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# On the Impact of Exports on the Number of Employed Population and on the Professional Structure of Employment in Russia: An Input – Output Approach

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**Abstract.** The transformation of export activity, which is a "pillar" of the Russian economy and some of its regions, taking place amid geopolitical instability, determines the importance of assessing the consequences of this process for employment, as well as searching for the most promising types of economic activity that could become locomotives of development in the new economic conditions. In this regard, the aim of our study is to assess the impact of export activities on the number and professional structure of employment, as well as to identify promising areas for changing the structure of Russian exports. The multi-country input – output tables of the international database "The World Input – Output Database" served as the basis for modeling; the information base also included data from Rosstat and the Federal Customs Service. The study is of particular relevance, since the most technologically developed territories and industries facing the risks of deterioration of the investment climate and quality of life. Based on an input – output approach, which, along with an assessment of the economic effect on employment from export activities, constitutes the novelty of the study, we identify promising industries for job creation in the context of professions; we also highlight industries with a high multiplier of production costs as promising areas of development. It is noted that the export of minerals, in comparison with other types of activities, has less impact on employment. We point out the branches of the Russian economy, the output of which brings a greater economic effect in comparison with export activities. It is concluded

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that increasing exports of products from these economic sectors, combined with the development of new types of production within the country, will significantly enhance the impact of export activities on the number of employees and on the professional structure of employment. The results can be useful to a wide range of researchers in the field of economics of industries and territories, as well as to federal and regional authorities in the development and revision of various strategic and sectoral documents.

**Key words:** value chains, fragmentation of production, employment, exports, input – output tables.

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**Introduction**

Exports have played an important role in the structural transformation of the Russian economy over the previous decades. Export activity has rapidly expanded, stimulated by supportive government policies, allowing Russia to capitalize on the international fragmentation of production in time to become a member of globally integrated production networks. At the same time, the structure of Russian exports is dominated by raw materials and semi-finished products, while final products (primarily machine building) are still largely purchased abroad. This model of participation in global value chains carries a number of problems, among which the most painful are the increased specialization in the production of primary and medium-sized products and the weak ability of raw materials export industries to transform profits into household incomes.

The risks associated with the high importance of export activities for the Russian economy development have always been a topic of active discussions. Following the intensification of sanctions restrictions in 2022, the situation of Russian exporters has been complicated by the need to restructure supply chains and often seek new markets to preserve accumulated technologies and production capacities, while calls to stimulate domestic consumption and change the nature of servicing external demand have intensified.

The share of unfriendly economies in exports from Russia has fallen to 35% by the end of 2022 according to the Ministry of Economy, while at the beginning of the year it was 58%. Consequently, the share of neutral and friendly countries increased from 42% to 65%. By the end of 2023, the share of friendly countries in Russia's foreign trade reached 75%[1]. The structure of exports and imports has not undergone significant changes. In general, imports decreased at the expense of European countries, the weighted drop of which amounted to about 16%[2].

An outstanding example of successful adaptation to new economic conditions is Russian timber producers, who were able to promptly replace European markets with Asian countries. The share of Asian countries in purchases of domestic sawn timber increased by 11 p.p. and amounted to 98%. For comparison: the share of Asian countries in the export structure amounted to 76% in 2021. There will be no European

[1] Vladimir Ilyichev: By the end of 2023, the share of friendly countries in Russia's foreign trade will be more than 75%. Available at: https://www.economy.gov.ru/material/news/vladimir_ilichev_po_itogam_2023_goda_dolya_druzhestvennyh_stran_vo_vneshney_torgovle_rossii_sostavlyaet_bolee_75.html (accessed: May 30, 2024).

[2] Russia redirected almost a quarter of its exports to friendly countries. Available at: https://www.rbc.ru/economics/10/02/2023/63e2411a9a794730042580a5 (accessed: May 29, 2024).

countries left in the top 10 importing countries of Russian sawn timber in 2023[3].

It is obvious that the nature of the structural shifts taking place will be determined by the speed and quality of adaptation of exporting enterprises to the new realities (including reorientation to the domestic market of the country), while the changes will inevitably affect employment and living standards. The consequence may be new sectoral, regional, professional, qualification, educational and other structural mismatches in the labor market, which will increase the risks of loss of labor productivity growth rates, decrease in the volume of potential GDP, difficulties in finding jobs and personnel, etc. The scale of these changes cannot be assessed without analyzing the indirect effects caused by inter-sectoral links in the economy. A particularly interesting issue is the assessment of the nature and significance of export activities for the Russian economy, since understanding the contribution of this factor will simplify the definition of economic policy measures that will have a corrective impact on the adaptation of the most affected industries and territories.

In connection with the above, the aim of the research is to assess the relationship between Russian exports and employment, as well as to identify promising areas of transformation of the number and professional structure of employment through the development of export activities. It is clear that any assessment of potential changes is approximate, since the picture of the Russian economy is only partially formed, but the analysis of various scenarios allows us to formulate some assumptions regarding the short-term dynamics of changes in labor demand.

**Literature review**

Studying the impact of various employment factors is an important issue for economists. The reasons for this phenomenon are objective: in addition to the issues of balancing supply and demand in the Russian labor market, the importance of determining and forecasting ways to accelerate the adaptation of the country's economy to foreign trade restrictions has significantly increased. The works of V.E. Gimpelson and R.I. Kapeliushnikov occupy an important place among the studies of trends and factors concerning the national labor market development. In particular, we note a recently published article that analyzes the shifts in the structure of jobs in the Russian economy in the period 2000–2019 and concludes that there has been an "evolution in the scenario of improvement" (Gimpelson, Kapeliushnikov, 2023). By improvement the authors mean a reduction in the share of "bad" (routine and pending reduction) jobs with the growth of "good" (highly skilled and highly paid) jobs. The key condition for improving the quality of fixed capital and providing the economy with labor resources is acceleration of scientific and technological development.

A foreign paper (Ping, 2023) presents a similar conclusion, which, based on econometric models, highlights issues related to the impact of the nature of participation in global value chains on employment using China as an example in 2005–2014. According to the research results, the shift in the commodity composition of exports from semi-finished to finished goods contributed to the decline in manufacturing employment during the study period, which supports the "mixed blessing hypothesis" of participation in the global production system. It is worth noting that China faces the need to provide jobs for a significant number of young graduates and the unemployed, and therefore the path of accelerated modernization of the industrial complex carries certain social risks for it, while for Russia it seems to be optimal, as it can become an effective lever in solving the issue of personnel shortage.

[3] Russia has found an alternative to selling sawn timber to Europe. Available at: https://www.rbc.ru/business/02/02/2024/65b8fc719a79470f2a20dbfd (accessed: May 29, 2024).

We should add that export activity is an important source of funds required for industrial modernization, and the efficiency of this process is largely determined by the country's position in global value chains. In this regard, the importance of determining the directions for increasing the beneficial effect of export activities on certain parameters of the economy is growing. A significant place in solving this issue is given to inter-sectoral modeling tools, which allow assessing the indirect effects of the proposed changes in the economy. As an example, we can cite the work (Johnson, Noguera, 2012), the authors of which concluded that if the value added in manufacturing exports is high, its volume can be significantly increased in the services sector in the course of further production process. The size of this economic effect will depend on the strength of in-country inter-industry linkages. Researchers have also found that exports of goods that require domestic materials for production, such as textiles, had a much higher multiplier effect than exports of goods produced solely on the basis of imported components, such as electronics assembly plants (Chen et al., 2004; Koopman et al., 2012; Pei et al., 2012). Such works can include those that assess the effect of stimulating various sectors of the economy (Leonidova, Rumyantsev, 2023). There are also studies devoted to this issue at the microeconomic level (Upward et al., 2013).

Russian studies also cover the issues of assessing the impact of the inter-industry structure of jobs in the economy on certain employment indicators. In particular, the author of the article (Yedinak, 2021) notes the ability of industries of the real sector to create more employment in related sectors of the economy, while the services sector is characterized by the largest direct increase in the wage fund with a low multiplier effect. Another paper (Yedinak, 2020), based on the matrix of total labor costs, gives a decomposition of labor costs into direct and indirect ones, and it is found that mining has the highest indirect effect of creating employment in other sectors of the Russian economy among other economic sectors. The reason for this phenomenon is the low labor intensity of production of the extractive industry.

At the same time, attempts to link the expected changes in the structure of exports with the projected shifts in the occupational structure of employment are quite rare. As an example, we can cite the work of (Los et al., 2015), where the international input–output tables are used to identify the industries, the increase in exports of which will provide the Chinese economy with high-skilled employment. It is also worth noting the attempts of researchers to identify the relationship between sectoral and professional-qualification structures of employment[4] (Luk'yanova, Kapeliushnikov, 2019). In particular, the paper (Kuznetsov, 2023) presents a set of econometric models linking changes in the occupational and qualification structure of employment by types of economic activity in the period from 2002 to 2021, and analyzes the impact of factors on the dynamics of individual employment groups.

An attempt to measure the impact of exports on the size and occupational structure of employment was made using China as an example in a study (Feenstra, Hong, 2010) using input–output tables to account for both direct and indirect effects. The authors found that between 1997 and 2002, the effect of export growth on employment was much smaller than the effect of increased domestic demand. This difference was also found in a study (Chen et al., 2012) for 2002 and 2007.

Various forecasting methods are used in the practice of assessing the occupational and qualification composition of the employed for the future. In particular, direct methods that study

[4] Vishnevskaya N.T. (Ed.). (2017). *Professions in the Russian Labor Market: Analytical Report of the National Research University Higher School of Economics.* Moscow: Izd. dom Vysshei shkoly ekonomiki.

the dynamics of employment in professional-qualification groups with the dynamics of any macroeconomic parameters on the basis of correlation and regression relationship between them are popular. For example, methodological approaches that study the correlation of the growth rate of employment of a particular occupational and qualification group with the GDP growth rate or the dynamics of production of the type of economic activity in which the employees of a particular occupational and qualification group are most in demand (Bakumenko, Sarycheva, 2011; Sarycheva, 2012; Schmidt, 2013).

Summarizing the above, we note that the issues of assessing the direct and indirect impact of export activities on the number and professional structure of employment in Russia are hardly represented in scientific research. At the same time, the inter-industry modeling toolkit is of high importance for the fulfillment of this task due to the possibility to estimate indirect effects.

**Materials and methods**

Turning to the description of the applied methodological tools, we note that the foundations of the approach to modeling inter-sectoral interrelationships in the economy are laid in the works (Leontief, 1936; Leontief, 1941). Labor, capital and intermediate inputs are required to produce outputs, while intermediate products should be produced by ourselves, again involving factors concerning production and intermediate products, etc., until all intermediate products are taken into account. Leontief presented a mathematical model that tracks factor inputs required at all stages of production of a particular final good, which allows measuring the contribution of external demand relative to domestic demand in generating value added in the countries of origin of the product[5]. The approach we apply is based on a standard methodology for modeling input–output parameters with respect to multi-territory conditions (Johnson, Noguera, 2012),

Figure 1. Schematic of cross-country input–output tables

| | | Intermediate consumption | | Final use | | Total |
|---|---|---|---|---|---|---|
| | | Russia | Rest of the world (RW) | | | |
| | | Industry | Industry | Russia | RW | |
| Russia | Industry | Intermediate consumption in Russia of products manufactured in Russia | Intermediate consumption in the RW of products manufactured in Russia | Final use in Russia of products manufactured in Russia | Final use in the RW of products manufactured in Russia | Output in Russia |
| Rest of the world | Industry | Intermediate consumption in Russia of products manufactured in the RW | Intermediate consumption in the RW of products manufactured outside Russia | Final use in Russia of products manufactured in the RW | Final use in the RW of products manufactured outside Russia | Output in the RW |
| | | Value added | | | | |
| | | Output in Russia | Output in the RW | | | |

According to: An Illustrated User Guide to the World Input–Output Database: The Case of Global Automotive Production. Available at: https://onlinelibrary.wiley.com/doi/10.1111/roie.12178

[5] See (Miller, Blair, 2009) for initial introduction to the theory of intersectoral analysis. This approach was also followed (Bems et al., 2011) in modeling the effects from the 2008 drop in global demand.

[6] Input-Output tables of the WIOD 2016 release. Available at: https://www.rug.nl/ggdc/valuechain/wiod/wiod-2016-release (дата обращения 20.02.2024).

then supplemented with information on labor inputs required for production as well as labor compensation.

The data source on the structure of the economy and exports of the Russian Federation was the cross-country input–output tables for 2014 (the most recently published) for 41 countries and regions covering the world economy, also called the world input–output tables (WIOT[6]; *Fig. 1*). Details of these tables can be found in the documentation cited in (Timmer, 2012; Dietzenbacher et al., 2013). WIOT were constructed by linking national input–output tables based on national accounts series, and between countries using detailed bilateral trade statistics.

Further, we grouped the original WIOT tables into 25 industries based on data availability and compliance with OKVED 2 industries to build the model *(Tab. 1)*. We should add that the resulting matrix of direct costs of domestic products served as the basis for the calculations, while imports were put into a separate matrix of import product utilization.

The model is based on the fundamental input–output identity (Leontief, 1936):

$$x = Ax + y, \quad (1)$$

where $x$ – total output vector;
$A$ – matrix of direct input ratios;
$y$ – final product vector.

The equation used in the modeling is:

$$(I - A)^{-1} \cdot y = x, \quad (2)$$

where $I$ – unit matrix; $(I - A)^{-1}$ – full input factor matrix.

It reflects the values of gross output $x$ at all stages of production, which are generated in the process of producing one unit of final product $y$. Based on the obtained matrix dependence, it is possible to calculate what should be the volume of sales x in the economic branches, if the change in final demand y is planned.

The use of input–output tools helps to determine the effect that will be obtained by the economy when the demand for its products changes. Let us assume that as a result of additional export supplies of Russian products, the output of corresponding goods and services will also increase (this may happen during the implementation of investment projects in infrastructure, industry, growth of household incomes, etc.). The creation of additional demand for the products of certain industries will lead to an increase in the main economic indicators for all economic activity types.

We should add that the specification would require exogenously specified final use, the nature of which will determine induced employment growth[7] without explicitly modeling the price-volume interactions that are central to full-fledged general equilibrium models (see, for example, Levchenko, Zhang, 2012). While such models are richer in modeling behavioral interactions, there is an additional need to econometrically estimate various key parameters of the production and demand functions. Since intermediate inputs can be sourced both domestically and abroad, a central feature of global production systems, the number of required parameters to be estimated can be very large. Instead, we rely on a model in which resource and employment costs are known and we assume that their proportions are stable for actual output utilization.

Turning to the specifics of the model used further in the calculations, let us determine that the output can be used to meet the demand within the country or abroad. In the modeling results,

[6] Input–output tables of the WIOD 2016 release. Available at: https://www.rug.nl/ggdc/valuechain/wiod/wiod-2016-release (accessed: February 20, 2024).

[7] Unlike direct employment growth, which implies a change in the number of employed in each industry, induced (full) employment growth also includes the value of indirect employment growth due to inter-industry interactions.

Table 1. Grouping of industries in WIOT tables according to types of economic activities OKVED 2

| Economic activities types in WIOT tables | Economic activity types according to OKVED 2 classifier |
|---|---|
| Crop and animal production, hunting and related service activities; Forestry and logging; Fishing and aquaculture | Agriculture, hunting and forestry, fishing, fish farming |
| Mining and quarrying | Mining |
| Manufacture of food products, beverages and tobacco products | Food industry |
| Manufacture of textiles, wearing apparel and leather products | Light industry |
| Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials | Woodworking |
| Manufacture of paper and paper products; Printing and reproduction of recorded media; Publishing activities | Pulp and paper industry; publishing and printing activities |
| Manufacture of coke and refined petroleum products | Production of coke and petroleum products |
| Manufacture of chemicals and chemical products; Manufacture of basic pharmaceutical products and pharmaceutical preparations | Chemical and pharmaceutical industry |
| Manufacture of rubber and plastic products | Rubber and plastics production |
| Manufacture of other non-metallic mineral products | Other non-metallic mineral products |
| Manufacture of basic metals; Manufacture of fabricated metal products, except machinery and equipment | Metallurgical production |
| Manufacture of computer, electronic and optical products; Manufacture of electrical equipment; Manufacture of machinery and equipment n.e.c.; Manufacture of motor vehicles, trailers and semi-trailers; Manufacture of other transport equipment; Repair and installation of machinery and equipment | Machine building |
| Manufacture of furniture; other manufacturing | Manufacture of furniture and other production |
| Electricity, gas, steam and air conditioning supply; Water collection, treatment and supply; Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services | Production and distribution of electricity, gas and water; water supply; water disposal, organization of waste collection and utilization, pollution elimination activities |
| Construction | Construction |
| Wholesale and retail trade and repair of motor vehicles and motorcycles; Wholesale trade, except of motor vehicles and motorcycles; Retail trade, except of motor vehicles and motorcycles; Land transport and transport via pipelines; Water transport; Air transport; Warehousing and support activities for transportation, Postal and courier activities; | Trade and transport |
| Accommodation and food service activities | Hotel and catering activities |
| Motion picture, video and television program production, sound recording and music publishing activities; programming and broadcasting activities; Telecommunications; Computer programming, consultancy and related activities; information service activities | Information and communication activities |
| Financial service activities, except insurance and pension funding; Insurance, reinsurance and pension funding, except compulsory social security; Activities auxiliary to financial services and insurance activities | Financial activities |
| Real estate activities | Real estate operations, renting and provision of services |
| Legal and accounting activities; activities of head offices; management consultancy activities; Scientific research and development; Architectural and engineering activities; technical testing and analysis; Advertising and market research; Other professional, scientific and technical activities; veterinary activities; Administrative and support service activities | Professional, scientific and technical activities |
| Public administration and defense; compulsory social security | Public administration and military security; social security |
| Education | Education |
| Human health and social work activities | Health and social services |
| Other service activities | Other service activities |

the industries-producers of these product flows are divided into the ***domestic demand sector*** and the ***external demand sector***. The latter differs from exports in that it includes the induced economic effect, taking into account the inter-sectoral interactions that occur in the production of exported products. The separation of domestic and external demand sectors implies that the industries included in them can be included in both sectors simultaneously, with the degree of participation of each industry in these sectors commensurate with the share of its output of supplies to national and foreign markets (in the original WIOT tables). Accordingly, the multiplier effect[8] from the production of exported goods is defined as the ratio of the aggregate output growth of all sectors to the sum of the output of the full volume of exported goods. Thus, the impact of export activity on employment is further understood as the induced economic effect from the production of output of the external demand sector, expressed in the formation of jobs and labor compensation fund.

In addition to these sectors, sectors such as "extractive industry", "manufacturing industry" and "machine building" were identified, for which no separation by destination market was made.

Let us also focus on labor specifics within the framework of this study. Rosstat defines the term "employed" as "persons aged 15 years and older who in the surveyed week performed any activity (at least one hour per week) related to the production of goods or provision of services for payment or profit. The number of employed persons also includes those who were temporarily absent from their workplace for a short period of time and maintained contact with the workplace during their absence"[9].

We used the indicator "Average annual number of employed persons in the economy"[10] as data on employment by sectors of the Russian economy. The data source on the occupational structure of employment was the "Microdata of sample labor force surveys" published by Rosstat (IBM SPSS Statistics software was used in the processing of primary survey data). Microdata on this indicator have been presented since 2010, which determined the period of the study.

**Results**

**Impact of export activities on employment**

The multiplier effect for the Russian economy from the output of export activities in the volume of 1 ruble amounted to 1.83 rubles, which is less than in the economy as a whole (1.94; *Fig. 2*). One ruble of domestic demand, in turn, generates 1.97 rubles of output. This difference is largely explained by the fact that mineral extraction, which supplies the key goods of Russian exports, has a relatively low value of the indicator (1.56, while the manufacturing industry has 2.15). Metallurgy has the highest multiplicative effect for the Russian economy – 2.26[11]. We should mention that the multiplier effect in one of the most important industries for the Russian economy – machine building – is 2.09, but it can be significantly increased if more stages of production of manufactured products are developed within the country.

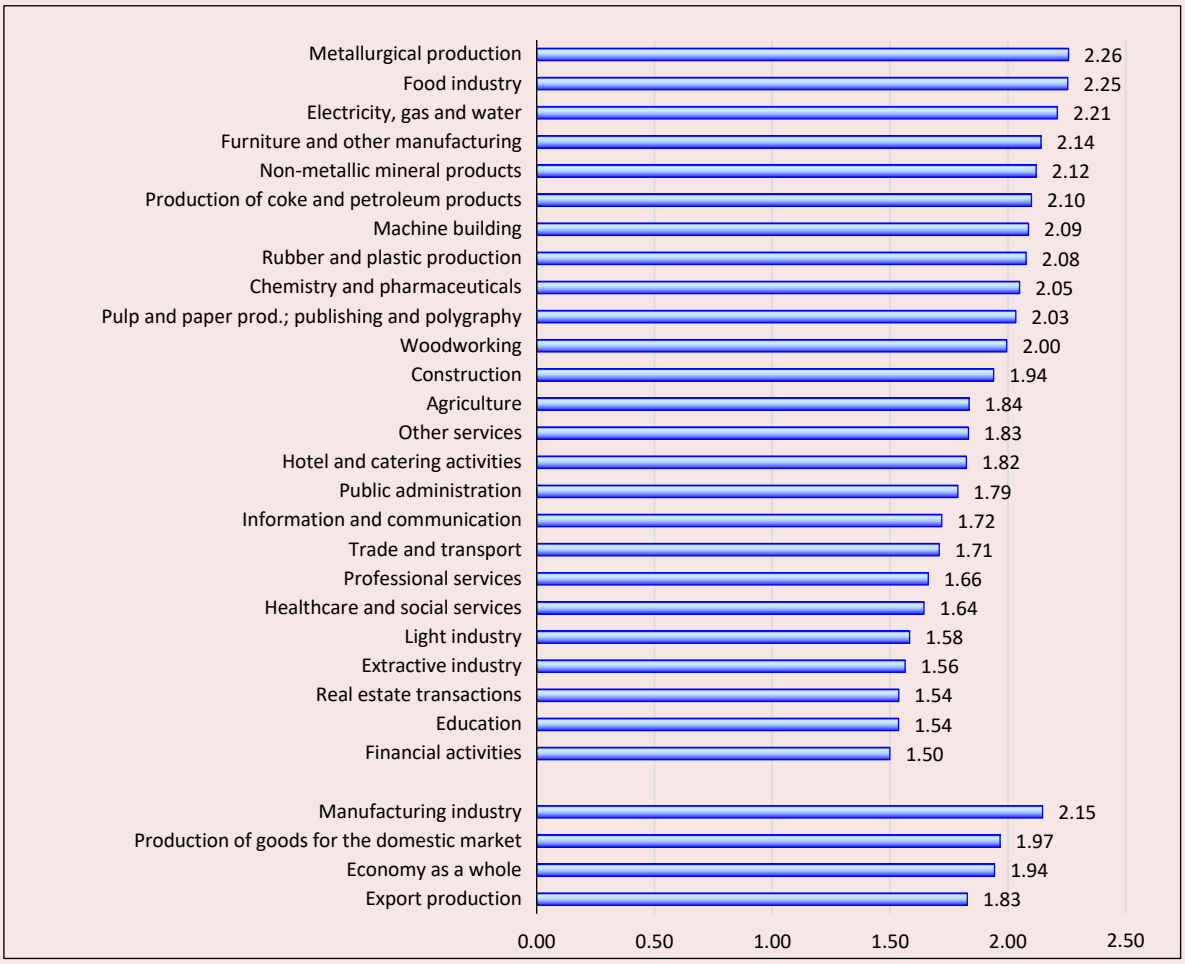
[8] The indicator, also called the total expenditure coefficient and the multiplier of production input, which reflects the increase in one of the macroeconomic indicators (gross output, GDP, budget revenues, etc.) due to the spread of the initial impulse – the increase in output in one of the sectors – through the system of intersectoral relations. In other words, the multiplier is a coefficient that shows how the magnitude of the effect and the initial increase in output that caused it relate to each other (Ksenofontov et al., 2018).

[9] Methodological explanations of Rosstat. Available at: https://rosstat.gov.ru/storage/mediabank/met_ors.docx (accessed: January 25, 2024).

[10] Available at: https://www.fedstat.ru/indicator/43211: https://www.fedstat.ru/indicator/58994 (accessed: January 29, 2024).

[11] One reason for this phenomenon is that the WIOT tables combine data on rolled metal and fabricated metal products production into a single industry, with the latter being the next production stage for the former and therefore having a higher multiplicative effect.

Figure 2. Multiplier effect for the Russian economy in different types of activities, 2014, rubles/rubles




Source: calculated based on WIOT data.

Thus, an increase in exports of manufacturing products will have a significantly greater multiplier effect than maintaining the current export structure. It is worth noting that restructuring of value chains in this direction will also make it possible to acquire added value, which the Russian economy is missing by importing final products.

According to calculations, taking into account inter-sectoral interactions, export activities create 10.6% [12] of employment in the Russian economy *(Tab. 2)*. To a slightly greater extent, the formation of the wage fund depends on export activities – 11.1% in the economy as a whole.

Approximately half of the contribution of export activities to the formation of employment and labor remuneration fund falls on such sectors as trade and transport, exports also have a significant impact on mining and professional, scientific and technical activities. At the same time, in percentage terms, manufacturing industries are most export-oriented.

[12] At this stage, we proceed from the unit elasticity of employment by output and assume that the structure of employment and labor compensation in the economy changes commensurately with changes in the structure of output. This simplification is conditional; further research is planned to clarify the relationship between the structure of output and employment.

Table 2. Contribution of export activities to the formation of employment and labor remuneration fund in the Russian economy in 2022

| Activity type | Export contribution to output (taking into account inter-industry effect), % | Average annual number of employed in total, thousand people | Among them, contribution of exports to the number of employed, thousand people | Total wage fund, billion rubles | Among them, contribution of exports to the labor remuneration fund, billion rubles |
|---|---|---|---|---|---|
| Trade and transport | 20.4 | 19,002 | 3,882 | 13,968 | 2,854 |
| Professional, scientific and technical activities | 9.7 | 4,883 | 472 | 4,684 | 453 |
| Public administration and military security; social security | 12 | 3,594 | 431 | 2,739 | 329 |
| Production and distribution of electricity, gas and water | 18.1 | 2,266 | 409 | 1,627 | 294 |
| Metallurgical production | 27.6 | 1,477 | 407 | 1,134 | 313 |
| Mining | 26.9 | 1,194 | 321 | 1,697 | 456 |
| Other service activities | 9.5 | 2,841 | 269 | 1,916 | 182 |
| Agriculture, hunting and forestry, fishing, fish farming | 5.2 | 4,466 | 232 | 2,507 | 130 |
| Machine building | 7.9 | 2,820 | 221 | 2,253 | 177 |
| Chemical and pharmaceutical industry | 24.7 | 546 | 135 | 510 | 126 |
| Woodworking | 21.7 | 610 | 133 | 296 | 64 |
| Real estate operations, renting and provision of services | 5.6 | 1,856 | 105 | 1,081 | 61 |
| Construction | 1.3 | 6,552 | 87 | 4,784 | 64 |
| Pulp and paper industry; publishing and printing activities | 25 | 310 | 78 | 234 | 59 |
| Financial activities | 5.5 | 1,303 | 71 | 2,293 | 126 |
| Education | 1 | 5,272 | 53 | 3,062 | 31 |
| Information and communication activities | 3.1 | 1,619 | 50 | 2,355 | 73 |
| Rubber and plastic production | 10.9 | 364 | 40 | 225 | 24 |
| Manufacture of furniture and other production | 7.2 | 524 | 38 | 266 | 19 |
| Hotel and catering activities | 1.9 | 1,862 | 36 | 839 | 16 |
| Production of coke and petroleum products | 22 | 160 | 35 | 188 | 41 |
| Other non-metallic mineral products | 5.1 | 544 | 27 | 353 | 18 |
| Food industry | 1.2 | 2,013 | 24 | 1,206 | 14 |
| Light industry | 2.5 | 636 | 16 | 246 | 6 |
| Health and social services | 0.1 | 4,443 | 5 | 2,955 | 3 |
| **Total** | **10.6** | **71,157** | **7,577** | **53,418** | **5,932** |

Source: Rosstat and WIOT data.

We should say that the average wage for the employment created by exports is 4.3% higher than for the rest of the country's employed. This is due to relatively high qualification requirements for the employment created, in addition to higher labor productivity due to the technological sophistication of the extractive industry.

**Impact of exports on employment by occupation**

Export activities directly and indirectly create the need for a wide range of professions in all sectors of the Russian economy. The largest group of the employed [13] according to the employment created by export activities are specialists of the highest level of qualification and workers in the service sector, housing and utilities, trade and related activities. There is also a significant number of middle-skilled specialists and operators, apparatus operators, plant and machine operators (in aggregate, the above four groups of professions account for 5.1 million of the 7.6 million jobs created by export activities in 2022; *Tab. 3*).

The distribution of created employment according to the professional structure has undergone significant changes in 2010–2022. For instance, export activities began creating more employment, at the same time reducing the number of attracted managers and unskilled workers (by 38.6% and 19.5% respectively) with a significant increase in the share of specialists of the highest level of qualification (by 49.9%). In addition, the number of agricultural workers attracted by export activities also decreased (by 37.7%) in 2022, compared to 2010. At the same time, the number of employees engaged in the preparation of information, documentation, accounting and maintenance, as well as workers in the service sector, housing and public utilities, trade and related activities increased (by 24.4% and 21.2%, respectively).

Table 3. Contribution of export activities to the formation of employment in the Russian economy depending on the occupational structure in 2010 and 2022*

| Activity type | Year | Aggregated groups of occupations for the employed population in their main job | | | | | | | | | Total, thousand people |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| Total | 2010 | 565 | 1234 | 1083 | 208 | 1,032 | 313 | 960 | 933 | 864 | 7,190 |
| | 2022 | 347 | 1849 | 1007 | 258 | 1,250 | 223 | 933 | 1015 | 695 | 7,577 |
| | *2022/2010, %* | *61.4* | *149.8* | *93.0* | *124.0* | *121.1* | *71.2* | *97.2* | *108.8* | *80.4* | *105.4* |
| Agriculture, hunting and forestry | 2010 | 18 | 15 | 16 | 3 | 4 | 144 | 15 | 63 | 63 | 341 |
| | 2022 | 7 | 15 | 12 | 3 | 5 | 76 | 11 | 44 | 39 | 213 |
| | *2022/2010, %* | *38.9* | *100.0* | *75.0* | *100.0* | *125.0* | *52.8* | *73.3* | *69.8* | *61.9* | *62.5* |
| Fishing and fish farming | 2010 | 1 | 0 | 1 | 0 | 0 | 2 | 1 | 1 | 1 | 7 |
| | 2022 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 6 |
| | *2022/2010, %* | *0.0* | – | *100.0* | – | – | *50.0* | *100.0* | *100.0* | *100.0* | *85.7* |
| Mining | 2010 | 21 | 28 | 19 | 4 | 8 | 0 | 68 | 110 | 21 | 280 |
| | 2022 | 9 | 46 | 35 | 7 | 10 | 0 | 49 | 129 | 18 | 303 |
| | *2022/2010, %* | *42.9* | *164.3* | *184.2* | *175.0* | *125.0* | – | *72.1* | *117.3* | *85.7* | *108.2* |
| Manufacturing industries | 2010 | 101 | 146 | 96 | 21 | 40 | 14 | 415 | 182 | 157 | 1,172 |
| | 2022 | 44 | 173 | 108 | 24 | 31 | 11 | 365 | 216 | 116 | 1,088 |
| | *2022/2010, %* | *43.6* | *118.5* | *112.5* | *114.3* | *77.5* | *78.6* | *88.0* | *118.7* | *73.9* | *92.8* |

[13] At this stage, the concepts of "profession" and "occupation group for employed population in the main job" are used interchangeably to simplify the presentation of the material.

End of Table 3

| Activity type | Year | Aggregated groups of occupations for the employed population in their main job | | | | | | | | | Total, thousand people |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| Production and distribution of electricity, gas and water | 2010 | 26 | 40 | 40 | 9 | 28 | 0 | 82 | 93 | 28 | 347 |
| | 2022 | 15 | 74 | 61 | 13 | 8 | 0 | 107 | 84 | 25 | 386 |
| | *2022/2010, %* | *57.7* | *185.0* | *152.5* | *144.4* | *28.6* | – | *130.5* | *90.3* | *89.3* | *111.2* |
| Construction | 2010 | 8 | 7 | 4 | 1 | 1 | 0 | 31 | 10 | 10 | 71 |
| | 2022 | 3 | 11 | 9 | 1 | 1 | 0 | 36 | 10 | 10 | 82 |
| | *2022/2010, %* | *37.5* | *157.1* | *225.0* | *100.0* | *100.0* | – | *116.1* | *100.0* | *100.0* | *115.5* |
| Wholesale and retail trade; repair of motor vehicles, motorcycles, household products | 2010 | 260 | 175 | 255 | 52 | 1,160 | 2 | 149 | 150 | 230 | 2,432 |
| | 2022 | 170 | 262 | 295 | 42 | 1,288 | 2 | 173 | 129 | 191 | 2,553 |
| | *2022/2010, %* | *65.4* | *149.7* | *115.7* | *80.8* | *111.0* | *100.0* | *116.1* | *86.0* | *83.0* | *105.0* |
| Hotels and restaurants | 2010 | 2 | 1 | 2 | 0 | 13 | 0 | 1 | 1 | 3 | 23 |
| | 2022 | 2 | 2 | 4 | 1 | 19 | 0 | 1 | 1 | 5 | 34 |
| | *2022/2010, %* | *100.0* | *200.0* | *200.0* | – | *146.2* | – | *100.0* | *100.0* | *166.7* | *147.8* |
| Transport and communication | 2010 | 59 | 66 | 88 | 39 | 39 | 1 | 150 | 357 | 82 | 880 |
| | 2022 | 47 | 180 | 94 | 113 | 61 | 0 | 104 | 503 | 56 | 1,158 |
| | *2022/2010, %* | *79.7* | *272.7* | *106.8* | *289.7* | *156.4* | *0.0* | *69.3* | *140.9* | *68.3* | *131.6* |
| Financial activity | 2010 | 7 | 25 | 12 | 11 | 1 | 0 | 0 | 2 | 2 | 61 |
| | 2022 | 4 | 30 | 15 | 11 | 3 | 0 | 1 | 1 | 1 | 67 |
| | *2022/2010, %* | *57.1* | *120.0* | *125.0* | *100.0* | *300.0* | – | – | *50.0* | *50.0* | *109.8* |
| Real estate operations, renting and provision of services | 2010 | 74 | 247 | 115 | 30 | 125 | 0 | 84 | 49 | 89 | 813 |
| | 2022 | 47 | 357 | 131 | 43 | 170 | 3 | 89 | 47 | 87 | 973 |
| | *2022/2010, %* | *63.5* | *144.5* | *113.9* | *143.3* | *136.0* | – | *106.0* | *95.9* | *97.8* | *119.7* |
| Public administration and military security; social insurance | 2010 | 42 | 146 | 109 | 18 | 66 | 0 | 7 | 30 | 45 | 463 |
| | 2022 | 24 | 160 | 70 | 20 | 73 | 1 | 5 | 25 | 29 | 407 |
| | *2022/2010, %* | *57.1* | *109.6* | *64.2* | *111.1* | *110.6* | – | *71.4* | *83.3* | *64.4* | *87.9* |
| Education | 2010 | 3 | 24 | 15 | 1 | 5 | 0 | 1 | 1 | 8 | 58 |
| | 2022 | 2 | 32 | 1 | 1 | 6 | 0 | 0 | 1 | 5 | 50 |
| | *2022/2010, %* | *66.7* | *133.3* | *6.7* | *100.0* | *120.0* | – | *0.0* | *100.0* | *62.5* | *86.2* |
| Health care and provision of social services | 2010 | 0 | 1 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 5 |
| | 2022 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| | *2022/2010, %* | – | *100.0* | *100.0* | – | *0.0* | – | – | – | *0.0* | *100.0* |
| Provision of other communal, social and personal services | 2010 | 26 | 41 | 34 | 19 | 59 | 1 | 8 | 10 | 38 | 237 |
| | 2022 | 16 | 59 | 34 | 8 | 90 | 1 | 18 | 6 | 21 | 254 |
| | *2022/2010, %* | *61.5* | *143.9* | *100.0* | *42.1* | *152.5* | *100.0* | *225.0* | *60.0* | *55.3* | *107.2* |

Symbols: 1 – managers; 2 – highest skill level specialists; 3 – middle skill level specialists; 4 – employees engaged in preparation of information, execution of documentation, accounting and service; 5 – employees of the service sector, housing and utilities sector, trade and related activities; 6 – skilled workers of agriculture, forestry, hunting, fishing and fishery; 7 – skilled workers of industrial enterprises, construction, transportation, communication, geology and subsoil exploration; 8 – operators, apparatus operators, plant and machine operators; 9 – unskilled workers.
Source: Rosstat and WIOT data.
* Data of the sample labor force survey for 2015–2022 are published without taking into account the results of the All-Russian Population Census in 2020. Available at: https://rosstat.gov.ru/storage/mediabank/Trud_2023.pdf

It is worth noting that these changes were in line with the transformation of the professional structure of employment in the country as a whole: the share of employed specialists of the highest qualification level increased by 7.2% in 2010–2022, while the share of managers decreased by 3.3%, and the share of unskilled workers decreased by 2.8%. These data are based on a sample survey of the labor force, and the explanation of their dynamics seems to be a topic for a separate study.

**Finding ways to transform employment**

The comparison of the aggregate input–output effect of an equal increase in the supply of exported products and additional output of products intended for domestic consumption (the production of which was previously designated as sectors of external and domestic demand) is important for assessing the positive impact of export activity on employment. In addition, the effects from stimulating the extractive and manufacturing industries, as well as machine-building (regardless of the place of consumption of their products) are presented to determine the directions of structural changes. The modeling condition was the assumed increase in demand in equal volume (1 billion rubles) for the products of the above sectors of the Russian economy.

We should emphasize that the employment increase is only conditionally described as a positive effect, since it is also important to pay attention to such threats as the growing need for personnel in the defense industry, the shrinking and aging workforce, and the complication of the development of traditionally export-oriented oil and gas sectors of the Russian economy due to foreign trade restrictions, which, in turn, creates a threat of a significant decrease in tax revenues. It is also worth mentioning the historically low unemployment rate in Russia – in March 2024 (the most current data), it amounted to 2.7%. According to a survey conducted by the hh.ru research service, employers cite increased geopolitical tensions, lack of specialized specialists and demographic problems as the main reasons for staff shortages. The so-called "self-reversing spiral effect" is also taking effect: fearing potential staff shortages due to poaching and the difficulty of new recruitment, employers are starting to proactively announce vacancies[14].

At the same time, there are potentially promising labor sources. One of the factors is the specific model of anti-crisis behavior of Russian entrepreneurs: people are trying not to be laid off, but to preserve employment by reducing working hours, thus creating an opportunity to distribute additional labor load.

In addition to traditional labor market support measures, other ways are vocational training and advanced training for the unemployed, as well as additional measures to support employment, such as temporary work, subsidized hiring, especially of young people, where employers receive support in the amount of three minimum wages. Another new popular measure is the retraining of employees at the enterprise itself. If an enterprise switches to new technology, purchases new production lines and equipment, raw materials and supplies, the state assumes the obligation to retrain employees[15]. Anton Kotyakov, Minister of Labor and Social Protection, noted that within the framework of the federal project "Employment Promotion" of the national project "Demography" more than 76 thousand people have already started training, and 32.2 thousand have completed it.

[14] "Perfect storm": How the battle for human resources is going on in Russia right now. Available at: https://www.rbc.ru/industries/news/65b24b2c9a7947083271df29 (accessed: February 25, 2024).

[15] Dmitrii Platygin, General Director of the All-Russian Research Institute of Labor of the Russian Ministry of Labor, told in an interview with "RG" why unemployment in Russia is so low. Available at: https://rg.ru/2022/10/18/legche-ne-teriat.html (accessed: May 30, 2024).

Experts traditionally note that the wide introduction of new technologies, including artificial intelligence, will also have an ambiguous impact on the labor market. On the one hand, labor productivity may increase many times, on the other hand, some jobs will be cut. A special status of priority industries can be enshrined[16] as an example of regulating economic modernization. First of all, we are talking about projects that eliminate the low level of localization and critical dependence on unfriendly states. This process will also be facilitated by changes in the organizational structure of traditional activities, such as the gradual transition of retail trade from retail outlets to the "darkstore" format, designed exclusively for the transfer of delivered goods to couriers.

Returning to the assessment of the multiplicative effect from the increase in output of the sectors of the Russian economy, we note that the employment created per unit of output of the external demand sector significantly exceeds the values of the extractive industry, at the same time lagging behind the other sectors under consideration *(Tab. 4)*. The highest employment growth in the production of a fixed value volume of output is observed in the sector of internal demand.

When the demand for the products of the external demand sector increases, a significant part of employment is created in trade and transportation, which is also true for the other economic sectors under consideration. Also, in case of additional demand for the products of mechanical engineering, about half of the created employment will be in the sub-sectors of this type of activity, which distinguishes mechanical engineering among other sectors of industry. The increase in

Table 4. Employment increase in the activity types from the increase in demand for the products of the Russian economy sectors for 1 billion rubles in 2022, persons

| Activity type | External demand sector | Internal demand sector | Extractive industry | Manufacturing industry | Machine building |
|---|---|---|---|---|---|
| Agriculture, hunting and forestry, fishing, fish farming | 16 | 64 | 2 | 47 | 4 |
| Mining | 22 | 4 | 46 | 4 | 2 |
| Food industry | 2 | 25 | 0 | 43 | 0 |
| Metallurgical production | 28 | 20 | 4 | 41 | 24 |
| Machine building | 15 | 43 | 8 | 69 | 334 |
| Production and distribution of electricity, gas and water | 29 | 46 | 25 | 29 | 23 |
| Construction | 6 | 58 | 4 | 6 | 5 |
| Trade and transport | 271 | 282 | 110 | 240 | 183 |
| Professional, scientific and technical activities | 33 | 68 | 27 | 32 | 32 |
| Public administration and military security; social security | 15 | 43 | 16 | 15 | 15 |
| Other industries | 94 | 249 | 51 | 134 | 65 |
| **Total** | **513** | **856** | **282** | **640** | **672** |

Source: Rosstat and WIOT data.

[16] On Approval of priority directions of projects of technological sovereignty and projects of structural adaptation of the economy of the Russian Federation: RF Government Resolution 603, dated April 15, 2023; On the Strategy of scientific and technological development of the Russian Federation: Presidential Decree 145, dated February 28, 2024.

Table 5. Increase in the labor remuneration fund in the activity types from the increase in demand for the products of the Russian economy sectors by 1 billion rubles in 2022, million rubles

| Activity type | External demand sector | Internal demand sector | Extractive industry | Manufacturing industry | Machine building |
|---|---|---|---|---|---|
| Agriculture, hunting and forestry, fishing, fish farming | 9 | 36 | 1 | 26 | 2 |
| Mining | 32 | 6 | 65 | 6 | 2 |
| Food industry | 1 | 15 | 0 | 26 | 0 |
| Metallurgical production | 22 | 15 | 3 | 31 | 18 |
| Machine building | 12 | 34 | 6 | 55 | 267 |
| Production and distribution of electricity, gas and water | 20 | 33 | 18 | 21 | 17 |
| Construction | 4 | 43 | 3 | 4 | 3 |
| Trade and transport | 199 | 207 | 81 | 177 | 135 |
| Professional, scientific and technical activities | 32 | 65 | 26 | 31 | 30 |
| Public administration and military security; social security | 12 | 33 | 13 | 11 | 11 |
| Other industries | 58 | 151 | 30 | 82 | 40 |
| **Total** | **401** | **638** | **246** | **470** | **525** |
| For reference: average monthly salary of newly recruited employees, rubles (For the economy as a whole for 2022, 62,558 rubles). | 65,283 | 62,413 | 73,319 | 60,999 | 65,364 |
| Source: Rosstat and WIOT data. | | | | | |

the labor remuneration fund will be distributed in a similar way, with the average wage in the created employment in export activities being the closest to the wage in mechanical engineering *(Tab. 5)*.

The average wage will be higher in the group of employees attracted by the increase in demand for the products of the extractive industry, but due to low labor inputs the increase in the labor remuneration fund in this industry will be lower than in the other economic sectors under consideration. We should say that domestic demand, on the contrary, generates a high increase in the labor remuneration fund with a lower average wage of the involved workers.

The production of products of the external demand sector in comparison with the production of products of the internal demand sector creates significantly less employment in all groups of occupations from the point of view of the occupational structure *(Tab. 6)*. At the same time, the share of managers in the employment created by the external demand sector will be higher than in other sectors (5.2%). The largest group of occupations among the employed directly and indirectly attracted by the sector of external demand are the workers in the service sector, housing and communal services, trade and related activities (23.7%). The internal demand sector is characterized by a different picture – the largest group of the employed is specialists of the highest qualification level (19.7%), and the increase in final demand for its products in the amount of 1 billion rubles will employ almost twice as many specialists of the highest and middle qualification level as compared to the external demand sector.

Despite a relatively high share of specialists of the highest and middle level of qualification, the results of modeling allow concluding that the extractive industry lags behind the manufacturing

Table 6. Employment increase in the professional sector from the increase in demand for the products of the Russian economy sectors for 1 billion rubles in 2022, people

| Aggregated groups of occupations for employed in their main job | External demand sector | | Internal demand sector | | Extractive industry | | Manufacturing industry | | Machine building | |
|---|---|---|---|---|---|---|---|---|---|---|
| | People | % by sector | People | % by sector | People | % by sector | People | % by sector | People | % by sector |
| Managers | 27 | *5.2* | 42 | *4.9* | 14 | *4.9* | 31 | *4.9* | 32 | *4.7* |
| Highest skill level specialists | 86 | *16.8* | 169 | *19.7* | 56 | *19.7* | 104 | *16.3* | 115 | *17.1* |
| Medium skill level specialists | 58 | *11.2* | 104 | *12.2* | 34 | *12.1* | 69 | *10.7* | 73 | *10.8* |
| Clerical staff involved in the preparation of information, documentation, record-keeping and services | 19 | *3.7* | 30 | *3.5* | 11 | *3.8* | 21 | *3.3* | 21 | *3.1* |
| Employees in the service sector, housing and communal services, trade and related activities | 122 | *23.7* | 165 | *19.3* | 58 | *20.5* | 114 | *17.8* | 95 | *14.1* |
| Skilled workers in agriculture, forestry, hunting, fish farming and fisheries | 7 | *1.3* | 24 | *2.8* | 1 | *0.5* | 19 | *3.0* | 5 | *0.8* |
| Skilled workers of industrial enterprises, construction, transportation, communications, geology and subsoil exploration | 68 | *13.2* | 122 | *14.3* | 36 | *12.6* | 114 | *17.8* | 153 | *22.8* |
| Operators, apparatus operators, plant and machine operators | 86 | *16.8* | 123 | *14.3* | 52 | *18.5* | 109 | *17.0* | 117 | *17.4* |
| Unskilled workers | 41 | *7.9* | 77 | *9.0* | 21 | *7.4* | 59 | *9.2* | 62 | *9.2* |
| **Total** | **513** | *100.0* | **856** | *100.0* | **282** | *100.0* | **640** | *100.0* | **672** | *100.0* |
| Source: Rosstat and WIOT data. | | | | | | | | | | |

industry in terms of the numerical growth of this group of occupations. Consequently, the change in the export structure by increasing the supplies of manufacturing industry products will favorably affect the number and professional structure of the employed. In this respect, the professional structure of machine-building is interesting due to a smaller share of managers (4.7%, compared to 4.9% in the manufacturing industry) with a high share of qualified workers of industrial enterprises, construction, transportation, communications, geology and subsoil exploration (22.8%). We should add that to strengthen the contribution of export activity to the formation of employment it will be effective to increase supplies of other manufacturing industries with a high multiplier effect, but the use of such a factor as export revenues for the development of the domestic machine-building industry in the light of increasing foreign trade restrictions is seen as particularly valuable.

Researchers hold a similar opinion on the issue of economic development through support for exports of investment machine building products (Borisov et al., 2020). The authors note that stimulating exports of this product group within the framework of the policy of "non-autarkic developmental import substitution" creates an opportunity for additional financing of R&D, since export prices are in most cases higher than domestic market prices.

It is worth mentioning separately that the dynamics of formation of a wide range of highly skilled and highly paid jobs necessary for the development of machine building in the Russian economy is negatively affected by the inertial system of business functioning in the mode of "cheap labor trap", under which enterprises do not have sufficient motivation to increase automation, labor is unproductive, poorly paid, and it is inefficient to replace it with technologies. However, military personnel, as well as engaged workers of the defense industry complex, who receive high payments, will not fully "return to their old jobs with multiples of less compensation. As a result, the economy will face a new trend – the exhaustion of the population's readiness for cheap labor, the growth of its territorial and professional mobility will become a new challenge for the economy. When it will be fully understood, we can expect a powerful incentive for technological modernization of production, robotization, professional retraining of the employed"[17]. The median value of salaries offered by Russian employers for the first time in several years exceeded the median value of salaries expected by job seekers[18] in March 2024 according to hh.ru.

A noteworthy tool for additional exports of products of the Russian economy may be the model of "tied loans", following the example of China, where the condition for granting money loans to other countries is the sale of goods and services of own production to the recipient country. Budgetary resources can also become a crucial source for launching a new investment cycle, as they allow directing resources to where there are opportunities to achieve the greatest macroeconomic effect; in addition, they show businesses the directions for effective investment (Shirov et al., 2022).

[17] Cheap labor goes into the stockpile. Available at: https://www.rbc.ru/newspaper/2024/04/19/661fb0ab9a79477de1080a16 (accessed: May 30, 2024).

[18] Ibidem.

**Conclusion**

Summarizing the analysis of the impact of export activities on the number and professional structure of the employed, we can note the following.

1. Russia's export activities in 2022 directly and indirectly provided jobs for 10.6% of the employed in the economy. At the same time, the impact of additional exports on employment lags significantly behind the domestic demand sector: 1.67 times in terms of the number of employed and 1.59 times in terms of the labor remuneration fund. It should be added that domestic demand due to a greater multiplier effect generates a relatively high increase in the labor remuneration fund with a lower average wage of the employed. In the context of professions, the difference is also significant: the multiplier effect for employment from the production of products of the internal demand sector is 1.89 times higher for specialists of higher and middle levels of qualification.

2. In the professional context, export activities in 2010–2022 reduced the number of hired managers and unskilled workers (by 38.6% and 19.5%, respectively), while the share of top-level specialists increased significantly (by 49.9%). These changes took place simultaneously with the transformation of the professional structure of employment in the country as a whole, but turned out to be more pronounced. The largest group among the employed directly and indirectly attracted by the sector of external demand is the workers in the service sector, housing and communal services, trade and related activities (23.7%). For comparison, in the internal demand sector the largest group of attracted employees is formed by specialists of the highest skill level (19.7%), and with the increase in final demand for its products will be involved almost twice as many specialists of the highest and middle level of qualification in comparison with the sector of external demand.

3. As an example of the levers of strengthening the impact of export activity on the number and professional structure of employment, we present the increase in supplies of manufacturing industry products, in particular, machine building, with which the share of attracted skilled workers of industrial enterprises, construction, transportation, communication, geology and exploration of subsoil will amount to 22.8%. We note that the growth in the impact of export activity on employment is also possible with the increase in supplies of other manufacturing industries with a high multiplier effect. The tool for increasing the multiplier effect of individual industries, in turn, is the development of production of new or missing stages of product processing within the Russian economy. Also, it will be useful the development of such a source of money as domestic consumer demand for the comprehensive modernization of the country's economy.

Our plans include further improvement of this topic, expansion of assessments of qualitative characteristics of employment growth during the implementation of various projects, construction of forecasts, improvement of visualization of the results obtained (maps, graphs), etc.

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