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# DIFFERENTIATION OF LABOR PRODUCTIVITY LEVEL AND WAGES AS A BASIS FOR CHANGES IN LABOR MARKET

**Kuznetsova A., Askarov A., Gusmanov R., Askarova A., Pypłacz P.** [*]

**Abstract:** Differentiation of the level of labor productivity has a direct impact not only on the level of wages, but also on the formation of labor market. The growth of labor productivity, mechanization, automation and digitalization of economy contribute to the release of part of labor resources. On the other hand, motivation of workers in various sectors of economy contributes to the outflow of people to more paid and prestigious industries. The study of trends in motivation of workers, the redistribution of labor resources between sectors of economy in connection with a significant differentiation of productivity and wages is of high importance. The purpose of this research is to study the trends and structure of the labor market in Russian Federation in conjunction with productivity and wages, as well as to identify factors affecting the growth of labor productivity The research methodology includes the analysis of secondary data of official statistics for the period from 1995 to 2017, institutional analysis, binary regression models, as well as the results of own research. It was established that labor market has changed. The number of employed labor resources increased in financial activity, public administration, wholesale and retail trade, hotels and restaurants, health care, education, construction and mining. At the same time, the number of people employed fell in research and development, real estate operations, manufacturing industries, agriculture, the provision of other services (municipal, social and personal), transport and communications.

**Keywords:** labor productivity, labor market, wages, motivation

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## Introduction

New industrial revolution is changing the structure of employment and productivity. The rapid development of artificial intelligence and automation technologies can significantly destroy labor markets, since information technologies and automation can increase labor productivity and contribute to the mass release of labor (Frank et al., 2019). New technologies affect the creation and destruction of jobs, but a lot depends on the specific tasks performed by the

[*] **Kuznetsova Alfiya** Prof.**, Askarov Almir** Prof.**, Gusmanov Rasul** Ass. Prof.**, Askarova Aigul** Ass. Prof., Faculty of Economics and management, Federal State Budgetary Educational Establishment of Higher Education «Bashkir State Agrarian University».
**Paula Pypłacz**, PhD, The Management Faculty, Czestochowa University of Technology
✉ Corresponding author: alfia_2009@mail.ru
✉ org.ap.bgau@rambler.ru; 757121@mail.ru; dalina2004@mail.ru; paula.pyplacz@wz.pcz.pl

machines and on how many new tasks are created thanks to the introduction of new digital technologies (Carlier et al., 2019; Afonasova et al., 2019).

Due to advances in information, communication and technology and reducing trade barriers, countries are increasingly participating in global value chains, while countries at higher positions in the global value chain cause more demand for highly skilled jobs and a better employment structure (Ma et al., 2018). Positive technological shocks, although stimulating the growth of gross domestic product, in general, have a negative effect on employment (Ferraresi et al., 2019).

There is active development of service sector and reduction in employment in agricultural sector in the world. The main obstacles to strengthening Croatian regional exports are the lack of domestic demand and reduced labor productivity. Since foreign direct investment is mainly focused on the services sector, the importance of strengthening domestic production and strong export growth should be recognized (Jaksic et al., 2019). The reduction in the number of people employed in agricultural sector occurs in all countries. In India's agriculture, where more than 50% of the working-age population works, the mechanization of Indian farms is indispensable for increasing the efficiency of resource use, reducing labor intensity, increasing production and productivity, and reducing costs (Mehta et al., 2019).

Due to cross-country and inter-sectoral differentiation of the cost of goods and services, real wages are declining in industries which are actively involved in international trade, and slightly increasing in industries which are relatively closed to international trade (Lysenko, 2019). Productivity growth affects income growth: labor productivity and real incomes grow by 1% per year (Grosse et al., 2019). Wage levels and inequality increase the growth of urban population, and increasing demand for labor increases nominal wages, when country prefers to attract highly skilled workers (Albouy et al., 2019, Kopycinska & Krynska, 2016).

The quality and intensity of labor itself has a direct impact on productivity: in conditions of perfect competition in the labor market, wage rates are determined by working productivity, because wage dispersion reflects the marginal contribution to the results of work of various workers (Policardo et al., 2019 The relationship between diversification and labor productivity is an urgent problem, while synergies between several production systems are an alternative way to increase labor productivity (Ferguson and Lovell, 2019). Among the key factors affecting productivity growth are: education (Danvila-del-Valle et al., 2019), age (Croce et al., 2019), gender differentiation (Cochrane and McKeown, 2015 ), cultural values (Moriconi and Peri, 2019), emotional intelligence of workers (McKenzie et al., 2019), natural and climatic conditions of production (Matsumoto, 2019), size of enterprises (Van Stel, 2019), leadership (Gilbert and Stephanie, 2018; Klapper and Reitzig, 2018), staff turnover (Adiguzel and Kiloglu, 2019), intrinsic motivation (Islam et al., 2019) and quality of work organization, including production automation (Kalleberg, 2019).

Human resource training influences the growth of labor productivity (Danvila-del-Valle et al., 2019) and there are significant differences in wages for the elderly (55-64) and adults (34 -54) workers in Italy (Croce et al., 2019). There is also a gender and heterogeneous differentiation of labor with economic, psychological and social vulnerability (Cochrane and McKeown, 2015).

Management of emotions in workplace is divided into directions of sociological or organizational psychology. Organizational psychology focuses on using individual qualities and skills (emotional intelligence) to regulate emotions in order to increase productivity and retain employees (McKenzie et al., 2019).

Emotional intelligence and true leadership have a direct impact on employees in organizations, while in highly competitive environment of business world, organizations introduce personnel policies and practices to increase employee motivation and productivity growth; efforts to keep employee turnover at a minimum level are directly proportional to employee satisfaction and their willingness to remain in the organization (Adiguzel and Kiloglu, 2019).

The welfare of employees is influenced by transformational leadership, since transformation leaders contribute to increasing the relationship between recognition and well-being (Gilbert and Stephanie, 2018). Zones with low and medium air temperatures had a positive economic effect with comparative advantages due to differences in labor productivity (Matsumoto, 2019). This relationship is especially significant in those sectors of the economy where work takes place in an open natural space (agriculture, construction, mining, etc.). The impact of enterprise size on labor productivity should be subject of separate research, since the study of the effect of growth in labor productivity of small and medium-sized enterprises on the growth of labor productivity of large firms is of economic importance (Van Stel et al., 2019).

When managers use their authority to make decisions on behalf of their employees, they risk dismissing employees from work and forcing them to separate from the organization, especially when highly motivated teams of employees work autonomously on corporate issues and are used to controlling themselves (Klapper and Reitzig, 2018). Organizational factors of increasing labor productivity through non-standard labor relations, such as part-time work, temporary agency assistance and employment in contracting organizations, short-term and conditional work and independent contacts, have recently become increasingly visible ways of organizing work (Kalleberg, 2019). The willingness of employees to switch to temporary contracts is determined by a high level of financial compensation (Mertzanis and Said, 2019). To solve the problem of shortage of skilled labor, people can be offered systemic motivation and career opportunities (Kuznetsova et al., 2018; 2019), including by way of attracting the most qualified migrants (Kuznetsova et al., 2018b; 2019b). The lack of information containing comparable data on gross output and the number of labor resources in various sectors of economy between countries does not allow for broad investigation of these issues, however, relying on official data from the Federal State Statistics Service of

Russian Federation for the period from 1995 to 2017, the study covers the trends and structure of labor market in Russia in relation to productivity and wages.
There are three main research hypotheses elaborated based on the theoretical consideration:
H1. The growth of labor productivity contribute to the reduction of required labor resources, and increase in unemployment.
H2. The level of labor productivity in different sectors of economy is not the same because the cost of final product is significantly differentiated.

## Methods

Research methodology includes monographic, economic-statistical, tabular, graphical, and correlation-regression research methods. An empirical analysis of the study was based on open data published by ILOSTAT and the Federal State Statistics Service of Russian Federation for the period from 1995 to 2017. In course of the study the following parameters were analyzed: level of labor productivity; level of wages of workers in various industries; ratio of workers employed in various industries to the national average; number of people employed by economic activity; structure of employment by type of economic activity; graduation of qualified specialists by higher, secondary and primary educational institutions; structure of the unemployed by level of education; percentage of people employed by level of education.
To identify factors affecting labor productivity in agricultural sector (in calculation of thousands of euro per person per year), correlation and regression analysis was conducted. As $X_1$, the indicator «the share of workers employed in agricultural sector» (as a percentage) was chosen; as indicator $X_2$, the average monthly wage of agricultural workers (in euro per person). All indicators are selected for the period from 1995 to 2017. The regression equation obeys the following equation:

$$Y = 48 + 3{,}9 * X_1 + 0{,}02 * X_2 \quad (1)$$

To determine the factors influencing the Y indicator - labor productivity in agricultural sector (thousand euro per person per year), the following factors were chosen as influencing factors: $X_3$ - depreciation of fixed production assets in agricultural sector; $X_4$ - level of remuneration of workers of agricultural sector in national average (in percent).

$$Y = 0{,}5 * X_3 + 23{,}3 * X_4 \quad (2)$$

## Data analysis and results

According to official data of ILOSTAT economically active population in the world increased by 44.8% from 1991 to 2018 Economically active population of Africa increased by 2.1 times, America - by 55.1%, Central Asia - by 53,6%, East Asia - by 17%, in the European Union - by 13.1% (Figure 1).

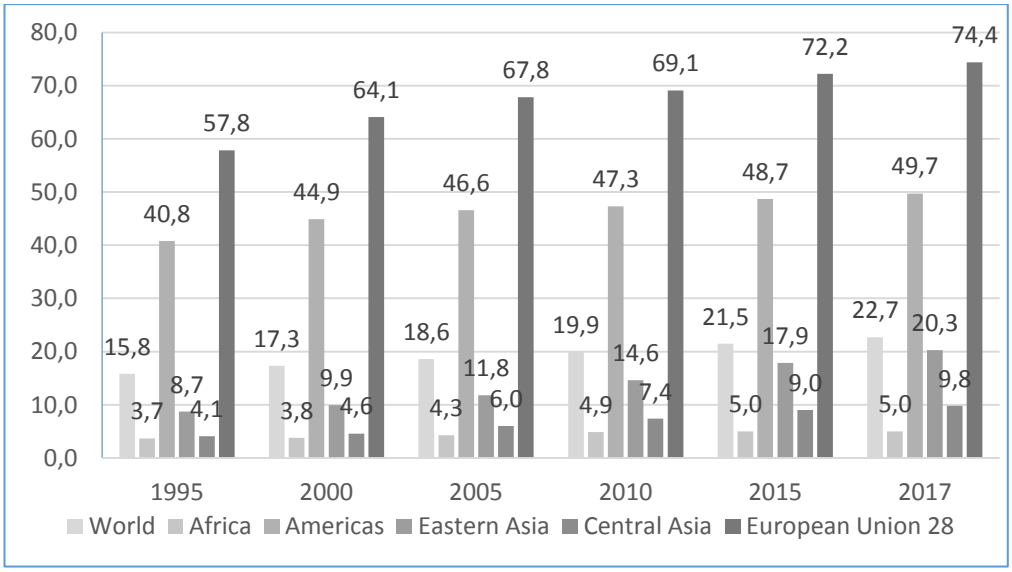


**Figure 1. Level of labor productivity in the world**
Source: Official website of the ILOSTAT https://ilostat.ilo.org/data/bulk/

The world average value of level of labor productivity in 1995 was equal to 15,8 thousand euro, in 2017 - 22,7 thousand euro, i.e. 44% more.

According to official data from the Federal State Statistics Service of Russian Federation, economically active population increased by 8.3% from 1995 to 2017, in construction industry - by 1.9%. In agricultural sector, the number of labor resources decreased by 47.7%. If on average in the country's economy the level of labor productivity in 2017 was 24-25 thousand euro per person, then in agriculture it was two times lower. The process of reducing the number of employees is accompanied by increase in labor productivity in comparison with the level of 1995. In 1995 the level of labor remuneration of workers in construction industry was about 124% and dropped to 86% by 2017. The level of remuneration of workers in agricultural sector in 1995 was round 55%, in 2003 it comprised 42%, and increased to 65.5% by 2017.

The share of labor resources employed in agriculture decreased by 7.5% from 14.6% in 1995 to 7.1% in 2017, although the total number of employees in this sector increased by 1.9%. The share of construction workers in 1995 was 9.3% decreasing by 0.5% to 8.8% in 2017. The total number of workers in agricultural sector tended to decrease from 9,700 to 5,074 thousand people (by 47.7%). For the period from 1995 to 2017, the largest inflow of labor resources was observed in trade sector: from 10.1% to 15.9%, in health sector: from 6.7% to 8%, in transport sector: from 6.6 to 8.6%, in management sector: from 2.9% to 7.1%; in financial sector: from 1.3% to 2.3%. These sectors are most demanded in terms of vacancies and decent and regular wages. Changes in labor market in Russian Federation are shown in Table 1.

**Table 1. Average annual number of people employed in Russia by economic activity (thousands of people)**

| Indicators | 1995 | 2000 | 2005 | 2010 | 2015 | 2017 | 2017 in % to 1995 |
|---|---|---|---|---|---|---|---|
| Total | 66409 | 64517 | 66683 | 67493 | 68389 | 71742,7 | 108,0 |
| including: | | | | | | | |
| financial activities | 236 | 657 | 865 | 1121 | 1278 | 1423,5 | 6 times |
| public administration | 1060 | 3098 | 3367 | 3901 | 3730 | 3702,5 | 3,5 times |
| wholesale and retail trade | 4822 | 8806 | 11038 | 12073 | 12890 | 13685,7 | 2,8 times |
| hotels and restaurants * | no data | 948 | 1017 | 1181 | 1338 | 1661,6 | 175,3 |
| health and social services | 3001 | 4408 | 4433 | 4617 | 4529 | 4450,3 | 148,3 |
| education | 4188 | 5979 | 6048 | 5897 | 5541 | 5525,1 | 131,9 |
| building | 5549 | 4325 | 4986 | 5399 | 5652 | 6318,9 | 113,9 |
| mining* | no data | 1110 | 1122 | 1054 | 1082 | 1126,6 | 101,5 |
| transportation and communication | 5564 | 5056 | 5262 | 5336 | 5501 | 5240,4 | 94,2 |
| provision of other services* | no data | 2313 | 2359 | 2524 | 2560 | 1659,1 | 71,7 |
| agriculture, hunting and forestry | 10003 | 8996 | 7489 | 6622 | 6293 | 5074,5 | 50,7 |
| manufacturing industries | 22210 | 12297 | 11631 | 10260 | 9844 | 10173,2 | 45,8 |
| real estate transactions * | no data | 4490 | 4980 | 5374 | 6002 | 1933,9 | 43,1 |
| research and development | 2133 | 1201 | 1047 | 902 | 859 | 902,4 | 42,3 |

* data calculated to the level of 2000

*Source: Official website of the Federal State Statistics Service of the Russian Federation http://www.gks.ru/*

Total number of people employed in country's economy increased by 8%, including in financial activities - by 6 times, in public administration - by 3.5 times, in wholesale and retail trade - by 2,8 times, in hotels and restaurants - by 75%, in healthcare - by 48.3%, in education - by 31.9%, in construction - by 13.9%, in mining, by 1.5%. The decrease in number of employees occurred in transport and communications - by 5.8%, in provision of other services (municipal, social and personal) - by 28.3%, in agriculture - by 49.3%, in manufacturing industries - by 54.2%, in real estate operations - by 56.9%, in research and development - by 57.7%.

According to the data of the Federal State Statistics Service of the Russian Federation, there have been significant changes in labor market for the period from 1995 to 2017. If in 1995, the largest share of employed was in manufacturing (33.4%), followed by agriculture (15.1%), construction, transport and communications (8.4%), wholesale and retail trade (7 , 3%), education (6.3%), health care (4.5%), public administration (1.6%) and financial activity (0.4%). In

2017, the largest share of employed population was in wholesale and retail trade (19.1%), manufacturing (14.2%), construction (8.8%), education (7.7%), transport and communications (7.3%), agriculture (7.1%), health care (6.2%), public administration (5.2%), real estate operations (2.7%), production and distribution of electricity, gas and water (2.3%), financial activities (2%), mining (1.6%). In research and development the number of scientists decreased from 2133 to 902.4 thousand people (by 57.7%), and their proportion decreased from 3.2 to 1.3%, i.e. by 2 %.

On average, one university in 1995 has for 3.7 thousand students, in 2017 - 5.5 thousand. By 2000, the number of university students decreased by 10.4%, and the number of universities - by 20.6% (Figure 2).

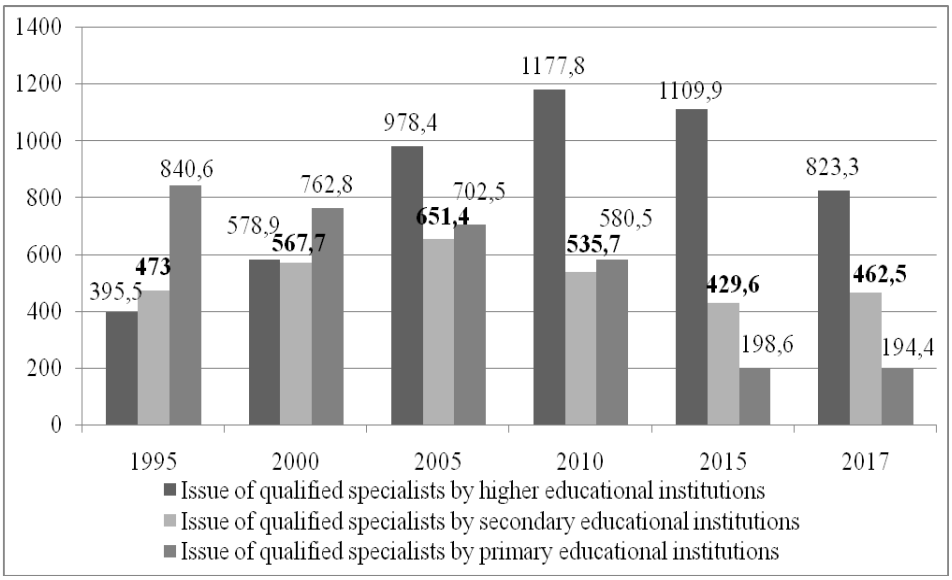


**Figure 2. Graduation of qualified specialists by higher, secondary and primary educational institutions in Russian Federation (thousands)**

Source: Official website of the Federal State Statistics Service of the Russian Federation http://www.gks.ru/

In 1995, there were 4 graduates with primary education (1:4) per graduate with higher education, in 2017 this ratio was equal to 1:0.2. The number of graduates with secondary vocational education in 2017 in comparison with 1995 remained almost unchanged.

**Table 2. Structure of the unemployed in Russia by level of education (as percentage of total number of unemployed, total unemployed = 100 percent)**

| Years | Higher | Secondary Vocational (Intermediate) | Primary professional | Secondary General | Basic General | Do not have a basic general |
|---|---|---|---|---|---|---|
| 1995 | 11,5 | 28,7 | 13,5 | 41,8 | 16,7 | 1,3 |
| 2000 | 13,3 | 26,3 | 12,2 | 31,5 | 14,1 | 2,6 |
| 2010 | 15,0 | 20,8 | 20,8 | 32,4 | 9,9 | 1,0 |
| 2015 | 19,7 | 20,7 | 20,1 | 29,5 | 9,0 | 0,9 |
| 2017 | 20,6 | 20,0 | 20,1 | 29,1 | 9,1 | 1,0 |
| 2017 to 1995 (+/-) | +9,1 | -8,7 | +6,6 | -12,7 | -7,6 | -0,3 |

According to table 2, the proportion of the unemployed with higher professional education increased from 11.5% to 20.6% by 9.1% %. The proportion of unemployed with primary vocational education increased from 13.5 to 20.1%.
In 2017 34% of employed population had higher education, 26% - specialized secondary, 19% - elementary vocational, 17% - general secondary, 4% - no education (Figure 3).

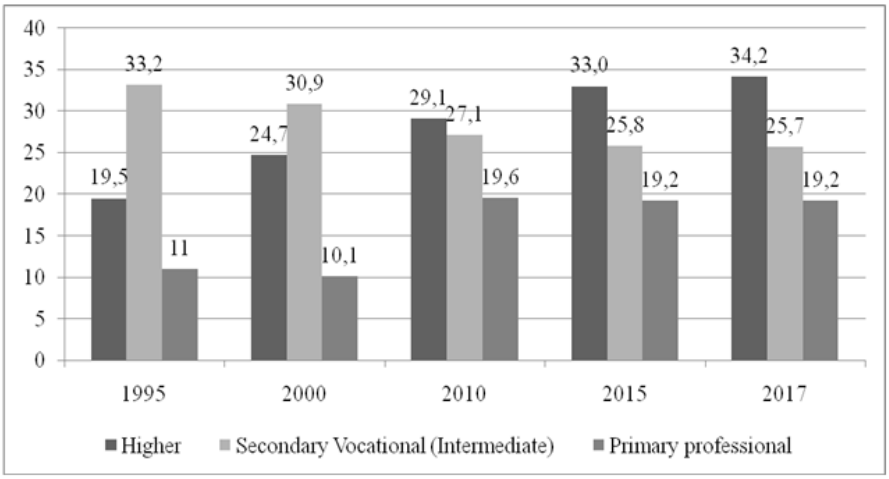


**Figure 3 Percentage of people employed by level of education in Russia**

According to the survey "Statistical measurement of qualifications of employed population to the work performed" (2018), the connection of work with the profession (specialty) obtained in educational organization 83% of employed

population aged 15 and older had postgraduate education, 71% - higher education, 59% - secondary vocational, 55% - initial professional education. The closest interrelation of work with the received specialty among university graduates was detected in areas being most in demand in the labor market: health (97%), aviation technology (85%), computer science (76%), education (76%), information security (76%), culture and art (75%), electrical engineering (74%), chemical technology (72%), marine engineering (71%), construction (71%), energy (70%).
As to factors affecting labor productivity in agricultural sector, as a result of correlation and regression analysis, multiple regression coefficients occurred to be 0.982. The closeness of relationship between the factors was 96.4%. The multiplicity factor is equal to R 0.946, the proximity of the relationship between the factors was 89.5%.

**Discussions**

In recent years we are witnessing a rapid growth in the development of services and tourism, as well as related industries (Jaksic et al., 2019). The increase in labor productivity is primarily associated with increased competition in the labor market. Narrow-profile activities have appeared and the demand for high-class specialists has increased (Policardo et al., 2019; Libanova, 2019).
The growth of labor productivity is also associated with increase in wages and with an increase in the automation of production. (Frank et al., 2019) The higher level of remuneration of workers compared in some sphere with the average value for the economy, the higher labor productivity and the lower the degree of depreciation of basic assets, the higher the labor productivity (Policardo et al., 2019).
The quality level of a company's products depends on the efforts of workers' labor productivity (Carlier et al., 2019). The growing demand for highly skilled labor in the European Union is driven by the fact that most of the tasks that are at risk of automation are performed by employees with low and medium qualifications, while most of the new tasks arising from the introduction of digital technologies complement highly skilled labor (Balsmeier and Woerter, 2019).
The issue of motivation and demotivation is one of the most important aspects affecting productivity. Similarly, the choice of a system of long-term or short-term employment has an impact on the productivity of workers, reduces the degree of job satisfaction, does not allow to fully unleash their professional potential. (Adiguzel and Kiloglu, 2019). According to the study results, labor market has experienced significant shifts in job growth and employment in favor of the financial sector, government, wholesale and retail trade, hotels and restaurants, health care, education, and construction over the past twenty-two years.
The main tool for increasing the knowledge economy and increasing labor productivity education has always been a major factor in the competitiveness of any country (Kuznetsova et al., 2017). Throughout the entire study period, the level of labor productivity in construction industry exceeded the level of labor productivity in agricultural sector. This is due to two reasons: (1) the differentiated

level of the cost of final products in these sectors of the economy; (2) the differentiated opportunities for distribution of profits in favor of expanded reproduction and the motivation of workers to work. (Lysenko, 2019)

**Summary**

Among the key factors affecting productivity growth are: education, age, gender differentiation, cultural values, emotional intelligence of workers, natural and climatic conditions of production, size of enterprises, leadership, staff turnover, internal motivation, as well as the quality of work organization, including the mechanization and automation of production. Labor productivity in Russia and in the world has a steady upward trend.

The development and improvement of professional competencies, continuous training will reduce unemployment and demand for specialists in labor market. Labor resources began to move to those sectors of the economy in which the rate of turnover of funds is the highest. From 1995 to 2017, the largest inflow of labor resources was observed in trade sector: from 10.1% to 15.9%, in health sector: from 6.7% to 8%, in transport sector: from 6.6% to 8.6%, in management sector: from 2.9% to 7.1%; in financial sector: from 1.3% to 2.3%. Over the past twenty-two years, the labor market has experienced significant shifts in job growth and employment in favor of financial sector, government, wholesale and retail trade, hotels and restaurants, health care, education, and construction.

The changes that have developed over the years of reforms have also affected the education system, as the main tool for increasing the knowledge economy and increasing labor productivity In 2017 34% of employed population had higher education, 26% - specialized secondary education, 19% - primary vocational education, 17% - general secondary education, 4% had no education. Two major trends in labor market were identified: 1) steady demand in labor market for people with higher education, and 2) demand for specialists with elementary vocational education.

Correlation and regression analysis showed that direct positive impact on the growth of labor productivity is provided by: 1) the level of remuneration of agricultural workers in relation to the average for the economy in the country; 2) the proportion of workers employed in agricultural sector". The opposite effect on the growth of labor productivity is provided by depreciation of fixed assets in agricultural sector.

To eliminate the imbalances in the level of prices and labor productivity for industrial and agricultural products, the differentiated income tax is recommended. In high-income industries there should be higher income tax rate, and in socially significant ones (agriculture, education and health care) - the reduced one.

In each sector of the economy, the maximum and minimum indicators of the work complexity shall be determined to identify the need for labor resources. This approach will create the conditions for the development of competent internal personnel and migration policy.

This study is limited by the labor market of Russian Federation. Based on the results and methods of this research, further investigations of changes in labor markets and labor productivity can be performed both on a country / regional level and globally.

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# RÓŻNICOWANIE POZIOMU WYDAJNOŚCI PRACY I PŁAC JAKO PODSTAWA ZMIAN NA RYNKU PRACY

**Streszczenie:** Zróżnicowanie poziomu wydajności pracy ma bezpośredni wpływ nie tylko na poziom płac, ale także na kształtowanie rynku pracy. Wzrost wydajności pracy, mechanizacja, automatyzacja i cyfryzacja gospodarki przyczyniają się do uwolnienia części zasobów pracy. Z drugiej strony motywacja pracowników z różnych sektorów gospodarki przyczynia się do odpływu ludzi do bardziej płatnych i prestiżowych branż. Bardzo ważne jest badanie trendów w motywowaniu pracowników, redystrybucji zasobów pracy między sektorami gospodarki w związku ze znacznym zróżnicowaniem wydajności i płac. Celem tych badań jest badanie trendów i struktury rynku pracy w Federacji Rosyjskiej w połączeniu z produktywnością i płacami, a także identyfikacja czynników wpływających na wzrost wydajności pracy Metodologia badań obejmuje analizę wtórnych danych z oficjalnych statystyk za okres 1995–2017, analiza instytucjonalna, modele regresji binarnej, a także wyniki własnych badań. Ustalono, że rynek pracy się zmienił. Wzrosła liczba zatrudnionych zasobów pracy w działalności finansowej, administracji publicznej, handlu hurtowym i detalicznym, hotelach i restauracjach, służbie zdrowia, edukacji, budownictwie i górnictwie. Jednocześnie zmniejszyła się liczba zatrudnionych osób w pracach badawczo-rozwojowych, nieruchomościach, przemyśle wytwórczym, rolnictwie, świadczeniu innych usług (komunalnych, społecznych i osobowych), transporcie i łączności.

**Słowa kluczowe**: wydajność pracy, rynek pracy, płace, motywacja

## 劳动力生产率水平和工资的差异是劳动力市场变化的基础

**摘要**:劳动生产率水平的差异不仅直接影响工资水平，而且直接影响劳动力市场的形成。劳动生产率，机械化，自动化和经济数字化的增长促进了部分劳动力资源的释放。另一方面，经济各部门工人的积极性促使人们流向更多有偿和享有声望的行业。研究工人的动机趋势，经济部门之间劳动力资源的重新分配以及生产率和工资的显着差异非常重要。这项研究的目的是结合生产率和工资来研究俄罗斯联邦劳动力市场的趋势和结构，并找出影响劳动生产率增长的因素。研究方法包括对官方统计数据的二次数据进行分析。在1995年至2017年期间，进行了机构分析，二元回归模型以及自己的研究结果。可以确定的是劳动力市场发生了变化。在金融活动，公共管理，批发和零售贸易，旅馆和饭店，卫生保健，教育，建筑和采矿业中，雇用的劳动力资源有所增加。同时，在研发，房地产业务，制造业，农业，提供其他服务（市政，社会和个人），运输和通讯方面的就业人数有所下降。

**关键词**:劳动生产率，劳动力市场，工资，动机