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DYNAMICS OF LABOUR PRODUCTIVITY IN REGIONS OF RUSSIA

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Abstract

The article analyses the dynamics of labour productivity in Russian regions during 2003–2018. Non-informativity has been determined in inter-regional comparison of index of labour productivity per a certain year due to the low base effect. To increase the adequacy of the analysis results a model for labour productivity growth in the regions of the Russian Federation was created basing on the econometric models of panel data. It has been shown that during the period of 2010–2018 the dynamics of labour productivity in the regions in Russia was provided by: the industrial output, real salary, fixed investments, number of the unemployed, average annual number of the employed people, value added ratio of the high-tech and knowledge-intensive industries in Gross Regional Product. It has been proved that the rise in labour productivity in regions during the denoted period is provided by the decrease in the number of the employed and high rates of the industrial production. It has not been proved that the dynamics of the labor productivity is influenced by the level of education of the employed as well as high productivity of export-oriented regions in Russia has not been proved either. These results allow suggesting a new hypothesis about the presence of the ineffective workplaces in the economy of Russia and their influence on the dynamics of the labour productivity.

Keywords: Regions in Russia, labour productivity, index of labour productivity, Cobb-Douglas production function, econometric mode

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1. Introduction

In deceleration of economic growth in Russia due to such factors as COVID-19, declining oil prices and high ruble volatility the issues of labour productivity increase are acute. For the performance management there is a problem to discover factors determining spacial and temporal labor differentiation in the regions of the Russian Federation in contemporary economic conditions.

To monitor and analyze labour productivity across the RF and in the context of the subjects there is an imperfection of the approaches to measure it and lack of the characteristic data. Federal State Statistics Service publishes data only about the index of labour productivity, which is calculated in the wider economy and in the regions of the RF as physical quantity subscript of the Gross Domestic Product (or Gross Regional Product) and index of labour combined costs. Data on index of labour productivity approved by this method are available since 2008 across the RF regions.

2. Problem Statement

Factors of labour productivity across the RF regions determined by the econometric tools have been studied in the works of Russian scientists. Thus, the works by Averina et al. (2020), Basovskiy et al. (2019), Mirolubova (2016), Burtseva (2017), Rukobratskii (2019) prove basing on single moment or transparent regression equations in the form of unifactor and multifactor, linear or polynomial specifications, correlation analysis the influence of fixed assets value, investments, innovations, salary, inequality of income distribution, created highly-productive working places, information resources on labour productivity. Labour productivity in high-tech spheres of the Russian economy has been studied (Malykh & Gafarova, 2018). Modelling based on Cobb-Douglas production functions proved the influence of the average education period of the employed population on the labour productivity in the subjects of the Volga Federal District (Komarova, 2015). Basing on the spacial regression model a galvanizing effect of agglomerations has been proved on labour productivity growth among the urban population in Russian regions (Rusanovsky & Markov, 2015).

It should be noted that foreign researchers use more complex econometric tools and the variety of model specifications. Empirical works in the sphere of labour productivity modeling in EU can be given as examples. The quantitive assessment basing on spacial model of the impact of spacial external effects on labour productivity, connected with human assets and agglomerative economics are in the works by Azorin and Vega (2015). Innovation impact on labour productivity has been studied basing on the panel model in Solow model specification (Vieira et al., 2008). The impact of the structural changes on labour productivity convergence has been studied at the national, regional, industry levels basing on the dynamic model of the panel data (Naveed & Ahmad, 2016). Spacial distribution of technological knowledge and its impact on the labour productivity in manufacturing sectors of EU regions basing on the panel data models is analyzed in the work by Cainelli et al. (2007). Decomposition of labour productivity growth factors in the modern literature is diverse. They are staff turnover (Pereira da Rocha et al., 2019), technological innovations (Kijek & Kijek, 2019), scientific studies productivity (Rubin & Callaghan, 2019). Some works have been devoted to the development of the labour productivity assessment methodology in some spheres (Espinosa-Garza et al., 2017).

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3. Research Questions

Dealing with long-term index of labour productivity in the Russian Federation we can see an existing long-term negative tendency of labour production decrease after the Russian financial and economic crisis in 2008–2010 (fig. 1).

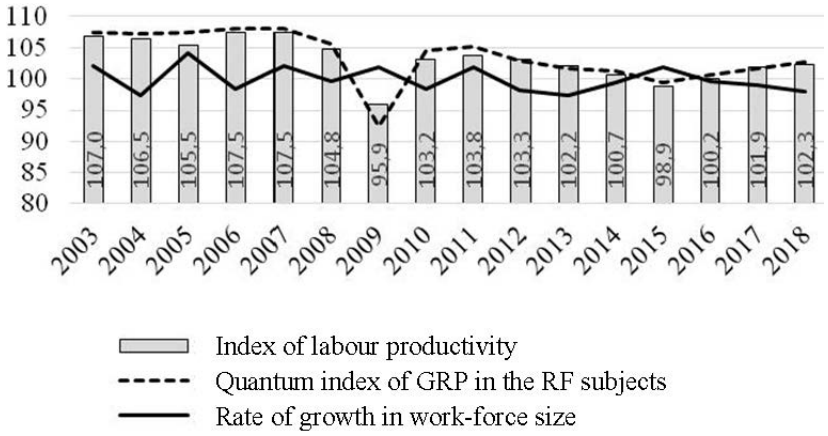

Figure 1. Dynamics in index of labour productivity, quantum index of GRP in the RF subjects and rate of growth in work-force size in the Russian Federation in 2003 – 2018, %. The source: author's development based on the data obtained from Federal State Statistics Service (https://www.gks.ru/)

In 2009 the labour productivity loss and physical quantity of GRP in the RF regions was 4.1 and 7.6 points correspondingly at labour force increase by 2 points. In 2010-2011 and during the last three years there was an economic recovery of labour productivity and GRP physical quantity in the RF subjects due to work force decrease, and comparative low crisis 2009 and 2015. During the period after the crisis in 2009 till nowadays average annual rate of growth in labour productivity in the RF was about 1.8 % against higher average increase of GRP physical quantity 2.3 % and annual work force decrease by 0.7 %. To compare, during the period 2003–2008 annual average growth rate of productivity was 106.5 % annual work force growth 100.7 %.

The RF subjects are highly different in labour productivity. In 2008–2018 the greatest annual average labour productivity growth was in the Republic of Adygeya (105.1 %), the Belgorod region (105.1 %), the Kaluga region (105.0 %). Annual loss in labour productivity in 2008–2018 was only in two subjects: in the Chechen Republic (99.4 %) and the Ivanovo region (99.0 %). Instability of leaders in the group by the labour productivity index in 2017, 2018 and 2008–2018 evidences about the imperfection of the inter-regional comparison of labour productivity increase in a certain year, as the values of labour productivity index in region-leaders are the result of little comparison base.

It is notable, that among the leaders in 2017 and 2018 by labour productivity index there is only one subject-participant of the national project for the increase of labour productivity in the studied period – (the Perm Territory in 2017 and the Tyumen region in 2018). At the same time high indexes in the Perm Territory in 2017 and the Tyumen region in 2018 are also explained by low index in the previous year. By the results in 2017 in 14 RF subjects there was a loss in labour productivity, in 2018 in 8 RF subjects. To

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compare in 2009 and in 2015 against crisis in economics the loss in labour productivity was in 53 and 31 RF subjects correspondingly.

4. Purpose of the Study

In order to provide the labour productivity increase in Russian economics it is necessary to distinguish factors which determine spacial and temporary differentiation of productivity in regions of Russia in contemporary economic situation. The dynamics of labour productivity in Russian regions is analysed in 2003–2018 with application of the panel model.

5. Research Methods

The model for the labour productivity index is based on the data across the RF regions in 2010-2018. The period is determined by the data on the amount of the highly productive working places and amount of products of high-tech and knowledge-intensive industries in the GRP. Econometric modeling is based on panel data methods in terms of specification by the type of expanded Cobb-Douglass production function:

$$y_{it} = A \cdot \prod_k x_{k_{it}}^{\alpha_k} \cdot e^{\gamma_t} \cdot e^{\beta_i} \cdot e^{u_{it}}, \quad (1)$$

where y_{it} is a dependent variable, characterizing labor productivity growth in *i*-th subject in the RF at the moment of time *t*, $x_{k_{it}}$ are influence factors of *i*-th subject of the RF at the moment of time *t*, u_{it} – odds of the regression equation of the *i*-th region in the RF at the moment of time *t*, β_i are fixed individual effects, which characterise immeasurable individual differences of the RF regions, γ_t – are recorded temporal effects which characterise changes for all RF regions in time. The multiplier A characterizes the contribution of science-technological progress into the labour productivity increase.

The model (1) is estimated in logarithms by the equation:

$$ln\, y_{it} = ln A + \sum_k \alpha_k \cdot ln\, x_{k_{it}} + \beta_i + \gamma_t + u_{it}. \quad (2)$$

6. Findings

The results of model estimation by the form (2) are in table 1. Model 1 includes all the range of analyzed factors which include insignificant variables. There is also multicollinearity of factors due to noticeable correlation between the change of the number of high-productive working places and real salary of workers in the RF subjects. Further choice of factors and forms of panel models showed that the best model is the one with individual and temporary fixed effects in table 1 (model 2) and includes only statistically important factors.

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Table 1. The results of modeling the labour productivity index in the RF regions in 2010–2018 (a dependent variable – a logarithm for index of labour productivity in the RF subject)

Factors	Coefficient values	
	Model 1	Model 2
Constant (logarithm *A*)	5.397***	5.226***
Logarithm of industrial production index	0.148***	0.151***
Logarithm of real salary	0.069	0.095**
Logarithm of investments physical volume into the basic capital	0.051***	0.048***
Logarithm of the share of added value for hi-tech and knowledge-intensive industries in to the GRP at the previous period of time	0.040**	0.032**
Logarithm of changes in the number of unemployed at the age of 15–72 years	-0.007	-0.019**
Logarithm of changes in the annual number of the employed	-0.482***	-0.428***
Logarithm of export changes	0.006**	×
Logarithm of changes in the number of highly productive working places	0.037*	×
Logarithm of changes in the share of internal spending on the research and innovations into the GRP at the previous period of time	0.007	×
Logarithm of employees at the age of 15–72 years with high education	-0.016	×
Logarithm of employees at the age of 15–72 with the vocational education for specialists with middle ranking	-0.010	×
Logarithm of employees at the age of 15–72 with the vocational education for qualified workers and office workers	-0.005	×

Notes: * – the significance of the coefficient at the level of 10 %; ** – the significance of the coefficient at the level of 5 %; *** – the significance of the coefficient at the level of 1 %; × – excluding the factor from the model.
The source: author's development.

The economic modeling shows that the increase in labor productivity in the RF regions is provided by the increase of the industrial production, real salary and physical quantity of fixed investment, decreasing the number of unemployed and annual number of employed. Besides, in the regions with high share of added value into high-tech and knowledge based industries in GRP of the subject at other equal conditions, the labor productivity increase was higher.

Greater labour productivity growth in the regions is provided by the decrease of the employed. Fig. 2.a shows the correlation field for the labor productivity index (%) and changes of annual number of employees (%) in the RF regions in 2018 which demonstrates the reverse interdependence between the test parameters. Among 80 RF subjects tested in 59 regions there is a growth in the labour productivity against the slowdown of the average annual number of the employed, and in 7 regions, there is a decrease in labour productivity at the increase of the employed. The highest growth of the labour productivity was in the RF subjects with the highest rates of the average annual number of the employed.

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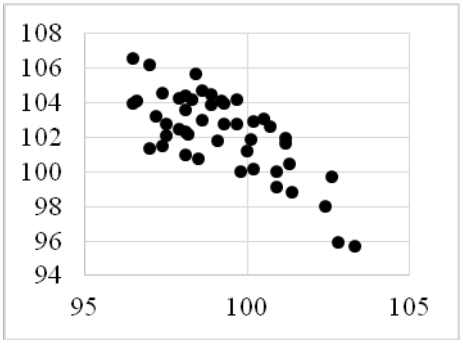
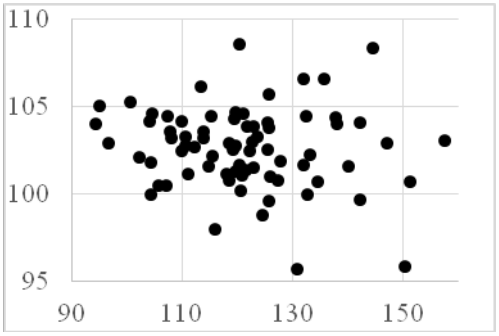


a) changes of the average annual number of the employed people, % (X axis) and the labour productivity index, % (Y axis)



b) export changes, % (X axis) and and the labour productivity index, % (Y axis)

Figure 2. Scatter diagram of the tested parameters for the RF regions in 2018.The source: author's development based on the data obtained from Federal State Statistics Service (https://www.gks.ru/)

At the same time, changes in the number of the unemployed have statistically important influence on the labor productivity. As calculations show, slow down in unemployment growth rates by 1 % in the RF subjects resulted in the increase of the labor productivity index by 0.02 % at other constant factors. On the one hand the reverse dependence of the labour productivity and unemployment can be considered a positive effect. On the other hand, a low level of productivity means latent unemployment and ineffective working places. Different forecasts of the economic development show that labor productivity increase in digitalization will inevitably result in the unemployment growth. The unproved hypothesis on the influence of the employees' level of education on the labour productivity growth can be a consequence of low labor market efficiency.

7. Conclusion

According to the modeling results the important factor of labor productivity growth is the index of the industrial production. This result predictably correlates with the industry-specific differentiation of the labor productivity, and the predominance among the participants of the national project "Labour productivity and employment support" manufacturing enterprises. Here, we should turn to the poll results of the industry enterprises (Karlova et al., 2019), which showed that large export-oriented industrial enterprises are not always highly productive. This research does not disclose the impact of changes in export rates to the far-abroad countries and the CIS countries on the labour production index. Fig. 2.b. shows the visualization of interconnectedness of export growth rates and labor production index. The chaotic scatter of the points on the graph evidences the absence of relation between the labor productivity growth and faster export rates in the RF regions. In this connection we think that the programmes of export acceleration within the national project "Labour productivity and employment support" are acute and allow increasing the productivity of the export-oriented enterprises.

The received model results also evidence that the increase in real salary is a motivational factor of labor productivity growth. However, the elasticity of the labor productivity index in real salary in the RF subjects remains low: 0.1 %. In its turn, low increase in labor productivity cannot provide further increase

in salary. Going off the endless circle is in creating new highly productive working places and labour efficiency increase. Low elasticity of labor productivity has place in the fixed investments and share of added value of high-tech and knowledge-based branches in GRP (correspondingly 0.05 % and 0.03 %). It evidences about the necessity of increase in investments and innovations efficiency.

Drawing the conclusion, it should be noted that the reserves of labour productivity increase in the RF regions should be looked for in the increase of their innovative activity and investments efficiency, creating new highly productive working places, introduction of high technologies, improving the process organization, and advance of workers professionalism and qualifications.

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