DEMOGRAPHIC RANKING OF THE BALTIC SEA STATES

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The relevance of the study lies in the acute need to modernise the tools for a more accurate and comparable reflection of the demographic reality of spatial objects of different scales. This article aims to test the methods of "demographic rankings" developed by Yermakov and Shmakov. The method is based on the principles of indirect standardisation of the major demographic coefficients relative to the age structure.

The article describes the first attempt to apply the method to the analysis of birth and mortality rates in 1995 and 2010 for 140 countries against the global average, and for the Baltic Sea states against the European average. The grouping of countries and the analysis of changes over the given period confirmed a number of demographic development trends and the persistence of wide territorial disparities in major indicators. The authors identify opposite trends in ranking based on the standardised birth (country consolidation at the level of averaged values) and mortality (polarisation) rates. The features of demographic process development in the Baltic regions states are described against the global and European background.

The study confirmed the validity of the demographic ranking method, which can be instrumental in solving not only scientific but also practical tasks, including those in the field of demographic and social policy.

Key words: demographic ranking, standardised coefficients, countries of the world, Baltic region

Introduction

Demographic development of countries and regions of contemporary world is hugely inconsistent. This can be explained by the increasing globalisation and democratisation of international exchange of human and intellectual resources, on the one hand, and by the aspiration to preserve the independence of elites and ensure the reproduction of the "nation",

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on the other hand. The inconsistencies are further aggravated by such global trends as population ageing, declining birth rate, transformation of family traditions, and a general decline in the natural increase rate. These circumstances emphasise the need for an accurate, timely, and comprehensive assessment of the demographic situation in certain countries and regions of the world and possible trends in its short-term development and long-term forecasting. At the same time, traditional demographic indicators do not always meet the objective of reflecting global, regional, and country-specific demographic processes. Traditional demographic rates (for instance, birth and mortality rates) — although not influenced by the absolute population size — are affected by numerous structural factors, including the sex structure, urban/rural population structure, marriage structure, etc. However, one of the key factors affecting the development trends and the level of other demographic rates is the age structure of population [1; 5—7].

Age Structure in Demographic Assessment

The significance of age structure for the demographic situation can be demonstrated through a comparison of countries that differ considerably in the level of socioeconomic development, for instance, Poland and Sweden. In 2010, according to the UN, the former had a mortality rate of 9.8‰, the latter of 10.2‰. These rates seem to be comparable. However, the paradox is that the age specific mortality rates are greater in Poland then in Sweden almost in all age groups (see table 1). The reason behind it is the methodology of calculating the mortality rate that uses total population as its denominator. However, it is not homogenous, in particular, in terms of the age structure; and different age groups show different mortality rates. Population aged 0—14 accounted for 14.8% in Poland and 15% in Sweden, that aged 15—64—71.7 and 65.5% respectively, that above 65—13.5 and 19.5% respectively [12]. In other words, the age structure of population has a major effect on the mortality rate, which does not give a comprehensive picture of the qualitative estimation of mortality.

Table 1

Age-specific Mortality Rates in Poland and Sweden, 2010

Age group	Poland	Sweden
0—4	0.007	0.003
5—9	0.001	0.000
10—14	0.001	0.001
15—19	0.002	0.001
20—24	0.003	0.002
25—29	0.004	0.002
30—34	0.005	0.003
35—39	0.008	0.003
40—44	0.015	0.005
45—49	0.027	0.008
50—54	0.037	0.015

End of table 1

Age group	Poland	Sweden
55—59	0.048	0.025
60—64	0.062	0.035
65—69	0.115	0.055
70—74	0.166	0.098
75—79	0.253	0.182

Source: calculated using the data from [11].

Standardisation of Demographic Rates and Demographic Forecasting

Methods that make it possible to mitigate the distortion caused by structural factors, first of all, the age structure, have already been developed. One of the ways to navigate around the problem is to use specific rates that are slightly or not at all affected by structural factors. The other way is to standardize demographic coefficients. Such standardization is usually based on factoring overall rates. These factors reflect, on the one hand, the intensity (level) of the demographic process and, on the other hand, the size or percentage of the given subpopulation in total population [1]. The essence of standardisation is that the actual overall rates are compared against the indicators describing a certain conditional population (real or artificially created), whose demographic process intensity or structure is used as a benchmark. The efficiency of chosen methods — direct, indirect or reverse standardisation — depends on what is taken as a benchmark.

For the purpose of this study, we will turn to indirect standardisation, which has been widely used for analysing the mortality and — more recently — birth rate. Statistically, it is based on the age structures of real population as the benchmark, as well as the age-specific indicators of the demographic process intensity in standard population. In other words, the age-specific rates are re-weighted against the age structure of the real population. As a result, it was possible to project a number of events that would take place in standard population if its age structure were identical to that of real population. The correlation between the number of demographic events in real population with and the expected number is expressed by the indirect standardisation index. The product of the overall standard rate and the index is the standardised overall rate, which expresses the probable level of the overall rate in real population given the age-specific intensity of demographic processes is similar to those in standard population. It is expressed by the following formula:

$$I_{ind} = \frac{\sum_x P_x^1 \cdot m_x^1}{\sum_x P_x^1 \cdot m_x^0}, \quad (1)$$

where I_{ind} is the indirect standardisation index; P_x^1 the age structure of relation population expressed in absolute terms; m_x^1 is the age specific indicators of the demographic process in standard population; m_x^0 the age-specific indicators of the demographic process in the given population.

When using standardised rates, one should not forget that they do not have an independent value, because they depend on the chosen benchmark. Therefore, application of standardised coefficients and corresponding rates and rankings is limited to comparing different populations under the condition that the standardisation was conducted using the same method and benchmark. At the same time, the benchmark should be a population "sample", whose demographic (first of all, age) structure is close, although not similar, to the age structures of the compared populations.

This work presents the first attempt to develop a ranking [2—4; 8; 9] based on the standardised correlation of the birth and mortality rate for almost 140 countries against the global average and for the Baltic region against the European average. The study uses the official UN data and the resources of the World Bank as of 1995 and 2010 [10—12]. The general formula for calculating the average birth rate (standardised birth rate correlation — SBRC) is as follows [2; 8]:

$$\text{SBRC}_k = \text{SUM}_k/\Sigma_i\ (\text{AIB}_i \cdot \text{POP}_{ki}), \qquad (2)$$

where k is the number of a country, i the number of an age group, SBRC_k the value of standardised birth rate correlation for the k^{th} territory; SUM_k is the total annual number of births on the k^{th} territory; AIB_i the age-specific incidence (age-specific birth rate in women of the i^{th} age group), POP_{ki} the average annual size of the i^{th} age group of female population for the k^{th} country.

The numerator in formula (2) is the actual annual number of births in the k^{th} country, whereas the denominator is the hypothetical number of births in the k^{th} country if the age-specific birth rates in women of different ages on this territory equal the corresponding indicator for a population of a higher level.

Similarly, one can calculate the standard mortality rate correlation (SMRC_k) — a ratio of the number of deaths in the k^{th} country to the hypothetical number of deaths under the conditions that the age specific mortality rates in the country coincide with the global age-specific mortality rates [9]. The formula is as follows:

$$\text{SMRC}_k = \text{DE}_k/\Sigma_i\ (\text{AID}_i \cdot \text{PP}_{ki}). \qquad (3)$$

In other words, it is a comparison of the same process that is taking place within two populations — the real and hypothetical ones. The hypothetical population is the real population of a country characterised by the global average mortality rate. The ratio of the actual (DE_k) to the hypothetical number of deaths in the k^{th} country is such as if the mortality rate in each age group i were at the global average: $\Sigma_{\text{i}}\ (\text{AID}_{\text{i}} \times \times\ \text{PP}_{\text{ki}})$. In the denominator of formula (3), AID_i is the age-specific global incidence (per 1,000 population) in the i^{th} age group; PP_{ki} is the average annual size of the i^{th} age group in the k^{th} country. Therefore the denominator totals the results for each age group

(5 year age groups correspond to the UN classification), which imparts the SMRC additional depth and, therefore, reduces the effect of internal structural characteristics on the final result.

The 1995 and 2010 SBRC and SMRC-based Ranking of Countries and the Position of the Baltic Region

The global SBRC and SMRC-based ranking is presented in tables 2 and 3. Our calculations allow to identify seven distinct groups in both cases. As to the SBRC, in all countries of group one (a SBRC of 0.5 and lower), the birth rate would be twice or more as high if the age-specific incidence of the process were at the global average. However, the sixth (SBRC of 1.5—2.0) and seventh (SBRC of above 2.0) groups, whose core is predictably formed by African countries at the early stage of demographic transitions, are characterised by values that significantly exceed the standard. In case of the SMRC, the first group (SMRC of 0.5 and lower) brings together countries that show a mortality rate significantly below the global average, whereas the sixth and the sevenths groups are comprised by countries (SMRC of 1.5—2.0 and above 2.0), whose rates considerably exceed the global average.

The development of BRC and SMRC-based rankings using an original methodology [2—4; 8; 9] for two selected years, and their comparison, make it possible to identify the key trends, work with different scales, and conduct analysis at different territorial levels — those of individual countries, regions, and the entire world. The first attempt of a study from the global perspective resulted in a number of interesting observations and preliminary conclusions, in particular, those based on the data of a final table of ranking changes (table 4).

There are a number of general conclusions that we can make from studying the data presented above. One, the world of demography remains highly differentiated, and the range of indicator values is very wide. Two, spatial distribution of indicators corresponds to the global centre-periphery model, whose conditional core is the African region with the extraordinary high both birth and mortality rates and the periphery the more developed countries characterised, as a rule, by rather low rates. Three, global trends of decline in the birth and mortality rates exhibit different intensity on different territories. Moreover, there are numerous examples of reverse and rather stable trends not only at the national, but also regional levels. Four, the median group of countries is poorly represented in all SMRC and SBRC-based rankings (10—17%), which is indicative of certain illusoriness of global average values and requires adjustment in each individual case. Five, the 1995—2010 SBRC ranking structure is characterised by a process of smoothing the peak, extreme values, whereas an increasing number of countries consolidated within the range of the global average. If, in 1995, the third — fifth groups accounted for less than 37% of all countries, in 2010, the accounted for 50%. Sixthly, the development of the SMRC ranking structure over the same period is characterised by a process of polarisation, the core of the ranking loses its representatives in favour of the first (+2.03) and the seventh (+3,27) groups.

Table 2

Changes in the SBRC-based Ranking between 1995 and 2010

SBRC	1995	2010
0.5 and lower	Canada, South Korea, Japan, Portugal, Spain, Netherlands, Belgium, Luxembourg, Austria, Italy, Switzerland, Czech Republic, Slovakia, Hungary, Croatia, Bosnia and Herzegovina, Slovenia, Romania, Bulgaria, Greece, Ukraine, Belarus, *Germany, Lithuania, Latvia, Russia, Estonia*[1]	Austria, Slovakia, Croatia, Slovenia, Bosnia and Herzegovina, Macedonia, Romania, Ukraine, UAE, South Korea, *Germany, Poland*
0.5—0.7	France, UK, Ireland, USA, Serbia, Macedonia, Tunisia, China, Australia, Norway, *Denmark, Finland, Sweden, Poland*	Canada, Portugal, Spain, Italy, Switzerland, Czech Republic, Hungary, Serbia, Bulgaria, Greece, Georgia, Iran, China, North Korea, Thailand, Belarus, *Latvia, Lithuania, Russia, Denmark, Finland, Sweden, Estonia*
0.7—0.9	Brazil, Mexico, Chile, Uruguay, Guyana, Suriname, Dominican Republic, Albania, Armenia, Azerbaijan, Kazakhstan, Myanmar, Vietnam, Indonesia, North Korea, Sri-Lanka, Iceland	USA, UK, Ireland, France, Netherlands, Belgium, Luxembourg, Australia, Turkey, Algeria, Tunisia, Morocco, Argentina, Malaysia, Brazil, Chile, Uruguay, Guyana, Dominican Republic, Albania, Armenia, Azerbaijan, Myanmar, Vietnam, Indonesia, Sri-Lanka, Iceland, Norway
0.9—1.1	South Africa, Turkey, Iran, Mongolia, Libya, Algeria, Morocco, Argentina, Colombia, Peru, Ecuador, Venezuela, Panama, Costa Rica	Mexico, Kazakhstan, India, Laos, Cambodia, Botswana, Madagascar, Sri-Lanka, Bangladesh, Syria, Jordan, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan, South Africa, Mongolia, Libya, Colombia, Peru, Ecuador, Venezuela, Panama, Costa Rica

End of table 2

SBRC	1995	2010
1.1—1.5	Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan, India, Bangladesh, Philippines, Papua New Guinea, Egypt, Syria, Jordan, Namibia, Botswana, Zimbabwe, Bolivia, Paraguay, Nicaragua, Honduras	Pakistan, Iraq, Nepal, Bhutan, Egypt, Philippines, Papua New Guinea, Namibia, Zimbabwe, Bolivia, Paraguay, Nicaragua, Honduras, Ghana, Gabon, Equatorial Guinea, Côte d'Ivoire
1.5—2.0	Pakistan, Nepal, Bhutan, Laos, Cambodia, Guatemala, Kenya, Tanzania, Mozambique, Madagascar, Zambia, Congo, Gabon, Equatorial Guinea, Togo, Cameroon, Nigeria, Central African Republic, Benin, Ghana, Côte d'Ivoire, Guinea, Sierra Leone, Guinea, Guinea-Bissau, Senegal, Mauritania	Yemen, Ethiopia, Kenya, Sudan, Central African Republic, Cameroon, Congo, Nigeria, Benin, Togo, Liberia, Sierra Leone, Guinea, Guinea-Bissau, Senegal, Mauritania, Mozambique
Above 2.0	Mali, Burkina Faso, Niger, Chad, Sudan, Ethiopia, Somalia, Uganda, Ruanda, Burundi, Democratic Republic of the Congo, Angola, Afghanistan, Saudi Arabia, Oman, Yemen	Mali, Burkina Faso, Niger, Chad, Somalia, Uganda, Ruanda, Burundi, Democratic Republic of the Congo, Tanzania, Angola, Zambia, Afghanistan, Saudi Arabia, Oman

Source: calculated using the data from [10; 11].

[1] The Baltic region states are show in italics in tables 2 и 3.

Table 3

Changes in the SMRC-based Ranking between 1995 and 2010

SMRC	1995	2010
0.55 and lower	Qatar, Oman, UAE, Singapore, Costa Rica, Japan, Brunei, Israel, Bahrain, Kuwait, Canada, Australia, French Guiana, Spain, Switzerland, Chile, Belize, France, New Zealand, Syria, Italy, Iceland	Qatar, UAE, Singapore, Costa Rica, Brunei, Israel, Bahrain, Kuwait, Canada, Australia, French Guiana, Switzerland, Chile, Japan, France, New Zealand, Syria, Italy, Mexico, Cuba, Costa Rica, Ireland, South Korea, Iceland
0.5—0.7	USA, Mexico, Argentina, Uruguay, Venezuela, Libya, Tunisia, Saudi Arabia, Iraq, Jordan, Thailand, Malaysia, Portugal, Austria, UK, Cyprus, Ireland, Netherlands, Belgium, Luxembourg, Greece, Albania, South Korea, North Korea, Cuba, Panama, Ecuador, Norway, *Germany, Denmark, Finland, Sweden*	USA, UK, Netherlands, Spain, Argentina, Austria, Czech Republic, Venezuela, Tunisia, Mexico, Panama, Iraq, Lebanon, Thailand, Cuba, Ecuador, Egypt, Algeria, Albania, Jordan, Saudi Arabia, Oman, Nicaragua, Guatemala, Portugal, El Salvador, Belgium, Slovenia, Belize, Malaysia, Vietnam, Cyprus, Guatemala, Norway, *Germany, Sweden, Finland*, *Denmark*
0.7—0.9	Serbia, Macedonia, Slovenia, Bulgaria, Romania, Czech Republic, Slovakia, Croatia, Uzbekistan, Armenia, Georgia, Brazil, Paraguay, Peru, Colombia, Nicaragua, El Salvador, Honduras, Dominican Republic, Suriname, Lebanon, Algeria, Morocco, Iran, China, Sri-Lanka, Belarus, *Lithuania, Poland*	Serbia, Macedonia, Bulgaria, Turkey, Azerbaijan, Slovakia, Armenia, Georgia, Morocco, China, Paraguay, Uruguay, Peru, Colombia, Brazil, Honduras, Greece, Croatia, Lebanon, Thailand, Sri-Lanka, Iran, Bosnia and Herzegovina, *Poland*, *Estonia*
0.9—1.1	Ukraine, Moldova, Azerbaijan, Kazakhstan, Kyrgyzstan, Turkmenistan, Hungary, Turkey, Egypt, Indonesia, Gabon, South Africa, Namibia, Botswana, Philippines, Guatemala, *Latvia, Russia, Estonia*	Iraq, North Korea, Madagascar, Indonesia, Philippines, Suriname, Laos, Nepal, Bangladesh, Bhutan, Mongolia, Tajikistan, Kyrgyzstan, Uzbekistan, Bolivia, Hungary, Romania, Guyana, *Lithuania, Latvia*

End of table 3

SMRC	1995	2010
1.1—1.5	Tajikistan, Bosnia and Herzegovina, India, Pakistan, Bangladesh, Nepal, Myanmar, Laos, Cambodia, Papua New Guinea, Mongolia, Yemen, Kenya, Zimbabwe, Ghana, Mauritania, Bolivia, Guyana, Haiti	Yemen, Ukraine, Moldova, Kazakhstan, India, Myanmar, Papua New Guinea, Sudan, Eritrea, Mauritania, Namibia, Pakistan, Gabon, Cambodia, Belarus, Turkmenistan, *Russia*
1.5—2.0	Sudan, Chad, Cameroon, Congo, Benin, Togo, Côte d'Ivoire, Guinea, Tanzania, Madagascar, Senegal, Bhutan	Kenya, Tanzania, Congo, Liberia, Togo, Benin, Côte d'Ivoire, Senegal
Above 2.0	Afghanistan, Somalia, Ethiopia, Central African Republic, Niger, Nigeria, Burkina Faso, Mali, Guinea, Guinea-Bissau, Sierra Leone, Liberia, Democratic Republic of the Congo, Equatorial Guinea, Uganda, Ruanda, Burundi, Angola, Zambia, Mozambique	Afghanistan, Somalia, Ethiopia, Chad, Niger, Central African Republic, Nigeria, Burkina Faso, Mali, Guinea, Guinea-Bissau, Sierra Leone, Cameroon, Democratic Republic of the Congo, Ruanda, Equatorial Guinea, Uganda, Angola, Burundi, Zambia, Zimbabwe, Mozambique, Botswana, South Africa, Lesotho, Swaziland

Source: calculated using the data from [10; 11].

Table 4

Changes in the Structure of SBRC and SMRC-based Rankings of World Countries between 1995 and 2010

Group	SBRC ranking, %			SMRC ranking, %		
	1995	2010	Changes in 1995—2010	1995	2010	Changes in 1995—2010
First	20.84	10.42	−10.42	14.73	16.76	+2.03
Second	9.72	15.97	+6.25	20.85	22.76	+1.91
Third	12.50	20.14	+7.64	18.41	16.16	−2.25
Fourth	9.72	16.66	+6.94	11.65	11.97	+0.32
Fifth	14.59	13.19	−1.40	13.49	10.77	−2.72
Sixth	20.13	11.80	−8.33	7.36	4.79	−2.57
Seventh	12.50	11.80	−0.70	13.49	16.76	+3.27
Total	100	100	0	100	100	0

Calculation based on tables 2 and 3.

In 1995, the Baltic region states formed a rather consolidated cluster in the SBRC ranking — they comprised the first two groups with a significant but unfulfilled potential. Over the following years, a pronounced divergence between them emerged. Without going into detail (it is a subject for a separate study), one can state that, against the global demographic background, only Poland demonstrates a stable downward trends as to the birth rate and only Germany is characterised by "negative stability". The other countries improved their situation as compared to the global average by 2010.

As to the SMRC, the overall trends in the regional development are positive. The position of only two countries deteriorated of the period — Russia moved down one position to group five and Lithuania to group four. Latvia remained in the fourth group, whereas the other six Baltic region states experience a "demographic transition" that accompanied the positive trend. Today, with the exception of Poland and Estonia, they are in the group of countries with the lowest mortality rate in the world.

The Baltic Region States in European Rankings

For a number of reasons, European countries have traditionally shown a low birth rate (SBRC < 1) at the global level, however, the situation is not homogenous. Against this background, in 1995, the Baltic region states comprised a rather coherent group with relatively favourable characteristics (tables 5, 6).

Table 5

The SBRC of the Baltic Region States Vs. the Global and European Average Standard of Age-specific Birth and Mortality rates in 1995 and 2010

Country	SBRC against			
	global average standard		European average standard	
	1995	2010	1995	2010
Denmark	0.61	0.69	1.28	1.23
Sweden	0.62	0.66	1.31	1.19
Finland	0.6	0.63	1.34	1.16
Estonia	0.5	0.56	1.28	1.03
Latvia	0.49	0.55	1.27	1
Lithuania	0.49	0.51	1.25	0.94
Russia	0.48	0.51	1.3	0.94
Germany	0.49	0.49	1.27	0.91
Poland	0.55	0.46	1.31	0.85

Source: calculated using the data from [10; 11].

Table 6

The SMRC of the Baltic Region States Vs. the Global and European Average Standard of Age-specific Birth and Mortality rates in 1995 and 2010

Country	SMRC against			
	global average standard		European average standard	
	1995	2010	1995	2010
Denmark	0.68	0.58	0.93	0.75
Finland	0.61	0.6	0.83	0.77
Sweden	0.56	0.62	0.76	0.8
Germany	0.64	0.69	0.87	0.89
Poland	0.81	0.77	1.1	1
Estonia	0.96	0.79	1.31	1.02
Latvia	0.99	0.96	1.35	1.24
Lithuania	0.85	0.99	1.16	1.28
Russia	0.99	1.18	1.35	1.53

In almost all countries, the SBRC was around 1.3, which means an increased age-specific incidence of births against the European average standard. However, the following period saw a steep decline in the SBRC, although it did not occur at the same pace. As of 2010, Denmark retained its position in the ranking followed by Sweden and Finland. This situation is a result of a number of factors, which include high standard of living and a consistent policy aimed at increasing the birth rate pursued since the 1970s. Probably, a certain contribution is made by a large influx of migrants (in

Sweden, they account for 15—19 % of population according to different estimates) that exhibit increased fertility (often, of more than three children per woman of reproductive age). Four countries of the region — Estonia, Latvia, Lithuania, and Russia — are approximately at the European average, whereas Germany (despite the high standards of living and a large influx of migrates) and Poland are characterised by a gradual decrease in the birth rate since the mid-1990s.

The analysis shows that, in and around 1995, the mortality rate was the leading differentiating factor of the demographic situation in the Baltic region states. While in the SBRC the countries show similar results, in the SMRC they are divided into two equal groups. The rates of the first group are below the European average standard (Sweden, Finland, Germany, and Denmark), those of the second group are above that (Poland, the Baltics, and Russia). Over the next 15 years, the situation remained stable. The composition of the first group and the values of the SMRC did not significantly change, however, Denmark improved its position and topped the ranking. The trends characteristic of the second group of countries are more ambiguous. For instance, Poland and, notably, Estonia reached the European average in terms of SMRC and occupied a central position in the Baltic region ranking against the background of a decrease in the age-specific incidence. An opposite trend is observed in Lithuania and Russia. The latter's rate (1.53, sic!) emphasises the acuteness and depth of the demographic crisis caused, according to experts, by a combination of numerous factors of demo-economic, socioeconomic, sociomedical, and socio-ethical nature.

Conclusion

The search for new tools of a more accurate and effective assessment of the demographic situation in individual countries and regions made it possible to discover a unified approach to developing demographic rankings (designed for and tested on Russian regions using the data of official Russian statistics) in the works of S. P. Ermakov and N. A. Shmakov [2—4; 8; 9]. Standardised birth and mortality rates minimise the significance of structural differences in the population of different territories. Therefore, it becomes possible to make comparisons at any level — from the global to municipal one. The first attempt to apply the method to long-term international statistical data proved its validity and applicability to the studies in the field. Notable conclusions regarding the nature of certain development trends in the birth and mortality rates in both the global and macroregional context were achieved. New experimental data were obtained and the features of development of demographic processes in the Baltic region were identified. At the same time, the results obtained require further investigation, detailed interpretation, and an in-depth analysis, also that at the level of individual countries and regions. Moreover, the "pure" data on the condition of population and demographic processes seems to be important for all relevant authorities. This information can be used in the formulation and targeted implementation of both demographic and social policies.

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