

IDENTIFYING REGIONAL MODELS OF ACTIVE GRANDPARENTING IN RUSSIA BASED ON CLUSTER ANALYSIS

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ABSTRACT

One of the important social roles the elderly perform is that of grandparents. Our study aims to identify groups of Russian regions with similar models of grandparental activity. The research focuses only on grandmothers. To determine these models, we applied the hierarchical cluster analysis. We used indicators that characterize potential (based on the age criterion) and active (based on intensive involvement in caring for grandchildren) grandparenting in Russian regions. In the process of clustering, we use the growth rates of active grandmothers in the total number of potential grandmothers in 2011-2014, 2014-2016, 2016-2018. The analysis based on the Ward method and the Euclidean distance allowed us to identify 4 models of grandparental activity (regarding grandmothers) in Russian regions. The models differ significantly in the specifics of changes in the degree of grandmothers' involvement in caring for their grandchildren. These models provide the framework for developing specific demographic policy measures with the regional heterogeneity in mind.

INTRODUCTION

In recent decades, population ageing has become one of the most crucial global trends, which is now becoming more evident in many countries. The share of the elderly is steadily increasing in Russia, too. For example, over the past twenty years, the share of those aged 65 and above has grown from 12.4% to 15.8% (Demographic indicators 2022). The consistent trend results in the more intense economic, social, political, and demographic involvement of the elderly population in the social life.

One of the important social roles the elderly perform is that of grandparents while taking part in childcare is becoming increasingly popular among the older generation. Their activity – actual or potential – generates interest in new research. The last decade has seen a rapid development of the grandparenthood demography (Arpino et al. 2018; Margolis and Arpino

2019). An increasing number of grandparenthood demography studies found, inter alia, some positive psychological, social, demographic, and economic effects from grandparents' involvement in their grandchildren's lives (Arpino and Bordone 2014; Mahne and Huxhold 2015; Hilbrand et al 2017; Shubat and Shubat 2021).

One of the positive demographic effects is the influence of proactive grandparenting on increasing the birth rate, which is particularly important for Russia. In fact, the country witnesses negative demographic trends; the birth rate is falling annually, the natural population decline is growing whereas the total population is decreasing. According to a medium variant of demographic projection (i.e., the most likely one), the population will be declining until 2035 (Demographic indicators 2022; Demographic projections 2021). To address demographic problems, the government has extensively designed and implemented various demographic policy measures; however, according to statistics, they have not produced desired results yet – the birth rate keeps declining. Clearly, it inspires new initiatives, which could enable more effective demographic policy measures. One of these initiatives is to support proactive grandparenting in the country.

Researchers from different countries explore a positive impact of proactive grandparenting on increasing the birth rate. Kaptijn R. et al. (2010) demonstrated that in the Netherlands, childcare support from grandparents increases the probability that parents have additional children in the next 8 to 10 years. The conclusion is based on three-generation longitudinal data anchored in a sample of grandparents aged 55 and over. Similar results were obtained by Thomese and Liebroer (2013), who used a survey of 898 Dutch men and women. In other countries, researchers also found positive implications of grandparenting for birth rates (Chapman S.N. et al. 2021; Hejun Gu et al. 2021; Hank and Kreyenfeld 2003) or the reverse effect, when the absence of grandparents (or their death) results in lower birth rates (Okun and Stecklov 2021).

The grandparents' childcare may be regionally and nationally specific. For example, Buchanan and Rotkirch (2018) showed differences between childcare patterns in the Northern and the Southern Europe. Similarly, Russia may also have its own specificities of

how grandparenting affects the birth rate. However, a critical issue now is to identify these specificities. Although the active involvement of grandparents into taking care of and developing their grandchildren is traditional in Russia, the country lacks national-level studies which could help soundly estimate characteristics of the grandparents' activity. Today, Russian statistics does not collect data on grandparents as people with grandchildren. Making evaluations is possible only through secondary data and indirect recalculations.

One of the peculiarities of grandparenting in Russia may be considered its high regional specificity. Historically, Russian regions differ greatly in a number of social, economic, and demographic indicators. For example, Table 1 presents minimum and maximum regional values of indicators which are frequently used for exploring the socio-economic development of the country or a region (Regions of Russia 2021). The Table proves that these values differ sharply.

Table 1: Regional Differences of Some Socio-Economic Indicators in Russia

Variable	Minimum		Maximum		MMR*
	Value	Region	Value	Region	
Total Fertility Rate	1.061	Leningrad region	2.971	Tyva Republic	2.8
Unemployment Rate, %	2.4	Yamal-Nenets Autonomous Area	29.8	Republic of Ingushetia	12.4
Gross Regional Product, per capita, roubles	145723	Republic of Ingushetia	7530485	Nenets Autonomous Area	51.7

* MMR is Maximum-Minimum Ratio

We argue that the statistical method of the cluster analysis may be appropriate to meet the goal. Interestingly, the cluster analysis is not widely used today for designing differentiated demographic policy measures. Although researchers perform modelling of space and other structures based on the cluster analysis quite often, demographic studies use this method of modelling infrequently; it is supported by our analysis of papers indexed in the Web of Science global citation database. We chose those publications which used "cluster analysis" as a keyword and compared the number of such publications in different research areas from the Web of Science classification. Results of the

analysis are presented in Table 2. They reveal that only 26 publications out of nearly 18 thousand which used cluster analysis deal with demography.

Table 2: Number of Publications with "Cluster Analysis" as a Keyword (indexed in Web of Science as of 7 February 2022)

Web of Science Categories	Number of Papers
Demography	26
Sociology	111
Economics	787
Total	17,972

Due to positive implications from the active involvement of grandparents into taking care of grandchildren, which were found by researchers from different countries, and the uneven demographic and socio-economic development of Russia, exploring regional models of active grandparenting in the country and tendencies for their changes is of great relevance. Thus, our study aims to identify groups of Russian regions with similar models of grandparental activity. We hypothesise that the degree of grandmothers' and grandfathers' involvement in caring for grandchildren differs and thus argue that these groups should be studied separately; this research focuses only on grandmothers.

DATA AND METHODS

From the methodological point of view, it is difficult to identify the socio-demographic group of grandparents. As was mentioned, Russia does not collect statistical data on the number of grandparents. We can estimate it only through secondary data – based on the age criterion. To that end, we have to define the age when men and women in Russia become grandparents. In our previous research, we presented the methodology for it (Shubat and Bagirova 2020, Shubat and Shubat 2021); to define the age of becoming grandmothers, the age when a woman gives birth to her first child is added for two adjacent generations of mothers.

On defining the age of becoming grandparents, we can evaluate the number of grandparents based on the age criterion; however, this method allows us to evaluate only the number of potential grandmothers. Not all of them will be active grandmothers, that is actively involved in taking care of and developing their grandchildren. To determine them, we used "Comprehensive monitoring of the living conditions of the population" – a survey by the Russian Federal State Statistics Service held biannually (Comprehensive monitoring 2018). At the time of the study, data were available for 2011, 2014, 2016, and 2018. Some questions in this survey give a preliminary idea of how active grandmothers are in taking care of grandchildren. In particular, the following question may be a good identifier: "Is taking care of children – yours or someone else's – a part of your daily routine (without

being paid for it)?" A positive answer to this question allowed us to categorise a potential (by age) grandparent as an active one.

Based on these data, we calculated three variables for each region of Russia and used them throughout the research:

- Var 1: the growth rate of active grandmothers in the total number of potential grandmothers in 2011-2014;
- Var 2: the growth rate of active grandmothers in the total number of potential grandmothers in 2014-2016;
- Var 3: the growth rate of active grandmothers in the total number of potential grandmothers in 2016-2018.

To determine regional models of active grandparenting, we applied the hierarchical cluster analysis. We tested different distance measures and various ways to group regions in clusters. We chose those measures which showed the best differentiation potential and allowed dividing regions into clusters as clearly as possibly. To decide on the number of clusters, we used a dendrogram and coefficients of the agglomeration schedule. Clusters were profiled through analysing cluster centroids. For each group of regions, we calculated mean and median values of clustering variables. Medians are known to be a non-parametric measure of central tendency insensitive to outliers in the population analysed – as opposed to means. They can be used when analysing the mean value is inadequate due to outliers or high variation of data.

RESULTS

We obtained the following results.

1. Based on the methodology for assessing Russian women's age of becoming grandmothers, we concluded that, on average, a woman in Russia becomes a grandmother at the age of 47-48 years (Table 3). These numbers are growing due to the increasing age of first births – a tendency not only in Russia but also in many other developed and developing countries.

Table 3: Russian Women's age of Becoming Grandparents

Year	2011	2014	2016	2018
Age	47.86	48.03	48.28	48.51

We used these data to form groups of potential grandmothers for each year. Then we selected active grandmothers – those who participate in taking care of and developing grandchildren daily. Further, we calculated variables characterising the dynamic of the number of active grandmothers in Russian regions.

2. The analysis showed that the variables characterising the dynamic of the number of active grandmothers differ significantly in Russian regions – the minimax ratio of their values varies from 7.8 to 16.8 times, as shown in Table 4.

Table 4: Minimum and Maximum Values of Clustering Variables

	Var 1 2014/2011	Var 2 2016/2014	Var 3 2018/2016
Minimum	0.262	0.000	0.213
Maximum	4.423	2.032	1.661
Maximum- Minimum Ratio	16.882	-	7.798

Such heterogeneity is a precondition for performing the cluster analysis that may identify typical region groups, that is, regional models of grandparental activity.

3. The hierarchical cluster analysis based on the Ward method and the Euclidean distance allowed us to identify 4 clusters of Russian regions that differ significantly in the levels of the indicators studied. Thus, we determined 4 models of grandparental activity (regarding grandmothers) in Russian regions.

The clustering dendrogram is shown in Figure 1; the mean and median values of the variables studied are presented in Table 5. We applied the cluster analysis based on these distance measures because it provides the clearest division of all regions into clusters.

Table 5: Mean and Median Values of Variables in Clusters

Model (cluster)	Statistics	Var 1 2014/2011	Var 2 2016/2014	Var 3 2018/2016
1	Mean	0.76	1.21	0.75
	Median	0.76	1.16	0.76
2	Mean	0.98	0.81	1.01
	Median	1.06	0.82	0.91
3	Mean	1.95	1.12	0.95
	Median	1.91	1.11	0.98
4	Mean	3.45	0.89	0.57
	Median	3.23	0.79	0.58

The study of cluster centroids based on median values revealed a non-linear dynamic of the number of active grandmothers in Russian regions. We did not observe a continuous growth in any model of grandparental activity. Crucially, all models have shown a decrease in the number of active grandmothers in recent years – from 9% in Model 2 to 42% in Model 4.

At the same time, there are obvious differences in the models identified. For example, in Model 1, the number of active grandmothers changed non-linearly – it decreased in the beginning, then increased, and decreased again; this is the only regional model where in 2011–2014 the number of active grandmothers decreased.

Model 4 is characterised by the highest volatility. With the largest increase in the number of active grandmothers in 2011–2014 (by more than 220%), there was also the greatest decrease in subsequent periods – by 21% and 42%.

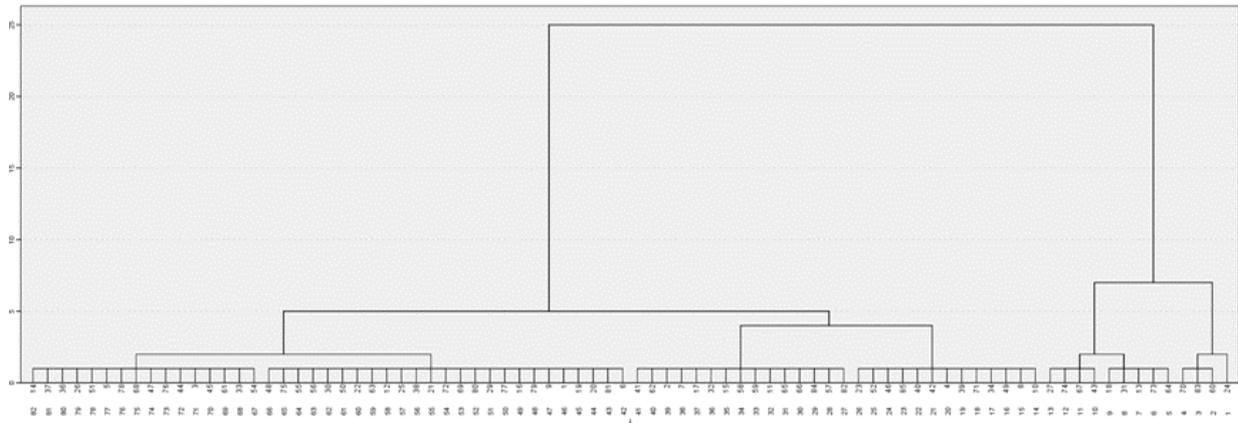


Figure 1: Clustering Dendrogram

Model 3 is the most stable and unproblematic one. It is characterised by an increase in the number of active grandmothers in 2011–2016 and the smallest decrease among other models in 2016–2018.

As an additional variable for profiling the clusters found, we can consider the growth rate of active grandmothers in the total number of potential grandmothers in 2011–2018 – that is, how it changed relative to the base year. We argue that using this variable for clustering is irrelevant because it undermines our initial idea – to identify models of the Russian grandparents’ activity according to dynamics of specific time periods. Considering changes in the more long-term period will clearly conceal important specificities of changes, which occurred within the period. At the same time, the analysis of this variable can definitely reveal crucial characteristics of active grandparenting models. Table 6 shows mean and median values of the additional variable.

Table 6: The Growth Rate of Active Grandmothers in the Total Number of Potential Grandmothers in 2011–2018

Model (cluster)	Statistics	Value
1	Mean	0.69
	Median	0.67
2	Mean	0.80
	Median	0.79
3	Mean	2.07
	Median	2.08
4	Mean	1.75
	Median	1.48

To some extent, additional profiling proved our results. Model 3 indeed turned out to be more positive. The share of active grandmothers here more than doubled in 2011–2018. The total growth in the share of active grandmothers in Model 4, though, should not be regarded as positive because it results from a dramatic increase in 2011–2014, which did not subside even though the share of active grandmothers markedly decreased in the following years. Between 2011 and

2018, Models 2 and 3 saw a decline in the number of active grandmothers. However, the dynamic of this indicator within the period studied differed in two models, which allows us to conclude that these are two different models of the Russian grandmothers’ activity.

DISCUSSIONS

Our results raise some questions, and we see two courses of discussion – how these results can be used to improve the demographic policy and whether it is even possible to use them.

First of all, in 2016–2018, the number of active grandparents decreased in all models identified. At the same time, since 2016, the total fertility rate in Russia has also begun to decline. To confirm the influence of grandparenting on the birth rate in Russia, specialised studies are needed, but our results allow us to hypothesise this influence. A number of studies which showed a positive influence of active grandparenting on the birth rate increase in different countries also prove the adequacy of our hypothesis. In particular, these positive effects were revealed by Kaptijn R. et al (2010), Thomese and Liefbroer (2013), Chapman S.N. et al (2021), Hejun Gu et al (2021). Analogous positive effects in Russia should be explored in a dedicated study, which cannot be pursued at present due to the lack of necessary data and statistics.

Models of active grandparenting provide the framework for developing specific state measures with the regional heterogeneity in mind, which would be aimed at supporting and stimulating fertility considering possible positive implications from active grandparenting. The potential of active grandparenting needs governmental support; it can be provided, for example, in the form of compensation payments to grandparents who spend time with their grandchildren instead of their parents. It is also necessary to support active grandparenting in the media. Earlier, we showed some ways to support and stimulate the potential of active grandparenting (Shubat & Bagirova, 2020). We argue that the most active measures are demanded in Model 4 – the most dramatic one.

Further research is required to identify reasons for the specific dynamic of the number of active grandparents in different regional models. Our research may be considered pilot, but at the same time it inspires further and deeper research in this area. Besides, it is relevant to examine regional characteristics of the grandfathers' activity. Current trends for feminisation and active fatherhood may result in fundamentally different patterns of the grandparental activity.

We argue that it will be of importance to explore the duration of grandparenting and its effectiveness in further studies. It is critical that Russia has recently experienced an annual increase in the life expectancy; in 2011-2020, it grew by more than 4% and, in 2020, equaled to 72.91 years (Life expectancy, 2022). At the same time, our studies show that the age of Russian women's entering grandparenting accounts for 47-48 years; the median age of active grandmothers in 2018 was 60 years, whereas 90% of these grandmothers were up to 71 years inclusive. Therefore, grandparenting effectiveness will be mostly affected by an active life position and grandparents' willingness to take part in raising grandchildren.

The second course of discussion concerning our results is related to the possibility of using the cluster analysis to enhance demographic policy measures.

The cluster analysis is a method for modelling the structure of data based on the so-called person-oriented approach to data analysis (Bergman and Magnusson 1997). It is the opposite of a variable-oriented approach, which is much more often used in social, demographic studies and is oriented at studying the interaction between variables using linear statistical models. The person-oriented approach considers all the variables simultaneously as a complex system that cannot be divided and which functions and develops as a totality (Bergman and Trost 2006). The approach is aimed at studying intra-individual dynamics and variation, which is clearly its methodological advantage compared to the variable-oriented approach.

However, we should be prudent in considering the use of the cluster analysis for demographic research and the development of differentiated state measures of the demographic policy. One of the problems of the cluster analysis is that different clustering methods can give different results, which can result both in a different number of clusters and in a different composition of clusters. Aldenderfer and Blashfield (1984, 1988) presented a broad overview of using various clustering methods and described results of testing various metrics both on real data and on data modelled by the Monte Carlo method. The results of empirical studies showed some advantages of the Ward method.

In our study, this method also gave better results and segmented Russian regions into homogeneous groups more clearly. But we argue that the development of effective state demographic policy measures, differentiated according to regional peculiarities, requires further research and further modelling of the Russian demographic space performed both on real data

and the Monte Carlo simulation. It is necessary to compare clustering results and to search for reasons behind the differences identified in our research.

CONCLUSIONS

Our study yielded the following conclusions.

1. When developing demographic policy measures, it is important to consider the heterogeneity of Russian regions. The dynamic of demographic indicators in the regions is not similar and often multidirectional; therefore, designing universal state support measures for stimulating fertility equally effective in all regions cannot be possible.

2. The cluster analysis may be an effective analytical tool for identifying regional models in demography. Its results may help suggest regionally specific demographic policy measures. However, it should be first tested with different methods of clustering in a number of studies.

3. The grandparents' activity may be viewed as a resource for addressing demographic problems in Russia. The models of active grandparenting we identified allow determining regions with the most problematic situation, which require the most urgent support from the government. These models may be also used for more profound research in the field. Our study raises another issue for Russian authorities – a need to collect national-level statistical data on grandparenting. Without these data, research conducted cannot build a solid foundation for enhancing the demographic policy.

Future research on the topic can concentrate on additional studies intended to develop an information pool for finding cause-effect relationships between the birth rate and an active contribution of grandparents in Russia. Important aspects for future studies also include exploring the grandparenting duration in Russia for grandmothers and grandfathers and modelling the Russian demographic space based on both actual data and Monte Carlo simulation.

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REFERENCES

- Aldenderfer, M. S., Blashfield, R. K. (1984). *Cluster analysis*. Beverly Hills, CA: Sage Publications.
- Arpino B., Guma J., Julia A. (2018). Family histories and the demography of grandparenthood, *Demographic research*, No. 39, pp. 1105-115 .
- Arpino, B., Bordone, V. (2014). Does Grandparenting Pay Off? The Effect of Child Care on Grandparents' Cognitive Functioning. *Journal of Marriage and Family*, 76(2), 337-351. doi: <https://doi.org/10.1111/jomf.12096>
- Bergman, L. R., Magnusson, D. (1997). A person-oriented approach in research on developmental

- psychopathology. *Development & Psychopathology*, 9, 291-319.
- Bergman, L. R., Trost, K. (2006). The person oriented versus the variable-oriented approach: Are they complementary, opposites, or exploring different worlds?, *Merrill-Palmer Quarterly*, 3, 601–632.
- Blashfield, R. K., Aldenderfer, M. S. (1988). The methods and problems of cluster analysis. In J. R. Nesselrode, R. B. Cattell (Eds.). *International handbook of multivariate experimental psychology*. New York: Plenum Press.
- Buchanan A., Rotkirch A. (2018). Twenty-first century grandparents: global perspectives on changing roles and consequences. *Contemporary Social Science*, 13(2), 131-144.
- Chapman S.N., Lahdenperä M, Pettay J.E., Lynch R.F., Lummaa V. (2021) Offspring fertility and grandchild survival enhanced by maternal grandmothers in a pre-industrial human society. *Scientific Reports*, Feb 11(1), 36-52. doi: 10.1038/s41598-021-83353-3.
- Comprehensive monitoring of the living conditions of the population, conducted by the Federal State Statistics Service in 2018. Retrieved from https://www.gks.ru/free_doc/new_site/KOUZ18/index.html (access date 15.12.2021)
- Demographic indicators of the Federal State Statistics Service. Retrieved from <https://rosstat.gov.ru/folder/12781> (access date 01.02.2022).
- Demographic projections of the Federal State Statistics Service. Changes in population size by variants of projections (2021-2035). Retrieved from <https://rosstat.gov.ru/storage/mediabank/progn1.xls> (access date 13.01.2022).
- Hank, K., Kreyenfeld, M. (2003). A Multilevel Analysis of Child Care and Women's Fertility Decisions in Western Germany. *Journal of Marriage and Family*, 65(3), 584-596. <https://doi.org/10.1111/j.1741-3737.2003.00584.x>
- Hejun, Gu., Fengqin, Bian., Ehsan, Elahi. (2021). Impact of availability of grandparents' care on birth in working women: An empirical analysis based on data of Chinese dynamic labour force. *Children and Youth Services Review*, 121, (105859). <https://doi.org/10.1016/j.childyouth.2020.105859>
- Hilbrand, S., Coall, D. A., Gerstorf, D., & Hertwig, R. (2017). Caregiving within and beyond the family is associated with lower mortality for the caregiver: A prospective study. *Evolution and Human Behavior*, 38(3), 397–403. doi: <https://doi.org/10.1016/j.evolhumbehav.2016.11.010>
- Kaptijn R, Thomese F, van Tilburg TG, Liefbroer AC. How Grandparents Matter: Support for the Cooperative Breeding Hypothesis in a Contemporary Dutch Population. *Human Nature* 2010 Dec;21(4):393-405. doi: 10.1007/s12110-010-9098-9.
- Life expectancy at birth (2022). Federal State Statistics Service. Retrieved from <https://www.fedstat.ru/indicator/31293> (access date 29.03.2022).
- Mahne, K. and Huxhold, O. (2015). Grandparenthood and subjective well-being: Moderating effects of educational level. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 70(5), 782-792. <https://doi.org/10.1093/geronb/gbu147>
- Margolis R., Arpino B. (2019). The demography of grandparenthood in 16 European countries and two North American countries / Timonen V. (ed.) *Grandparenting practices around the world: Reshaping family*. Bristol: Bristol University Press, Policy Press. Pp. 23-41.
- Okun, B.S., Stecklov, G. (2021). The Impact of Grandparental Death on the Fertility of Adult Children. *Demography*, 58(3), 847-870. doi: <https://doi.org/10.1215/00703370-9015536>
- Regions of Russia. Social and Economic Indicators 2021. Statistical Book. Rosstat, Moscow. URL: <https://rosstat.gov.ru/folder/210/document/13204> (access date 15.01.2022).
- Shubat O., Bagirova A. (2020). Russian Grandparenting: Demographic and Statistical Modelling Experience, *Communications of the ECMS*, no. 34(1), pp. 78-83. DOI: <http://doi.org/10.7148/2020>
- Shubat, O., Shubat, M. (2021). Demographic and statistical modelling of grandfatherhood in Russia. *Communications of the ECMS*, 35(1), 57-62.
- Thomese, F., Liefbroer, A. (2013). Child Care and Child Births: The Role of Grandparents in the Netherlands. *Journal of Marriage and Family*, 75(2), 403-421. doi: <https://doi.org/10.1111/jomf.12005>

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