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Educational Trajectories of University Students in Russia: Analysis before The COVID-19 Pandemic and Development Trends

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The COVID-19 outbreak has significantly affected the education system. Both the labor market and the education market have undergone dramatic changes during the pandemic. A rather serious discrepancy between the structure of labor demand and the structure of graduates underlies the relevance of the present study. The paper aims to analyze the relevant fields of higher education, as well as to identify key trends in 2013–2020 admission campaigns to assess development prospects. In the course of the study, we put forward several hypotheses that were tested using the case study of Russian undergraduates with state-funded tuition. Structural and dynamic analysis of the 2013–2020 period indicated the growing demand from students for education in all fields except Social sciences. A comparison of the indicator of structural shifts between 2019 and 2020 shows a fundamental change in the demand for fields of educational training for Healthcare and medical sciences, the growth rate was 2.5 times. Considerable changes in the structure of supply were observed in social sciences (a drop in the percentage of enrolled students), engineering, technology and technical sciences (a rise in the percentage of enrolled students). However, with increased demand for engineering-technical programs in 2020, there was no similar increase in supply. Our hypothesis about a decline in demand and supply for the humanities was not confirmed. At the same time, we proved the hypothesis about an increase in applicants' demand for medical specialties by 9.4% in 2013–2020 and by 22.6% in the 2020 crisis year. The COVID-19 pandemic has revealed the problem of the healthcare staffing shortage and the need to increase the number of students enrolled in medical education programs. The COVID-19 outbreak has had a profound impact on changes in learner profiles. The identified trends are pushing for a rethinking of the higher education system and the labor market in search for an optimal balance in educating staff .

Keywords: structure of education, COVID-19 pandemic, labor market, Higher education.
JEL: I21, I23

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The COVID-19 pandemic has significantly affected the education system, which was among the first ones to face global changes and the need to develop distance learning technologies. The span of 2020–2021 became a landmark period, which gave grounds for the analysis of the past decade and the forecast of promising trends in future development.

The global market for education services has experienced dramatic disturbances (Wangenge-Ouma & Kupe, 2022; Tilak & Kumar, 2022; Liu & Gao, 2022; Purcell & Lumbreras, 2021). Underestimating the potential threat of COVID-19 and its scale, ignoring the experience of other countries in combating the pandemic led to serious consequences (Bruin et al., 2020). Since universities are structurally involved in global processes (Marginson, 2017), their sustainability was subjected to a serious test. The coronavirus breakdown halted educational migration. According to the OECD (2020), in the pre-pandemic period the number of foreign students enrolled in higher education programs accounted for 5.6 million people; however, in 2020, there was a significant decline in their numbers. It is also estimated that the crisis-related decline in the number of resident students will be varying between 15% and 25% (Dennis, 2020). This caused an increase in demand for higher education within the country and changed the structure of education profiles in universities. Special attention is paid to the impact of the COVID-19 pandemic on these processes.

On the other hand, keeping borders conditionally open during the pandemic had a positive effect on enrollment rates. In the Netherlands, the enrollment of international students in 2020 decreased by no more than 4% (Nuffic, 2021), while in France the drop was 25%. Due to the liberalization of the procedure, Russia managed to maintain the enrollment level of foreign students and even increased their total number in 2020 by 6% compared to 2019 (RF Ministry of Education, 2022). Australia's strict border crossing requirements fueled a 63% drop in international student enrollment (Campus France, 2021). Brazil and a number of other developing countries have not been able to fully and effectively switch to distance learning (Marinoni & van't Land, 2020).

The perception and assessment of the pandemic-caused changes in the education system vary from positive to strictly negative. Some researchers argue that there is a threat of the distance learning process being formalized, since the teacher-student personal and emotional contact is believed to be crucial and, therefore, it should be maintained (Levinsen, 2007; Siritongthaworn et al., 2006). Studies highlight some adverse effects, such as longer class periods, higher workload, etc. (Klyagin, 2020; Pililyan, 2020; Tomczyk & Walker, 2021; Shtykhno, Konstantinova, & Gagiev, 2020). To maintain the quality of distance learning, appropriate response at various levels of management is important (Okulich-Kazarin, Bokhonkova, & Ruda, 2022).

At the same time, the distance format allows one to quickly share educational materials with students; learners' schedule is more flexible; teachers have an opportunity to implement new forms of information presentation, knowledge control, and the development of skills for self-regulation of learning behavior, which positively affects academic performance (Grishin et al., 2020; Traxler, 2009; Maatuk et al., 2022; Kukulska-Hulme, 2010; Driver, 2012; Khan, Shah, & Sahibzada, 2020). Meanwhile, only from 5% to 10% of students enrolled in the fully-online education programs complete their studies successfully (Kolesnikova, 2019). Differentiation also manifests itself in groups of students with different levels of giftedness and locality (Yusof, Ismail, & Radzi, 2022). Thus, it is necessary to consider possible consequences for the educational process caused by the coronavirus crisis.

Exploring the factors influencing the forms of education is important from the perspective of the subsequent adaptation of the education system to similar crises and the development of the most effective technologies for the interaction of participants in the educational process that contribute to gaining high-quality university education. Transformation during the COVID-19 pandemic emphasizes the need for research aimed at analyzing the most relevant fields of higher education and identifying key trends in admission campaigns of previous years. In our study, the COVID-19 pandemic became the backdrop for analyzing changes in student educational trajectories. The impact of the pandemic is considered by us in the context of the proposed hypotheses. The study horizon of 2013-2020 imposes some limitations in terms of interpreting the strength and long-term impact of the pandemic. We focus on analyzing the dynamics and the structure of submitted applications and students enrolled in universities, and identifying the most popular education profiles and trends during the period of 2013–2020.

Literature Review

Higher education forms human resources and serves as a backbone element of the national economy. Among the central problems of modern education is a significant discrepancy between the structure of labor demand and the structure of supply (graduates). This discrepancy has long been existing and is observed in many countries (Eichhorst, Marx, & Rinne, 2020; Flisi & Santangelo, 2022). The problem is compounded by extremely quick global changes, since universities are unable to promptly respond to the fast-changing economic demands for graduates' competences.

Firsova (2020) analyzes the effectiveness of higher education and discusses current problems and imbalances in its development. The research findings show that students' preferences for educational programs are often not due to the structure of the economy, but to the demand of the population in the field of education, as well as inclinations and ideas of applicants. In Russia, there is a consistently high demand for management, law, education and pedagogy programs (Kovalenko, 2011). We assume that this trend is no longer supported. The demand for such specialists in the labor market is decreasing. This leads to imbalances and inefficiencies in public and private spending on higher education. The hypotheses of our study, based on a review of the literature, changes in the economy over the past few years, indicate that other training profiles occupy leading positions in the educational field.

In contrast to foresight forecasts, which allow outlining a list of professions that are expected to be in demand in the future (Talwar & Hancock, 2010; Frey, 2011; Armstrong, 2017; Slayter, 2019), there is an approach (Hines, 2019) stating that work will gradually lose its central role in the daily life of most people (the so-called "post-work future" (Houston Foresight Program, n.d.). Hines (2017) demonstrates that the goal of receiving higher education is changing: preparing for work life is no longer a key task for students; the boundary between different aspects of their activities is gradually blurring; it is becoming increasingly difficult to identify students' occupation. This integration of various aspects causes a decrease in labor productivity (Gavett, 2015), thereby creating a gap in the performance of exclusively labor tasks. The noted observations can be considered as new limitations of studies that are devoted to the analysis of students' educational trajectories. In this case, the change in learning trajectories should be studied in a comprehensive manner, because these changes now do not fully indicate a change in the structure of labor resources.

Changes in the requirements for staff competences are due not only to the fact that some specialties will lose their significance, but also to the extent to which the knowledge and skills acquired in the learning process are consistent with the format of the new economy. The

rise of digital technologies will cause the eventual dissolution of about 50% of professions in the near future, and 67% of today's schoolchildren will end up working in those professions that do not yet exist (Frey & Osborne, 2013). This is confirmed by the OECD (2019): 40% of jobs created between 2005 and 2016 were in digitally intensive sectors. At that, it is estimated that by 2030 between 400 million and 800 million individuals around the world could be displaced by automation and need to find new jobs (Manyika et al., 2017).

Experts emphasize that in the pandemic, the success of universities depends on how quickly they can integrate digital educational technologies into their system, provide a high level of distance learning and track the digital footprint of students (Gallagher & Palmer, 2020). This goal is dictated by the desire of universities to pick up the trends of the labor market and provide in-demand training for students.

Currently, one of the main trends in the field of education in Russia is the priority of information technology and engineering-technical training over other fields to intensify innovative development (Dashkovskaya, 2021). It is worth noting that for a long time in Russia there has been an imbalance between the labor and education markets. The negative consequence of this was graduates facing difficulties with finding their first employment in their specialty. We will try to show in the study the existing gap between different profiles of education.

Based on the sample observation of Kolosova, Rudakov and Roshchin (2020) study the problem of graduates employment according to the profile of education received at the university from the standpoint of determinants, such as salary and job satisfaction. They confirmed that the probability of finding a job in the degree field was higher for students in medical, computer (information technology) and legal sciences. This once again confirms the relevance of the research problem.

Lanchakov, Filin and Yakushev (2020) investigated the distribution of state-funded openings in Russian universities, analyzed the peculiarities of graduates employment since 2015, and discussed the possible trends in this field until 2025. The researchers conclude that the most effective solution is the targeted attraction of potential applicants, continued involvement in joint events, getting to know the university at an early stage, and orientation of future applicants towards choosing the most in-demand professions. As it turned out, school plays a significant role in choosing the educational trajectory. According to the survey conducted by the Higher School of Economics (Prakhov, Rozhkova, & Travkin, 2021), 66% of bachelor's degree students entered the university after secondary school; 28% of respondents applied to the university after graduating from lyceums, gymnasiums, schools with gymnasium classes or in-depth study of certain subjects. Only 6% of students obtained primary and secondary vocational education before entering the university. The results of our study and the findings of Lanchakov, Filin and Yakushev (2020), Prakhov, Rozhkova, and Travkin (2021) can be useful in developing targeted interventions to balance learning gaps and labor market demand.

Amid fierce competition, universities are pursuing active marketing policy to attract applicants that is aimed at building the image of the future profession with an emphasis on the quality of the education provided. Generally, applicants adopt a rational approach to choosing their future profession. First of all, they think over the opportunities that employment can provide them with, and look over their competencies that imply certain knowledge, skills and abilities to be acquired in the learning process.

Similar to deciding on an education profile, choosing an educational institution is a complex process influenced by numerous factors, including labor market demands that have changed during the pandemic (Anufrieva et al., 2021). Rapid changes stimulate applicants to reconsider their educational plans just as quickly.

Using admission campaigns of 2013–2020 as examples, we attempt to track the change in preferences of Russian applicants and identify education profiles they chose.

Methods

Purpose of the study

The study aims to analyze the changes in the structure of fields of education preferred by students when entering Russian universities. During the analysis of 2013–2020 admission campaigns, we will also highlight key trends in the sphere of higher education, which will allow us to assess the prospects for further development.

Study design

In the course of the study, a structural-dynamic analysis was used (Sivelkin & Kuznetsova, 2002). This method lies in calculating individual and summarizing indicators of structural changes, i.e. absolute and relative structural shifts with a constant and variable comparative base.

The structural indicator was calculated by formula (1):

$$d_i = \frac{x_i}{s} \times 100, \quad (1)$$

where d_i is the share of the i-th structural element, i=N,1; x_i is absolute value by the i-th element; s is the sum total of absolute values of structural elements. When calculating, data on the selected indicator is used as a structural element to analyze structural changes (e.g., number of submitted applications for bachelor's degree programs; number of students enrolled in bachelor's programs).

The individual indicator of absolute structural shifts with a variable comparative base is calculated by formula (2):

$$\Delta = d_j - d_{j-1}, \quad (2)$$

where d_j is the proportion of the element in the j-th period; d_{j-1} is the proportion of the element in the period j–1.

The individual indicator of relative structural shifts with a variable comparative base is calculated by the ratio (3):

$$J_d = \frac{d_j}{d_{j-1}}. \quad (3)$$

The linear coefficient of absolute structural shifts with a variable comparative base (L^{Ab}_z) is calculated as a percentage (4):

$$L^{Ab}{}_{z} = \frac{\sum_{i=1}^{n} | d_j - d_{j-1} |}{n}, \quad (4)$$

where d is the proportions of attributes; n is the number of gradations in the structures; j is the periods compared.

The indicators of structural shifts allow tracing the dynamics of demand for profiles (specialties). To identify a field of education, the All-Russian Classifier of Specialties in Education is used (Rosstandart, 2016) that covers: mathematics and natural sciences; engineering, technology and technical sciences; healthcare and medical sciences; agriculture and agricultural sciences; social sciences; education and pedagogical sciences; the humanities; art and culture.

Study Hypotheses

As part of the study, we put forward a number of hypotheses about changes expected to happen in the structure of higher education by professional educational programs caused by the reorientation of companies and households in the pre-pandemic period and after the COVID-19 outbreak. The central hypotheses are as follows.

H1: during the period under review, the Russian system of higher education witnessed an increase in supply and demand for engineering specialties. This should be due to trends in the technological development of the economy, demand from the labor market, and government contracts for state-financed education in this group of specialties. The pandemic exerted a positive impact on students' interest in engineering specialties in 2020. The imposed restrictions on individual mobility and social distancing altered the forms of employment and study. This necessitated developing additional means to ensure distance learning and led to the increased demand for specialists in this field.

H2: during 2013–2020, there was a decline in supply for the humanities programs resulting from a decreasing demand for such specialists in the labor market.

H3: in 2020, there was an increase in students' interest in medical specialties and the consequent rise in supply of such educational programs. The prolonged COVID-19 pandemic has caused a serious shortage of medical staff at all levels. Fixing the problem of the healthcare staffing shortage will take time; however, the growing interest of the state in expanding medical programs is obvious.

By using structural-dynamic analysis of demand and supply, we aim to test the above hypotheses and identify the development patterns of higher education in Russia.

Study limitations

It is noteworthy that the subject and object of research impose some restrictions. Firstly, the analysis of fields of education is carried out only for higher educational institutions, whereas secondary vocational education was not considered. Secondly, the research timeframe is limited by the available statistical data on applicants enrollment; this period covers the 2023–2020 admission campaigns. Thirdly, we analyzed changes in the structure of state-funded education programs (government contract), while the commercial (paid) forms of training were not taken into account.

Data

The information base of the research includes data from Rosstat (Russian Federal State Statistics Service) and the Ministry of Science and Higher Education of the Russian Federation. The horizon of the study is the period of 2013-2020.

Results and Discussion

Higher education in Russia is undergoing constant reforms, which is accompanied by the regulation of supply and demand for educational services. The state is an active market player that provides tuition-free openings on a competitive basis for certain education profiles. The transformation of higher education during the COVID-19 pandemic was unprecedented and affected more than 4 million students and 235 thousand teachers in Russia (Shtykhno, Konstantinova, & Gagiev, 2020). The accumulated experience in the implementation of distance technologies has allowed the system of higher education to quickly switch to the format of mass remote learning (Djeki et al., 2022). However, the primary deterrent of the last few years is the declining number of applicants, which forces universities to employ a more flexible approach to accepting students. Let us more closely look at these shifts from the position of the changing structure of students' preferences.

Having analyzed 2013–2020 admission campaigns, we identified aggregated groups of education fields and determined the actual number of educational programs (specialties) corresponding to them.

In 2020, there were 181 bachelor's degree programs (specialties) offered by Russian higher educational institutions. The engineering, technology and technical sciences education field was the one providing the largest number of educational programs (74 out of 181) with the limited number of state-financed positions (Table 1). The next fields with the largest number of specialties were social sciences (27 programs), art and culture (26 programs), and mathematics and natural sciences (21 programs). It is worth noting that the number of applications for all these educational programs exceeds the number of state-funded openings.

Table 1

Fields of education and higher educational programs in Russia

Field of education (education profile)	Number of educational programs/specialties in 2020
Mathematics and Natural Sciences	21
Engineering, Technology and Technical Sciences	74
Healthcare and Medical Sciences	1
Agriculture and Agricultural Sciences	13
Social Sciences	27
Education and Pedagogical Sciences	5
Humanities	14
Art and Culture	26
Total	181

Source: (Minobrnauki, n.d.).

During 2013–2020, there was a steady growth in the number of applications submitted to such fields as mathematics and natural sciences, medical sciences, agricultural sciences, pedagogical sciences, the humanities, and art and culture. Table 2 shows the dynamics of applications to Russian universities between 2013 and 2020. The overall decrease in the number of applications was recorded only for engineering (decrease by 1.83%, or 22,542 units) and social sciences (decrease by 61.39%, or 1,193,066 units).

In 2020 compared to 2019, there was a significant increase in the number of applications submitted for programs in the field of mathematics and natural sciences (+7.85%), engineering (+10.67%), medical sciences (+22.62%), agricultural sciences (+4.26%), social sciences (+15.84%), pedagogical sciences (+6.91%), the humanities (+34.73%), and arts and culture (+30.35%).

It is quite difficult to compare the total number of applications submitted by applicants on a yearly basis, since demographic processes have a significant impact here: currently, the situation in higher education in Russia is gradually improving and moving away from the demographic bottom line reached in 2017 (Yudina, Mkrtchan, & Boyko, 2021).

According to experts, a constant demand for higher education in a difficult year of 2020 was due to favorable demographic factors and "cleansing of the higher education system, when there was a serious reduction in both the branch network and head universities, and an increase in the number of the target audience against this background" (Dashkovskaya, 2021).

In 2013–2020, the most popular fields of education among bachelor's degree students were engineering, technology and technical sciences, social sciences, education and pedagogical sciences. The share of applications in other fields did not exceed 10%. During the period under consideration, the share of applications for programs in engineering, technology and technical sciences grew from 30.3% to 41.0%. At the same time, the share of social sciences decreased from 47.7% to 25.4%.

In 2020, despite the COVID-19 caused economic crisis, the number of applicants for educational programs in medical sciences, the humanities, art and culture, engineering and social sciences increased compared to 2019. Hence, we can conclude that hypotheses *H1* and *H2* are partially confirmed.

Table 2

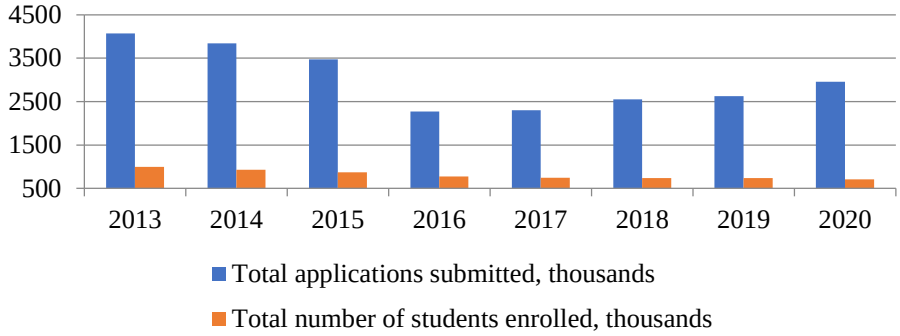
Dynamics of applications submitted to Russian universities between 2013 and 2020

Field of education	2013	2014	2015	2016	2017	2018	2019	2020
Mathematics and natural sciences	217,576	207,665	186,208	171,835	181,235	213,692	229,195	247,181
Engineering, technology and technical sciences	1,233,527	1,121,051	1,097,472	941,126	956,256	1,052,900	1,094,180	1,210,985
Healthcare and medical sciences	2,210	2,592	2,477	1,158	1,651	1,954	1,971	2,417
Agriculture and agricultural sciences	98,011	106,516	99,362	87,477	86,675	102,337	103,643	108,057
Social sciences	1,943,561	1,783,407	1,477,133	608,481	605,602	660,081	647,885	750,495
Education and pedagogical sciences	374,902	436,840	410,243	319,453	322,745	360,809	375,674	401,637
Humanities	144,211	117,278	130,436	89,499	96,325	104,615	113,606	153,060
Art and culture	58,975	62,683	70,824	50,871	52,690	57,591	61,874	80,651
Total	4,072,973	3,838,032	3,474,155	2,269,900	2,303,179	2,553,979	2,628,028	2,954,483

Source: (Minobrnauki, n.d.).

As for supply dynamics, despite the ideas of "excessive availability", the number of state-funded positions has been steadily falling over the past 8 years (Fig. 1).

Figure 1: *Dynamics of applications submitted and students enrolled for bachelor's programs in Russian universities between 2013 and 2020*



Source: (Minobrnauki, n.d.).

In 2013–2016, there was a marked decrease in the number of applicants to higher educational institutions; however, the growth recovery was recorded between 2016 and 2020. Despite the coronavirus pandemic, the number of applications increased by 12.4% in 2020, compared to 2019.

Dynamics of the number of students enrolled in Russian universities between 2013 and 2020 mostly corresponds to the dynamics of applications submitted: the increment was observed in mathematics and natural sciences (+1.5%), medical sciences (+12.3%), the humanities (+26.3%), and art and culture (+13.1%). A decline in the number of enrolled students during this period was in engineering sciences (–13.6%), agricultural sciences (–36.9%), social sciences (–47.5%), and pedagogical sciences (–10.5%).

The largest share of enrolled students in 2020 was in the fields of social sciences (36.8%), engineering, technology and technical sciences (32.3%), and education and pedagogical sciences (12.4%). The share of students enrolled in other fields of education did not exceed 10%.

A noticeable increase in the number of enrolled students (increase in supply) was observed in medical specialties (by 2.41 times) in 2020, compared to 2019. In the humanities and art and culture, student enrollment was similar to the level of the previous year. In other specialties, the admission of students to tuition-free openings was reduced, which was partially attributed to the overall reduction in the number of educational institutions (Orlova, 2019).

Thus, the third hypothesis (*H3*) about the growing supply of medical specialties was confirmed. However, the first hypothesis (*H1*) is partially rejected: while in 2020 there was an increasing demand for engineering specialties, no similar growth in supply was recorded.

We have calculated the ratio of submitted applications (demand) and the number of enrolled students (supply) for certain fields of education (Table 3). This indicator shows the competition per one state-funded place.

Table 3

Ratio of submitted applications and the number of students enrolled in Russian universities in 2013–2020

Field of education	2013	2014	2015	2016	2017	2018	2019	2020
Mathematics and natural sciences	6.25	6.08	5.65	5.14	5.40	6.06	6.22	7.00
Engineering, technology and technical sciences	4.67	4.50	4.46	4.02	4.17	4.47	4.61	5.30
Healthcare and medical sciences	1.59	1.89	1.99	1.05	1.45	1.45	3.06	1.55
Agriculture and agricultural sciences	1.95	2.94	2.90	2.67	2.77	3.10	3.15	3.41
Social sciences	3.92	3.91	3.66	1.86	1.99	2.32	2.37	2.89
Education and pedagogical sciences	3.84	4.38	4.43	3.54	3.57	3.88	4.01	4.58
Humanities	4.40	3.36	3.69	2.49	2.66	2.70	2.78	3.70
Art and culture	3.16	3.14	3.45	2.55	2.78	2.89	3.15	3.82
Total	4.09	4.12	4.01	2.93	3.09	3.45	3.58	4.18

The general competition rate in 2013 was 4.09, whereas in 2020 it rose to 4.18, despite the COVID-19 pandemic and a steady decline in 2013–2019. From 2019 to 2020, the competition rate increased by almost 17%.

An analysis of the number of applications submitted to popular specialties in 2020 shows that the highest supply-demand ratio was found for mathematics and natural sciences – 7.0, followed by engineering, technology and technical sciences – 5.3. The lowest rate was observed in medical specialties with only three applicants applying for two state-funded openings.

Based on the data obtained, we determine the linear coefficient of absolute structural shifts in the distribution of submitted applications for bachelor's degree programs: $L_{2020/2019}$=0.49, $L_{2019/2018}$=0.34, $L_{2018/2017}$=0.21, $L_{2017/2016}$=0.17, $L_{2016/2015}$=3.93, $L_{2015/2014}$=1.00, $L_{2014/2013}$=0.71. The highest rate of structural shifts in specialties was found in the 2015/2016 period. In 2016–2019, subtle structural shifts were observed.

According to absolute chain and basic structural shifts in the distribution of submitted applications, the largest decline in the number of applicants in 2020 compared to 2013 was recorded for social sciences. At that, the largest increase in the share of submitted applications (by 10.7%) was observed in the field of engineering, technology and technical sciences. Thus, the hypothesis about the growing demand for engineering specialties and the falling demand for programs in the humanities is confirmed (partially *H1* and partially *H2*).

The analysis of the structural shifts' intensity by individual absolute measures is generally consistent with the assessment of relative indicators (Table 4).

Table 4

Individual absolute measures of structural shifts in the distribution of submitted applications for bachelor's degree programs in 2013–2020

Field of education	Basic						
	2014	2015	2016	2017	2018	2019	2020
Mathematics and natural sciences	1.01	1.00	1.42	1.47	1.57	1.63	1.57
Engineering, technology and technical sciences	0.96	1.04	1.37	1.37	1.36	1.37	1.35
Healthcare and medical sciences	1.24	1.31	0.94	1.32	1.41	1.38	1.51
Agriculture and agricultural sciences	1.15	1.19	1.60	1.56	1.67	1.64	1.52

Field of education	Basic						
	2014	2015	2016	2017	2018	2019	2020
Social sciences	0.97	0.89	0.56	0.55	0.54	0.52	0.53
Education and pedagogical sciences	1.24	1.28	1.53	1.52	1.53	1.55	1.48
Humanities	0.86	1.06	1.11	1.18	1.16	1.22	1.46
Art and culture	1.13	1.41	1.55	1.58	1.56	1.63	1.89

Source: (Minobrnauki, n.d.).

The largest increase in the share of applications submitted in 2020 compared to 2013 was observed in the fields of art and culture (1.89 times), mathematics and natural sciences (1.57 times), healthcare and medical sciences (1.51 times), education and pedagogical sciences (1.48 times), the humanities (1.46 times), engineering, technology and technical sciences (1.35 times). A decrease in the share of submitted applications by 47% was recorded in the field of social sciences.

The growth in demand for a number of fields of education in Russia can be explained in part by government policy. Over the past decades, state authorities and local governments have paid special attention to the development of culture (Kurina & Kurulenko, 2020). The competitiveness of graduates of universities of culture and arts is high and is determined, among other things, by a sufficiently stable and constantly increasing professional need of cultural and art institutions for highly qualified personnel (Gemranova, 2018). Similar trends can be traced in other fields of education. Since the indicators of structural change are calculated for the base data for 2013, we can observe the effect of a low base.

Thus, the assumption about a decline in applicants' interest in the humanities programs has been rejected, despite the falling demand for such specialists in the labor market (partly *H2*). The third hypothesis (*H3*) about the increasing popularity of medical specialties among university applicants has been confirmed. In 2013–2020, there was a significant rise in popularity of mathematics, engineering, medical, agricultural, and pedagogical sciences, as well as culture and the humanities, while the demand for social sciences was slowing down.

Similarly, we determine the linear coefficient of absolute structural shifts in the distribution of students enrolled in bachelor's degree programs: $L_{2020/2019}$=0.19, $L_{2019/2018}$=0.33, $L_{2018/2017}$=0.61, $L_{2017/2016}$=0.37, $L_{2016/2015}$=1.10, $L_{2015/2014}$=0.60, $L_{2014/2013}$=0.49. The highest rate of structural shifts in the specialties of enrolled students was found in the 2015/2016 period. In 2016–2019, subtle structural shifts in student enrollment were observed.

The analysis of structural shifts in the specialties of enrolled students demonstrates that the most significant changes were observed in the fields of engineering, technology and technical sciences, social sciences, education and pedagogical sciences, and the humanities. The slightest structural shifts were noted in healthcare and medical sciences, agriculture and agricultural sciences. Significant changes in the distribution of the specialties of enrolled students in these fields occurred between 2018 and 2020.

Table 5

Individual relative measures of structural shifts in the distribution of students enrolled in bachelor's programs in 2013–2020

Field of education	Basic						
	2014	2015	2016	2017	2018	2019	2020
Mathematics and natural sciences	1.05	1.09	1.24	1.29	1.36	1.43	1.43
Engineering, technology and technical sciences	1.01	1.07	1.14	1.16	1.20	1.22	1.22
Healthcare and medical sciences	1.06	1.03	1.02	1.10	1.30	0.63	1.58
Agriculture and agricultural sciences	0.77	0.78	0.84	0.83	0.88	0.89	0.89

Field of education	Basic						
	2014	2015	2016	2017	2018	2019	2020
Social sciences	0.98	0.94	0.85	0.82	0.77	0.75	0.74
Education and pedagogical sciences	1.09	1.09	1.19	1.24	1.28	1.30	1.26
Humanities	1.14	1.24	1.41	1.48	1.59	1.69	1.78
Art and culture	1.14	1.26	1.38	1.36	1.44	1.42	1.59

Source: (Minobrnauki, n.d.)

The largest increase in the share of enrolled applicants in 2020 compared to 2013 was observed in the fields of the humanities (1.78 times), art and culture (1.59 times), healthcare and medical sciences (1.58 times), mathematics and natural sciences (1.43 times), education and pedagogical sciences (1.26 times), engineering, technology and technical sciences (1.22 times). A decrease in the share of enrolled applicants was recorded in agriculture and agricultural sciences (by 11%) and social sciences (by 26%).

A comparison of the indicator of structural shifts between 2019 and 2020 shows a fundamental change in the demand for fields of educational training. For Healthcare and medical sciences, the growth rate was 2.5 times. All other fields of education did not show such bright dynamics: no changes in Mathematics and natural sciences, Engineering, technology and technical sciences, Agriculture and agricultural sciences; slight decline in Social sciences, Education and pedagogical sciences; relatively small increase in Humanities, Art and culture.

Thus, the growing supply of medical specialties in 2020 indicates that the hypothesis *H3* is confirmed. The COVID-19 pandemic has revealed the problem of the healthcare staffing shortage and the need to increase the number of students enrolled in medical education programs. The assumption that the supply of engineering and technical professionals was growing while the supply of specialists in the humanities was decreasing has not been confirmed (partly *H2*). Despite the structural imbalance in the labor market, the state maintains the supply of specialists in the humanities by providing state-funded positions.

Conclusion

The conducted research has change happened in the Russian market for higher education: the increasing demand for medical specialties. An increase in the popularity of applicants for a bachelor's degree was noted in the absolute number of applications in engineering, technology and technical sciences, social sciences, education and pedagogical sciences; the lowest demand was recorded for such fields as healthcare and medical sciences, art and culture, and the humanities.

In 2013–2020, there was a surging demand for education profiles in the fields of art and culture, mathematics and natural sciences, healthcare and medical sciences. What can be explained on the one hand by the effect of a low base, on the other hand, by the ongoing state policy. Our hypothesis about the falling demand from applicants for the humanities was not confirmed. At the same time, we have proved the hypothesis about an increase in demand from applicants for medical specialties during the period of 2013–2020 (by 9.37%) and in the pandemic year 2020 (by 22.63%).

In general, the structure of supply of specialists corresponds to the structure of demand. The most substantial changes in 2013–2020 were observed in the education profiles of engineering, technology and technical sciences, social sciences, education and pedagogical sciences, and the humanities. We have found no evidence to support the assumption about the rising supply of specialists in engineering-technical specialties and a simultaneous decline in

the supply of those in the humanities. We have confirmed the hypothesis about an increase in the supply of medical specialties in 2020. The COVID-19 pandemic has detected the problem of the healthcare staffing shortage and the need to attract more students to medical education programs.

Contrary to some experts arguing that there is no need for mass higher education, the supply of specialists with a university degree keeps growing. With some structural imbalance in the labor market, the state maintains the supply of specialists in the humanities by providing state-funded openings. This is due to the priorities of Russia's educational policy that, among other things, takes into account applicants' interest in gaining pedagogical education. At the same time, it is engineering-technical specialties that are leading in terms of both the absolute number and the specific growth rate of tuition-free places.

It is worth noting that the transformation of higher education was initiated much earlier under the influence of global risks, but it was the COVID-19 pandemic that became a trigger for reconsidering the system of socio-economic institutions, in particular universities and the labor market in search for an optimal balance in educating future professionals. Here, as a prospect for further research, it is expedient to conduct a detailed analysis of individual sectors of the economy in order to clarify the existing staffing gap between supply and demand.

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