# DEMOGRAPHY

## POPULATION AGEING AS A SOCIODEMOGRAPHIC PROBLEM IN THE BALTIC REGION

***A. G. Manakov*** [*]
***P. J. Suvorkov*** [*]
***S. A. Stanaitis*** [**]

*Population ageing is a major problem of European development in the 21st century. Rapid population ageing in most developed countries will continue to drive the dependency ratio up.*

*This research aims to forecast the dependency ratio in the Baltic region until the end of the century. A more detailed population analysis and projections are provided for the case of the Baltic States — Estonia, Latvia, and Lithuania.*

*The authors use Bayesian probabilistic predictions based on data from the Population Division of the United Nations Department of Economic and Social Affairs. Principle research methods include multifactor simulation modelling; some findings are presented on schematic maps.*

*The study shows that by the end of the century the highest dependency ratio in the Baltic region will be observed in Poland, while Finland, Estonia, Denmark, Norway, and Sweden will also face significant challenges. The authors put forward demographic policy recommendations for those Baltic region states that will reach the highest dependency ratio by the second half of the 21st century.*

***Key words:*** demographic forecast, population ageing, Baltic Sea region

[*]Pskov State University
2 Lenin Sq., Pskov, 180000, Russia
[**]Lithuanian University of Educational Sciences
39 Studentu, Vilnius, LT — 08106, Lithuania

*Submitted on April 20, 2016*

doi: 10.5922/2079-8555-2017-1-5



## Introduction

The measures that help us understand national demographic trends are crucial to demographic projections, which represent the most probable correlations between the birth, mortality, and migration rates. Probabilistic forecasting is based on the balance methods — net migration rate, net birth rate by age cohort, net death rate by age

cohort, and others. These demographic measures are used to calculate demographic indices designed to compare various characteristics of demographic processes.

In the last decade, the demographic ageing has become a global phenomenon. This process has multiple aspects and affects not only the social and political life of society but also its medical and sanitary organisation. In developed countries, population ageing leads to a higher dependency ratio and a lower unemployment rate. This process is particularly pronounced in the countries of the Baltic Sea region.

In this article, the term Baltic region refers to the basins of rivers flowing into the Baltic Sea. If such a basin overlaps even a small part of a country's territory, the country is considered a Baltic Sea region state. Thus, the region comprises twelve states — Russia, Estonia, Latvia, Lithuania, Belarus, Ukraine, Poland, Germany, Denmark, Norway, Sweden, and Finland. This article will pay special attention to analysing demographic processes in the Baltics — Estonia, Latvia, and Lithuania — and making relevant projections.

A thorough analysis of demographic changes is necessary for decision-making in the public interest. Studying the processes of demographic ageing, which are affected by the factors of spatial development, is important for both science and the authorities.

*This article aims* to present the results of a simulation-based demographic projection for the Baltics in comparison with that for other Baltic Sea states.

## Current research on the problem

The post-Soviet demographic and migration situation in the sub-regions and countries of the Baltic Sea region has been addressed by T. Hanell (situation in the Baltic Sea region [11]), N. V. Mkrtchyan and L. B. Karachurina (the Baltics and North-West Russia [5]), T. Michalski (Poland and the Baltics [13; 14]), A. Berzins and P. Zvidrins (the Baltics [10]), A. K. Stanaytis and S. A. Stanaytis (Lithuania [7]), E. Apsite, Z. Krišjāne, and M. Berzins (Latvia [9]), and others. The geographical demographic situation across the Baltic Sea region is examined in a comprehensive 2009 monograph by Tatyana Kuznetsova, who has addressed this topic in several works ([3;4], and others).

A number of studies focus on the problems of ageing in the European Union states with a forecast for 2060 [15]. Such studies include the Baltics [8], for instance, Lithuania [12]. There have been attempts to find a clear measure for analysing the current demographic situation. The method of demographic ranking has been applied to the Baltic Sea region states (2010 in comparison with 1995) [6]. Researchers have tested a new method for short-term demographic forecast based on the 'geographical demographic ensemble' concept [1]. Of particular interest is a demographic projection for the Baltic region countries for the end of the 21st century. This article is an attempt at such a projection.

## Sources and methodology

This article uses a series of Bayesian probabilistic projections, which are based on the data provided by the Population Division of the United Nations Department of Economic and Social Affairs [16; 17]. The study employs the formal methodology used by the UN Department of Economic and Social Affairs in analysing demographic trends. The 2015 revision of the methodology and the retrospective demographic measures from 1950 are taken into account.

Probabilistic population projections are based on measuring demographic variables in view of the prospective numbers of births and deaths and net migration. The trajectories of changes in the dominant factors within medium variants are calculated using a probabilistic model that takes into account a certain initial distribution of the random component, which changes in line with these trends. Global trends are considered in this context.

One hundred thousand trajectories were calculated for each country. The median trajectory obtained using all the outcomes calculated helps to produce a medium variant. The expected number of births in the projection year is calculated by multiplying the number of women of the fertile cohort by the total fertility rate for the cohort. The expected number of deaths is calculated as the difference between the number of cohort members at the beginning of the projection period and the number of cohort members at the end of the period, which is calculated based on the death rate for each cohort.

The projected migration, which reflects the number of immigrants and emigrants by territory, is taken into account. The incoming migration flow of women of fertile age is allowed for and the outgoing migration flow of women of fertile age is subtracted from the cohorts that serve as the basis for calculating the number of births on the territory. The outgoing migration flows are subtracted from the relevant age cohorts, whereas the incoming migration flows are included in the corresponding age cohorts.

## Results

Today, the Baltics and other states of the Baltic Sea region have low birth rates. This means that the number of births is insufficient for each woman to be replaced by a daughter who will survive to reach childbearing age. Most European countries have low birth rates, which leads to population ageing.

Over the period examined (1950—2015), a significant reduction in the number of births per woman took place in the Baltic Sea region countries. The average number of births per woman (total fertility rate) and the average annual number of births per 1,000 population (crude birth rate) in 1950—2015 are presented in table 1 (the Baltics are marked in bold).

*Table 1*

**Average total fertility rate and average crude birth rate in the Baltic Sea region countries, 1950—2015**

| Country | Average total fertility rate | Average crude birth rate, ‰ |
|---|---|---|
| Poland | 2.20 | 16.9 |
| Norway | 2.14 | 14.5 |
| Belarus | 2.01 | 15.7 |
| **Lithuania** | **2.01** | **15.3** |
| Finland | 2.01 | 14.3 |
| Russia | 1.97 | 15.9 |
| Denmark | 1.95 | 13.5 |
| Sweden | 1.93 | 12.9 |
| Ukraine | 1.88 | 14.7 |
| **Estonia** | **1.85** | **13.7** |
| **Latvia** | **1.75** | **13.0** |
| Germany | 1.70 | 11.8 |

As the table shows, Lithuania is the only Baltic state that had a birth rate within the regional average, whereas Estonia and Latvia ranked among the bottom three countries, outperforming only Germany. The total fertility rate at replacement for the projection period (2015—2100) is 2.08 in Estonia and Latvia and 2.07 in Lithuania. Despite the increase in the birth rate expected in the Baltics in 2015—2100, it will be significantly below the replacement rate. The average gap between the total fertility rate at replacement and the expected rate is estimated at 0.32 in Latvia and 0.26 in Lithuania and Estonia.

Despite a general decrease in birth rates in the Baltics, it is interesting to consider the changes in the birth rates of younger age groups of women. Particularly, in Estonia and Latvia, the 20—24 age cohort accounted for the maximum birth rate per woman in 1950—2000. In 2000—2015, it was the 25—29 age cohort. In Lithuania, the 25—29 age cohort accounted for the maximum birth rate per woman in 1950—1965, the 20—24 age cohort in 1965—2000, and the 25—29 cohort in 2000—2015. In 2015—2010, further cohort shifts are expected in the Baltics. In Estonia and Latvia, the 30—34 age cohort will become dominant in terms of fertility as early as 2015—2020. In Lithuania, the 25—29 age cohort will account for most births in 2015—2025 to be replaced by the 30—34 cohort in 2025—2100.

The demographic situation characterised by the insufficient number of births, which has been observed in the Baltics in the post-Soviet period, is aggravated by a high mortality rate and a negative net migration.

The average number of deaths per 1,000 population (the crude death rate) in 1950—2015 and the median trajectory of the crude death rate for 2015—2100 in the Baltic Sea region countries are presented in table 2.

*Table 2*

**Average annual crude death rate in 1950—2015 and the projection of crude death rate in the Baltic Sea region to 2100 (medium variant)**

| Country | Average annual crude death rate, ‰ | Country | Median trajectory crude death rate (medium variant), ‰ |
|---|---|---|---|
| Poland | 9.4 | Norway | 9.2 |
| Norway | 9.6 | Sweden | 9.3 |
| Finland | 9.6 | Denmark | 10.5 |
| Sweden | 10.4 | Finland | 11.0 |
| Denmark | 10.4 | Germany | 13.0 |
| **Lithuania** | **11.2** | **Estonia** | **13.6** |
| Germany | 11.5 | Poland | 14.4 |
| Russia | 11.6 | Russia | 14.4 |
| Belarus | 11.8 | **Lithuania** | **14.6** |
| Ukraine | 12.1 | Belarus | 14.7 |
| **Estonia** | **12.3** | **Latvia** | **15.0** |
| **Latvia** | **12.9** | Ukraine | 16.3 |

As table 2 shows, in 1950—2015, Latvia and Estonia had the highest death rate in the Baltic Sea region and Lithuania an average one. However, in 2015—2100, the increase in the mortality rate will be below the regional average in Estonia and above the regional average in Latvia and Lithuania. The most rapid increase will be observed in Lithuania, whereas that in Estonia will not exceed the regional average.

The annual average net migration per 1,000 population (net migration rate) in 1950—2015 and the median projection of net migration rate to 2100 are shown in table 3.

*Table 3*

**Average annual net migration rate in 1950—2015 and the projection of net migration rate in the Baltic Sea region countries to 2100 (medium variant)**

| Countries | Average annual net migration rate, ‰ | Countries | Average annual net migration rate (medium variant), ‰ |
|---|---|---|---|
| Sweden | 2.6 | Norway | 3.1 |
| Norway | 2.3 | Sweden | 2.6 |
| Germany | 1.9 | Denmark | 2.0 |
| **Estonia** | **1.3** | Germany | 1.7 |
| Denmark | 1.2 | Finland | 1.7 |
| Russia | 0.9 | Russia | 0.7 |
| Ukraine | 0.3 | Belarus | 0.2 |
| Finland | 0.2 | **Latvia** | **– 0.1** |
| **Latvia** | **– 0.02** | Poland | – 0.2 |
| Poland | – 0.7 | Ukraine | – 0.2 |
| Belarus | – 0.7 | **Estonia** | **– 0.8** |
| **Lithuania** | **– 2.3** | **Lithuania** | **– 0.9** |

In 1950—2015, a small migratory increase was observed in Estonia, whereas in Latvia and especially Lithuania, the post-Soviet out-migration resulted in a negative net migration. In 2015—2100, a negative migration rate is expected in all the three Baltic States, with Estonia and Lithuania topping the list of countries with the highest out-migration rate.

Improving living and healthcare standards have led to an increase in life expectancy for people of senior years. Table 2 shows the 2015 data on life expectancy at birth for both sexes in the Baltic Sea region.

*Table 4*

**Life expectancy at birth for both sexes in 2015 and projected life expectancy to 2100 in the Baltic Sea region countries (medium variant)**

| Country | Life expectancy at birth for both sexes, years | Country | Life expectancy at birth for both sexes (projected average), years |
|---|---|---|---|
| Sweden | 81.9 | Sweden | 87.9 |
| Norway | 81.3 | Norway | 87.2 |
| Germany | 80.6 | Germany | 87.1 |
| Finland | 80.5 | Finland | 87.0 |
| Denmark | 80.0 | Denmark | 86.1 |
| Poland | 77.1 | Poland | 83.7 |
| **Estonia** | **76.5** | **Estonia** | **82.7** |
| **Latvia** | **73.9** | **Latvia** | **79.4** |
| **Lithuania** | **73.1** | **Lithuania** | **79.0** |
| Ukraine | 70.7 | Belarus | 76.4 |
| Belarus | 71.1 | Russia | 75.2 |
| Russia | 69.8 | Ukraine | 74.9 |

The life expectancy at birth for both sexes in Estonia exceeded that in Latvia and Lithuania in 2015. Overall, the Baltics significantly outperformed all other former Soviet republics.

The average gap between the projected life expectancy for men and women over the period examined (1950—2015) was rather wide, reaching 9.7 years in Estonia and Latvia and 9.5 years in Lithuania. The gap decreased towards the end of the period in Estonia (9.5 years) and increased in Latvia (9.8 years) and Lithuania (11.4 years).

The projection trajectory of life expectancy for 2015—2100 in the Baltic Sea region countries is presented in table 4. The life expectancy at birth for both sexes in the Baltics will increase by approximately six years. The Baltics will remain within the regional average.

The projected ratio between the number of births of boys and that of girls is assumed to be equal to that observed over the period examined — 1.06 in Estonia and 1.05 in Latvia and Lithuania. This ratio is 1.05 in Finland and Russia and 1.06 in Germany, Sweden, Norway, Denmark, Belarus, Ukraine, and Poland.

Thus, the simulation results for the projection period corroborate the potential increase in life expectancy across the Baltic Sea region. Combined with a total fertility rate below replacement, negative migration trends, and the excess of births of boys over those of girls will result in accelerated population ageing and a rapid population decline in the Baltic Sea region states.

Due to the above negative trends, in 2015—2100, the population will decrease by 4.2 ‰ per year in Lithuania, 4.4 ‰ in Estonia, and 5.1 ‰ in Latvia.

The negative population growth rate translates into a population decline of 31.21 % in Estonia (from 1313 to 904 thousand people), of 35.21 % in Latvia (from 1971 to 1278 thousand people), and of 30.13 % in Lithuania (from 2878 to 2013 thousand people). As to other countries of the Baltic region, a population growth is expected in Finland, Sweden, Norway, and Denmark. A population decline will be observed in Russia, Germany, Belarus, Ukraine, and Poland. Figure 1 shows population projections for the Baltic region states to 2100.

Among the Baltic States, the process of ageing will be most pronounced in Estonia, where the average age of the population will increase from 38.7 years in 2015 to 43.53 years in 2100. This trend is explained by the rising life expectancy and the rapid narrowing of a gap in life expectancy between men and women. The average population age will also increase in the other two Baltic States. The average population age will increase from 39.6 to 41.9 years in Latvia and from 39.5 to 41.3 years in Lithuania. The average age of the population of the Baltic Sea region and the projections for 2045, 2070, and 2100 are shown in figure 2.

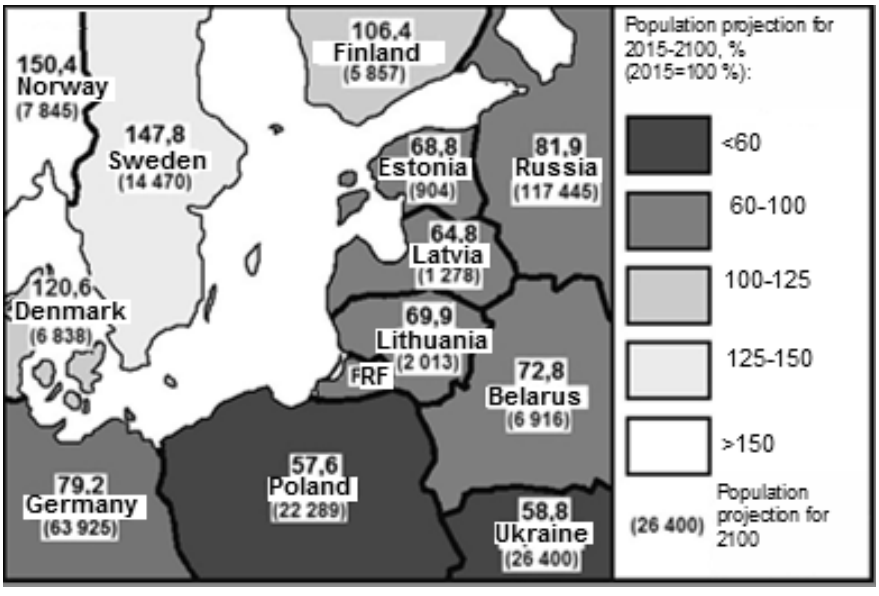


Fig. 1. Projection of population change in the Baltic Sea region in 2015—2100

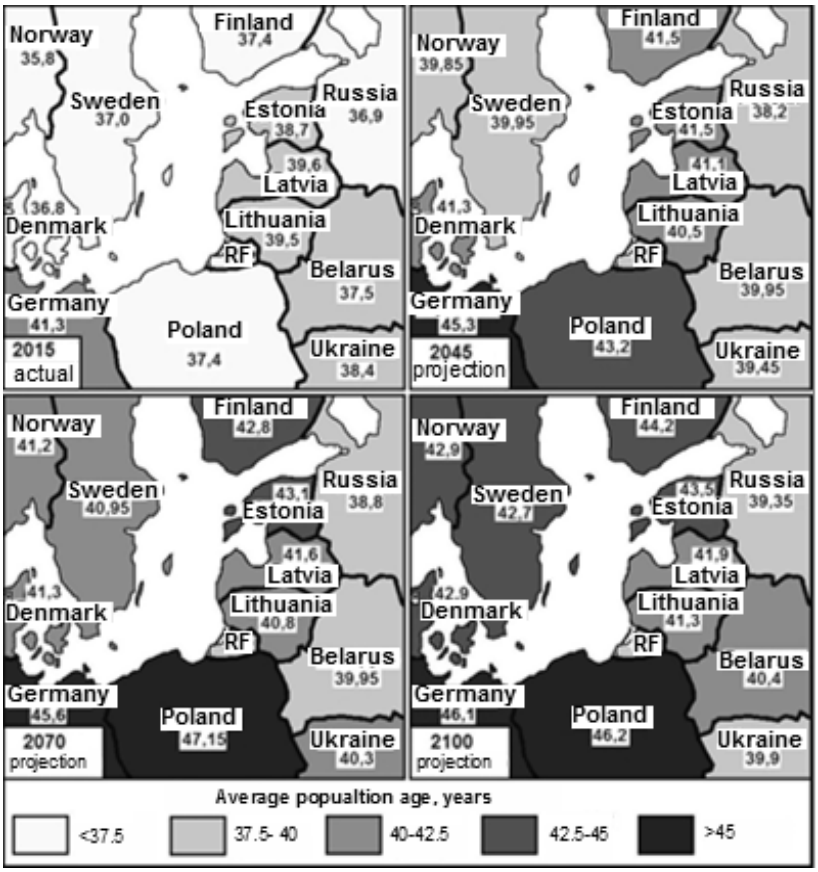


Fig. 2. Average population age in the Baltic Sea region countries in 2015 and a projection for 2045, 2070, and 2100

In the Baltic Sea region, the process of population ageing will be most pronounced in Germany and Poland, where the average population age will increase significantly. This trend is explained by a low birth rate in Poland and a high out-migration rate of younger population groups.

Based on the calculated age group ratio trajectory in the Baltics, the median age will increase most dramatically in Estonia (from 41.7 to 47.6 years). A more modest increase is expected in Latvia (from 42.9 years to 45.8 years) and Lithuania (from 43.1 to 45.0 years). Figure 3 shows the median age of the population of the Baltic Sea region states in 2015 and a corresponding projection for 2045, 2070, and 2100.

The difference between the average and median population age will increase, which is indicative of an accelerated population ageing in the projection period. The median/average age difference amounts to 2.9 and 4.0 years in Estonia, 3.3 and 4.0 years in Latvia, and 3.6 and 3.5 years in Lithuania for 2015 and 2100 respectively. These data suggest that population ageing is more rapid in Estonia than in other Baltic States. As to other Baltic Sea region countries, the most rapid population ageing is observed in Poland. In

Poland, the difference between the median and average population ages amounted to 2.2 years in 2014 and it is expected to reach 5.8 years in 2100. For instance, in Germany, it will change from 4.9 to 4.6 years.

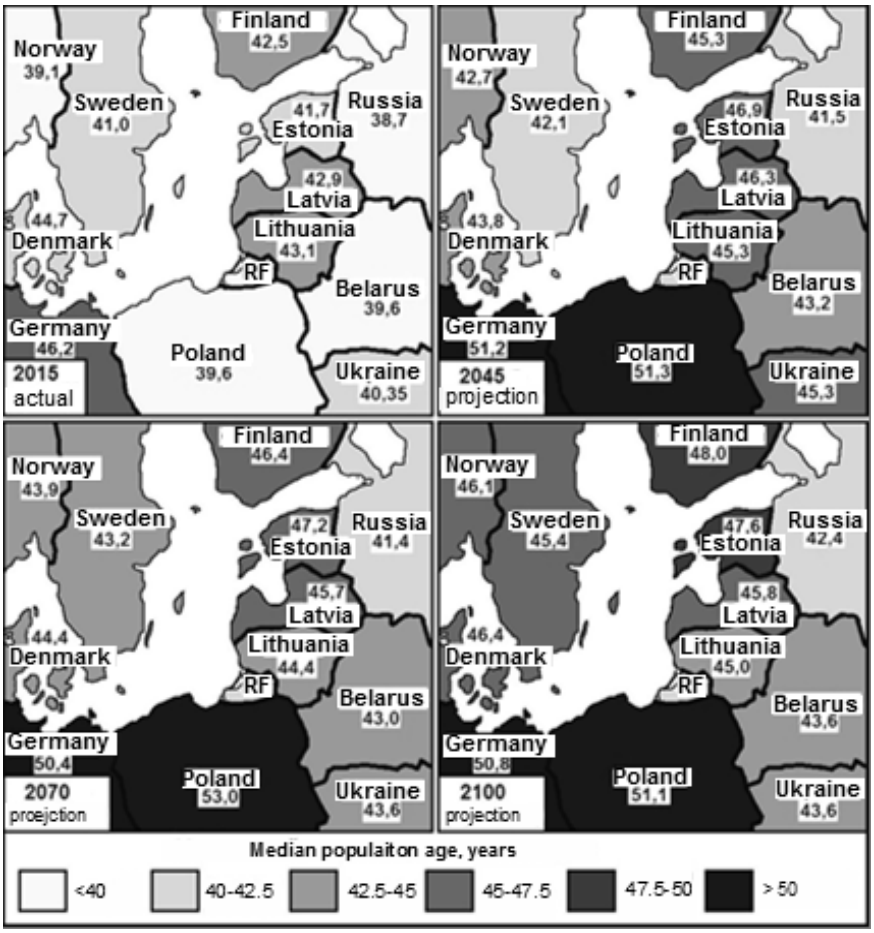


Fig. 3. The median age of the population of the Baltic Sea region states in 2015 and projections for 2045, 2070, and 2100 (according to the confidence interval average obtained by simulation)

Based on the proportion of age cohorts in the total population and the projections of birth, death, and migration rates, it is possible to calculate projected aged and child dependency.

It is important to build a projection trajectory of the first-type aged dependency in the Baltics (the number of people aged 65 and over to the number of people aged 15—64). The most considerable increase in the aged dependency ratio (the first type of calculation) in 2015—2100 will take place in Estonia — from 288 to 527 ‰. In Latvia, the aged dependency ratio will rise from 295 to 466 ‰ and, in Lithuania, from 283 to 452 ‰. Figure 4 shows the first-type aged dependency ratio in the Baltic Sea region countries.

It is also possible to consider a projection of the third-type aged dependency ratio — that of the number of people aged 70 and over to the number of people aged 20—69. The need for such a calculation methodology is explained by the rising age of assuming a social role. The most considerable increase in the third-type aged dependency ratio will be observed in Estonia in 2015—2100 — from 209 to 432 ‰. In Latvia, the ratio will increase from 219 to 371 ‰ and, in Lithuania, from 218 to 357 ‰.

To understand the general demographic trends in the region, it is important to calculate a trajectory of the first-type dependency ratio (the number of people aged 65 and over and people aged 0—14 to the number of people aged 15—64). The most considerable increase in the dependency ratio will be observed in Estonia in 2015—2100 — from 535 to 800 ‰. In Latvia, the ratio will increase from 522 to 736 ‰ and, in Lithuania, from 501 to 728 ‰. Figure 5 shows the total first-type dependency ratio for the Baltic Sea region countries.

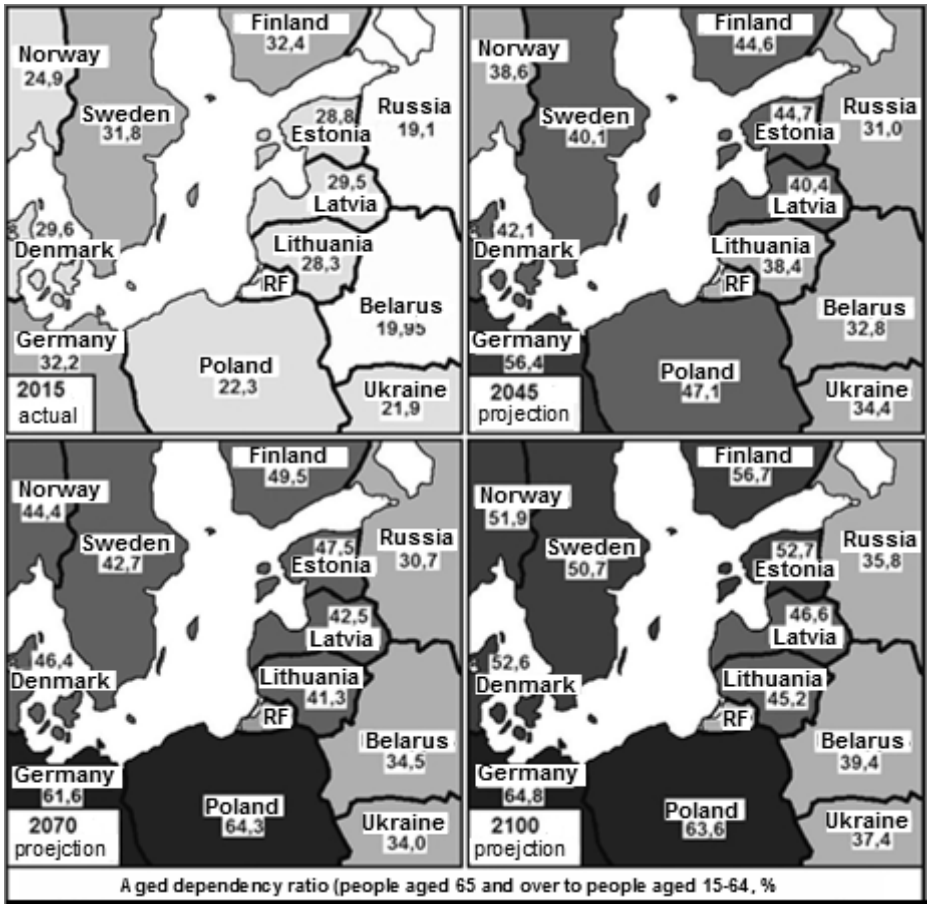


Fig. 4. Aged dependency ratio (the number of people aged 65 and over to the number of people aged 15—64) in the Baltic Sea region states in 2015 and projections for 2045, 2070, 2100 (based on the confidence period average obtained by simulation)

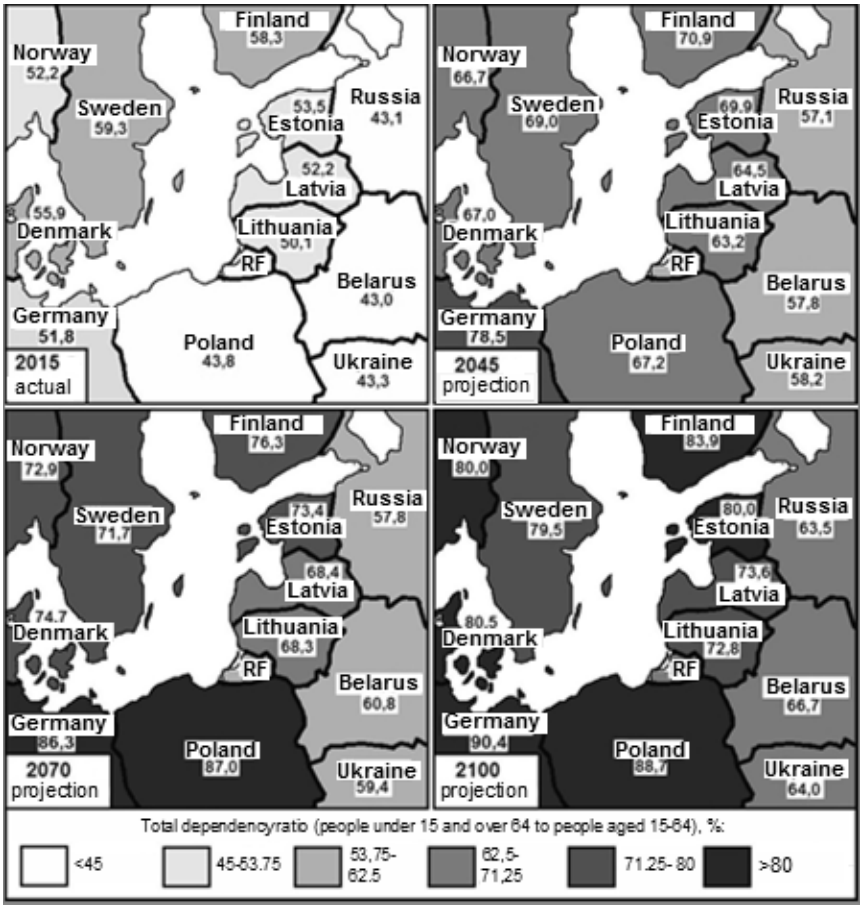


Fig. 5. The dependency ratio (the number of people aged 0—14 and those aged over 65 to the number of people aged 15—64) in the countries of the Baltic region in 2015 and projections for 2045, 2070, 2100
(based on the confidence interval average obtained by simulation)

Let us consider the projection trajectory of the total dependency ratio in the Baltics, based on the third type of calculation (the number of people aged 70 and over and people aged 0—19 to the number of people aged 20—69). The most considerable increase in the dependency ratio of the third type will be observed in Estonia in 2015—2100 — from 517 to 802 ‰. In Latvia, the ratio will rise from 504 to 735 ‰ and, in Lithuania, from 523 to 731 ‰.

## Conclusions and recommendations

All projections suggest that Germany and Poland will top the list of the Baltic Sea states with the highest dependency ratio, followed by Finland. The group of countries with the highest dependency ratio will also include Estonia, Denmark, Norway, and Sweden. In Latvia and Lithuania, the ratio will increase but it will not exceed the regional average.

The situation in the rapidly aging countries of the Baltic Sea region can be improved by the following initiatives: 1) popularising the 'delayed pension' practices; 2) banning abortions with few exceptions (the Polish solution); 3) encouraging motherhood using monetary incentives (the Russian solution); 4) adopting an analogue of the Fillon law (a full-rate pension requires from 160 to 164 quarters in which contributions were paid, the French solution); 5) gradually increasing the statutory retirement age to 67 and 69 years; 6) introducing an opportunity for receiving part of the pension and working part-time from the age of 60 and receiving a full pension and working full-time from the age of 65 (the Spanish solution); 7) combining various direct fiscal methods of demographic regulation (an increase in contributions, subsidies to pension funds, etc.)

References

1. Bashlachev, V. A. 2014, A new meter demographic development in the range of 100 calendar years, *Pskovskii regionologicheskii zhurnal*, no. 19, p. 97—112. (In Russ.)

2. Kuznetsova, T. Yu. 2009, *Geodemograficheskaya obstanovka v stranakh Baltiiskogo makroregiona: problemy i perspektivy* [Geo-demographic situation in the Baltic macro-region: problems and prospects], Kaliningrad, 158 p. (In Russ.)

3. Kuznetsova, T. Yu. 2013, Trends and factors of demographic development in the Baltic region: Regional Analysis, *Regional'nye issledovaniya* [Regional studies], no. 3 (41), p. 50—57. (In Russ.)

4. Kuznetsova, T. Yu. 2008, Territorial differentiation of demographic development in the regions of the Baltic Sea, *Regional'nye issledovaniya* [Regional studies], no. 3 (18), p. 58—62. (In Russ.)

5. Mkrtchyan, N., Karachurina, L. 2014, The Baltics and Russian North-West: the Core and the Periphery in the 2000s, *Balt. Reg*., no. 2 (20), p. 48—62. DOI: 10.5922/2079-8555-2014-2-4.

6. Sluka, N., Ivanov, D. 2014, Demographic Ranking of the Baltic Sea States, *Balt. Reg*., no. 2 (20), p. 22—34. DOI: 10.5922/2079-8555-2014-2-2.

7. Stanaytis, A. K., Stanaytis, S. A. 2012, The population of Lithuania in the second half of XX — beginning of XXI centuries, *Pskovskii regionologicheskii zhurnal,* no 14, p. 74—84. (In Russ.)

8. Nurmela, K., Osila, L., Leetmaa, R. 2014, *A comparative analysis of the active ageing policies in the Baltic countries*, Tallinn, 50 p.

9. Apsite, E., Krišjāne, Z., Berzins, M. 2012, Emigration from Latvia under economic crisis conditions, *International Proceedings of Economics Development and Research*, Vol. 31, p. 134—138.

10. Berzins, A., Zvidrins, P. 2011, Depopulation in the Baltic States, *Lithuanian Journal of Statistics*, Vol. 50, no. 1, p. 39—48.

11. Hanell, T. 2000, Troubling demographic trends in the Baltic Sea Region, *North*, Vol. 11, no. 2—3, p. 5—11.

12. Juska, A., Ciciurkaite, G. 2014, Older-age care politics, policy and institutional reforms in Lithuania, *Ageing and Society*, Vol. 35, no. 4, 25 April 2014, p. 725—749. DOI: 10.1017/S0144686X13001037.

13. Michalski, T. 2001, The main demographic and health problems of the former Soviet part of Baltic Europe*, Baltic Europe on the Eve of Third Millennium. Published series: Coastal Regions*, no. 3, p. 113—119.

14. Michalski, T. 2005, *Changes in the Demographic and Health Situation Among Post-Communist Members of the European Union*, Pelplin.

15. The 2015 Ageing Report. Economic and budgetary projections for the 28 EU Member States (2013—2060), 2015*, European economy*, no. 3, p. 397.

16. *The 2015 Ageing Report Economic and budgetary projections for the 28 EU Member States (2013—2060),* 2015, European Commission, Directorate-General for Economic and Financial Affairs, available at: http://esa.un.org/unpd/wpp/ (accessed 17.03.2016).

17. *World Population Prospects: The 2015 Revision, Methodology of the United Nations Population Estimates and Projections,* 2015, NY, United Nations Department of Economic and Social Affairs Population Division.

## *The authors*

*Prof. Andrei G. Manakov*, Department of Geography, Pskov State University, Russia.

E-mail: region-psk@yandex.ru

*Pavel J. Suvorkov*, PhD student, Department of Geography, Pskov State University, Russia.

E-mail: pavel_suvorkov@mail.ru

*Prof. Saulius A. Stanaitis*, Department of Geography and Tourism, Lithuanian University of Educational Sciences, Vilnius, Lithuania.

E-mail: saulius.stanaitis@leu.lt

**To cite this article:**

Manakov, A. G., Suvorkov, P. J., Stanaitis, S. A. 2017, Population Ageing as a Sociodemographic Problem in the Baltic Region, *Balt. reg*., Vol. 9, no. 1, p. 55—67. doi: 10.5922/2079-8555-2017-1-5.