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Social Inequality and Demographic Dynamics: Regions of the Russian Far East

S N Naiden[1], A V Belousova[1], M A Gritsko[1]

[1]Economic Research Institute, Far Eastern Branch of the Russian Academy of Sciences, Khabarovsk, Russia

E-mail: nayden@ecrin.ru, belousova@ecrin.ru, gritsko@ecrin.ru

Abstract. Both Russian and foreign studies show persistent attention to the question of correlation between demographic and socioeconomic factors, among which the growing social inequality in income occupies a significant place. The problem of leveling social stratification is especially notable for the Far East as a macroregion with decreasing population. The goal of this study is to estimate the relations between regional demographic dynamics (birth, net and infant mortality, morbidity rates) and income inequality (Gini coefficient, decile dispersion ratio, poverty level). The object of the study is the Far Eastern Federal District (FEFD). By using the quantitative analysis based on the linear regression models, calculated by using the method of weighted least squares, it is possible to get the estimates of their modifications – models with fixed effects. Model building using the dynamic data of 2000-2018 allows getting the estimates of the effect of social inequality on the indicators of demographic development by subjects of the FEFD. With increasing differentiation of income, the positive shifts in the demographic dynamics appear to be caused by faster growth of income of the highest-income population. Decrease of morbidity coupled with the increase of the share of poor population is seen as the result of social "self-isolation" and "marginalization" of the lowest-income population who have lost access to healthcare services, caused by optimizing (closing) healthcare facilities in the remote regions of the Far East. It is postulated that the realization of the progressive demographic policy in the macroregion is possible only by decreasing social inequality and increasing state expenses on social support and investment into social goods.

1. Introduction

The influence of socioeconomic inequality on the demographic dynamics and the level of population health attracts the attention of many researchers in different countries and continents [1-3]. This is explained by high significance of reproduction and human potential development, which determines the successes of each individual and is a valuable resource for a state. The scope of interests is vast: theoretical and methodological aspects of determining and estimating inequality and health [4-7]; empirical studies of inequality and health by countries or population groups [8-10]. The interest around the issue of connection between demographic and socioeconomic factors is explained by desire to foresee and negate adverse effects of crises and destructive trends in social and economic development [11, 12]. This remains relevant for Russia today. If the quality of life decreases, the observable social stratification [13, 14] may cause the increase of morbidity rates, lower birth rates and decrease of population [15, 16]. Therefore a significant portion of studies is devoted to analyzing and estimating the effect of different forms and kinds of inequality on the population health.

The present study is the continuation of our research of the influence of state expenses on the demographic development [17] and the population welfare [18], which have shown that the relationship between the expenses on health care and the parameters of the population welfare becomes statistically significant only when taking into account spatial distribution, which signifies the concentration of the effects on certain territories. The estimates for the Russian Far East have shown that the growth of state expenses and the increase of social investments in the economy of the macroregion leads to positive demographic changes, normally after some time, meaning there is a "delayed" effect. The question is, is the social inequality by income an additional limitation on the substantial changes of the demographic situation in the Russian Far East?

2. Income inequality and demographic trends in the Russian Far East: starting point

Solving the ambitious tasks of advanced economic development and creation of comfortable living conditions in the macroregion is hindered by certain limitations on the socioeconomic development [19]. The Russian Far East has been the first among the regions with the worst demographic indicators for the past two decades. Only 4.2% of the population of the country lives in the area taking up 36% of Russia. Three quarters of this population is clustered in the South, along the Trans-Siberian Railway. The Far East has higher than average birth rates thanks to the younger population and the indigenous peoples with traditionally higher birth rates (Sakha Republic, Kamchatka Krai, Chukotka Autonomous Okrug). However, the birth rate coefficient (1.858) doesn't allow for local reproduction, and the "mortality to live births ratio is 2.1 times higher than country average, which shows the poor demographic development of the region" [20]. While the net mortality rate in the Far East is lower than country average (12.1 permille against 12.4), the infant mortality is on the contrary higher (5.8 and 5.6 permille respectively). The morbidity rates in the Far East are 3-5% higher than country average. Depending on the disease the difference can be even greater: the local population is 20% more likely to have infections, 7% more likely to have respiratory diseases, 20% – digestive tract diseases, 15% – birth defects and chromosomal defects, 13% – diseases caused by injuries and other external causes.

The negative population dynamics is worsened by the massive population exodus from the macroregion that lost almost 700 thousand people in 2000-2017 or one in every ten people. A significant portion of those who have left – highly skilled labor resources together with teenaged generation of potential Far Easterners. The main reasoning of the migrants – high living prices, low income, social stratification [21].

The share of poor people in 2018 was 15.5% of total population in the region against 12.9% country average. The largest poor population resides in the Jewish Autonomous Oblast – 24.9% of the population, the Sakha Republic – 19%, Kamchatka Krai – 16.5%, Amur Oblast – 15.1%. The rural and remote settlements in the north see the "stagnant" poverty, where there are almost no economic sources of income apart from the state support.

Despite the higher share of poor population, the level of income inequality in the subjects of the FEFD is lower. The Gini coefficient, which shows the deviation of the real income distribution from the absolute equal distribution, in 2018 varied from the minimal (0.341) in the Jewish Autonomous Oblast to (0.400) in the Sakhalin Oblast, where it was almost equal to the country average (0.411). Thus the ratio between the income of the 10% of the highest-earning population and the income of the 10% of the lowest-earning population (decile dispersion ratio) was lower than the country average (15.5 times): the highest level in the Sakhalin Oblast (15.4), the lowest – in the Jewish Autonomous Oblast (9.4).

Despite the relatively softer income inequality, the macroregion remains the territory with higher risks for reproducing human potential. We suggest estimating to which extent could the social inequality limit the positive trends of the demographic development of the Russian Far East.

3. Data and research method

Econometric modeling is used to test the hypothesis that there is a correlation between the demographic dynamics of the region and the differentiation of the population by income. The object of the study is the Far Eastern Federal District (FEFD), which includes 9 subjects (Sakha Republic, Kamchatka Krai, Primorsky Krai, Khabarovsk Krai, Amur Oblast, Magadan Oblast, Sakhalin Oblast, Jewish Autonomous Oblast, Chukotka Autonomous Okrug).

The base model is the multifactorial linear dependence (1).

$$Y_{it} = \Sigma A_{\kappa} X_{it\kappa} + B \quad (1)$$

where Y – demographic indicator; X – social inequality characteristic; i – subjects of the FEFD, $i=1..9$; t–time, t=2000..2017; A, B – estimated coefficients; κ – number of factor attributes.

The demographic indicators include:

birth rate (number of live births per 1000 in a population – *Rogd*; mortality rate (number of deaths per 1000 in a population) – *Sm*; infant mortality (number of deaths of children under the age of 1 per 1000 live births) – *Msm*; morbidity rate (number of people found to be newly affected by a medical condition) – *Zabol*;

the social inequality characteristics include:

Gini coefficient – *G*; decile dispersion ratio – *KF*; poor population share (number of people with income below the cost of living, % of the total population in the subject) – *PPM*.

The data used for the study has been made available for open access by the Federal State Statistics Service [22]. The period observed for the study: 2000-2017.

Regression analysis of the equation (1) allows receiving quantitative estimates of the demographic indicators of the region, inducted by the changes of the social inequality. The coefficient A_{κ} shows how much on average would the demographic indicator change if the social inequality characteristic would change one point. Coefficient B shows the influence of factors other than the income differentiation that affect the demographic dynamics of the FEFD.

The option of formalization of the effect of the social inequality on the demographic indicators of the region (1) suggests working with space-time (panel) selection. The respective organization of the input data determines the expansion of the analytical and prognosis qualities of the used model constructions. Thus, apart from the linear regression models estimated by using weighted least squares methods it is possible to get the estimates of their modifications – models with fixed effects. The latter are the factors specific for each observed object determining the resulting attribute.

All the above means that in case of estimating the dependency of the regional demographic dynamics on the "level" of internal social inequality when using the panel data and accounting for the specifics of the observed objects, the model construction (1) is transformed into (2).

$$Y_{it} = \Sigma A_{\kappa} X_{it\kappa} + B' + B_i \quad (2)$$

where B', B_i – sought coefficients.

This way the common for all regions coefficient B in model (1) is separated into two components: one is common for all regions, the other is unique for each. Also, as seen in formula (2), these components (B', B_i) are not included in the sum of exogeneous attributes, meaning they determine the aggregate effect of the factors differing from the ones in the model.

The quantitative analysis of all the models above was done using the econometric package for "EconometricViews" software.

4. Study results

The results prove the hypothesis of correlation between the regional demographic dynamics and the income inequality: there are statistically significant models for the FEFD that connect the respective indicators.

For birth rates: there is a positive dependence of the indicator with the Gini coefficient (3), the decile dispersion ratio (4) and the negative relation with the poor population share (5).

$$Rogd = 44.7\,G - 4.47 \quad (3)$$

$$Rogd = 0.42KF + 7.15 \quad (4)$$

$$Rogd = -0.08PPM+14.2 \quad (5)$$

For example, according to (3) if the Gini coefficient was to increase by 0.01, the number of live births per 1000 in a population in the FEFD would increase by 0.447. Since the present study views the Gini coefficient as a social inequality indicator by income per capita, this relationship means that increasing the differentiation of population by income explains the birth rate growth, decreasing it signifies the decline of population growth. The results are unconventional. Normally it's assumed that negating social differences leads to welfare growth and to increased childbirth. As it is, on the contrary, the growing difference between the incomes of the poor and the rich leads to growing population. This is confirmed by the relationship (4). If the decile dispersion ratio were to grow 1 point, the birth rate would increase 0.42. Since the decile dispersion ratio is the ratio of the income of the 10% highest-earning and the 10% lowest-earning people, its growth can be achieved as a result of: a) decreasing income of the poorest without changing the income of the richest; b) increasing income of the richest without changing the income of the poorest; c) increasing income of the richest and decreasing income of the poorest. The analysis of the dependence (5) between the birth rates in the region and the share of the population with income below the cost of living brings clarity. When increasing (or decreasing) the share of the population by 10 percentage points, the total birth rate in the FEFD decreases (increases) by 0.8.

Consequently, the rate of the natural increase in the Far East in the studied period has been mainly maintained thanks to the richest population that holds the largest share of the total income.

When studying the mortality rates, there is a positive relation between the mortality and the share of the poor population (8), and the negative relation between it and the Gini coefficient (6) and the decile dispersion ratio (7).

$$Sm = -29.94\ G+24.97 \quad (6)$$

$$Sm = -0.37KF+18.28 \quad (7)$$

$$Sm = 0.06PPM+12.19 \quad (8)$$

The received ratios partially mirror the birth rate case in the FEFD: decrease of mortality leads to the increased concentration of income of the richest population.

The infant mortality shows similar conditions depending on the dynamics of the social inequality (9)-(11).

$$MSm = -138.53\ G+65.60 \quad (9)$$

$$MSm = -1.67KF+33.81 \quad (10)$$

$$MSm = 0.34PPM+5.46 \quad (11)$$

To maximize the statistical quality of the relationships (9)—(11) they were represented as part of the model (2). The values of the fixed effects were the following:

Table 1. Values of fixed effects (B_i) for dependence of the infant mortality (MSm) on the indicators of the social inequality.

Federal subject	Gini coefficient *(G)*	Decile dispersion ratio *(KF)*	Poor population share *(PPM)*
Sakha Republic	-0.63	-0.58	-2.05
Kamchatka Krai	-3.80	-3.99	-2.23
Primorsky Krai	-2.88	-2.99	-2.80
Khabarovsk Krai	-0.65	-0.84	-0.18
Amur Oblast	-0.37	-0.48	-0.32
Magadan Oblast	-1.75	-1.70	-1.29
Sakhalin Oblast	-1.33	-0.95	-2.05
Jewish Autonomous Oblast	0.84	0.72	1.21
Chukotka Autonomous Okrug	10.56	10.82	9.07

Note: 1) coefficients (9)-(11) are estimated only when the fixed effects are present; 2) for dependences (3)-(8) the Russian Far East is presented as a multi-regional system while coefficient *B'* is common for all regions.

The received estimates of the fixed effects for each Far Eastern subject show the heterogeneity of their influence on the studied attribute. For example, the presence of negative factors (apart from the social inequality) increases the possibility of population decline in the Jewish Autonomous Oblast and the Chukotka Autonomous Okrug.

The less obvious case is seen when studying the relation between the dynamics of morbidity and income differentiation (12)-(14).

$$Zabol = 614.43\ G + 602.26 \quad (12)$$

$$Zabol = 32.44KF + 407.77 \quad (13)$$

$$Zabol = -3.52PPM + 889.31 \quad (14)$$

The increase of morbidity is clearly dependent on the increase of income differentiation (12)-(13); the decreasing morbidity coupled with the increase of poverty (14) requires explanation. It is possible that the loss of financial opportunities of the poor population forces the people to stop seeking healthcare, effectively isolating themselves. As a result, the number of the newly diagnosed people declines despite the growing mortality.

Ranging the subjects of the Far East by influence of social inequality on the demographic dynamics presents a certain interest.

For example: the dynamics of the share of poor population in the Sakha Republic shows the largest effect on the birth rates: increasing the independent parameter by 1 causes the result to change by 0.36. In the Amur oblast and the Primorsky Krai changing the level of poverty doesn't affect the dynamics of birth (regression coefficients equal to -0.08). The social inequality influences the demographic dynamics of the Khabarovsk Krai and the Kamchatka Krai approximately the same (regression coefficients equal to -0.21 and -0.19 respectively), much like in the Magadan Oblast, the Sakhalin Oblast, and the Jewish Autonomous Oblast (-0.12, -0.13, and -0.11 respectively). In the Chukotka Autonomous Okrug the dependence between the demographic dynamics and the income differentiation showed its statistical insignificance (the determination coefficient in the regression is 0.27; t-statistics of the regression coefficient is -2.06).

5. Conclusion

The analysis and its results confirm the hypothesis of the effect of social inequality on the demographic dynamics in the regions of the Russian Far East. Our conclusions add new proof to the discussion of the relationship between demographic processes and the existing stratification in the society. This concerns not only the differences in the material conditions of the population of certain regions but the attitude of the society and the authorities to the growing wealth of a small share of citizens while other groups of population continue to marginalize.

The results show that the demographic breakthrough is unlikely to happen without increasing the welfare and decreasing the inequality. As noted by different studies [23] an important role in inheriting the social inequality and maintaining high level of social inequality belongs to the "geographical origins". In studies devoted to issues of healthy generation reproduction [24, 25], it is noted that the influence of inequality based on the objective economic limitations on conditions and quality of life in certain countries and regions is much higher than the effect of inequality based on the subjective specifics of families.

Since the Russian Far East is characterized by high spatial heterogeneity and significant economic differences in providing welfare and comfortable living conditions, achieving progress in the regional demographic dynamics is possible only with active state support. European researches note that levels of inequality decrease significantly when aggregating family income and social benefits. Family income only mildly affects the inequality values, while state support significantly decreases inequality [26]. Massive state investments can lessen the significant effect of remoteness of the region, encourage social mobility and fair opportunities for the inhabitants of the Far East [17, 18].

The results by the territories of the Russian Far East show that accounting for spatial heterogeneity is a necessary condition for reliable estimates allowing correctly interpreting the relationships between social inequality and indicators of demographic development.

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