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Structural and Dynamic Changes in Economy and Labor Productivity

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ABSTRACT

Purpose. Modern conditions of socio-economic development lead to structural changes in the economy. Structural changes are of particular relevance due to their influence on the change in the performance of economic sectors. *Methodology.* We analyzed structural changes in the economy of the Russian Federation and identified their impact on labor productivity in this study. *Approach.* We calculated indicators of structural differences between economic activities. We performed a factor analysis of changes in the average labor productivity in the economy. The study made it possible to draw a number of conclusions regarding the structural and dynamic changes in the economy and changes in labor productivity in the Russian Federation. *Findings.* Significant differences in the types of economic activity of the Russian Federation by indicator of the structure of gross value added and the number of employees were in 1995-2019. A low significant level of differences in structures is observed in terms of the volume of investments in fixed capital. There is a movement of labor force into employment in a less productive service sector. The proposed methodology for analyzing structural changes using the indices of structural differences and the system of indices of changes in average labor productivity has practical value.

INTRODUCTION

Structural transformation is one of the processes of productivity growth (Ssozi and Bbaale, 2019). Structural changes in the economy are of particular relevance due to their impact on changes in labor productivity. Labor productivity is one of the main indicators of the efficiency of the economic entities operating in the economy. Modern realities are making their own adjustments to the already, it would seem, quite seriously developed models of labor productivity, the influence of various factors on its level. The growth of labor productivity ensures the success and stability of the country's economy on the world stage. It is important to study in this regard the contribution of economic activities and the structure of the economy to the growth of labor productivity. De Sousa Filho et al. (2020) note, that the production structure is an important field of research because it enables the assessment of sectoral policies and technological progress to support sustained economic growth in the long-term. Martins (2019) provides a

comprehensive assessment of structural change in the world economy. The analysis relies on a constructed dataset comprising 169 countries and covering the period from 1991 to 2013. The widespread reallocation of labor force from agriculture to the services sectors has been the key driver of structural change. The pace of structural change is significantly shaped by human and physical capital. The policy implication is that investments in education and economic infrastructure are crucial to accelerating structural change (Martins, 2019). Moussir and Chatri (2020) argue in their writings about the need to invest in education and human capital. Sukharev (2020) discusses about the role of education and science. The formation and development of the “knowledge economy” is an important characterization of the modern global world (Pejanovic, 2020), and this process depends a lot from the development of education and science, which ensure the production and transfer of knowledge. In this regard, the dimension of the influence of this aggregated sector on the dynamics of the development of the economy as a whole is of importance.

Ssozi and Bbaale (2019) analyze how international contacts and domestic absorptive capacity constraints are shaping the pattern of structural transformation. Services that involve transfer of skills and technology, such as international tourism and information and communications technology services exports, provide opportunities for structural change and productivity growth. Pariboni and Tridico (2019) explain the determinants behind the decline of labor share in the last three to four decades in OECD countries. This decline was determined by financialisation and was deepened by the structural changes that occurred almost simultaneously in those economies. Financialisation, or finance-dominated capitalism, from the 1980s onwards, was a key element in the strategic offensive of the advanced countries' dominant classes to appropriate higher shares of national income and to restore their control over the political process, a control that had been threatened by a generalized advancement of the labor movement in the 1970s. The development of a finance-dominated capitalism was helped by the process of globalization. A new, though unstable, macroeconomic model emerged, which we will call financial capitalism. In financial capitalism, trade unions lost power vis-a-vis capital, labor flexibility increased enormously, and a structural change from manufacturing to services was accelerated in rich countries. This resulted in negative consequences for labor share and income inequality (Pariboni and Tridico, 2019).

Cruz and Raurich (2020) observe the following patterns in the US economy during the period 1965-2015: the rise of the service sector, the increase in leisure time, and the increase in recreational services. They measure the fraction of the value added of the service sector explained by the consumption of recreational services and we show that it increases during this period. The introduction of recreational services contributes to explain the rise of the service sector, inequality in leisure, and employment differences across countries caused by differences in income taxes (Cruz and Raurich, 2020). Scientists also link gender and migration issues in their impact on the structure of economy. Barba and Iraizoz (2020) use an input-output model and structural decomposition analysis to assess the contribution of factors such as technological change, changes in productivity and changes in final demand to the distribution of women's employment by industry. Hao et al. (2020) note that migration changes account for the majority of the reallocation of workers out of agriculture and the drop in regional inequality. Migration policy changes are central to China's structural change and regional income convergence. The recent slowdown in aggregate economic growth between 2010 and 2015 is associated with smaller reduction in inter-provincial migration costs and a larger role of capital accumulation (Hao et al., 2020).

Change in the share, role of certain types of economic activity falls into the sphere of interests of scientists. Zhang and Diao (2020) analyze the implication of structural change to the evolving role of agriculture using China as an example. The evolving role of the agriculture is quantitatively measured. By combining a growth decomposition exercise with Input-Output (IO) and CGE model analyses using China's seven input-output tables (IOTs) in 1987-2017 (Zhang and Diao, 2020). Han (2020) examines China's structural transformation. Labor transfer from the tradable sector to the no tradable sector would be accompanied by relatively large aggregate output changes due to population ageing and efficiency changes in the tradable sector. Consumer price and real exchange rates are less affected during structural transformation (Han, 2020). Dennis and Iscan (2020) develop a novel trade-accounting framework that is based on a multi-country, multi-industry model of trade. The framework links observed changes in wages, sectoral employment shares, total labor force, and bilateral trade costs to changes in bilateral trade values at the sector level. They quantify the changes in trade patterns from 1995 to 2010 among

15 advanced and emerging market economies attributable to structural change in China, focusing on three manifestations of trade creation and destruction: China's replacement of manufactured final goods exports to advanced economies at the expense of other economies; an expansion of China's imports of manufactured final goods and commodities; and an expansion of China's imports of parts and components that are then processed and exported as manufactured final goods to the advanced economies. Main findings are: scale effects have more than compensated for the loss of competitiveness due to higher wages in China; China's wage growth has been an economically more significant determinant of trade creation and destruction than its reallocation of labor across sectors, and structural change in China has shifted other countries toward more commodity-intensive production (Dennis and Iscan, 2020).

Scientists analyze structural changes at the macro and micro levels. Ganguly (2020) analyses the structural change in microenterprises located at India's unorganized manufacturing sector in terms of output mix, choice of technique and productivity. There is a significant structural change which has occurred in the small firm sector in Indian manufacturing. The share of capital-intensive industries has increased substantially in recent years. Further, though small firms are more labor intensive, the labor productivity and total productivity of these firms are very low. The falling labor productivity and rising capital intensity indicates replacement of labor with capital in Indian small firm sector. The findings have strong implications for creation of a viable ecosystem of entrepreneurship in the country (Ganguly, 2020). Goyal (2020) analyses structural changes and its implications on the growth of production and employment of the manufacturing sector in Punjab. To achieve the optimum level of employment opportunities and mitigate the current crisis there is a need to design a mechanism for encouraging investments in manufacturing sector particularly, in small scale industries. Small scale industries have a greater advantage over medium/large scale units, because it uses local inputs, creates more employment opportunities and needs less start-up capital than the latter (Goyal, 2020).

Research on structural change is constantly expanding, cover unexplored issues. Voskoboynikov (2020) note that strong growth, intensive structural change, and expanding informality have characterized many developing and emerging economies in recent decades. Yet most empirical investigations into the relationship between structural change and productivity growth overlook informality. Labor reallocation from the formal sector to the informal sector tends to reduce growth through the extension of informal activities with low productivity levels (Voskoboynikov, 2020). Cardinale and Scazzieri (2019) researched theories of structural change identify the range of transformations that are possible under given economic structures. However, in order specify a path of change out of those which are possible, these theories need to make explicit or implicit assumptions about actions taking place within structures. These theories can identify potential, but not actual paths of change. Structural change is to some degree open-ended, because existing structures open up a range of possibilities but do not determine the specific actions taken therein. In order to explain which path of structural change is activated under specific historical conditions, we need to study how actual actions take place within structures (Cardinale and Scazzieri, 2019). This leads to the use of index, factor analysis in space and in time (Khasanov et al., 2020; Zaynagabdinov et al., 2020).

The purpose of the study of Sukharev and Voronchikhina (2020) is to determine the degree of impact of investment in technological renewal on economic growth, to establish the ratio of the contribution of investment in old and new technologies to the growth rate. This problem is solved when considering the GDP structural dynamics by expenditure in the case of the United States, Germany, Russia and China. The research methodology is based on structural analysis, which establishes a "structural formula" assessing the contribution of investment in new and old technologies to the growth rate of the economy, as well as the contribution of other GDP components by expenditure. This approach allows us to distinguish the existing models of economic growth in the countries under consideration - consumer, investment, mixed models and technological development modes according to the sensitivity of the overall technological economy to investment in new and old technologies (Sukharev and Voronchikhina, 2020).

Sukharev and Voronchikhina (2020) N. conduct a structural analysis of the Chinese economic growth in comparison with the United States, Germany, Japan, and Russia, as well as to identify features of its structural dynamics and macroeconomic policy. Three basic growth models are defined. The model based on the dominance of gross consumption in the USA and Russia, investment in China, and a mixed growth model in Germany and Japan (Sukharev and Voronchikhina, 2020). Ciarli et al. (2019) study the

relation between income distribution and growth, mediated by structural changes on the demand and supply sides. Using the results from a multi-sector growth model, they compare two growth regimes that differ in three aspects: labor relations, competition and consumption patterns. Both institutional and structural features explain differences. Amongst structural determinants, firm organization and the structure of demand are particularly relevant (Ciarli et al., 2019).

Our research contributes to the study of structural changes in the economy and their impact on labor productivity. It is based on the relative values of the structure, uses the calculation of complex relative values such as indices and their systems. The proposed research methods are transparent, applicable to temporal datasets. Structural transformations of the economy are taking place in all countries, including the Russian Federation. Their study and understanding is important for determining the strategy for the development of the economy and society, identifying reserves for increasing the performance of enterprises in all sectors of the national economy, meeting the needs of society for benefits. Changes in the economy and the labor market in the Russian Federation are taking place in modern conditions. People's thinking, their vital interests and priorities are changing too. The digital economy is developing. This has a great influence on the emergence or disappearance of some professions, which of course will affect the structure of the economy and labor productivity. These processes are actively taking place in the Russian Federation. The purpose of this study is to analyze the structural changes in the economy of the Russian Federation and to determine their impact on labor productivity. Research objectives are:

- to analyze the structural differences between types of economic activity, identify trends in structural development;
- to study the change in the share of indicators by type of economic activity;
- to carry out a factor analysis of changes in labor productivity in the economy, to determine the impact of structural differences on labor productivity and to outline directions for increasing labor productivity.

1. METHODS AND MATERIALS

The methodology of this study is represented by a system of methods. We measure structural changes in the economy using the Ryabtsev structural differences index. Ryabtsev index is calculated by the formula:

$$I_R = \sqrt{\frac{\sum_{i=1}^n (d_i^1 - d_i^0)^2}{\sum_{i=1}^n (d_i^1 + d_i^0)^2}} \quad (1)$$

where d_i^1, d_i^0 – unit weights of features in statistical populations in reporting and base periods; i – number of gradations in structures (Ryabtsev and Chudilin, 2001). Comparison is made for five-year periods since 1995. Annual changes in the scale of the country's economy are not very significant. The use of five-year periods was preferred.

This index can be applied to any set of statistical data. There is a scale for assessing the significance of structural differences. It allows to explain the calculation results without using comparative analysis (Table 1).

Table 1. Scale for assessing the significance of structural differences according to Ryabtsev index

| Index value | Characteristic of the measure of structural differences |
|----------------|---|
| 0.000 – 0.030 | Identity of structures |
| 0.031 – 0.070 | Very low level of structural differences |
| 0.071 – 0.150 | Low level of structural differences |
| 0.151 – 0.300 | Low significant level of structural differences |
| 0.301 – 0.500 | Significant level of structural differences |
| 0.501 – 0.700 | Very significant level of structural differences |
| 0.701 – 0.900 | Opposite type of structures |
| 0.901 and over | Complete opposite of structures |

Source: Ryabtsev and Chudilin, 2001.

Indicators of the share of gross value added by type of economic activity in its total volume, employed by type of economic activity in their total number, investment in fixed capital by type of economic activity in the total amount of investments are taken as indicators to assess the structure of the economy and its changes. These indicators characterize the resource provision of the types of economic activities, the results of activities, the preferences of the economically active population (labor force) in the choice of employment depending on various factors. The use of relative structural values makes it possible to eliminate the influence of the price factor.

We conduct an index analysis of the average labor productivity using a system of indices of variable composition, constant composition and structural changes for factor analysis of the level of labor productivity depending on structural changes in the economy in dynamics. The index of average labor productivity of variable composition reflects the change in average labor productivity in the economy as a whole. It is formed under the influence of two factors: changes in the level of labor productivity for each type of economic activity and structural changes. Structural changes are a change in the share of employed by types of economic activity in the total number of employed in economy. The index of average labor productivity of constant (fixed) composition shows the influence of the first factor. The index of structural changes shows the impact of changes in the structure of employed in the economy on average labor productivity. We are most interested in it in the context of this study.

Average labor productivity index of variable composition:

$$I_{\bar{x}} = \frac{\sum x_1 f_1}{\sum f_1} : \frac{\sum x_0 f_0}{\sum f_0} \quad (2)$$

Average labor productivity index of constant (fixed) composition:

$$I_{\bar{x}/x} = \frac{\sum x_1 f_1}{\sum f_1} : \frac{\sum x_0 f_1}{\sum f_1} \quad (3)$$

Structural change index:

$$I_{\bar{x}/str.change} = \frac{\sum x_0 f_1}{\sum f_1} : \frac{\sum x_0 f_0}{\sum f_0} \quad (4)$$

where x_1, x_0 – gross value added per one employee by type of economic activity in Russian Federation in reporting and base periods, thousands dollars per one employee (labor productivity);

f_1, f_0 – annual average number of employed by economic activity in Russian Federation in reporting and base periods, thousands persons (Magasumovna et al., 2017).

The source and materials of information at all stages of the study was the official data of the Federal State Statistics Service of the Russian Federation for 1995-2019 (Federal state statistics service of the Russian Federation, n.d.).

2. RESEARCH RESULTS

We present the values of the relative indicators selected for analysis for last four years to characterize the structure of the economy of the Russian Federation (Table 2).

Table 2. Structure of indicators by economic activities, percent of total

| Economic activities | Gross value added | | | Annual average number of employed | | | Investments in fixed capital | | |
|---------------------|-------------------|-------|---------------------------------|-----------------------------------|-------|---------------------------------|------------------------------|-------|---------------------------------|
| | 2015 | 2019 | 2019 to 2015, percentage points | 2015 | 2019 | 2019 to 2015, percentage points | 2015 | 2019 | 2019 to 2015, percentage points |
| Total | 100.0 | 100.0 | x | 100.0 | 100.0 | x | 100.0 | 100.0 | x |

| | | | | | | | | | |
|--|------|------|------|------|------|------|------|------|------|
| Agriculture, forestry and fishing | 4.3 | 3.9 | -0.4 | 6.7 | 5.8 | -0.9 | 3.7 | 4.3 | 0.6 |
| Mining and quarrying | 9.8 | 12.9 | 3.1 | 2.1 | 2.3 | 0.2 | 17.2 | 17.0 | -0.2 |
| Manufacturing | 13.8 | 14.4 | 0.6 | 14.0 | 14.3 | 0.3 | 15.6 | 14.5 | -1.1 |
| Electricity, gas, steam and air conditioning supply | 2.8 | 2.6 | -0.2 | 2.8 | 2.6 | -0.2 | 6.6 | 5.5 | -1.1 |
| Water supply; sewerage, waste management and remediation activities | 0.5 | 0.5 | 0.0 | 0.8 | 0.7 | -0.1 | 0.9 | 1.0 | 0.1 |
| Construction | 6.3 | 5.5 | -0.8 | 7.6 | 6.9 | -0.7 | 2.9 | 3.4 | 0.5 |
| Wholesale and retail trade; repair of motor vehicles and motorcycles | 15.8 | 13.1 | -2.7 | 15.7 | 15.6 | -0.1 | 3.9 | 4.1 | 0.2 |
| Transportation and storage | 6.7 | 6.8 | 0.1 | 8.4 | 8.8 | 0.4 | 15.5 | 16.9 | 1.4 |
| Accommodation and food service activities | 0.9 | 0.9 | 0.0 | 2.4 | 2.6 | 0.2 | 0.7 | 0.6 | -0.1 |
| Information and communication | 2.5 | 2.6 | 0.1 | 1.8 | 1.8 | 0.0 | 3.0 | 4.1 | 1.1 |
| Financial and insurance activities | 3.6 | 4.3 | 0.7 | 2.2 | 2.3 | 0.1 | 1.4 | 2.1 | 0.7 |
| Real estate activities | 10.1 | 9.8 | -0.3 | 2.0 | 1.7 | -0.3 | 18.5 | 15.1 | -3.4 |
| Professional, scientific and technical activities; administrative and support service activities | 6.9 | 6.4 | -0.5 | 5.1 | 5.8 | 0.7 | 4.0 | 5.3 | 1.3 |
| Public administration and defence; compulsory social security | 7.7 | 7.5 | -0.2 | 7.4 | 7.0 | -0.4 | 1.7 | 1.5 | -0.2 |
| Education | 3.1 | 3.2 | 0.1 | 9.2 | 9.5 | 0.3 | 1.7 | 1.8 | 0.1 |
| Human health and social work activities | 3.2 | 3.5 | 0.3 | 7.7 | 7.9 | 0.2 | 1.3 | 1.5 | 0.2 |
| Arts, entertainment and recreation | 0.9 | 1.0 | 0.1 | 1.7 | 2.0 | 0.3 | 1.3 | 1.2 | -0.1 |
| Other service activities | 0.5 | 0.6 | 0.1 | 2.4 | 2.4 | 0.0 | 0.1 | 0.1 | 0.0 |
| Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use | 0.6 | 0.5 | -0.1 | x | x | x | x | x | x |

The data of Table 2 show that for 2015-2019 the largest increase was observed: by indicator of gross value added – the type of activity “Mining and quarrying” (+3.1 percentage points), in terms of the number of employed – the total type of activity “Professional, scientific and technical activities; administrative and support service activities” (+0.7 percentage points), for investments in fixed capital – the type of activity “Transportation and storage” (+1.4 percentage points). The largest decrease was observed: by indicator of gross value added – the type of activity “Whole sale and retail trade; repair of motor vehicles and motorcycles” (-2.7 percentage points), in terms of the number of employed – the type of activity “Agriculture, forestry and fishing” (-0.9 percentage points), for investments in fixed capital – the type of activity “Real estate activities” (-3.4 percentage points). The movement of labor and changes in the sphere of application of labor changes at a relatively low rate in comparison with the indicators of investment and production volume. Thus, the number of employed depends on the number of jobs created in the process of inflow of investments in a particular industry and an increase in the volume of gross value added as ensuring the flow of funds, making a profit, and a decent wage.

At the same time, not for all types of economic activity, the indicators of the structure have changed consistently. So, for the type of activity “Agriculture, forestry and fishing” the share of gross value added and employed decreased, and the share of investments in fixed capital increased. The opposite picture was observed for the type of “Mining and quarrying” – the share of gross value added and employed increased, while the share of investments in fixed capital decreased. There is a kind of balancing and regulation of indicators by type of activity – the outflow of labor from a strategically important industry causes an increase in investments. Also the growth of investments and the introduction of digital technologies leads to a decrease in the number of employed in the relevant sector of the economy. It is rather a negative process in the social life of society if the total number of employed decreases (with an increase in

unemployment). The number of people employed in the economy was 76.588 thousand people in the Russian Federation in 2015 (employment rate is 65.3% of the population), in 2019 – 75398 thousand people (59.4%). The number of unemployed was 4264 thousand people in 2015 (the unemployment rate was 5.6%), in 2019 – 3465 thousand people (4.6%). The structural changes that took place were rather neutral in terms of the impact on the living standards of the population. In general, an increase in the share of service sector in the structure of economy is observed. We will calculate the Ryabtsev structural difference indices for five-year periods starting from 1995 and give a description of the measure of differences for longer dynamics (Table 3).

Table 3. The values of the Ryabtsev structural differences index in the economy of the Russian Federation

| Period | By gross value added | | By annual average number of employed | | By investments in fixed capital | |
|-----------|----------------------|---|--------------------------------------|---|---------------------------------|---|
| | index value | characteristic of the measure of structural differences | index value | characteristic of the measure of structural differences | index value | characteristic of the measure of structural differences |
| 1995-2000 | 0.084 | low level | 0.048 | very low level | 0.195 | low significant level |
| 2000-2005 | 0.418 | significant level | 0.464 | significant level | 0.090 | low level |
| 2005-2010 | 0.076 | low level | 0.046 | very low level | 0.109 | low level |
| 2010-2015 | 0.153 | low significant level | 0.153 | low significant level | 0.167 | low significant level |
| 2015-2019 | 0.073 | low level | 0.027 | identity | 0.065 | very low level |
| 1995-2019 | 0.316 | significant level | 0.474 | significant level | 0.202 | low significant level |

Significant differences in the types of economic activity of the Russian Federation in terms of the structure of gross value added and the number of employed have been observed over 25 years. A low significant level of differences in structures is observed in terms of the volume of investments in fixed capital. At the same time, we observe such a picture that in 1995-2000 there were significant changes in the structure of the economy in terms of investment in fixed assets with very low levels of change in two other indicators. However, the investments made during the indicated period entailed a significant level of differences in the structure of gross value added and employed in the economy. Historically, during the transitional period, difficult for the country from 1995 to 2000, it turned out that the application of labor and the result of production turned out to be the most sensitive to investment. Such a strong reaction of some indicators to changes in others was not observed in the future. We assume that according to the final statistics for 2020 there will be significant changes in the structure of the economy. A retrospective analysis shows that particularly severe shocks occurring in history are causing significant changes in the structure of the economy.

For the development of society and the state, it is necessary that a change in the structure of economic activity lead to an increase in labor productivity. The index systems calculated because of official statistical data on the value of gross value added and the average annual number of employed by type of economic activity in the Russian Federation for five-year periods are shown in Table 4.

Table 4. Average labor productivity indices in the Russian Federation

| Period | Average labor productivity index of variable composition | Average labor productivity index of constant (fixed) composition | Structural change index |
|-----------|--|--|-------------------------|
| 1995-2000 | 0.825 | 0.799 | 1.032 |
| 2000-2005 | 2.886 | 3.339 | 0.864 |
| 2005-2010 | 1.891 | 1.874 | 1.009 |
| 2010-2015 | 0.861 | 0.897 | 0.960 |

| | | | |
|-----------|-------|-------|-------|
| 2015-2019 | 1.323 | 1.328 | 0.996 |
|-----------|-------|-------|-------|

Average labor productivity in the economy grew from 2000 to 2005, 2005-2010 and 2015-2019. This change was coordinated with the change in labor productivity for certain types of economic activity. Index of structural changes in above calculation results characterizes the effect on the change in average labor productivity in economy of the Russian Federation of changes in the structure of employed, that is, the share of employed by type of economic activity with one or another level of labor productivity on average in industry. Change in the structure of employment by type of economic activity had a positive effect on change in average labor productivity in economy of the Russian Federation from 1995 to 2000 and from 2005 to 2010. Movement of labor force between activities was from industries with lower level of labor productivity to industries with higher level of labor productivity. Movement of labor force between types of economic activity had a negative impact on the average labor productivity in economy of the Russian Federation in other five-year periods. There was a movement of labor force from industries with a higher level of labor productivity to industries with a lower level of labor productivity. This indicates the filling of jobs in high-performance industries and the need for a person to find a job in other areas of activity. And there is a movement of labor to employment in a less productive service sector. This trend is observed all over the world.

3. DISCUSSION OF THE RESULTS

Our results are consistent with the conclusions of world researchers. For example, Moussir and Chatri (2020) analyzed structural transformations in Morocco. The analysis of the economic structure reveals a structural inertia, linked to a volatile agricultural sector, a poorly and weak integrated industrial and service sector. The results of the decomposition show that the intrasectoral component (within) would account for much of the growth in labor productivity (Moussir and Chatri, 2020). Our study also showed that intrasectoral changes had the greatest impact on changes in labor productivity in economy (index of constant (fixed) composition).

Methods used by scientists to characterize the structure of economy are of great interest. De Sousa Filho et al. (2020) did research using input-output matrices for a short and long-term analysis which enabled us to verify the importance of twelve aggregate sectors regarding changes in production, final demand and technological coefficients. The production structure of Brazilian economy remains fragile and dependent on demand shocks for its growth. Manufacturing industry remains the major sector capable of promoting structural changes in production (De Sousa Filho et al., 2020). Wang and Lu (2020) explain the impact of structural change on innovation using a global sample for a panel of 75 developed and developing countries. They find a positive significant effect of service sector share and a significant negative impact of the agriculture sector share on innovation. Shifting away from the agriculture sector is found to be important for more advanced economies, while the industry sector is important for innovation among upper middle income economies. The low income economies generally benefit much less from their structural change efforts than lower middle, upper middle and high income economies do (Wang and Lu, 2020).

Results of our study are consistent with results of the analysis of growth decomposition in other countries. So the growth decomposition analysis shows that between 1978 and 2017, China doubled the size of its total labor force, while the absolute number of agricultural workers falls in this period (Zhang and Diao, 2020). An increase in the number of employed with a decrease in their number in agriculture was also observed in the analyzed period in the Russian Federation. Rising labor productivity in agriculture has led to rapid agricultural growth without increasing agricultural employment, allowing agriculture to indirectly contribute to the economy wide productivity growth through structural change. Exploring further integration between agriculture and the rest of the economy should be part of the new growth strategy (Khabirov et al., 2019; Zhang and Diao, 2020). A rationale for providing support to the farm sector in the course of economic development and structural change is a growing gap between the incomes of non-agricultural workers and the incomes of farmers. Stark and Falkowski (2019) think so. even without an increasing gap between the incomes of non-agricultural workers and the incomes of farmers, support to farmers might be needed/can be justified. This finding can inform policymakers who seek to alleviate the social stress of the farming population about the timing and intensity of this intervention (Sultanova

et al., 2019).

De Lima Almeida and de Freitas Balanco (2020) show that the use of multivariate analysis facilitates comparative static studies on the economy from a sectorial approach. An algorithm of cluster analysis, called affinity propagation, was used to find some temporal patterns in the multipliers in the US economy between 1997 and 2017. The study enabled to reach three main conclusions. First, to confirm that the established concept that structural changes in the US economy did not occur suddenly. Second, the five-year interval time (as upper limit) may be inappropriate for studies based on input-output analysis for the US economy in the period. Third, the formation of the clusters (periods with structural similarities) of both backward and forward multipliers was sensitive to the 2007 Financial Crisis (De Lima Almeida and de Freitas Balanco, 2020; Nigmatullina et al., 2019). We also widely use cluster analysis in our other studies for the multidimensional classification of objects, regions, industries in order to develop a strategy for their development. Studies over five years are taken as a basis for this study too.

Based on the analysis, Sukharev and Voronchikhina (2019) conclude that in order to ensure the investment growth model, it is necessary, in addition to encouraging investment, to change the characteristics of structural dynamics, including changes in the instruments of macroeconomic policy. Aivazian et al. (2019) consider a macroeconomic model created upon the main ideas of the structural modeling, which enables us to describe the main trajectories of economic development in different scenarios. This model disaggregates the sphere of the real production of the Russian economy into the following sectors: export-oriented markets, domestic-oriented markets, natural monopolies. The novelty of the proposed approach to applied macroeconomic modeling of the Russian economy, thus, consists in taking into account the inner structure of the Russian economy, on the one hand, and the specific methodology of modeling for description of nonstationary transitional dynamics of the real data, on the other (Aivazian et al., 2019).

Important conclusions are drawn regarding the development of education in the structure of economy. Sukharev (2020) concludes that the competence-based approach to basic education is limited in solving the problem of training personnel with higher education. The unreasonableness of institutional reforms that adjust education to the current tasks of the business, replacing the teacher with a computer, has a number of significant limitations that will not affect the measurement key, but can lead to a quality that will subsequently affect the rate of economic growth not upward (Sukharev, 2020). An increase in the share of education indicators in the structure of economic activities is observed in the Russian Federation. However, the quality of education is insufficient in view of modern realities. The results of our study showed this. New approaches and significant efforts to improve the quality of education and its development are required (including in connection with the need to comply with the epidemiological regime in the current conditions). In our opinion, high quality education will lead to positive changes in the structure of the economy and an increase in labor productivity.

CONCLUSIONS

The study made it possible to draw a number of conclusions regarding the structural and dynamic changes in the economy and changes in labor productivity in the Russian Federation. The movement of labor and changes in the sphere of application of labor changes at a relatively low rate in comparison with the indicators of investment and production volume. Thus, the number of employed depends on the number of jobs created in the process of inflow of investments in a particular industry and an increase in the volume of gross value added as ensuring the flow of funds, making a profit, and a decent wage. Also the growth of investments and the introduction of digital technologies leads to a decrease in the number of employed in the relevant sector of the economy.

Significant differences in the types of economic activity of the Russian Federation in terms of the structure of gross value added and the number of employed have been observed over 25 years. A low significant level of differences in structures is observed in terms of the volume of investments in fixed capital. A retrospective analysis shows that particularly severe shocks occurring in history are causing significant changes in the structure of the economy.

Average labor productivity in the economy grew from 2000 to 2005, 2005-2010 and 2015-2019. This change was coordinated with the change in labor productivity for certain types of economic activity. Change in the structure of employment by type of economic activity had a positive effect on change in average labor productivity in economy of the Russian Federation from 1995 to 2000 and from 2005 to 2010. Movement of labor force between activities was from industries with lower level of labor productivity to industries with higher level of labor productivity. Movement of labor force between types of economic activity had a negative impact on the average labor productivity in economy of the Russian Federation in other five-year periods. This indicates the filling of jobs in high-performance industries and the need for a person to find a job in other areas of activity. There is a movement of labor force into employment in a less productive service sector.

The proposed methodology for analyzing structural changes using the indices of structural differences and the system of indices of changes in average labor productivity has practical value. The price factor interferes with the correct analysis of indicators usually. The study based on relative structure and comparison indicators does not have this disadvantage. The discrepancy may appear due to the difference in the growth rates of prices for goods and services of various types of economic activity, which are included in the calculation of gross value added and also due to the difference in the value of different elements of fixed capital in which investment is made. Further development of the research methodology is seen in study of the regional aspect of the structure of economy, in use and construction of multidimensional models of industries and regions that characterize changes in the structure and performance of production, in study of the share and role of education in increasing qualitative changes in the structure of economy and labor productivity.

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