisites for investing that are determined by the presence and diversity of spheres and entities for investing in as well as their economic "health". We believe that, while being connected and interdependent, the notions of "investment capacity" and "investment potential" reflect different aspects of investing as a process.

Building upon our earlier studies, we define investment potential as financial resources concentrated in an area and possibilities for their efficient use [4-5]. In this context, investment potential is interpreted as the supply of financial resources that can be transformed into investment expenditures.

The term "investment capacity" has been researched by Russian (V.O. Marzoyev [6], Ye.I. Muzyko [7], Yu.A. Stepanov, A.M. Letov, S.N. Chasovnikov [8], Ye.Ye. Shvakov, A.Ya. Trotskovsky [9], N.I. Lakhmetkina [10], Ye.A. Shtele, V.G. Voronin [11]) as well as foreign authors (V. Hagspiel, J. Huisman, P. Kort [12], Q. Dong, J. Barcena-Ruiz [13]). Most of the works interpret investment capacity only as the maximum amount of investments that an area must secure in order to reach its strategic goals. This definition disregards the fact that some of the invested resources may not be used effectively.

In this regard, we suggest distinguishing between the actual and potential investment capacity of a region. The actual investment capacity of a region is the sum total of investment expenditures on capital assets, labor resources and innovations. The optimum investment capacity is the volume of investments that enables the maximum economic growth in the region at the current values of the region's macroeconomic indicators.

2. Method

Basing on the above definition of actual investment capacity, we shall compute its value using the following formula:

$$IC_r = \frac{K+W+I}{Q}, \quad (1)$$

where K is fixed investments (million roubles); W is total wages paid to employed workers (W), million roubles; I – innovation expenditures (I), million roubles; Q – gross regional product (GRP), million roubles.

Having calculated the actual investment capacity of a region, we shall determine its optimum value.

We suggest that the estimation model for the optimum investment capacity of a region be based on the linear nonhomogeneous production function.

GRP is the main macroeconomic indicator describing economic growth on a regional level.

The main task is to produce a quantitative evaluation of the factors that cause an increase or decrease in GRP and to study the specific features of the region's development.

There is a general agreement among researchers that economic factors impacting GRP are labor, capital and scientific and technological progress. The latter describes the process of the adoption of new equipment and technology [14].

In 1987, Robert Solow was awarded the Nobel Prize for his works proving that technical development accounted for nearly a ninth of labor productivity growth in the USA in 1909-49 [15].

Paul Romer [16] and Robert Lucas [17], the authors of the new theory of economic growth, introduced the factor of technical progress as an endogenous one in the growth model. The key measures of technical progress are R-and-D expenditures and human capital investment. One of the main conclusions of the model is that the long run growth rate is higher in an economy with indefinite human capital accumulation and a high pace of innovation development.

Taking that into account, the author proposes the following function for estimating the optimum investment capacity of a region:

$$Y_r = (a + b * IC_r) * IC_r * L_r + (c + d * IC_r) * IC_r * F_r + (m + n * IC_r) * IC_r * ln_r + B, \quad (2)$$

where Y_r is output (GRP), million roubles.; L_r is labor (average annual workforce in the economy); F_r capital (cost of fixed assets in the economy), million roubles; ln_r – innovations (R-and-D expenditures), million roubles; IC_r – actual investment capacity of the region, %; a, b, c, d, m, n, B are parameters that are estimated by means of retrospective time series analysis.

The optimum investment capacity is the peak point of the function and is calculated using the formula (1):

$$IC' = - \frac{a * L_r + c * F_r + ln_r}{2 * (b * L_r + d * F_r + n * ln_r)}, \quad (3)$$

At this level of investment capacity GRP reaches its maximum in absolute value.

3. Results

Using the above formula (1) we shall determine the actual investment capacity of Amur Region for the period 2000-16 (Table 1)

Table 1. Actual investment capacity of Amur Region in 2000-2016 in comparable prices of 2000.

Years	Fixed investment (K), RUB.	Total invest-ment (W), RUB.	wagesInnovation mlnexpendi-tures (I), RUB.	GRP (Y), mln(I), RUB.	<i>Actual investment capacity (IC), as a decimal quantity</i>
2000	2944,0	805,5	37,8	19124,4	0,20
2001	8835,7	949,1	21,3	24361,7	0,40
2002	7356,3	1267,0	11,7	24670,6	0,35
2003	8638,4	1377,1	3,3	25227,0	0,40
2004	8684,5	1509,4	25,7	25325,9	0,40
2005	7844,5	1704,6	0,2	25395,5	0,38
2006	8684,9	1854,9	87,7	27273,2	0,39
2007	12364,0	2071,3	28,4	28167,3	0,51
2008	15023,5	2238,3	56,0	28100,2	0,62
2009	13858,4	2329,7	61,7	31643,9	0,51
2010	16358,2	2428,9	352,7	32764,7	0,58
2011	21220,6	2578,4	738,8	35690,7	0,69
2012	18852,7	2612,5	919,2	34044,0	0,66
2013	15863,2	2736,0	717,8	30357,3	0,64
2014	11100,7	2622,4	703,0	30871,3	0,47
2015	13949,4	2185,2	630,3	34881,2	0,48
2016	16464,2	2152,8	301,9	34972,3	0,54

Source: author's own calculations based on Rosstat data.

Judging by the data provided by the Federal State Statistics Service, the analysis of investment activity in Amur Region showed its growth in 2000-16. Fixed investments considerably grew over the studied period in comparable prices of 2000 and exceeded the level of 2000 by 460% in 2016.

The key factor that drove up investment in the region is major investment projects in transportation, power engineering and mining [18]. Total wages grew, too. Between 2000 and 2016, the growth reached 267%.

Innovation expenditures have been growing irregularly. The main source of finance for innovation in Amur Region is self-funding. One has to bear in mind that the adoption of innovations requires higher public investment and stronger involvement of the state in funding innovation. It is also necessary to enforce an effective government policy of investment in innovation [19-20].

The actual investment capacity of Amur Region fluctuated between 20 and 66% of GRP over the studied period.

Table 2 presents input data for calculating the optimum investment capacity of Amur Region.

Table 2. Input data for building an estimation model for the optimum investment capacity of Amur Region in 2000-16 in comparable prices of 2000.

Year	Value of fixed assets (F), mln. RUB	Average as-annual workforce (L), sons.	Innovation R-and-D expenditures (In), mln. RUB	GRP and (Y), mln. ex-RUB	<i>Actual investment capacity (IC), as a decimal quantity</i>
2000	139945,8	40000	52,4	19124,4	0,20
2001	144292,9	41500	60,8	24361,7	0,40
2002	160027,8	42020	54,8	24670,6	0,35
2003	177436,8	43800	44,5	25227,0	0,40
2004	164192,1	45900	49,6	25325,9	0,40
2005	164650,5	43800	51,2	25395,5	0,38
2006	161245,8	44300	60,2	27273,2	0,39
2007	169407,4	48800	69,7	28167,3	0,51
2008	154912,7	49400	87,9	28100,2	0,62
2009	151705,8	52800	91,2	31643,9	0,51
2010	147082,0	46800	92,3	32764,7	0,58
2011	151462,4	51500	91,6	35690,7	0,69
2012	172218,3	52900	102,0	34044,0	0,66
2013	171802,9	51600	104,0	30357,3	0,64
2014	158223,3	50300	94,6	30871,3	0,47
2015	145875,1	46200	82,9	34881,2	0,48
2016	162337,8	45000	76,6	34972,3	0,54

Source: author's own calculations based on Rosstat data.

Using the obtained values of the indicators, we constructed the following function (2) to describe the economy of Amur Region:

$$Y_r = (-2,05 + 4,57 * IC_r) * IC_r * L_r + (0,64 - 1,24 * IC_r) * IC_r * F_r + (894,81 - 1168,94 * IC_r) * IC_r * ln_r + 10693,14.$$

The function is adequate to the dataset as it passes all key statistical tests (Tab. 3).

Table 3. Parameters of econometric model for economy of Amur Region in 2000–2018.

Indicator	a	b	c	d	m	n	B
Value							10623,
	-2,05	4,57	0,64	-1,24	894,81	-1168,94	14
t-statistic	-1,39	1,54	-0,76	0,74	0,81	-0,64	1,48
Statistical meters	para-R ² = 0,75; F=4,9; N=17						

Source: author's own calculations.

The dynamics of the parameters of investment capacity of Amur Region in 2000-16 is presented in Fig. 1.

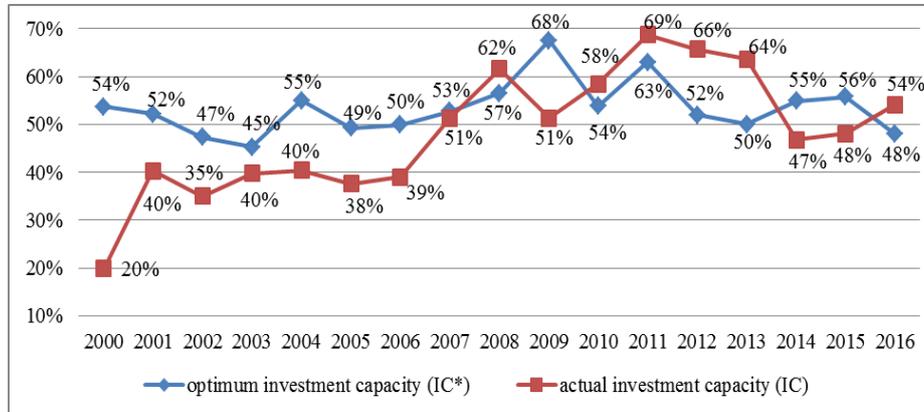


Figure 1. Dynamics of the parameters of investment capacity of Amur Region in 2000-16.

Source: calculated by the author.

The calculations show that in 2000-07 the economy of Amur Region suffered from a shortage of investment resources that are required for the optimum GRP. During that period, the actual investment capacity did not exceed the optimum level but exhibited steady growth that was not, however, due to an improved investment climate in Amur Region. Among the factors driving up the growth are an increase in government investments in major energy projects (construction of the Bureyskaya HPP (2000-2007), transportation and mining. Between 2000 and 2007, fixed investment quadrupled. The trend towards investment in the region being boosted by major projects persists today.

Between 2010 and 2013, the actual investment capacity exceeded the optimum level, which leads us to a conclusion that either invested funds were not used effectively, failing to bring about GRP growth in the region (within the limits of the actual investment capacity excess over the optimum), or the investments in major projects based in the territories of advanced socio-economic development and the Free Port of Vladivostok will produce GRP growth in the future. We do not rule out that both options might occur simultaneously.

The investment capacity of Amur Region in 2016 was 54.1%. Today, it needs to be reduced by 6.2 percentage points (to 47.9%) in order to prevent the risk of ineffective investment spending and to maximize GRP in the region.

4. Conclusion

As the federal government is paying particular attention to promoting balanced development of Russia's Far Eastern territories, having the regions' needs and their optimum investment capacity clearly defined and determined would result in a more consistent and rational approach to the distribution of limited public investment resources among the regions of Russia and prevent the risk of ineffective investment spending.

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