# An Industrial Region in Russia: Factors of Growth and Development

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*Abstract* — **The Russian economy is based, first of all, on industrial production. In the majority of regions the share of an industrial product in a gross regional product significantly exceeds 75-80%. Steady growth of regions often depends on the industrial sector. The Ural region is not an exception. Historically the region always was an industrial one.**

**The article's purpose is to analyse possible sources of the Ural region growth. The analysis methodology is based on creation of nonlinear econometric function where labor and capital resources act as regressors. Besides, we make a hypothesis of possible influence of the bank crediting to real capital. We add this indicator in the function as the third regressor. After the creation of the econometric function we can answer what factor (the human capital, investments into real capital or volumes of the crediting to real capital) is main.**

*Keywords* — *industrial production, industrial region, development of the industrial region*

## I. INTRODUCTION

The problem of industrial region growth is relevant not the first decade. Strategy for the scientific and technological development of the Russian Federation point to necessity of national competitiveness growth and connectedness of the territories [1]. It is possible to increase competitiveness of the country only thanks to the national integrity.

## II. LITERARY REVIEW

As for Russia we can refer to industrial absolute majority of regions. Nevertheless, in the Russian economic literature there is no uniform understanding what region is industrial.

For example, Gilmanova R. I. defines an industrial region as the administrative subject of the Russian Federation, where a share of gross value added by the industry to a gross regional product (GRP) is not less than 33% [2].

There are also other concepts of the industrial region. M.K. Kumaneeva uses the concept "regions of industrial type" in research of regional sustainable development problems, but without giving an accurate definition to this concept. This author gives the main signs of the industrial region: a large resource base (and as a result – high resource intensity of economy); weakness of agrarian sector (less than 10% in GRP); use of traditional technologies and low innovation of

regional economy [3]. These factors are combined with high ecological tension, the prevalence of urban population and more.

The academician A.I. Tatarkin paid special attention to problem of the Ural region development [4,5,6,7]. The questions connected with sustainable development of regions clustering, and the competition between regions of the Ural Federal District (industrial regions) are deeply investigated also him colleges – Yu.G. Lavrikova, O.A. Romanova, etc.

A.I. Tatarkin and S. V. Doroshenko suggest considering the region as a spontaneous system [6]. They understand self-development as the "ability of the region to provide expanded gross regional product reproduction based on available potential of own resource opportunities and profitable sources in interests of realization both the macroeconomic purposes and national priorities, and regional purposes in the conditions of its environment". Thus, for sustainable development the region needs to provide not only an increase in GRP using internal sources, but it also needs to develop necessary regional institutions.

L.M. Grigoriev, Yu.V. Urozhayeva, D.S. Ivanov's works are devoted to synthetic classification of regions. They as grouping indicators call population, VRP, volume of investment, volume of foreign investments, number of students, a share of urban population, dependence on budgetary subsidies, etc [8].

M.V. Matveeva, A.P. Chuprov analyze a role of state policy. As sources of regional development they call, first, degree of regional openness, secondly, activity of industrial innovations, thirdly, resistance to influence of external factors, and at last, harmony of regional development [9].

Speaking about the industrial capacity of Khabarovsk Krai, K.V. Filippova calls the following reasons constraining regional industrial development: structural isolation from other part of Russia, low intraregional transport communication, the focal nature of resettlement at low population density [10].

Investigating success of small and medium-sized enterprises of Chelyabinsk region, a source of growth of the industrial enterprise V.I. Barkhatov calls the intellectual capital of the businessman and worker who forms the base of technological production [11,12,13]. D.S. Bents and E.S.

Silova also research the factors of growth and development of Chelyabinsk region. These authors investigate questions of agricultural sector. Authors assume that food security [14] can be a source of regional industrial growth. Investigating growth and development factors of any economic system, Yu.Sh. Kapkaev and D.A. Sorokin on the first place put a factor of the comfortable environment [15].

In international literature devoted to regional development, today the dominant theory is the cluster theory (Wolman H., Hincapie D., 2015) [16]. The cluster theory suggests firms that are part of clusters acquire additional competitive advantages, which has a positive effect on economic growth and business activity in the region. C. S. Fowler and R. G. Kleit justify the influence of industrial regional clusters on lowering poverty in regions, showing the main regularities of this process [17].

In Peter Nijikamp's papers such concept as the "resource" region within the analysis of new strategy of regional growth is researched. Indicating the need of integrating regional policy, this author posits a concept of the resource region, which outlines a set of the opportunities and conditions necessary for development [18]. The combination and optimization of the present possibilities becomes the main task of regional policy.

Also in some studies, attention to problems of old industrial regions development abroad is examined. For example, Lars Coenen, Jerker Moodysson and Hanna Martin research opportunities and restrictions of innovative regional policy, including the capacity, barriers and restrictions of development in old industrial regions. They conduct this study using the regions of Northern Sweden occupied with forestry as an example [19]. Birch, K., MacKinnon, D., Cumbers, A. and Hassink, R. also explored the problem of old industrial regions' development [20,21]. Henderson, S. R. studies the ways of transforming old industrial regions in England [22].

The set of researches is devoted to the nature of the industrial region [2,3] and also questions of regional growth and competitiveness [2,4], sources of such growth [2,5,6,7,23]. Nevertheless, there is no definite and universal answer to a question – what these drivers of growth of the industrial region.

### III. Materials and methods

For the further analysis we will accept that the industrial region is that one where the share of industrial production exceeds 50%.

According to the federal law number 488 from 31.12.2014 "About industrial policy in Russian Federation" industry is understood as "the set of the types of economic activity relating to mining, the processing production, ensuring with electric energy, gas and steam, air conditioning, water supply, water disposal, the organization of collecting and recycling, and also elimination of pollution defined on the basis of the All-Russian Classifier of Economic Activities (RCEA)" [24]. According to RCEA it is four sections: B – mining; C – the processing productions; D – providing with electric energy, gas and steam, air conditioning; E – water supply, water

disposal, organization of collecting, recycling, elimination of pollution. [25].

In the Ural Federal District a share of only two sections (B and C) in a total amount of regional revenue as of the end of 2016 has made 64,35% [26]. In view of the fact that authors of article are residents of the Ural Federal District, the analysis will be concentrated on this federal district.

For the quantitative analysis we use the econometric tools. We will take the function of Kobba-Douglas which has appeared in the economic theory in the first third of the 20th century as a basis. In original the function looks so:

$$Q = A \cdot L^{\alpha} \cdot K^{\beta} \qquad (1)$$

where
$Q$ – production quantity,
$K$ – capital;
L – labour;
$A, \alpha, \beta$ – function parameters.

All available statistical regional reporting, as a rule, contains the data in cost units. Therefore, when we constructed econometric model we can receive doubtful result because of autocorrelation. The autocorrelation is an interdependence of the casual remains of regression model. The autocorrelation is, as a rule, characteristic for temporary ranks. We analyze such selection in our research. The probability of autocorrelation in our case, really, is high as we used indicators with cost units. Dynamics of cost indicator is, as a rule, inertial. Namely, the lag effect of many economic laws is also the reason of autocorrelation. Therefore, to reduce probability of autocorrelation, we modify function will use not just sizes, but indexes (growth rates):

$$i_Q = A \cdot i_L^{\alpha} \cdot i_K^{\beta} \qquad (2)$$

where

$i_Q$ – growth rate of regional companies revenue;

$i_L$ – growth rate of regional companies labour resources;

$i_K$ – growth rate of regional companies capital resources;
$A, \alpha, \beta$ – function parameters.

For deeper analysis we construct several functions:

*Regression 1:* covers all sectors of the Ural region – all sections RCEA (including the industrial sector). As an indicator "$L$ – labour" we'll accept the average number of workers in all sector in the region (people); as an indicator "$K$ – capital" – investments into real capital (thousand rubles). $Q$ – sales of the companies (all sectors of economy).

*Regression 2:* is similar to Regression 1, however, as an indicator "$L$ – labour" we'll accept fund of the wage (thousand rubles) charged in the region.

*Regression 3:* selection is represented here by the companies only of the section B according to RCEA (mining). As an indicator "$L$ – labour" we'll accept the average number of workers in the section B in the region (people); as an indicator "$K$ – the capital" – investments into real capital of

the section B (thousand rubles). $Q$ – sales of the companies of the section B.

***Regression 4:*** is similar to Regression 3, however, as an indicator "$L$ – labour" we'll accept fund of the wage (thousand rubles) charged in the region according to the section B.

***Regression 5:*** is similar to Regression 3, however, selection includes only the companies of the section C RCEA (the processing productions).

***Regression 6:*** is under construction similar to Regression 4. Selection includes the companies of the section C RCEA (the processing productions).

Regressors and selection are given in the Table 1.

TABLE I.     REGRESSIONS ARE LIKE $i_Q = A \cdot i_L^\alpha \cdot i_K^\beta$

| Models | Regressors | | The selection, section RCEA |
|---|---|---|---|
| | *1* | *2* | |
| Regression 1 | Growth rate of the average number of workers | Growth rate of the investments into real capital | All sections |
| Regression 2 | Growth rate of the wage fund | Growth rate of the investments into real capital | All sections |
| Regression 3 | Growth rate of the average number of workers | Growth rate of the investments into real capital | Section B |
| Regression 4 | Growth rate of the wage fund | Growth rate of the investments into real capital | Section B |
| Regression 5 | Growth rate of the average number of workers | Growth rate of the investments into real capital | Section C |
| Regression 6 | Growth rate of the wage fund | Growth rate of the investments into real capital | Section C |

The Source: Authors.

Creation of mentioned six functions assumes inclusion in model of only two regressors. However probably in practice there are many other factors affecting to growth of the region. Further we will analyse whether the condition of the financial market exerts impact on growth of the industrial region. For this purpose, as the third regressor we will include an indicator – "growth rate of banking credits directed to real capital". In this case the econometric model will be following:

$$i_Q = A \cdot i_L^\alpha \cdot i_K^\beta \cdot i_{BL}^\gamma \qquad (3)$$

where

$i_Q$ – growth rate of regional companies revenue;

$i_L$ – growth rate of regional companies labour resources;

$i_K$ – growth rate of regional companies capital resources;

$i_{BL}$ – growth rate of banking credits directed to real capital;

$A, \alpha, \beta, \gamma$ – function parameters.

Let's construct several functions with mentioned three regressors.

***Regression 7:*** The selection includes the companies of the section B according to RCEA (mining); an indicator "$L$ – labour" is the average number of workers in the sector B in the region (people); an indicator "$K$ – the capital" is investments into real capital of the section B (thousand rubles); an indicator "$BK$ – the banking credits" is the volume of banking credits directed to real capital (thousand rubles). $Q$ – sales of the companies of the section B.

***Regression 8:*** is similar to Regression 7, however, as an indicator "$L$ – labour" we'll accept fund of the wage (thousand rubles) charged in the region.

***Regression 9:*** is similar to Regression 7, however, the selection includes the companies of only section C RCEA (the processing productions).

***Regression 10:*** is constructed similar to Regression 9 (section C); includes indicators from Regression 8.

Let's summarize all mentioned above in the Table 2.

TABLE II.     REGRESSIONS ARE LIKE $i_Q = A \cdot i_L^\alpha \cdot i_K^\beta \cdot i_{BL}^\gamma$

| Models | Regressors | | | The selection, section RCEA |
|---|---|---|---|---|
| | *1* | *2* | *3* | |
| Regression 7 | Growth rate of the average number of workers | Growth rate of the investments into real capital | Growth rate of banking credits directed to real capital | Section B |
| Regression 8 | Growth rate of the wage fund | Growth rate of the investments into real capital | Growth rate of banking credits directed to real capital | Section B |
| Regression 9 | Growth rate of the average number of workers | Growth rate of the investments into real capital | Growth rate of banking credits directed to real capital | Section C |
| Regression 10 | Growth rate of the wage fund | Growth rate of the investments into real capital | Growth rate of banking credits directed to real capital | Section C |

The Source: Authors.

## IV. RESULTS

Results of all ten functions will be the following (the period 2005-2016) $\beta = \chi$.     (1)     (1)

*Regression 1:*

$$i_Q = 1,029 \cdot i_L^{0,161} \cdot i_K^{0,537} \qquad (4)$$

The equation is significant at the level of 5%. The coefficient of determination $R^2 = 0.63$. The importance of parameters of the equation at the level of 5%: $A$ and $\alpha$ are not significant, $\beta$ is significant.

*Regression 2:*

$$i_Q = 1,035 \cdot i_L^{-0,278} \cdot i_K^{0,69} \qquad (5)$$

The equation is significant at the level of 5%. The coefficient of determination $R^2 = 0.64$. The importance of

parameters of the equation at the level of 5%: *A* and *α* are not significant, *β* is significant.

*Regression 3:*

$$i_Q = 1,027 \cdot i_L^{-0,56} \cdot i_K^{0,48} \tag{6}$$

The equation is not significant at the level of 5%. The coefficient of determination $R^2=0.38$. The importance of parameters of the equation at the level of 5%: *A* and *α* are not significant, *β* is significant.

*Regression 4:*

$$i_Q = 1,094 \cdot i_L^{-0,9} \cdot i_K^{0,637} \tag{7}$$

The equation is not significant at the level of 5%. The coefficient of determination $R^2=0.45$. The importance of parameters of the equation at the level of 5%: *A* and *β* are significant, *α* is not significant.

*Regression 5:*

$$i_Q = 1,29 \cdot i_L^{4,053} \cdot i_K^{-0,258} \tag{8}$$

The equation is significant at the level of 5%. The coefficient of determination $R^2=0.49$. The importance of parameters of the equation at the level of 5%: *A* and *α* are significant, *β* is not significant.

*Regression 6:*

$$i_Q = 0,99 \cdot i_L^{1,533} \cdot i_K^{-0,149} \tag{9}$$

The equation is significant at the level of 5%. The coefficient of determination $R^2=0.58$. The importance of parameters of the equation at the level of 5%: *A* and *β* are not significant, *α* is significant.

*Regression 7:*

$$i_Q = 1,035 \cdot i_L^{-0,257} \cdot i_K^{0,582} \cdot i_{BL}^{-0,064} \tag{10}$$

The equation is significant at the level of 5%. The coefficient of determination $R^2=0.83$. The importance of parameters of the equation at the level of 5%: *A, β* and *γ* are significant, *α* is not significant.

*Regression 8:*

$$i_Q = 1,022 \cdot i_L^{0,232} \cdot i_K^{0,508} \cdot i_{BL}^{-0,068} \tag{4}$$

The equation is significant at the level of 5%. The coefficient of determination $R^2=0.84$. The importance of parameters of the equation at the level of 5%: *A* and *α* are not significant, *β* and *γ* are significant.

*Regression 9:*

$$i_Q = 1,328 \cdot i_L^{4,412} \cdot i_K^{-0,135} \cdot i_{BL}^{-0,4} \tag{4}$$

The equation is not significant at the level of 5%. The coefficient of determination $R^2=0.49$. The importance of parameters of the equation at the level of 5%: *A, α* and *γ* are significant, *β* is not significant.

*Regression 10:*

$$i_Q = 0,99 \cdot i_L^{1,718} \cdot i_K^{0,006} \cdot i_{BL}^{-0,482} \tag{4}$$

The equation is significant at the level of 5%. The coefficient of determination $R^2=0.65$. The importance of parameters of the equation at the level of 5%: *A* and *β* are not significant, *α* and *γ* are significant.

## V. CONCLUSION

Unfortunately, any of the received equations isn't completely adequate. Nevertheless, in view of the fact that the most equations are significant according to F-statistics, it is possible to make a number of conclusions. Firstly, correlation between growth of investments into real capital and growth of enterprises revenue unambiguously positive. We can see it from the equations 1, 2, 7, 8, 10 – degrees *β*.

Secondly, in the 5th, 6th and 10th equations degree *α* is significant, and also, positive. It means that with growth of both the number of workers, and the salary fund enterprises revenue will grow. This dependence is characteristic of the processing productions (section C). For all sectors in general and the section B, in particular, we can't make such conclusion as degree *α* in all other equations is not significant.

Thirdly, the impact of growth rates of labour resources to revenue is many times higher than the influence of capital resources (degree *α* in the equations where it is significant, namely in the 5th, 6th and 10th, is higher than degree *β* which is significant in the equations 1, 2, 7, 8, 10).

Fourthly, if to analyze the equations 7 – 10, then there is obvious feedback between growth of enterprises revenue and growth of the banking credits directed to real capital. In other words, the banking credits directed to real capital are higher the growth rates of enterprises revenue are lower. Meanwhile, such feedback was characteristic both for sector "mining" (section B), and for sector "the processing productions" (I have undressed C).

Thus probably we can speak about "financial trap". Let's call so revealed phenomenon. Possibly, the banking credits are so expensive to the industrial enterprises that even with rather essential growth of bank crediting, the similar growth of revenue at the same time isn't observed. Therefore, it is impossible to call the banking credit "driver" of growth of the industrial region in any way.

## *Acknowledgment*

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