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DEMOGRAPHIC PROBLEMS

Forecast of Population Size and Demographic Burden in Russia up to 2100

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Abstract—The article presents basic approaches to substantiating the hypotheses of fertility, mortality, and migration in Russia in the long term. The main results of the multivariate demographic development of Russia until 2100, which combines 30 different combinations of demographic processes, are analyzed. It is shown that the population will decline under most scenarios, including the most probable medium scenario – up to 137.5 million people by the end of the century. In the short term until the early 2030s, all options show an increase in the demographic load, and in the longer term it alternatively decreases and increases with different intensity time and again. The most favorable scenarios with high fertility and life expectancy and low migration growth put the greatest pressure on the working-age population due to the higher number of births and the elderly in these scenarios.

Keywords: demographic prospects, population forecast, demographic burden, fertility, mortality, migration

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Introduction. Long-term demographic projection has a wide margin of uncertainty and should be used with caution [1] but still it is the only way that makes it possible to look much ahead further than any socio-demographic development programs with their short and medium-term goals, or medium-term demographic projection of Rosstat, the last of which was completed up to 2035.[1]

In addition, the high and low scenarios act as boundaries, within which demographic indicators can vary, while the most realistic, medium, scenario plays the role of the main benchmark, which in itself is very valuable and makes it possible to foresee possible problems and necessary socio-economic reforms in advance.

Long-term demographic forecasts are calculated less often than the medium-term ones. For Russia, they were previously prepared by the Center for Human Demography and Ecology of the IEF RAS [3], Manakov and Suvorkov (up to 2095) [4] as well as by the Population Division of the UN Department of Economic and Social Affairs, starting with the revision of 2012 [5]. There are also well-known superlong-term forecasts for the future up to 2300, which were carried out by Akimov [6], the already mentioned UN Population Division [7], etc.

Unlike previous forecasts, this one includes Crimean residents in Russia, which initially increases the Russian population by 2.3 million people. In addition, this forecast takes into account the latest trends in mortality, fertility, and migration, including their performance in connection with the spread of the coronavirus infection COVID-19, and therefore outlines the future trajectories of demographic processes less optimistically than our forecasts made in 2019 and 2020. At the same time, it should be noted that, unlike, for example, the forecast [2], which was based on the negative trends of the 1990s, the present forecast is more optimistic. The range of possible levels of life expectancy is more clearly defined: 74.9–85.7 years for men in the present forecast, compared with a previously calculated range of 57–87 years, and 83.5–90.5 years for women, compared with 71.5–95 years in the previous projections. Hypotheses of migration growth have become more positive. While in [2] the value of net annual migration in the future ranged from −50000 to +110000 people, in the current forecast, the minimax corridor of net migration values is always positive and amounts to 63000–427000 people by the end of the century, and the most probable average variant of the forecast assumes an annual increase of about 250000 people. The scenarios of changes in the fertility in [2] were also pessimistic, mainly due to the establishment of a lower limit at

[1] Among the countries where national statistical services prepared long-term (up to 2100 and beyond) demographic forecasts as early as in 2015, we should mention Australia, Norway and the United Kingdom [2]. In the Demographic Yearbook of Russia of 2015, as well as in the Russian Statistical Yearbook of 2020, some results of calculations up to 2050 are presented.

the level of 0.95 births per woman, while in the current forecast it is increased to 1.4 births per woman. The upper limit in both variants gradually increases to 2.5 births by the end of the century.

In preparing the forecast, the cohort-component method was used. The population as of January 1, 2021, was taken as the base. The probabilities of death at older ages were smoothed using Heligman–Pollard model due to the unreliability of the data [8].

Main hypotheses regarding the dynamics in the fertility, mortality, and net migration.[2] In predicting the fertility, we rely, similarly to the specialists of the UN Population Division, on the theory of the demographic transition and the theory of the Second demographic transition [9, 10]. By 2100, the UN assumes the achievement of a total fertility rate (TFR) of 1.85 births per woman on average around the world and 1.78 births (with a confidence interval of 1.66–1.94) per woman for countries with low birth rates [5]. It should be noted that until 2012, in the long-term projections of the fertility rate, the UN assumed the convergence of countries to the level of 2.1 births per woman, however, the continued long-term increase in the number of countries with low fertility made the UN downgrade this benchmark [11].

Constructing a demographic forecast also involves developing hypotheses on the average age of a mother at the birth of her first child [10], which will increase at different rates depending on the forecast option. The highest growth rates are typical of the high-growth scenario: by 2100 the average age of mothers will reach 34.4 years; under the medium-growth scenario, 33.1 years; under the low-growth scenario, 31.9 years.

The UN, using probabilistic forecasts, first predicts the average variant of fertility, after which it develops high-growth and low-growth variants, the level of which is equidistant from the average. Thus, in the first five years of the forecast, the range is $2 \times 0.25 = 0.5$ births per woman, in the next five years $2 \times 0.4 = 0.8$ and, finally, from the third five years, the forecast corridor is constant and amounts to $2 \times 0.5 = 1$ birth per woman, which is the difference between the low and high TFR variants. In our version, its limit is constantly increasing for two reasons. Firstly, uncertainty grows with long-term forecasting, and secondly, we assume that TFR will rise above 2.1 births in the high variant, while maintaining the lower limit of the indicator at a level of at least 1.4 births in the low variant.

The scenario of the constant birth rate at the base year level is usually intended to show alarmist trends for countries with either high fertility (overpopulation) or low fertility (depopulation). In Russia, the fertility rate was 1.5 births per woman in 2020. We have not prepared a separate scenario with constant fertility, since the forecast level of the low-growth scenario in Russia is assumed to be constant from 2024 at the level of 1.4 births per woman, which is comparable to the current value of the indicator.

Predicting the level of mortality is based on the theory of demographic transition, in particular, the theory of epidemiological transition [12]. Taking into account the COVID-19 pandemic, it also appears feasible to use the concept of a reverse epidemiological transition when instead of an increase in life expectancy (LE) in a country, its decrease or stagnation is observed.

The LE scenarios assume constant growth starting from 2022 but with different intensity depending on the scenario: the most active growth is assumed in the high-growth scenario with prepandemic rates, including those previously typical of the Baltic countries when their level of life expectancy was comparable to the Russian one. In the high-growth scenario, the increase was assumed to start as early as in 2021.

COVID-19 reduced LE in 2020 by 1.75 years, and according to this indicator—66.49 years for men and 76.43 years for women—set Russia back by four and six years, respectively, thus causing the greater damage to women. However, recovery of the LE to prepandemic levels in women will occur sooner. 2014–2016 indicators are expected to recover by 2021–2022 in the high-growth scenario, by 2023–2024 in the medium-growth scenario, and by 2026–2029 in the low-growth scenario.

A common property for all forecast options is the condition, under which the growth rate is the higher, the lower LE (at the beginning of the forecast period), and vice versa, with high LE values, each new year of growth is more difficult to achieve and takes longer. The general logic of mortality prediction also takes into account the decrease in the difference in LE between the genders. There is a huge gap between the life expectancy in Russia and developed countries – an average of 4.8 years for women and 9.4 years for men; it is also characterized by one of the largest gender LE differences in the world of 9.9 years. It is expected that the territorial and gender gap in life expectancy will decrease, and most intensively in the high-growth scenario. For example, in this scenario, the difference between the genders will decrease to 4.9 years; on average up to 6.4 years and in the low-growth scenario and up to 8.6 years by the end of the century. The main reserve is the reduction in the mortality at working age, especially from external causes of death in men [13].

The forecast target for LE in 2100 is 80.3 years for men and 86.7 years for women according to the medium variant and it generally coincides with the

[2] This section discusses the main prerequisites for the development of hypotheses about the dynamics in the main demographic processes. Fertility hypotheses were developed by S.V. Zakharov, hypotheses of mortality by E.A. Kvasha and T.L. Khar'kova, and migration hypotheses by N.V. Mkrtchyan (employees of the A.G. Vishnevsky Institute of Demography, Higher School of Economics).

UN World Population Prospects 2019 (80.64 and 86.42 years, respectively) [5]. On the one hand, the COVID-19 pandemic has led to a huge loss in potential years of life in Russia, showing the inability of the healthcare system and society to withstand new challenges [14]. On the other hand, since the Russian Federation is essentially a catching-up country, in the long term, accelerated penetration of Western standards of prevention, treatment, and rehabilitation from the consequences of various diseases, including those of an infectious nature, is possible.

Another positive factor can be considered the results of the study, which show the hypothetical possibility of overcoming the 130-year milestone of human life already in the 21st century [15]. Assuming greater significance of negative or positive factors, low-growth and high-growth variants of the forecast were respectively developed. The forecast range of LE values gradually increases up to the 2040s reflecting future uncertainty within the given limits, after which the difference between the high and low option remains stable at seven years for men and about 11 years for women, while the medium variant of the forecast is equidistant from the upper and lower boundaries.

Preparing forecasts also requires hypotheses on the level of infant mortality (the death of children under one year of age per 1000 live births). In 2020, it amounted to 4.5 deaths per 1000 births and was comparable to the indicators of Canada, Slovakia, and the United States (considering that live birth criteria in the United States, for example, are rather "lax").[3] However, in some developed countries, for example, in Iceland, Finland, Sweden, Estonia, and Japan, this ratio has come close to two deaths per 1000 births or has already shown even better results. Taking also into account that in the context of the coronavirus pandemic, this indicator continued to decline in Russia, this threshold (two deaths per 1000 births) is quite achievable: in the high-growth scenario as early as in 2035, in the medium-growth scenario in the middle of the century, and in the low-growth scenario in 2073. In all options, it is assumed that the level of 1.0–1.2 deaths per 1000 births will be reached by 2100. The UN forecasts for revision of 2010–2015 assumed a decrease in the rate to four deaths per 1000 births by the end of the 21st century [10], the last scenario of 2019 is more optimistic – the infant mortality rate reaches one death per 1000 births by 2075.[4]

Net migration, after a sharp decline to 106500 in 2020 due to border closures and the COVID-19 pandemic will recover in the medium-growth case, as expected by the mid-2030s, reaching an annual value of about 250000, which is in line with the average values in 2011–2019, and will remain at this level until the end of the forecast period. The upper and lower scenarios assume values equidistant from the medium-growth option, which increase/decrease by 1% annually in the medium term and by 0.5–0.8% in the long term, thus forming a corridor of possible values with a minimum threshold of 62000 people and a maximum threshold of 426000 by the end of the period.

The pace of Russia's economic development will be a fundamental factor for potential migrants to choose their country of destination. The growth in per capita GDP of countries neighboring Russia, such as Kazakhstan and China, as well as the aging of the population in these countries, brings them up to the category of Russian competitors for human capital. The successful or not entirely successful economic development of our country thus forms the high-growth and low-growth forecast options, respectively. In addition, taking into account the decline in the migration potential of neighboring states (primarily Central Asia) in the medium term, Russia will soon need to reorient itself to other countries, such as South Asia (Syria, Afghanistan, Pakistan) and even Africa.

Forecast structure. Multivariate demographic projections is a different combination of high, medium and low fertility scenarios, life expectancy and net migration: (27 combinations, where letters mean process scenarios in the listed order, for example, "HML" means a variant that combines scenarios of high fertility, medium life expectancy, and low migration). In addition, in order to assess the contribution of migration, three forecasts with zero migration were made (options "HH0," "MM0," "LL0"). The total number of scenarios was thus 30.

High-growth scenario (HHH) represents the most optimistic demographic development in Russia and assumes a high growth in the fertility rate (up to 2.5 children per woman by 2100), life expectancy (up to 85.7 years for men and 90.5 years for women), and net migration (up to 430 000 people annually). The *medium-growth scenario* (MMM) is characterized by a lower but still existing growth in fertility as compared to the high-growth scenario (up to 1.85 children per woman by the end of the forecast period) and life expectancy (80.3 years for men and 86.7 years for women) and an annual net migration of 250000 people. The *low-growth variant* (LLL) reflects pessimistic views on fertility (down to 1.4 children per woman by 2023 and maintaining this level until the end of the century) and mortality (74.9 years for men and 83.6 years for women). The annual net migration in this option is less than 100000 people, and by the end of the period it is reduced to mere 60000 people.

Population size. The results of long-term forecasting show a wide range of possible values of the Russian population size, which vary from 67.4 to 216.7 million people. These values define some kind of boundaries, beyond which the population will not go. The lower

[3] World Population Prospects 2019. United Nations. 2021. https://population.un.org/wpp2019/DataQuery/ November 1, 2021.
[4] Ibid.

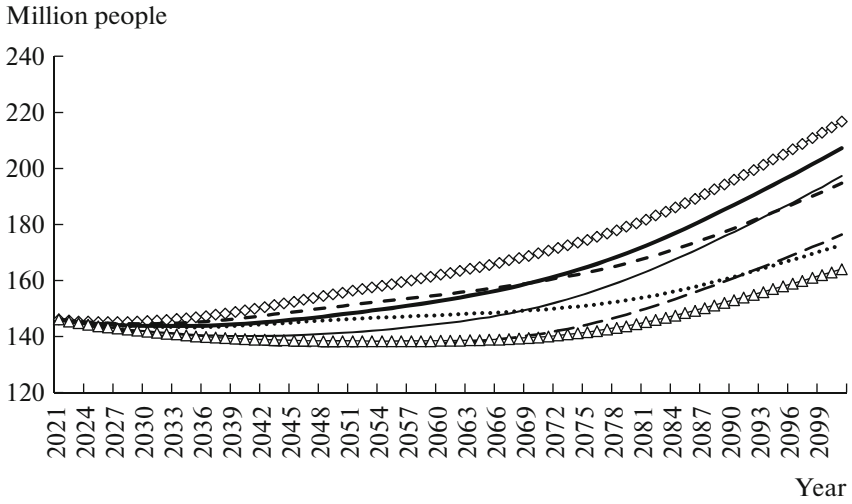

Fig. 1. Russian population according to some scenarios of its growth over 160 million people, 2021–2101: –◇– HHH; — HMH; — HLH; - - - HHM; — — — HLM; ···· HHL; –△– HML. Source: authors' calculations.

extremum is a variant assuming low values of the fertility and mortality as well as zero migration; the upper extremum is a combination of high-growth scenarios of all three components. Five scenarios assume relative stability of the population in the range of 146–156 million people, nine options assume an increase to 160 million and more, 16 assume a decrease in the number below 140 million, including 11 options indicating a decrease down to the level below 120 million.

Growth scenarios. As noted, the largest population size is provided by high-growth scenarios of all three components (fertility, life expectancy, and migration). As can be seen from Fig. 1,[5] according to most scenarios, a significant population growth only occurs in the second half of the 21st century, until that time the figures do not exceed 155 million people. Even a high-growth forecast in the short term leads to a decrease in the population from the current 146.2 to 145.2 million people. The consequences of the COVID-19 coronavirus pandemic have an unconditional impact on such negative dynamics: the restoration of indicators to prepandemic levels, even being the most accelerated, still takes time.

It is easy to see that population growth in most cases is provided by scenarios that combine high fertility, and more often than not, a high-growth scenario of either life expectancy or migration is also required for positive dynamics.

Comparing the variants HMH and HHM, HLH and HHL, HLM and HML, it turns out that in the long term, the first variants show a greater increase in population size than the second, i.e., in order to increase the population size, encouraging migration (the third letter in the scenario acronym) has a greater effect than caring for the health of the population (the second letter in the scenario acronym).

Relative stability scenarios. In order to maintain relative population stability in the long term, high levels of at least one of the three demographic components are required (Fig. 2).

In the case of zero net migration, it is necessary to follow high scenarios of both fertility and life expectancy, but even this option shows population growth only at the end of the forecast period, exposing the problems of an unfavorable age structure in Russia: until the mid-2070s, the population without migration will be incessantly reducing. It is noteworthy that a decrease in the population in the middle of the forecast period is also observed in other options for this group but due to the long-term forecast horizon, we see that the negative situation can change dramatically.

In the medium term up to 2055, the best scenario considered in this group is the life expectancy growth strategy MHM, which will stagnate a population size at the level of 143 million people and save 12 million lives, avoiding a rapid decline to 131 million, as will be in the case with medium variant MMM (Fig. 3).

Noteworthy is the option with a low level of life expectancy and migration with a simultaneously high fertility rate (HLL), as a result of which, after a rapid decline in the population to 130 million by the mid-2060s, there is an equally rapid increase in it, so that by the end of the period, the population is capable of exceeding modern indicators and equal in value to the MMH option. It is important to take into account that the restoration of the number in the HLL variant

[5] Full color versions of the figures are available in the Appendix to this article: https://disk.yandex.ru/d/OUj21HbJKf_5xg, March 6, 2022.

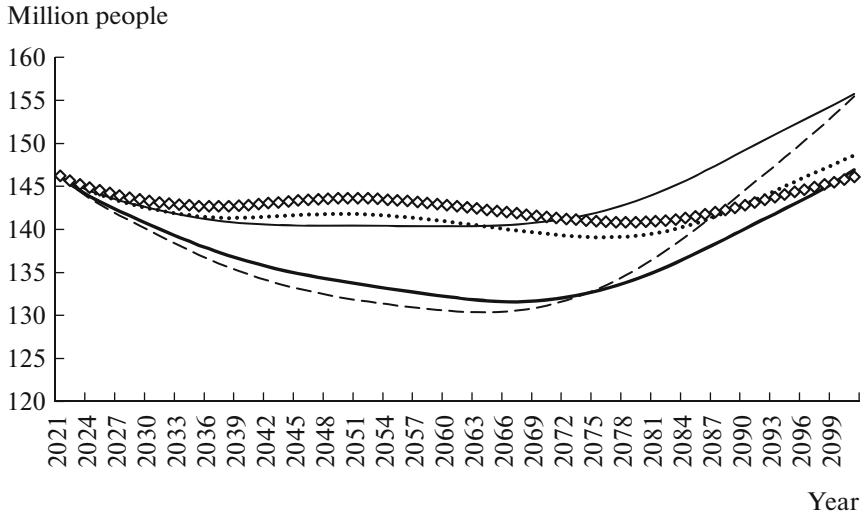

Fig. 2. The population of Russia, according to scenarios of its relative stability, providing for the preservation of its size at the level of 146–156 million people, 2021–2201 : — MMH; --- HLL; ···· HH0; — MLH; –◇– MHM.
Source: authors' calculations.

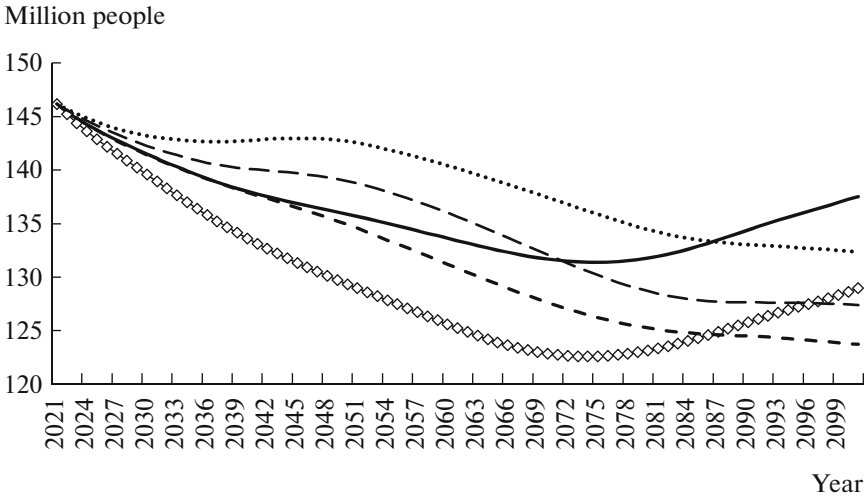

Fig. 3. The population of Russia, according to scenarios that provide for reduction in its size down to 120–140 million people, 2021–2101:
— MMM; ···· LHH; –◇– MLM; --- LMH; ——— MHL.
Source: authors' calculations.

occurs against the background of a systematic increase in the fertility rate, which in this variant exceeds 2.1 children per woman, starting from 2048, and reaches 2.5 by 2100.

Scenarios of moderate population reduction. The most probable medium-growth scenario of the MMM forecast cannot ensure the stabilization of the population and leads to its decline by 10% to 131 million by the mid-2070s (see Fig. 3). The subsequent population growth to 137.5 million people by the end of the period is not able to fully recoup the losses, which for the entire century will amount to almost 9.4 million people, and which would have been more if Crimea had not become the federal subject.

In the case of the medium scenarios of the fertility and migration and the low life expectancy (MLM) scenario, the population could decline to 123 million by the mid-2070s, and from that time on at least until the end of the period, the gap with the average MMM will be 8.6 million people, which will characterize the cost of slow progress in reducing mortality.

Scenarios for rapid population drop. A catastrophic decline in the population below 120 million by the end of the century does not seem unlikely, since this group

Table 1. Four groups of population projections at the end of 2100

Increase to 160 million people and higher			Relative stability in the interval 146–156 million people			Reduction to 120–140 million people			Rapid decline below 120 million people		
	scenario	size, million people		scenario	size, million people		scenario	size, million people		scenario	size, million people
1	HHH	216.7	1	MMH	155.7	1	MMM	137.5	1	MML	119.3
2	HMH	207.2	2	HLL	155.5	2	LHH	132.3	2	LHM	115.9
3	HLH	197.3	3	HH0	148.6	3	MLM	129.0	3	LLH	115.3
4	HHM	194.7	4	MLH	146.9	4	MHL	127.4	4	MLL	111.4
5	BCC	185.7	5	MHM	146.0	5	LMH	123.7	5	LMM	107.8
6	HLM	176.4							6	LLM	99.7
7	HHL	172.7							7	LHL	99.5
8	MHH	164.7							8	MM0	99.3
9	HML	164.1							9	LML	91.8
									10	LLL	84.4
									11	LLO	67.4

Source. Authors' calculations.

of options included those that imply a scenario of medium fertility and mortality combined with low migration (MML) and low fertility combined with medium scenarios of mortality and migration (LMM), i.e., very real options for the demographic development of Russia in the future (Fig. 4). Unlike the MLM option, which fell into the previous group of population decline to 120–140 million (which, however, was also very close to the lower threshold), the MML and LMM options do not "reverse" a negative trend in population dynamics during the forecast period, but only slow it down at the levels of 120 and 108 million people, respectively.

The lowest population size of 67.4 million people will be observed for the scenario with low levels of fertility and mortality under zero migration. The absence of migration under medium scenarios of natural development results in a decline to 99.3 million people.

In general, it is interesting to note that of the 11 options presented in this group, eight imply a low fertility rate, seven have a low (including zero) level of migration, and five imply a low level of life expectancy. This once again emphasizes the leading role of fertility in shaping future population dynamics.

The main characteristics of our forecast are presented in Table 2.

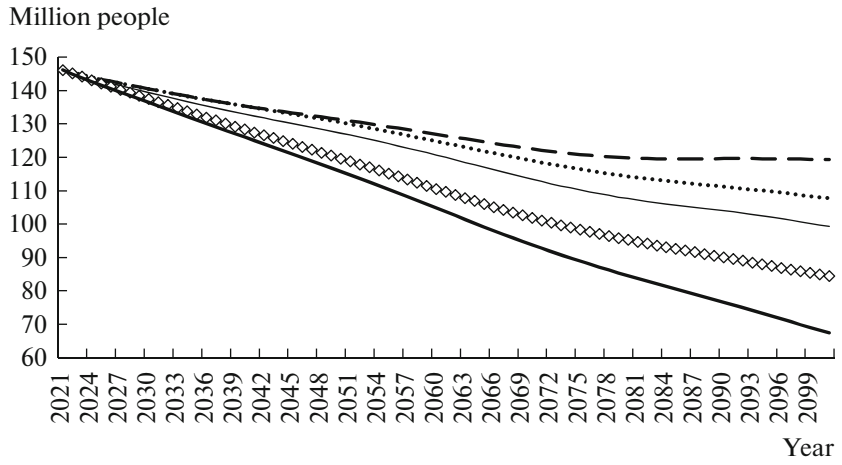

Fig. 4. The population of Russia according to some scenarios that provide for a reduction in its size below 120 million people, 2021–2101; — — — MML; ···· LMM; — MM0; –◇– LLL; — LL0.
Source: authors' calculations.

Table 2. Change in the population of Russia and its components for 2021–2100 according to the main forecast options

Forecast variants	Population at the beginning of the year, million people		Growth/Decrease in 2021–2100					
			total, million people			average per year, thousand people		
	2021	2101	general	natural	migrational	general	natural	migrational
High (HHH)	146.2	216.7	70.5	38.0	32.6	881.5	474.7	407.0
Medium (MMM)	146.2	137.5	–8.7	–28.3	19.6	–108.4	–353.2	245.0
Low (LLL)	146.2	84.4	–61.8	–68.4	6.7	–772.2	–855.1	83.8
Closed population/high scenarios of the fertility and LE (HH0)	146.2	148.6	2.4	2.4	0.0	29.9	29.9	0.0
Closed population/medium scenarios of the fertility and LE (MM0)	146.2	99.3	–46.9	–46.9	0.0	–586.1	–586.1	0.0
Closed population/low scenarios of the fertility and LE (LLO)	146.2	67.4	–78.8	–78.8	0.0	–984.6	–984.6	0.0

On comparing the obtained results with previous forecasts, we note that the estimates of the Russian population in 2100 made by Akimov in 2008 [6], are somewhat lower than ours: 111.5 million compared to 137.5 million in medium forecasts. According to [2], the median value of the population in 2100 was twice as low as modern estimates: only 63.6 million people, despite the fact that the population in the base year does not differ much according to these forecasts: 145.6 million people in 2000 and 146.2 million in 2021. However, in its prospects in the early 2000s, the UN also estimated the future population of Russia at only 80 million [7], which also reflects the pessimism of demographic trends in the late 1990s.

According to the latest UN prospects of the 26th revision completed in 2019,[6] the population of our country by the end of the 21st century will amount to 126.1 million people. The forecast values of the UN under the previous scenarios were 111.1 million according to the revision of 2010, 101.9 million people according to 2012 revision, 117.4 million people according to 2015 revision, and 124.0 million according to the revision of 2017 [10, 16]. Unlike our forecast, all of the above forecasts did not take into account the population of Crimea as part of Russia but the difference is explained not only by this. For example, the UN traditionally underestimates the net migration [2, 10]. Manakov and Suvorkov [4] obtained forecast values for the number of Russians close to UN estimates, 120 million by 2095. For more details on comparing the results of Russian and international forecasts, see [10, 16, 17].

Demographic burden on the able-bodied population. The demographic load forecast makes it possible to assess the consequences of upcoming changes in the age composition and determine the vector of the country's socioeconomic development. Due to the indented age structure of the population, the dynamics of the burden ratio for children (0–19 years old per thousand of working-age population) and the elderly (65 years and older per thousand of working-age population) (Fig. 5) has a wave character.

In the short term until the early 2030s, all variants show an increase in the burden of children and the elderly. Further, the burden of children decreases until the early 2040s, and it becomes lower than the current values, and the trajectories of the dynamics of the indicator begin to differ significantly expanding the forecast range of values.

Thus, variants with high fertility have higher child burden ratios than the rest. And within this group of forecasts, scenarios with low life expectancy are ranked higher in value than those with high life expectancy, which is primarily due to the fact that low life expectancy reduces the demographic burden at older ages and naturally increases the burden of children. The impact of migration is manifested through a decrease or increase in the denominator in the calculation of the demographic burden: low migration growth reduces the working-age population, which leads to an increase in the burden of children and vice versa.

The burden of the elderly in general will grow until the turn of the 2050s–2060s due to the aging of the large generation born in 1985–1988, after which the burden is expected to decrease due to the active aging of the small generation born in the 1990s. The greatest demographic burden by the end of the century is expected under the LHL variant: low fertility reduces the burden of children, which, in turn, increases the burden of the elderly, high life expectancy prolonging life increases the number of the elderly, and low migration reduces the working-age population.

The overall demographic burden is shown in Fig. 6.

As already noted in previous forecasts of the Institute of Demography [18, 19], the most favorable variants with high fertility and life expectancy, as well as

[6] Ibid.

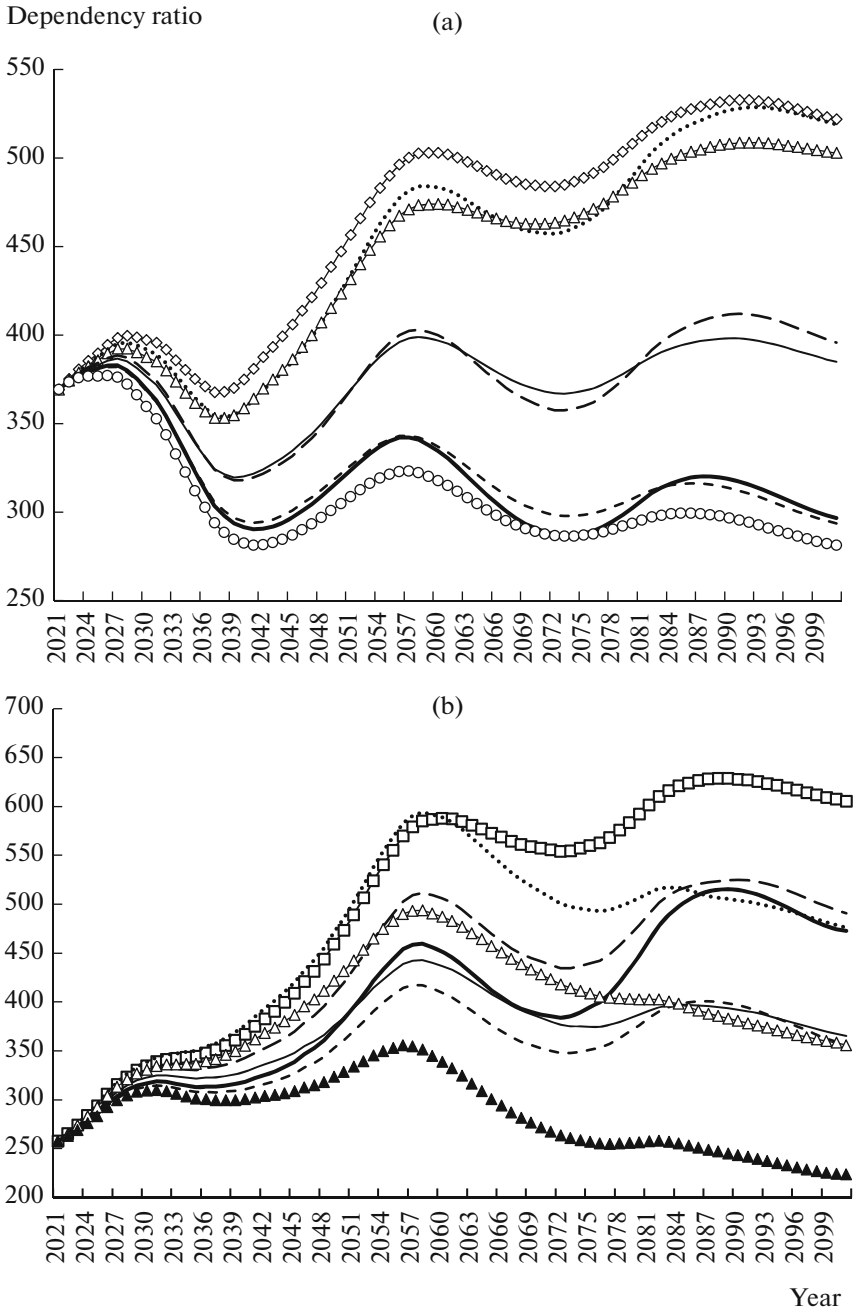

Fig. 5. Demographic burden of children (a) and elderly (b) per 1000 working-age people according to main scenarios up to 2100; –◇– HLL; ···· HH0; –△– HHH; — — — MM0; — MMM; — LL0; — — — LLL; –○– LHH; –□– LHL; ▲ HLH.
Source: authors' calculations.

zero or low migration, turn into an increase in the overall demographic burden due to a rise in the number of children and the elderly and a decrease in the working-age population. Therefore, demographically successful development requires that the government should adapt the existing infrastructure in a timely manner to changing needs, and if necessary, plan it ahead. Variants HH0 and HHL also differ in that in 2055–2065 the total burden exceeds 1000, in fact, this means that there will be one dependent per every worker. By the end of the forecast period, these favorable variants lead to an increase in the demographic burden by 46–60% compared to the current level, while variants with a medium level of fertility and low life expectancy, on the contrary, reduce the total burden by 6–14%.

The general demographic structure is also subject to undulating fluctuations over time. The current level

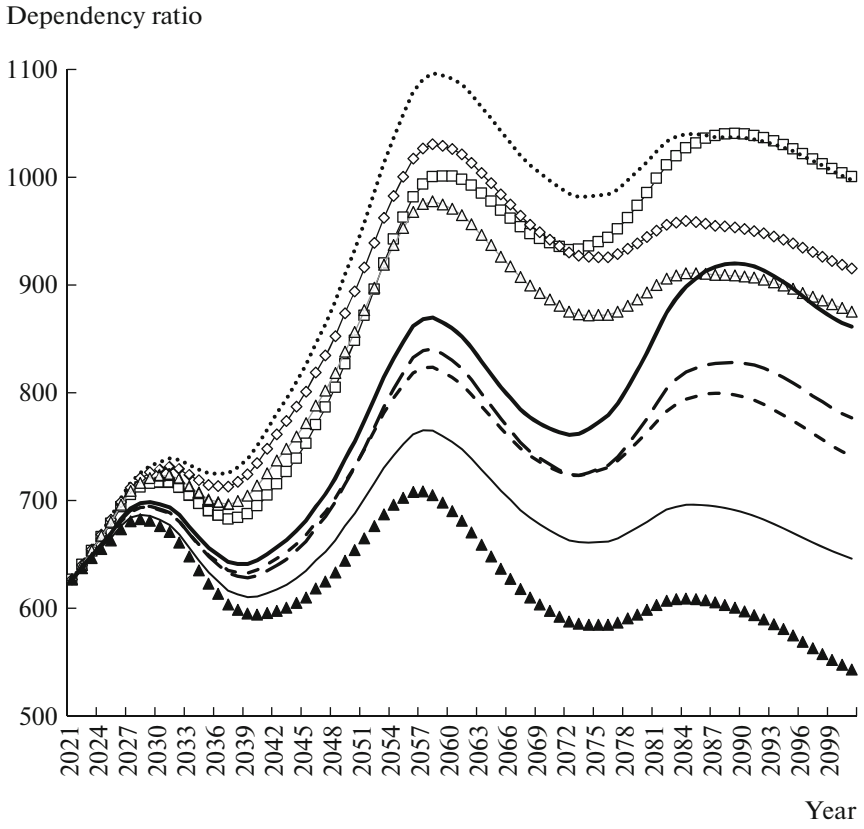

Fig. 6. Total demographic burden (of children and elderly) per 1000 working-age people according to main scenarios up to 2100; –□– LHL; ···· HH0; –◇– HHL; —△— HHH; — MMM; — LL0; — — — MM0; — — — LLL; ▲ MLH.

of 627 dependents per 1000 people of working age is on the ascending ridge and will rise to 687 people by 2030 according to the medium forecast variant, after declining to 610 people at the turn of the 2030–2040s, the indicator will begin to grow again and will reach 765 in the mid-2050s, after which in ten years it will begin to decline and will not exceed 700 people, and by the end of the century will nearly return to the current values. This will happen due to the fact that in the structure of the total burden, the burden of the elderly will increase, but the burden of children will decrease.

Conclusions. The COVID-19 pandemic has made adjustments to the initial population size in the base year (early 2021 for this forecast) and undermines optimism about the prospects for fertility, life expectancy, and migration. Life expectancy in 2020 rolled back by 4–6 years in its values; border closures and lockdown led to a sharp, 2.4 times, decrease in migration gain compared to the average values in 2011–2019. Both the complex epidemiological situation and the effect of the compensatory decline after its rise in 2006–2015 put pressure on the fertility rate. For these reasons, the scenario of the fertility in the medium version also turned out to be lower than in the previous forecasts of the HSE Institute of Demography. All this, of course, limits the possibilities not only in growth, but even in maintaining the current population size.

In Russia, since 2018, there has been a decrease in the population: the natural decline is increasing, and the net migration is not able to fully compensate for it. The well-known challenges of population aging, a decline in the fertility, a lag in life expectancy from developed countries, and a decrease in the country's migration attractiveness are intensifying against the backdrop of the coronavirus pandemic. Necessary for updating the data on size, age, and gender composition of the population and basic demographic indicators, the All-Russian Population Census of the 2020 round, after three transfers, was held in the most difficult epidemiological conditions in the fall of 2021. Demographic forecasting under such conditions, even for the short term, is inevitably characterized by a higher degree of uncertainty.

At the same time, the main forecasting results are quite definite. The population of Russia without migration will steadily decline. Even the most favorable hypotheses about fertility and mortality HH0 do not provide population growth without migration gain. Government target to achieve "sustainable population growth" by 2030,[7] which, according to our forecasts, could be realized under the high-growth

scenario carried out in 2019, according to the calculations made in subsequent years (in 2020 and 2021), cannot be achieved. According to the current high-growth forecast, the population is expected to decrease by 900000 by 2024, and even by 2030 it will be 600000 people below present values.

Another trend is the aging of the population. Previous projections for the shorter term showed a steady increase in the number of persons over 65 years of age, as well as an increase in the old-age burden ratio. The completed forecast up to 2100 shows that in the long term this growth will only be observed until 2050–2060, after which there will be a decline. After a new rise, much less significant than before, the dynamics of indicators for all scenarios, except for the high one, will again decrease. As a result, at the end of the century the number of the elderly and the demographic burden of the elderly, for example, under the medium scenario will be comparable to the level of the second half of the 2040s. On the one hand, this implies that the indicators on which the model of the pension system depends will have their growth limits in the foreseeable future, and on the other hand, the forecast shows that demographic waves will have an impact on the dynamics of specific age groups for a long time to come, periodically increasing or decreasing their size.

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