

Demographic risks, challenges, problems and disparities in the regions of the Central district of Russia

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Abstract. The paper considers the trends of population reproduction in Russia, highlighting its negative phenomena, processes, trends and imbalances. Also the paper dwells on demographic risks, their challenges and imbalances. We try to analyze the dynamics of population, population composition by sex and age, the ratio of urban and rural population, birth and death rates and life expectancy by using data on four regions of the Central Federal District: the Vladimir, Ivanovo, Kostroma and Yaroslavl regions. Also we take into account the factors influencing the dynamics of key demographic indicators and the impact of the coronavirus pandemic on demographic characteristics.

Keywords: demographic risks, threats, problems, imbalances, population greying, population size, depopulation, contracted reproduction, population composition, urban-rural population ratio, infant natality, population mortality, life expectancy, the Vladimir region, the Ivanovo region, the Kostroma region, the Yaroslavl region.

JEL codes: J11; J12; J13; R23

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Introduction

Presidential Decree No. 204 of 7 May 2018 "On the National Development Goals of the Russian Federation for the period until 2030" defines the "population preservation, health and well-being of people" as a primarily one. The problem of demographic preserving of Russia and demographic challenges attracts the attention of specialists from various fields of scientific knowledge – economics, demography, sociology, geography, etc.

The problems of overcoming the demographic crisis in Russia are the issues of the system of social reproduction processes. According to V.A. Gordeev, the study of social reproduction is a fundamental basis for the development of theoretical economics. Over the past 10-15 years in Russia there has been a steady interest to the issues of regional reproduction, because, on the one hand, both the importance of decentralized decisions and the responsibility of the regions for their own socio-economic development has increased, and, on the other hand, the regions contain the reserves to improve economic efficiency to a large extent (Gordeev, 2022).

Specialists highlight the challenges and risks to the country's demographic preserving. We agree with A.V. Kuchumov and E.V. Pecheritsa, possessing the demographic problems as "the catalyst for almost all existing global problems. Demographic issues have become a real global challenge, which prevention requires the efforts of all countries. According to the authors, the main demographic threats are depopulation;

degradation of the family institution; unregulated migration processes; population greying (Kuchumov & Pecheritsa, 2020).

The risks associated with the COVID-19 pandemic are also under study:

- public health risks (personal risk of "facing" COVID-19, risk of becoming ill yourself or someone close to you, risk of increased non-coronavirus-related disease, risk of worsening psychological health, risk of increased mortality);
- risks of creating and preserving families (risk of worsening family understanding in self-isolation or remote working, risk of falling marriage rates, risk of increasing divorce rates, risk of changing reproductive attitudes);
- risks of satisfaction of person's needs in education, acquisition of income (risk of a drop in the quality of education in distance learning settings, loss or reduction of wages and other income);
- risk of migrant situation (migration outflow of population from the region), etc.

There are direct and indirect risks. Sigareva, Sivoplyasova & Pletneva (2020) based their study on population surveys and concluded the less significance of direct risks in terms of demographic situation; in turn the indirect risks associated with a rapid transformation of economic situation. The risks relating to worsening of economic conditions of families, the decline of their material well-being (growing of unemployment, loss of wages and monetary savings) and the risks of spending spree are assessed as high and maximum ones.

The study of risks and their ranking (1 point – minimum risk, 2 points – low risk, 3 points – average risk, 4 points – high risk, and 5 points – maximum risk) allows establishing an effective system of measures to prevent and outcome these risks (Sigareva, Sivoplyasova & Pletneva, 2020).

Considering these demographic and the associated risks, problems and imbalances can be noted as:

- depopulation of the Russian people. Nowadays, there are two paradigms of the family: The first is the modernization paradigm, according to it all negative and positive changes in the family are perceived and interpreted as private, specific manifestations of the general and progressive process of family modernization and population reproduction, replacing one type ("traditional") with another ("modern") within the framework of modernization of the whole society (industrialisation, urbanisation, emancipation of women and children, etc.). The second one is the paradigm of the family crisis including family and values of the family way of life (declining of socio-normative regulation of family life, transformation of cultural symbols and patterns, reduction in the value of marriage, family with children, unity of all family generations) (Berendeeva & Zosimova, 2018).

There is a theory of demographic transition. It includes the transition from "high fertility and heavy mortality" to "low fertility and low mortality", which explains the inevitability of small families. As Sinelnikov (2021) notes, the theory of demographic transition "recognises the unsustainability and childlessness of most modern families as an irreversible and positive phenomenon, integrally associated with the modernization of society". The adherents of this theory ("modernizers") consider this transition as a progressive process, which occurs earlier in some countries and later in others, and which causes depopulation, including the Russian Federation. Pandemic of COVID-19 complicated this process, which led to increasing of mortality rates.

By Table 1, the natural decrease in population in Russia has been accelerating since 2016, while the migration increase since 2018 does not cover the natural decrease. For example, in 2019 population decline in Russia was 0.02%, and in 2020 (COVID-19 pandemic) - 0.39%.

Table 1 – Components of change in the total population of the Russian Federation (thousand people)

Period	Population at 1 January	Changes for the year			Population at 31 December	Total increase for the year, per cent
		total growth	natural increase of the population	positive migration balance		
2015	146,267.3	277.4	32.0	245.4	146,544.7	0.19

Period	Population at 1 January	Changes for the year			Population at 31 December	Total increase for the year, per cent
		total growth	natural increase of the population	positive migration balance		
2016	146,544.7	259.7	-2.3	262.0	146,804.4	0.18
2017	146,804.4	76.0	-135.8	211.8	146,880.4	0.05
2018	146,880.4	-99.7	-224.6	124.9	146,780.7	-0.07
2019	146,780.7	-32.1	-317.2	285.1	146,748.6	-0.02
2020	146,748.6	-577.6	-702.1	124.5	146,171.0	-0.39

Source: *Demographic Yearbook of Russia, 2021*

According to the Federal State Statistics Service's estimate, the resident population of the Russian Federation was 145.3 million at 1 March, 2022. Since the beginning of the year, the population has decreased by 220,500 or 0.15% (the same period of the previous year it decreased by 156,900 or 0.11%). In January-February 2022, along with natural population decline (-178.7 thousand people) there was a migration outflow (-41.8 thousand people) (Rosstat, 2022).

The depopulation factor of interregional migration flows is relevant for many regions of Central Russia. We analyzed these migrations data on the example of population outflows from the Vladimir, Ivanovo, and Yaroslavl regions to the Moscow agglomeration and showed the role of educational and labour migration of young people in total one (Berendeeva & Berendeeva, 2022);

- depopulation in rural areas. The proportion of the rural population in the Russian Federation was 25.3%, while in the Ivanovo region it was 18.2% and in the Yaroslavl region 18.5% (Regions of Russia, 2021). Researchers write about the demographic shrinkage of the population of small settlements. For example, there observed the reduction of the number of rural settlements in 54 constituent entities of the Russian Federation in 2010-2016. For the management system at the sub-regional level, especially for rural settlements with small population size, the problems of lack of "points of growth" and subsidization of local budgets, low level of entrepreneurial activity are typical (Sosnin & Stolbova, 2018).

The depopulation of small and single-industry towns is on the top. The main economic risks of single-industry towns are related to the crisis of city-forming enterprises, narrow specialization of economic activities (Elizarova & Berendeeva, 2018). At the same time, research shows the similarity of the natural and migratory movements of the population of small towns with those in rural areas in terms of their nature and intensity. In turn, in the large villages located on the suburbs of large cities and regional centres, the demographic processes proceed quite favorably;

- significant demographic differentiation between urban and rural populations. For example, Gayazov, Akhmetova, Utyasheva & Shamsutdinova (2020) show this differentiation by using natural and migratory population growth, total fertility rate, life expectancy, etc.

Batrakova (2021) notes a presence of sustainable and large-scale intra-regional inequality along with inter-regional one.

The statistics show a higher rural than urban migration loss as a result of inter- and intra-regional population migrations (Berendeeva & Berendeeva, 2022). Thus, Tebekin (2021) highlights a chain of socio-demographic problems and economic losses typical for the most regions of the country: reduction of jobs in schools and hospitals as a result of their optimization, the need for labour migration of teachers and doctors, the search for spatially accessible other educational and medical institutions, the need for labour migration for part of the working-age population. It can be concluded that "the availability of social infrastructure facilities – schools and hospitals – is the basis for the development of settlements in the Russian Federation" (Demographic Yearbook of Russia, 2021).

- unregulated migration in Russian regions poses risks of increased crime, drug trafficking, terrorism, epidemics, weapons trafficking, and inter-ethnic conflicts; under-receipt of taxes from the use of illegal

migrant labour, etc. Analyzing the impact of the COVID-19 pandemic, researchers note that "contemporary migration in an increasingly globalized world has itself become a trigger for accelerating the spread of the disease" (Sigareva, Sivoplyasova & Pletneva, 2020).

Today, experts note the poor quality of migration accounting in Russia as a whole and especially in the Moscow and St. Petersburg agglomerations. Migrants have the most difficulties with registration (e.g. migrant statistics according to the Ministry of Internal Affairs and the Federal State Statistics Service differ). It is difficult to assess the intensity of the impact of migration processes on the formation of the region's population clearly, hence an indirect assessment using forecasting methods is used.

This study of interregional and intraregional migration flows shows the existence of migrations of residents of many Central Russian regions permanently or temporarily (on a rotational basis) to the Moscow agglomeration, which is dictated by economic factors: the large number and diversity of vacancies and higher wages in the Moscow agglomeration. The Moscow agglomeration is constantly demanding qualified personnel;

- decline of birth rate, reduction in the birth rate, transition of the family to a nuclear one, and the predominance of a contracted reproduction type. According to the Federal State Statistics Service's sample survey of the reproductive plans of the population (the last survey was conducted in 2017), almost 37% of Russian women aged 18 to 44 participated in the survey had one child, about 27% had two children, about 6% had three, and a little over 1% had four or more children. Almost 30% of Russian women surveyed are childless. The average age of mothers at childbirth has increased. Thus, in 2000-2004, the average age of the mother at the birth of the first-born was 22.3 years, in 2015-2017 it increased by 3.8 years to 26.1 years (Rosstat, 2022).

Typical of the current phenomenon is the conscious avoidance of childbearing (so-called "voluntary childlessness"), which is gaining in popularity at the moment. According to Kobleva (2022), the motivational sphere of voluntary childless partners, especially for women, is more often fulfilled by the motive of professional realization, with the decision not to have a child coming more often from women of reproductive age, who do not want to divert from their career and personal growth to childbirth and the creation of a family. Childless women appear to be more socially adapted compared to mothers in terms of professional qualifications: success and level of professional training.

Kulkova's analysis shows the availability of almost a third of women to change their reproductive plans due to the pension reform. The changes of reproductive behaviour are multidirectional: some women have shown an intention to have more children due to the opportunity to retire earlier than women with few or no children, others to reduce the expected number of children. The main reason for the possible positive impact of the pension reform on women's reproductive behaviour was the opportunity to retire earlier (having three or more children). According to the survey, the negative impact of the pension reform on the birth rate is related to a possible reduction of grandparents' support in taking care of children due to the increased retirement age, as almost 60% of women expect such support if they have children (Kulkova, 2021).

There is an opinion about the negative impact of COVID-19 pandemic on reducing fertility and transforming reproductive behaviour (Sigareva, Sivoplyasova & Pletneva, 2020).

For the most families the financial situation declines with the birth of a child. For example, a study by Arkhangelskiy, Elizarov & Dzhanayeva (2021) has shown the difference of families intending and do not intending to have another child by four parameters. "Families who are going to have another child, have, on average, a lower number of existing children (i.e. they are more likely to have the intention of having their first and second child), a higher importance of children and a lower "loss" in importance to material well-being, higher average per capita income and a relatively higher estimate of the standard of living of the family".

- Russia's total fertility rate declined year by year from 23.2 ppm (1960) to 15.7 (1965), 13.4 (1990), 8.3 (1999), 13.3 (2012), 12.9 (2016), 10.9 (2018), 9.8 (2020);

- the total fertility rate (TFR) declined from 2.417 (1961-1962), to 1.193 (1995), 1.045 (1999). There was an increase: 1,189 (2002), 1,439 (2010), 1,672 (2016), 1,579 (2018), 1,505 (2020). But the reserves for growth of this indicator are exhausted and, in general, there remains a contracted reproduction of the country's

population (the limit of simple reproduction for Russia is 2.1-2.15) (Regions of Russia, 2021);

- net reproduction rate provides the replacing the generation of women by their daughters while maintaining the same fertility and mortality rates over time.) It declined from 1.1 (1961-1962) to 0.54 (1999) and 0.84 (2016), 0.72 (2020). The reduction of the rural population has a negative impact on the reproduction of the Russian population: the net reproduction rate for the rural population (0.83) is higher than for the urban population (0.686) (Demographic Yearbook of Russia, 2021).

One of the factors providing decline of Infant natality (along with the demographic transition) is the decline in the number of women of reproductive age. As shown in Table 2, in 2021 the number of women in the 20-24 years is 2.67 million lower than in 2010, and the 25-29 years by almost 1.8 million lower. The majority of newborns are born by the women of 20-29 years. But since 2009, the maximum number of births in Russia has been between the women' ages of 25-29, rather than 20-24, i.e. the birth of the first child is postponed by women (Demographic Yearbook of Russia, 2021).

Table 2 – Number of women of primary reproductive ages in the Russian Federation, by year

Period	2010	2019	2020	2021
Total women aged 15-49*	37 227 890	34 683 401	34 502 030	34 182 566
20–24 years	5 999 283	3 486 971	3 380 456	3 329 784
25–29 years	5 972 314	5 007 956	4 598 561	4 181 285
30–34 years	5 545 999	6 332 379	6 276 114	6 151 363

Source: Demographic Yearbook of Russia, 2021

As shown in Figure 1, the number of women of primary reproductive age in the Russian Federation is declining. Since 2010 it raised from the 20-29 age groups to the 30-34 age group in 2019. It may have a negative impact on the total number of births;

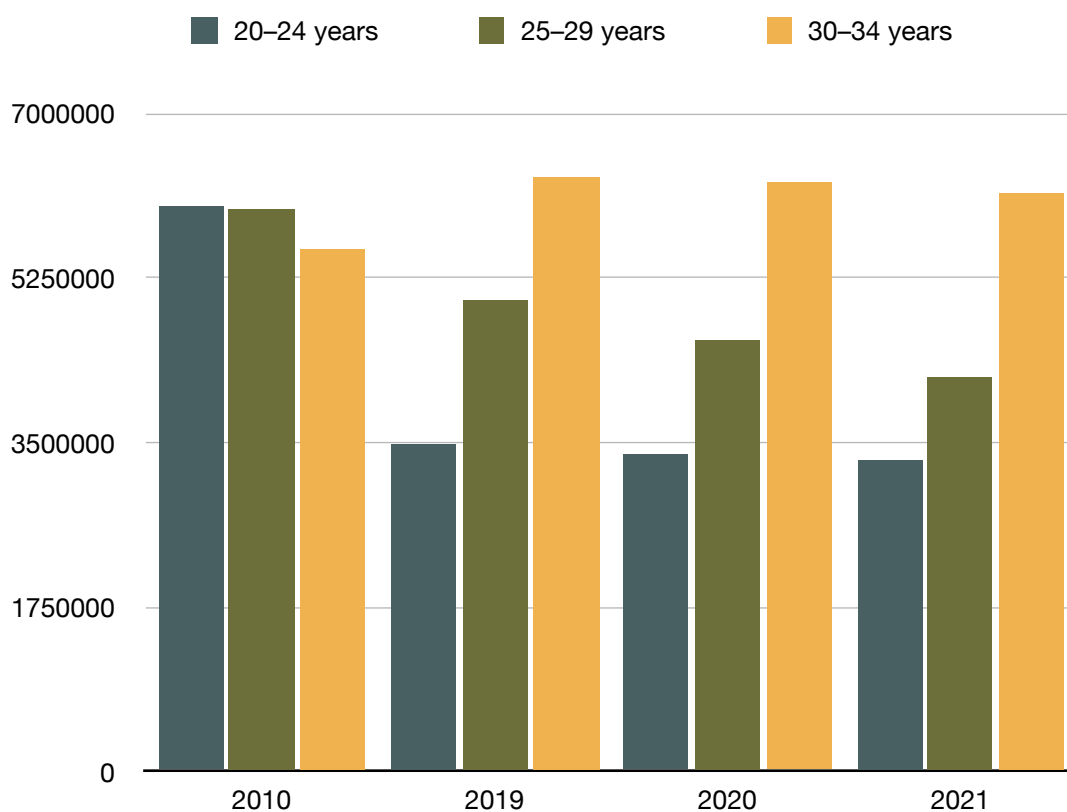


Figure 1. Dynamics of the number of women of primary reproductive age in the Russian Federation in 2010, 2019, 2020 and 2021, thousand people

Source: composed by authors

- population greying One distinguishes between "ageing from below" as a gradual decrease in the number of children due to a decline of birth and "ageing from above" as an increase in the number of older people due to decreasing of mortality in old age and a slow increase in the number of children. Population greying defines by the follows:

(a) The average age of the population as at 1 January was 34.9 (1990), 37.6 (2002), 38.9 (2010), 39.7 (2017). Thus, the average age of a Russian has risen by 4.8 years since 1990;

(b) the percentage of people over the working age has increased in Russia from 20.5% (2005) to 25.4% (2017) of the total population at the end of the year (Regions of Russia, 2021).

By Dobrohleb & Barsukov (2020), in some countries there is a decline in economic growth caused by a significant increase in the proportion and size of the older generation. As the authors note, "Russia... after the demographic dividend implementation phase is in an intermediate state between "aging from below" and "aging from above" due to the fact that fertility is at a fairly low level, and mortality at older ages is still significantly higher than in developed countries.

- Gender imbalance (asymmetry of the sexes) in the Russian sex and age pyramid. The gender imbalance is less in regions with a younger population. Accordingly, this difference is maximum one in the Central and North-West Federal Districts, where the rate of greying is higher, and minimum in the North Caucasus Federal District, where the proportion of young people is higher. Our study shows the determining impact of population pressure coefficients and total infant natality rates on the ratio of men to women in Russian regions; in particular, declining of infant natality depends on ageing and increasing population pressure;

- declining of the indicators of the public health. Since the 1960s, there has been an increase in the total mortality rate of the population: 7.4 ppm (1960), 15.0 (1995), 16.4 (2003), 14.2 (2010), 12.9 (2016). Male over-mortality persists, the age-specific male mortality rates exceeding those of females many times, especially at the working age (not typical for developed countries). The main resource for increasing life expectancy in our country for older age groups (over 50 years) is the reduction of mortality, primarily by diseases of the circulatory system and cancers, and for younger age groups, especially men, the reduction of mortality by external causes, which are responsible for the greatest demographic and socio-economic damage (Sizova & Berendeeva, 2021).

Thus, the purpose of this study is to analyze the dynamics of the main demographic indicators in the regions of Central Russia and the impact of these indicators on the prospects of population reproduction.

Methods

The methodological basis of our study consist in comparative analysis of statistical indicators by the Federal State Statistics Service of the Russian Federation on demography in the constituent entities of the Russian Federation, and scientific papers on the analysis of the demographic situation and demographic structures (by sex and age), demographic processes (infant natality, mortality, family formation, etc.) and phenomena (childlessness, voluntary childlessness, etc.) in Russian regions.

Results

We analyzed data on the main demographic indices using Federal State Statistics Service data on the example of the Central Federal District (CFD) regions – Vladimir, Ivanovo, Kostroma and Yaroslavl regions

The main demographic indices are population size, urban/rural population ratio, male/female ratio, age composition, birth rates (total crude birth rate and aggregate birth rate), mortality (total crude death rate), natural increase/decline, life expectancy.

We analyzed the population size dynamics of the regions. By Table 3, the population of the Vladimir, Ivanovo, Kostroma and Yaroslavl regions is declining: in 2005-2020 in the Vladimir region it declined from 1486 to 1342 (by 144 000 or 9.7%), and in the Ivanovo region from 1102 to 987 (by 115 000 or 10.4%), or 9.7%), in the Kostroma region from 700 to 628 (by 72 thousand persons or 10.3%), in the Yaroslavl region from 1313 to 1241 (by 72 thousand persons or 5.5%).

The population of the CFD is growing due to Moscow (in 2005-2020 from 10924 to 12655 thousand people, or 15.8%) and the Moscow region itself (from 6784 to 7708 thousand people, or 13.7%).

Table 3 – Population in the CFD (estimate at the end of the year; thousand people)

Period	2005	2010	2015	2018	2019	2020	Declining / growth for 2005-2020
Russian Federation	143,236	142,865	146,545	146,781	146,749	146171	+2.0
Vladimir region	1 486	1 441	1 397	1 366	1 358	1342	-9.7
Ivanovo region	1 102	1 060	1 030	1 004	997	987	-10.4
Kostroma region	700	666	651	637	633	628	-10.2
Moscow region	6 784	7 106	7 319	7 599	7 691	7708	+13.7
Yaroslavl region	1 313	1 271	1 272	1 260	1 254	1241	-5.5
Moscow	10 924	11 541	12 330	12 615	12 678	12655	+15.8

Source: *Regions of Russia, 2021*

Figure 2 shows the depopulation trend for these regions. Ivanovo and Kostroma regions have the highest rates of population decline among these 4 regions.

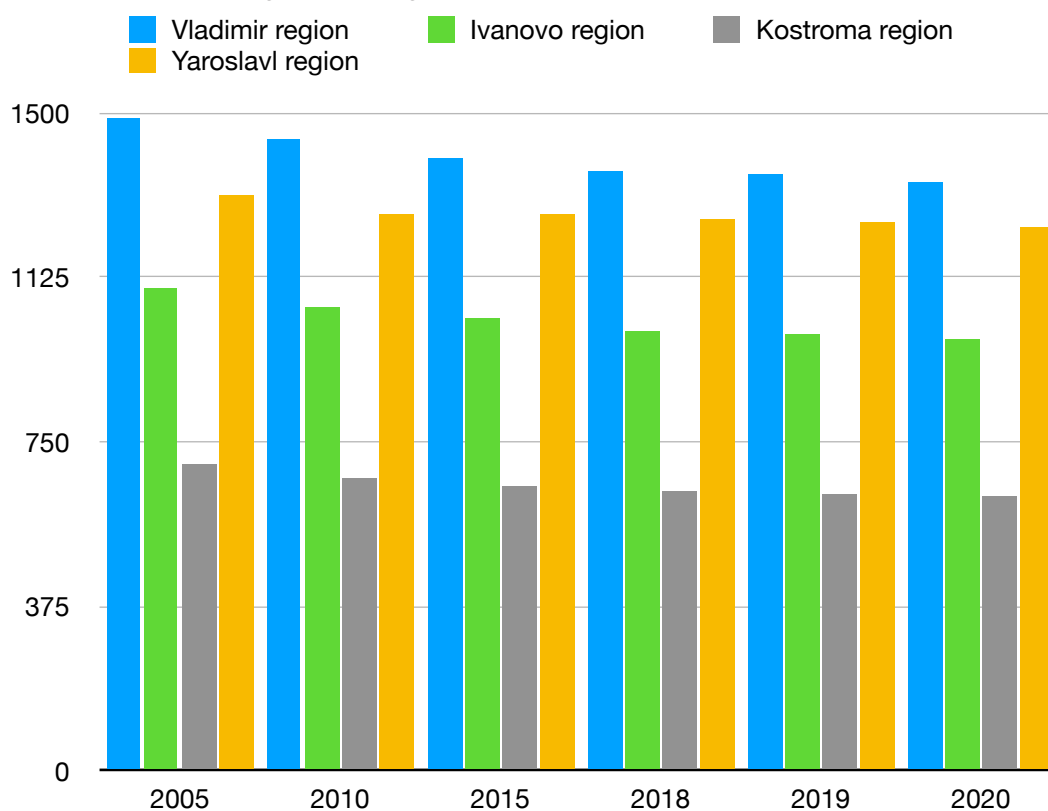


Figure 2. Regional population dynamics for 2005-2020, thousand people

Source: composed by authors

The majority of the population in these regions as in Russia as a whole lives in urban areas. The percentage of the urban population in 2020 is (in descending order) 81.8% in the Ivanovo region, 81.5% in the Yaroslavl region, 78.2% in the Vladimir region, 73.0% in the Kostroma region (Regions of Russia, 2021).

We analyzed male/female ratio in Russia. If in the country as a whole in 2020 there were 1165 women

per 1000 men, the same ratio was 1158 in the Vladimir region, 1206 in the Ivanovo region, 1174 in the Kostroma region, 1224 in the Yaroslavl region, which indicates a gender imbalance of the population, which is most noticeable in the Yaroslavl and Ivanovo regions.

Scientific literature on demography and migration studies considers the main factors influencing gender imbalance:

(a) Biological factors: predominance of boys among newborns (the ratio of girls among newborns used in calculations, including in the mortality table, is 0.488), women higher life expectancy;

(b) gender's differences in mortality (Russia has a male over-mortality rate and, consequently, a men lower life expectancy);

(c) a structural factor: a high proportion of the older generation, dominated by women, and a low proportion of young people under 30, dominated by men (this factor is a consequence of the low birth rate since the 1990s in Russia and the higher mortality of men, especially those of working age);

(d) different intensity of male and female migration (predominance of male migration) (Sizova & Berendeeva, 2021).

The gender imbalance in active reproductive age affects the socio-demographic problems of society: due to the high mortality of men of these ages there is an absence of husbands and fathers in families and grooms in the marriage market and, all other things being equal, it affects the decline of the birth rate. Potential mothers are unable to realize their reproductive attitudes due to the absence or loss of a marital partner. At the same time, state expenditure on support for single-parent families, orphans and children left without parental care, survivor pensions, etc., is increasing.

Also we analyzed the age composition of the population. By Table 4, between 2005 and 2020, the population under working age in the regions under study increased slightly: in the Vladimir region from 14.4% to 16.6%, in the Ivanovo region from 14.4% to 16.4%, in the Kostroma region from 15.4% to 18.4%, and in the Yaroslavl region from 14.3% to 17.4%. The working-age population declined from 61.3% to 54.4% (by 6.9%) in the Vladimir region, from 60.8% to 55.0% (by 5.8%) in the Ivanovo region, from 61.7% to 53.5% (by 8.2%) in the Kostroma region and from 61.2% to 54.5% (by 6.7%) in the Yaroslavl region. At the same time, the percentage of people above the working age has been growing and reached 28.1-29% in the regions (2020). With the raising of the retirement age in 2019, a retirement schedule has been drawn up by year of birth with a transition to the retirement age of 65 for men and 60 for women.

Table 4 – Age composition of the population in the regions (estimate at the end of the year; as a percentage of the total population)

Period	Below working age population		Working age population		Population above working age	
	2005	2020	2005	2020	2005	2020
Vladimir region	14.4	16.6	61.3	54.4	24.3	29.0
Ivanovo region	14.4	16.4	60.8	55.0	24.8	28.6
Kostroma region	15.4	18.4	61.7	53.5	22.9	28.1
Yaroslavl region	14.3	17.4	61.2	54.5	24.5	28.1

Source: *Regions of Russia, 2021*

By Figure 3, from 2005 to 2020, the percentage of working-age population in the Yaroslavl region decreased and the percentage of people above working age increased. The situation is similar for all the regions under study.

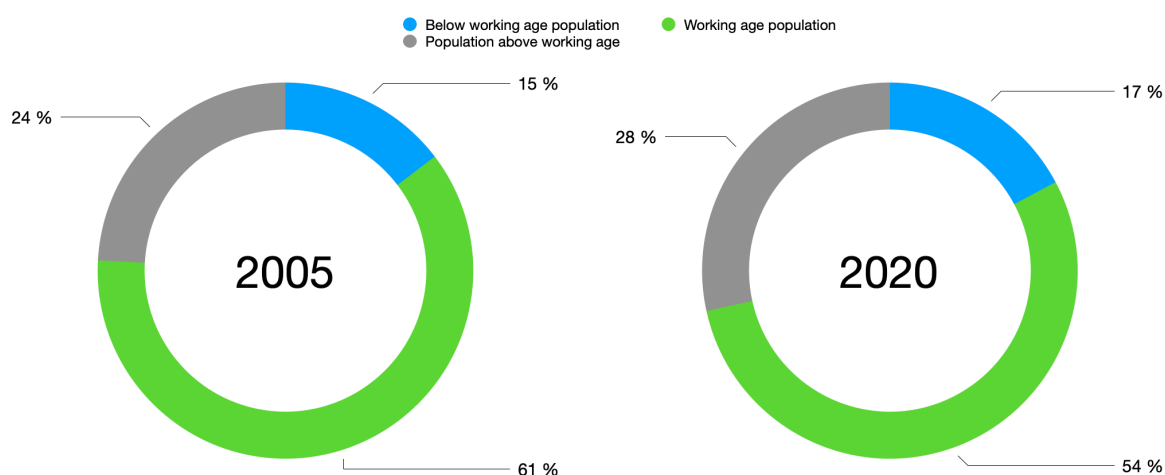


Figure 3. Population composition by age in the Yaroslavl region in 2005 and 2020, as a percentage of the total population

Source: composed by authors

The demographic burden coefficient (per 1,000 people of working age are incapable of work) as of January 1, 2021 (in descending order: in the Kostroma region – 870 people, in the Vladimir region – 838, in the Yaroslavl region – 836 and in the Ivanovo region – 817 (Regions of Russia, 2021).

We analysed the birth rates for 4 regions of the CFD. By Table 5, the total birth rate has reduced for all the regions during 2005-2020 in the Vladimir region – from 9.1 to 7.5 ppm (%), in the Ivanovo region – from 8.7 to 7.6%, in the Kostroma region – from 9.8 to 8.5%, in the Yaroslavl region – from 9.3 to 8.5%. The lowest birth rate is in the Vladimir region (79-th in the Russian Federation) and in the Ivanovo region (78-th in the Russian Federation), 0.9 ppm lower than in the Kostroma and Yaroslavl regions respectively.

Table 5 – Total birth rate (number of births per 1,000 population, ppm)

Period	2005	2010	2015	2018	2019	2020	Rank, Russian Federation, 2020
Russian Federation	10.2	12.5	13.3	10.9	10.1	9.8	-
The Central Federal District	8.7	10.7	11.7	9.9	9.3	9.0	8
Vladimir region	9.1	10.8	11.6	9.3	8.1	7.5	79
Ivanovo region	8.7	10.4	11.4	9.0	7.9	7.6	78
Kostroma region	9.8	12.1	12.5	9.7	9.1	8.5	61
Yaroslavl region	9.3	11.2	12.2	9.8	8.9	8.5	60

Source: Regions of Russia, 2021

By Figure 4, in 2020 in all 4 regions under study the total birth rates decreased compared to 2015: in the Vladimir region – by 4.1, in the Ivanovo region – by 3.8, in the Kostroma region – by 4.0, in the Yaroslavl region – by 3.7 ppm.

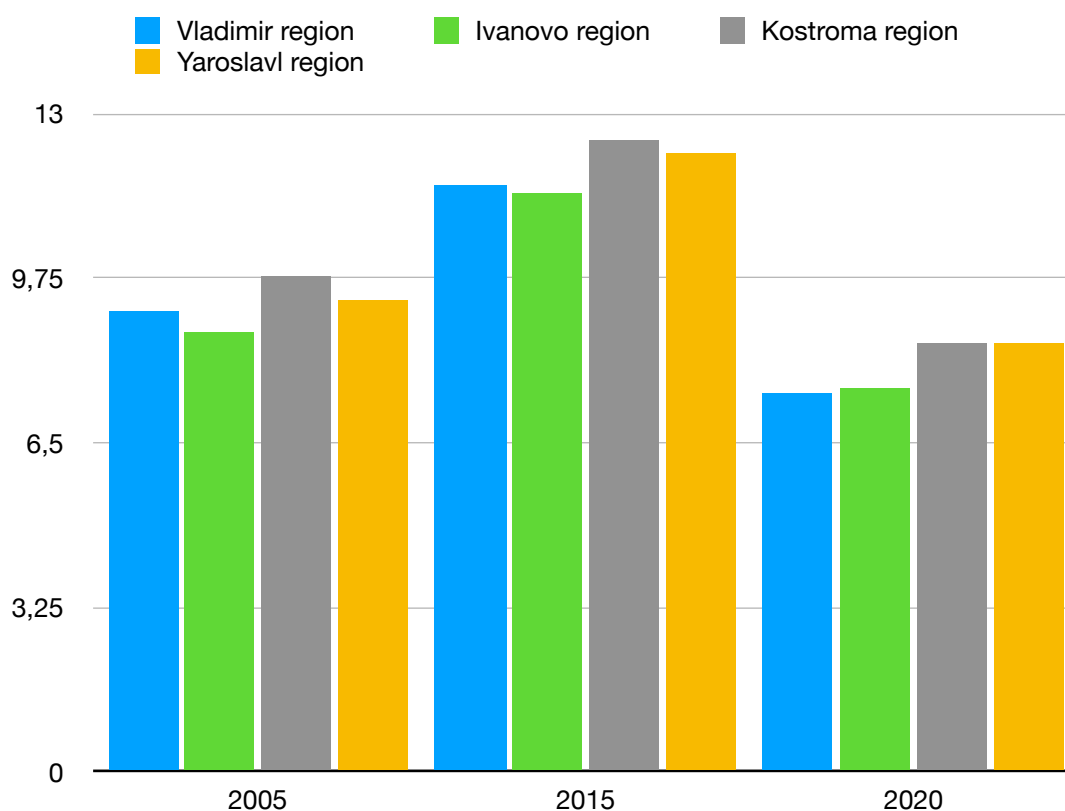


Figure 4. Dynamics of total birth rates in the regions in 2005-2020, ppm

Source: composed by authors

We analyzed the aggregate birth rate (ABR). By Table 6, over the period 2005-2020 the ABR in the regions under study was growing and reached a maximum in 2015 for the Vladimir region – 1.730, the Ivanovo region – 1.829, the Kostroma region – 1.890, the Yaroslavl region – 1.695. In the following years there was a decline in the ABR, but as a result, since 2005 the ABR has grown slightly: from 1.252 to 1.268 (by 0.016) in the Vladimir region, from 1.183 to 1.239 (by 0.056) in the Ivanovo region, from 1.334 to 1.464 (by 0.13) in the Kostroma region, and from 1.254 to 1.364 (by 0.11) in the Yaroslavl region. Thus, the Kostroma and Yaroslavl regions have the best growth rates.

Table 6 – Aggregate birth rate (number of children per woman)

Period	2005	2010	2015	2018	2019	2020
Russian Federation	1.294	1.567	1.777	1.579	1.504	1.505
The Central Federal District	1.160	1.367	1.575	1.441	1.396	1.407
Vladimir region	1.252	1.462	1.730	1.491	1.355	1.268
Ivanovo region	1.183	1.398	1.629	1.403	1.270	1.239
Kostroma region	1.334	1.650	1.890	1.610	1.543	1.464
Yaroslavl region	1.254	1.487	1.695	1.465	1.373	1.364

Source: *Regions of Russia, 2021*

We analyzed the mortality rate for 4 regions of the CFD. By Table 7, the crude mortality rate in the

regions in 2005-2020 have decreased: in the Vladimir region – from 20.2 ppm to 18.3 ppm, in the Ivanovo region – from 22.0 to 17.7 ppm, in the Kostroma region – from 21.3 to 16.7 ppm, in the Yaroslavl region – from 20.1 to 17.3 ppm. The highest crude mortality rate is in the Vladimir region (81-st in the Russian Federation in 2020) and Ivanovo region (76-th). Infant mortality rate is the lowest in the Ivanovo Region (18-th place in Russia) and Yaroslavl Region (21-st place in Russia).

Table 7 – Crude mortality rates (number of deaths per 1000 population, ppm)

Period	The crude mortality rate *						Neonatal mortality rate**	
	2005	2010	2015	2018	2019	2020	Rank,	
Russian Federation	16.1	14.2	13.0	12.5	12.3	14.6	-	4.5
The Central Federal District	17.1	15.2	13.5	12.9	12.6	15.1	6	3.9
Vladimir region	20.2	18.0	16.5	16.0	15.6	18.3	81	6.0
Ivanovo region	22.0	18.4	16.0	16.1	15.8	17.7	76	3.7
Kostroma region	21.3	17.7	16.0	14.9	14.7	16.7	62	7.7
Yaroslavl region	20.1	17.2	15.6	14.9	14.7	17.3	70	3.7

* number of deaths per 1,000 population

** (number of children died before the age of 1 year per 1,000 live births)

Source: Regions of Russia, 2021

By Figure 5, the positive reduction of mortality trend in Russian regions since 2005 reversed in 2020, when the indicators increased due to the coronavirus pandemic. Compared to 2019, the mortality rate increased in the Vladimir region by 2.7 ppm, the Ivanovo region by 1.9 ppm, the Kostroma region by 2.0 ppm and the Yaroslavl region by 2.6 ppm.

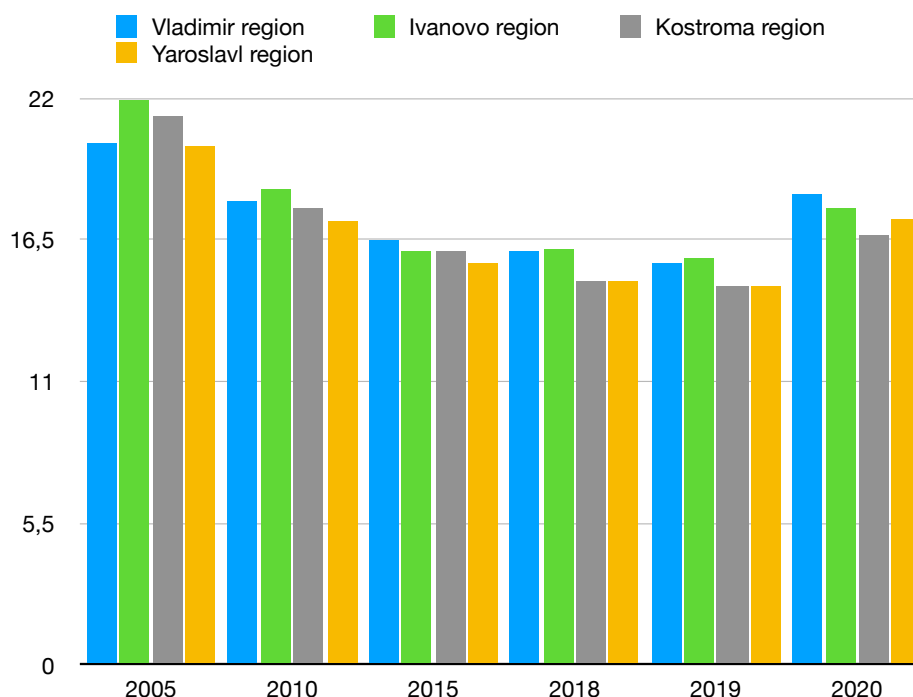


Figure 5. Dynamics of total mortality rates in the regions in 2005-2020, ppm

Source: composed by authors

The number of deaths per 100,000 inhabitants was 679.1 in the Vladimir region, 632.5 in the Ivanovo region, 581.4 in the Kostroma region and 616.2 in the Yaroslavl region. For example, in Moscow the index is 374.0. By Table 8, mortality rate excluding external causes is still higher in the Vladimir region (1,772 per 100,000 inhabitants) and lower in the Kostroma region (1,580.8 per 100,000 inhabitants).

Table 8 – Population mortality (without mortality rate from external causes) (number of deaths per 100,000 inhabitants)

Period	2011	2015	2018	2019	2020
Russian Federation	1 207,6	1 182,3	1 147,1	1 131,5	1 364,9
The Central Federal District	1 278,6	1 244,5	1 206,2	1 180,9	1 423,9
Vladimir region	1 564,7	1 518,2	1 495,7	1 452,4	1 722,0
Ivanovo region	1 545,0	1 489,7	1 501,3	1 490,7	1 672,8
Kostroma region	1 489,7	1 468,0	1 389,1	1 377,2	1 580,8
Yaroslavl region	1 431,0	1 419,4	1 383,8	1 362,3	1 624,3

Source: *Regions of Russia, 2021*

A positive trend is the decline of mortality in the working-age population in all regions under study from 2005 to 2019. In 2020 there is an increase due to the coronavirus pandemic. However, the rates in the regions under study are higher than in the Central Federal District and Russia as a whole. The highest mortality rate of the working-age population is in the Vladimir region (see Table 9).

Table 9 – Mortality of working-age population (number of deaths per 100,000 inhabitants)

Period	2005	2010	2015	2019	2020
Russian Federation	827.8	634.0	546.7	470.0	548.2
The Central Federal District	793.7	599.3	496.8	435.2	521.8
Vladimir region	1 040,3	800.8	654.0	562.3	679.1
Ivanovo region	1 168,1	787.3	614.0	562.6	632.5
Kostroma region	1 062,1	750.7	592.4	512.7	581.4
Yaroslavl region	1 031,0	714.2	585.1	506.8	616.2

Source: *Regions of Russia, 2021*

We analyzed the natural increase /decline of the population of the 4 regions. By Table 10, in spite of the reduction of crude mortality rate over 2005-2020, there was a decrease of crude birth rate, which in 2020 was lower than crude mortality rate in the Vladimir region by 10.8%, the Ivanovo region – by 10.1%, the Kostroma region – by 8.2%, the Yaroslavl region – by 8.8%. In 2020, the crude mortality rate was 2.44 times higher than the crude birth rate in the Vladimir region, 2.33 times higher than in the Ivanovo region, almost 2 times higher than in the Kostroma region, and 1.34 times higher than in the Yaroslavl region.

Life expectancy is growing, but its level is low: in Russia as a whole in 2020. – 71.54, in Central Federal District – 72.57, in the Vladimir region – 70.03, in the Ivanovo region – 70.66, in the Kostroma region – 70.92, in the Yaroslavl region – 70.94. The results show the difference between males and females life expectancy for regions under study ranges from 10.25 to 10.79 years (see Table 11).

Table 10 – Birth rate, mortality rate and natural population decline of Russian regions, ppm

Period	2005			2015			2020		
	crude birth rate	mortality rate	natural decrease	crude birth rate	mortality rate	natural decrease	crude birth rate	mortality rate	natural decrease
Vladimir region	9.1	20.2	-11.1	11.6	16.5	-4.9	7.5	18.3	-10.8
Ivanovo region	8.7	22.0	-13.3	11.4	16.0	-4.6	7.6	17.7	-10.1
Kostroma region	9.8	21.3	-11.5	12.5	16.0	-4.5	8.5	16.7	-8.2
Yaroslavl region	9.3	20.1	-10.8	12.2	15.6	-3.4	8.5	17.3	-8.8

Source: *Regions of Russia, 2021*

Table 11 – Remaining life expectancy of the population in 2020

	Total population	Rank, Russian Federation	Males	Females	Difference of males and females remaining life expectancy
Russian Federation	71.54	x	66.49	76.43	9.94
The Central Federal District	72.57	2	67.69	77.24	9.55
Vladimir region	70.03	65	64.59	75.30	10.71
Ivanovo region	70.66	45	65.14	75.91	10.77
Kostroma region	70.92	43	65.73	75.98	10.25
Yaroslavl region	70.94	42	65.40	76.19	10.79

Source: *Regions of Russia, 2021*

The main demographic indicators also include overall marriage and divorce rates. We have not considered them in the analysis, as these indicators only reflect registered marriages and divorces and do not reflect civil marriages and divorces. According to the Federal State Statistics Service, there are divorces per 1,000 registered marriages: 708 in the Vladimir region, 839 in the Ivanovo region, 854 in the Kostroma region, 713 in the Yaroslavl region.

Discussion

The main demographic threats are depopulation of the Russian people, demographic shrinkage of the population in small settlements, declining population size in rural areas, decreasing of the birth rates and the transition of families to nuclear ones, the predominance of contracted reproduction, unregulated migration processes, and population greying.

The risks and challenges include a significant differentiation in demographic indicators between urban and rural populations, a decline in the number of women of reproductive age, an increase in the average age of the mother at childbirth and postponement of the first child, deliberate refusal to have children, and decreasing indicators of the public health. There is an imbalance in Russia's regions in terms of gender and certain age groups of the population.

The risks related to the COVID-19 pandemic are: risks to public health, risks to family formation and

preservation, risks to human needs in education, receiving an income, risks to migrants, etc.

Conclusions

Our analysis for 2005-2020 shows the typical trends of depopulation for the regions under study – Vladimir, Ivanovo, Kostroma and Yaroslavl. Ivanovo and Kostroma regions have the highest rates of population decline. The population imbalance by gender is most evident in the Yaroslavl and Ivanovo regions.

These regions are characterized by "ageing from below" as a gradual decrease in the number of children due to a decline of birth and "ageing from above" as an increase in the number of older people due to decreasing of mortality in old age and a slow increase in the number of children. The demographic burden coefficient is the highest in the Kostroma region. These regions are characterized by an increase in the percentage of the population above working age and a decrease in the percentage of the population of working age.

The lowest birth rates are in the Vladimir and Ivanovo regions. The aggregate birth rate in the regions was rising and peaked in 2015, then declined and is now below the replacement level in these regions and corresponds to a sub-replacement type of the birth rate.

The crude mortality rate were declining until 2019. Since 2020, crude mortality rates have increased in these regions due to the effects of the coronavirus pandemic. The highest crude mortality rate is in the Vladimir and Ivanovo regions. A positive trend is the decline of mortality in the working-age population in all regions under study. The highest mortality rate of the working-age population is in the Vladimir region. The infant mortality rate is lowest in the Ivanovo and Yaroslavl regions.

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