

MODELS FOR FORECASTING THE NUMBER OF RUSSIAN GRANDPARENTS

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KEYWORDS

Forecasting, regression forecast model, number of grandparents, the age of entry into the grandparenthood, grandparents' labor

ABSTRACT

Russian demographic statistics does not provide information about the number of grandparents. The aim of our study is to present models for forecasting their number. We used data from the Human Fertility Database to estimate the average age of a mother at the birth of her first child. Based on the simulated age of Russian women's entry into grandparenthood, the time series of the number of Russian grandmothers was created. To obtain prospective estimates of the number of Russian grandmothers, we tested various models used in demography to forecast population size – mathematical (based on exponential and logistic functions) and statistical (based on statistical characteristics of time series). To estimate the number of grandmothers who are significantly involved in caring for grandchildren, we used data from the Federal statistical survey. Our results are as follows: 1) there is an increase in the age of entry into grandparenthood; 2) we estimated the size of potential grandmothers in different years and we found two models which are more appropriate for forecasting: linear trend model and average absolute growth model; 3) using these models, we predicted an increase in the number of both potential and active grandmothers in the next 5 years.

INTRODUCTION

Depopulation in Russia, as in many countries of the world, is associated with a number of demographic processes. The population decline is occurring amid a decrease in the birth rate (despite increased government measures to support families with children) and an increase of population aging. An increase in the average age of the population can be facilitated by both an absolute increase in the number of older people and an increase in the share of older people in the total population.

Traditionally, demographic data provide information about the population of certain age groups: young, working age and elderly population. For these categories of the population, both actual and forecast data are published - the latter are used to forecast the

development of the labor market. However, the family-role aspect of presented data on population size is also interesting, especially considering the priority of the state task of increasing the birth rate, the complexity and multifactorial nature of demographic processes and their mutual influence, as well as the variety of family models existing in modern societies.

The family roles that people implement affect different types of their behavior, such as labor, consumer, leisure, political behavior, etc. Therefore, data on population size in the family-role context can have important applied value. For example, the number and the share of parents in society can affect the marketing of certain product groups, the development of leisure infrastructure. The number of grandparents can affect the development of the institution of caring for this category of the population (Raišienė et al., 2019), the distribution of programs to improve their grandparent competencies, the development of special banking products, the development of medical services related to the provision of medical care to people with direct relatives, etc. It should be noted that "the intra-family organization of care for elderly relatives is positively portrayed in Russian society as the fulfillment of intergenerational moral obligations" (Tkatch 2015). The desirability of an intrafamilial organization of care for the younger generation (primarily through the involvement of grandparents) is interpreted in a similar way.

However, the social norms prevailing in Russian society, which are associated with the desirability of the participation of grandparents in the life of their grandchildren, may encounter a number of objective and subjective factors that impede the implementation of these norms. For example, one of such objective factors is a some specificity of Russian economics and society: people's entry into grandparenthood does not always mean that they leave the labor market or have enough time for grandchildren.

Stereotypes about old age can act as a subjective factor that prevents the revitalization of grandparental care for grandchildren. According to the Russian traditional understanding, grandparenthood is associated with old age - it is a trigger for age awareness, a marker of aging (Zelikova 2020). As sociologist Zelikova notes, "older women in Russia have only one role – a grandmother. So when a woman has grandchildren, she realizes that this event (the birth of a grandchild) fundamentally changes her status. All the events that

took place in her life before, events that were associated with age-related changes, could be described as maturing or developing. Marriage, birth of children, career changes are age-related roles, but they contain attractive images and behaviors, they are not associated with the discourse of decline and withering. The image of a grandmother is completely different” [*completely negative - authors*].

Forecasting the number of grandparents is a rather interesting issue from a methodological point of view, and it is not covered enough in modern demography. The solution to the issue involves the identification of other indicators - the age of entry into grandparenthood, the duration of grandparenthood. There is no unified approach to such assessments in demography (Margolis and Verdery 2019; Leopold and Skopek 2015; Margolis and Wright 2017; Margolis 2016; Yahirun, Park and Seltzer 2018).

Thus, it is necessary to highlight the following factors that hinder the forecasting of the number of grandparents in Russia: 1) lack of statistical data on the number of grandparents; 2) influence of numerous factors on the performance of grandparental functions by biological grandparents; 3) lack of a uniform approach in demography to assessing the age of entry into grandparenthood, the duration of grandparenthood.

These factors determine substantiation of the forecasting period. In demographic studies, forecasts are traditionally subdivided into short-term (up to 5 years), mid-term (up to 25 years), and long-term (more than 25 years). Considering the restrictions specified, we believe we can now undertake only short-term forecasts of the Russian grandparents’ number. Additionally, over recent years, Russia has actively implemented demographic policy measures aimed at improving the unfavourable demographic situation. These measures may significantly influence the trends being formed in the population dynamics; consequently, mid-term and long-term evaluations of socio-demographic groups’ sizes in Russia would not be accurate enough.

Therefore, the purpose of our study is to forecast, under these restrictions, the number of grandparents in modern Russia in the short term.

DATA AND METHODS

The specificity of the Age-Sex structure of the Russian population requires a construction of two different forecast models of the number of grandparents - separately for grandmothers and grandfathers. Historically, there is a significant difference in the life expectancy of these population groups in Russia – more than 10 years (Russian Statistical Yearbook-2019). Obviously, generalized forecast models will be rather arbitrary and approximate. This study presents models for forecasting the number of Russian grandmothers.

To construct such models, we needed data on the age of Russian women’s entry into grandparenthood. Since Russian official statistics do not have this kind of data, we modeled this age based on data on the average

age at which a woman gives birth to her first child – in the current year, i.e. in the current generation of mothers, and in the previous generation of women:

$$\begin{array}{l} \text{women's age} \\ \text{of entry into} \\ \text{grandparent-} \\ \text{hood} \end{array} = \begin{array}{l} \text{average age} \\ \text{of a mother} \\ \text{at the birth of} \\ \text{her first child} \\ \text{in the current} \\ \text{year} \end{array} + \begin{array}{l} \text{average age of} \\ \text{a mother at the} \\ \text{birth of her} \\ \text{first child in} \\ \text{the previous} \\ \text{generation of} \\ \text{women} \end{array}$$

We used data from the Human Fertility Database developed by the Max Planck Institute for Demographic Research (Rostock, Germany) and the Vienna Institute of Demography (Vienna, Austria) to estimate the average age of a mother at the birth of her first child. The database on the Russian Federation contains estimates of the average age of a mother at the birth of her first child until 2018 inclusive (The Human Fertility Database).

Based on the simulated age of Russian women’s entry into grandparenthood, the time series of the number of Russian grandmothers was created. The period from 2010 to the present was chosen for the analysis, since 2010 marked the beginning of a stable population growth in the country after a long period of depopulation.

To obtain prospective estimates of the number of Russian grandmothers, we tested various models used in demography to forecast population size – mathematical (based on exponential and logistic functions) and statistical (based on statistical characteristics of time series).

The described technique allows us to obtain estimates of only the potential number of Russian grandmothers. Indeed, not all Russian women in the simulated age range are, in fact, grandmothers, and not all of them are actively involved in caring for their grandchildren. To estimate the number of “active” grandmothers (those who are significantly involved in caring for grandchildren), we used data from the Federal statistical survey “Comprehensive monitoring of living conditions” (Comprehensive monitoring of living conditions 2018). This survey was conducted by the Federal State Statistics Service of Russia in 2011, 2014, 2016 and 2018. Its results are representative for the country as a whole, as well as for individual regions and socio-demographic groups of the population. Despite the fact that this study is not specialized for the study of grandparenthood, some of the questions still allow us to analyze the degree of grandparents’ involvement in caring for grandchildren. As an indicator of this involvement, we used the question “Is caring for children, your own or someone else's (without payment), included in your daily activities?” with answer options: “yes”, “no”, “find it difficult to answer”, “no answer”. The grandmothers who chose the first answer were identified as actively involved in the

process of caring for their grandchildren. Assessment of the share of such “active” grandmothers in the total number of grandmothers allowed us to adjust the forecast with regard to potential Russian grandmothers.

RESULTS

We obtained the following results in the research process.

Based on data on the age at which a woman gives birth to her first child, we modeled the age at which a Russian woman becomes a grandmother (Table 1). In Russia, as in many other European countries, the age at which a woman first becomes a mother is increasing. This, in turn, leads to an increase in the age of entry into grandparenthood.

Table 1: Estimates of the age of entry into the grandparenthood of Russian grandmothers

year	average age of a mother at the birth of her first child	year of birth of the previous generation of mothers	average age of a mother at the birth of her first child in the previous generation of mothers	average age of entry into grandparenthood
2000	23.54	1976	23.22	46.76
2001	23.66	1977	23.18	46.84
2002	23.76	1978	23.10	46.86
2003	23.85	1979	23.03	46.88
2004	23.96	1980	22.99	46.95
2005	24.11	1981	23.01	47.12
2006	24.21	1982	23.00	47.21
2007	24.34	1983	22.96	47.30
2008	24.44	1984	22.92	47.36
2009	24.67	1984	22.92	47.59
2010	24.90	1985	22.91	47.81
2011	24.91	1986	22.95	47.86
2012	24.96	1987	22.92	47.88
2013	25.14	1988	22.90	48.04
2014	25.25	1989	22.78	48.03
2015	25.45	1990	22.65	48.10
2016	25.63	1990	22.65	48.28
2017	25.77	1991	22.60	48.37
2018	25.91	1992	22.60	48.51
2019	–	–	–	48.58*
2020	–	–	–	48.68*

* - preliminary estimates

It is important to note that raw statistical data allow us to simulate the age of entry into parenthood only for data until 2018 inclusive. However, increased volatility has been observed in the natural movement of the Russian population in recent years. Therefore, we considered it necessary to include the 2019-2020 data in the analysis to increase the reliability of forecast. To do this, we estimated the average age of Russian women’s

entry into grandparenthood for these years based on the trend model and extrapolation.

In the process of further analysis, estimates of the size of age groups of women - potential grandmothers in different years - were obtained on the basis of estimates of the age of entry into grandparenthood. The visualization of these data (Figure 1) allowed us to select the following statistical models for forecasting:

- linear trend model;
- average absolute growth model:

$$S_t = S_0 + t \times \overline{\Delta}_t,$$

where $\overline{\Delta}_t$ – average absolute growth;

S_0 – the initial number of grandmothers in 2018;

S_t – projected number of grandmothers in year t .

Both models assume a steady annual increase in the number of Russian grandmothers. Their assessments are complementary, and they provide a more complete picture of the prospective dynamics of this age group of women.

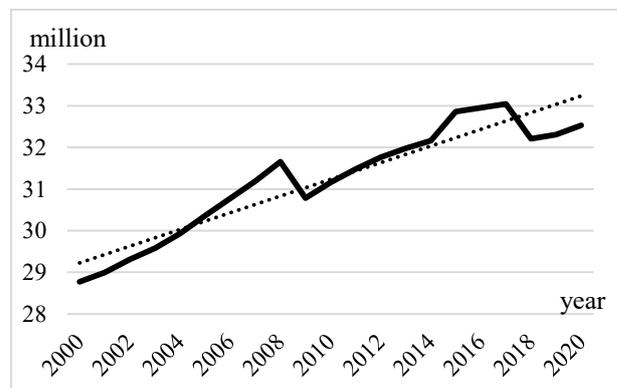


Figure 1: The number of potential grandmothers in Russia in 2000-2020 (actual data and trend)

Other models are also used in demographic statistics for the population forecast. Thus, mathematical models for forecasting the population size are most often based on exponential and logistic functions. Acceptance of the hypothesis about the model of population dynamics by exponential function implies the recognition of exponential population growth. The logistic function characterizes the growth which initially occurs at an accelerated pace, continues until a certain point, then decreases, and finally reaches zero. At the same time the trends emerging in the Russian demographic dynamics do not give us reason to consider such models suitable for forecasting the number of grandparents.

Table 2 presents the most important parameters of the forecast regression model (linear trend), and Table 3 presents parameters of the model of the average absolute growth. We also considered it necessary to obtain two estimates of such growth - for the entire study period and for the period since 2010. The former allows us to make forecasts by focusing on long-term, stable trends, while the latter allows us to consider the increased volatility of recent years and a previous

slowdown in the growth rate of the number of potential Russian grandmothers. Considering the noted features, the estimate of the average absolute growth for this period is slightly lower than the estimate for the entire period of the study.

Table 2: Model Summary and Coefficients of the Forecasting Model (Linear Trend) of the Number of Russian Grandmothers

	Constant	Years
Coefficient	-371875187.1	200549.7
T	-11.09	12.03
P-value	9.5E-10	2.5E-10
F	144.71	
Significance	2.4E-10	
R ²	0.88	

Table 3: Parameters of the regression forecast model (linear trend) of the number of Russian grandmothers

Period of model estimates	Value of the average absolute growth
from 2000 to 2020	188162.5
from 2010 to 2020	159458.0

In general, the parameters of the evaluated models allow us to forecast the growth in the number of Russian grandmothers in the next 5 years (Table 4). At the same time, a more reliable interval forecast (with a significance level of 95%) was presented on the basis of the regression model.

Table 4: Forecast of the number of Russian grandmothers

Interval forecast based on the regression model (linear trend)		
	lower bound of the forecast	upper bound of the forecast
2021	32 372 999	34 498 535
2022	32 560 455	34 712 179
2023	32 746 950	34 926 783
2024	32 932 522	35 142 311
2025	33 117 207	35 358 725
Forecast based on the model of average absolute growth		
	for data from 2000 to 2020	for data from 2010 to 2020
2021	32 722 482	32 693 777
2022	32 910 644	32 853 235
2023	33 098 807	33 012 693
2024	33 286 969	33 172 151
2025	33 475 132	33 331 609

Using the data from a survey of the Federal State Statistics Service "Comprehensive Survey of the Living Conditions of the Population" to forecast the number of active Russian grandmothers (those who are involved in

the process of caring for their grandchildren daily), we obtained estimates of the share of such grandmothers among potential grandmothers (Table 5). The data show no clear trend in the dynamics of this share. Therefore, we used the average estimate in forecasting, which was 19%.

Based on the data, we made forecasts of the number of Russian grandmothers who are actively involved in the process of caring for their grandchildren (Table 6). In the next 5 years, an increase in the number of both potential grandmothers and active grandmothers is predicted.

Table 5: The number and the share of active Russian grandmothers, calculated on the basis of Comprehensive Survey of the Living Conditions of the Population (Comprehensive monitoring of living conditions 2018)

Years	The number of potential grandmothers	The number of active grandmothers	The share of active grandmothers
2011	6024	1304	0.22
2014	35252	6765	0.19
2016	35879	7074	0.20
2018	34479	5462	0.16
average	27908.5	5151.3	0.19

Table 6: Forecast of the number of active Russian grandmothers

Interval forecast based on the regression model (linear trend)		
	lower bound of the forecast	upper bound of the forecast
2021	6 150 870	6 554 722
2022	6 186 486	6 595 314
2023	6 221 921	6 636 089
2024	6 257 179	6 677 039
2025	6 292 269	6 718 158
Forecast based on the model of average absolute growth		
	for data from 2000 to 2020	for data from 2010 to 2020
2021	6 217 272	6 211 818
2022	6 253 022	6 242 115
2023	6 288 773	6 272 412
2024	6 324 524	6 302 709
2025	6 360 275	6 333 006

DISCUSSIONS

The projected increase in the number of grandmothers entails the need to expand research on this category of the population. In our opinion, the studies of this topic in Russia should consider the following principles:

1) Selecting grandparents who perform grandparent' functions and participate in the care for their grandchildren from the total number of

grandparents; highlighting the labor nature of the grandparents' participation in the upbringing of their grandchildren. We propose to apply the approach to parenthood as a labor activity, which is quite common in the scientific literature, to the study of grandparenthood (Erickson 2005; Oakley 1974; Daniels 1987; Pedersen et al. 2011);

2) Applying an interdisciplinary approach to the study of grandparenthood and grandparent labor. It is advisable to study the grandparent labor from different angles: demography studies demographic characteristics of the actors of grandparent labor and demographic processes affecting them; sociology studies the motives of this type of labor, the satisfaction of various participants in the labor process, the attitudes in society; economic science studies labor costs and the organization of this type of labor, assesses the possibilities of its stimulation;

3) Differentiated study of grandparent labor by the actors of this labor – grandmothers and grandfathers. This principle is introduced due to a significant differentiation in the life expectancy of Russian men and women, which affects the duration of grandparenthood and, as a consequence, the performance of functions of the grandparent labor;

4) Considering regional differences in grandparent labor. Historically, Russia has developed a high degree of regional differentiation in many social and economic indicators (for example, Vlasov and Panikarova 2017). The regional specificity of grandparent labor may be due to the differentiation of life expectancy, fertility, divorce rate, morbidity, migration flows etc.;

5) Detailing the grandparenthood forecast in terms of age. Consideration of the age structure of grandparents can be important when assessing the potential for their participation in the upbringing and caring for grandchildren. The older the grandparents, the less they actively participate in the life of their grandchildren and the more care they require from their children. An increase in the share of grandparents of older age groups in the structure of Russian grandparents will lead to an increase in the number of the Sandwich Generation (Urlick 2017). It will inevitably reduce the volume and quality of parental functions realization by the middle generation, which will simultaneously have to take care of both children and elderly parents;

6) Studying the prevalence of grandparent labor in society as one of the most important elements of the active longevity index calculated by the World Health Organization (Active ageing: A policy Framework 2002). Creating conditions for active grandparent labor in the regions of Russia would make it possible to increase the values of the active longevity index there and obtain all the positive effects that arise in society when the grandparents are more involved in the life of their grandchildren;

7) Using a set of indirect estimates to determine the main indicators of the of the demography of

grandparenthood, which serve as the basis for the study of sociological and economic aspects of grandparenthood. The introduction of this principle is associated with several methodological difficulties. Firstly, Russia does not have a statistical record of direct family ties of the population that goes beyond two generations. For example, the population census does not have questions about grandchildren and grandparents. Thus, there is no "direct" way to select people with grandchildren from the older population. Secondly, it is difficult to select grandparents who perform their grandparents' functions on a regular basis from the total number of grandparents. It is also difficult to select grandparents who bear the time costs associated with grandparent labor.

CONCLUSIONS

Thus, in our study:

1) we substantiated the need to forecast the size of a special category of the Russian population - grandparents. Considering the strength of family ties in Russian families, as a hypothesis we assume that the number of grandparents who help raise grandchildren is a specific resource for increasing Russian birth rate;

2) we proposed a methodology that allows us to forecast the number of grandparents in Russia based on statistical models of a linear trend and absolute growth, in conditions of limited information resources;

3) based on the proposed methodology, we obtained estimates of the number of potential grandmothers; based on these estimates and the data of the national population survey, we forecasted the number of grandmothers who actively help their children in raising their grandchildren;

4) we proposed methodological principles for studying the phenomenon of grandparenthood, which is rarely studied in Russia.

From an economic point of view, our results may be of relevance to those organisations providing social services to elderly people when planning their activities. Forecasts may be also of interest to businesses producing goods and services for multi-generational families. Further development of the study lies in improving the models identified: firstly, the construction of models in the context of regions and age groups; secondly, verification and comparison of estimates we obtained on the basis of statistical models with estimates that will be obtained using other demographic forecasting methods (e.g. estimates derived from the age-shifting method) - after that, the final forecast will be possible; thirdly, the refinement of input parameters of the forecast models and the correction of forecast estimates based on the data of the upcoming population census in Russia and the next round of study of the population's living conditions.

We also see room for advancing our study in sociological and demographic domains. For instance, active grandparenting with its types, reasons for fulfilling, consequences, and regional diversity should be studied separately.

ACKNOWLEDGMENTS

The reported study was funded by RFBR, project number 20-011-00280.

REFERENCES

- Active ageing: A policy Framework*. 2002. Geneva: World Health Organization. URL: http://whqlibdoc.who.int/hq/2002/WHO_NMH_NPH_02_8.pdf (access date 12.02.2021).
- Comprehensive monitoring of living conditions. 2018. Rosstat, Moscow. URL: https://gks.ru/free_doc/new_site/KOUZ18/index.html (access date 12.02.2021).
- Daniels, A.K. 1987. "Invisible Work". *Social Problems*, No 34, 304-415.
- Erickson, R.J. 2005. "Why emotions work matters: Sex, gender, and the division of household labor". *Journal of Marriage and Family*, No 67, 337-351.
- Leopold, T. and J. Skopek. 2015. "The Demography of Grandparenthood: An International Profile". *Social Forces*, Vol 94 (2), 801-832. DOI: 10.1093/sf/sov066
- Margolis, R. 2016. "The changing demography of grandparenthood". *Journal of Marriage and Family*, No 78, 610-622.
- Margolis, R. and A.M. Verdery. 2019. "A Cohort Perspective on the Demography of Grandparenthood: Past, Present, and Future Changes in Race and Sex Disparities in the United States". *Demography*, Vol 56 (4), 1495-1518, DOI: 10.1007/s13524-019-00795-1
- Margolis, R. and L. Wright. 2017. "Healthy grandparenthood: How long is it, and how has it changed?" *Demography*, No 54, 2073-2019.
- Oakley, A. 1974. *"The sociology of housework"*. New York: Pantheon.
- Pedersen, D.E., Minnotte, K.L., Susan, E. and G. Kiger. 2011. "Exploring the relationship between types of family work and marital well-being". *Sociological Spectrum*, No 31, 288-315.
- Raišienė, A.G., Bilan, S., Smalskys, V. and J. Gečienė. 2019. "Emerging changes in attitudes to inter-institutional collaboration: The case of organizations providing social services in communities". *Administratie si Management Public*, No 33, 34-56. DOI: 10.24818/amp/2019.33-03.
- Russian Statistical Yearbook-2019 (Appendix). Rosstat. URL: <https://rosstat.gov.ru/folder/210/document/13396> (access date: 12.02.2021)
- The Human Fertility Database. URL: <https://www.humanfertility.org/cgi-bin/main.php> (access date: 12.02.2021).
- Tkatch, O. 2015. "Caring Home": Caring for Elderly Relatives and Problems of Living Together". *Sociological research*, Issue 10, 94-102.
- Urlick, M. J. 2017. "The Aging of the Sandwich Generation". *Generations-Journal of the American society on aging*, Vol 41 (3), 72-76.
- Vlasov, M and S. Panikarova. 2017. "Characteristics of the economic development of the multi-ethnic regions of Russia". In *Proceedings of the 5th International Conference on Management Leadership and Governance ICMLG 2017* (Johannesburg, South Africa, March 16th-17th, 2017), 472-477.
- Zelikova, J. 2020. "I Can Only Perceive Myself as a Babushka": aging, ageism, and sexism in contemporary Russia". *Laboratorium: Russian Review of Social Research*, 12(2), 124-145, DOI: 10.25285/2078-1938-2020-12-2-124-145. URL:

<https://soclabo.org/index.php/laboratorium/article/view/966/2403>

- Yahirun, J. J., Park, S. S. and J. A. Seltzer. 2018. "Step-grandparenthood in the United States". *Journals of Gerontology, Series B: Psychological Sciences & Social Sciences*, No 73, 1055-1065.

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