SOCIAL DEVELOPMENT

Social investment as a tool for modernization of the demographic development in the Far East

Svetlana N. NAIDEN
Economic Research Institute of Far Eastern Branch of RAS
Khabarovsk, Russian Federation, 153, Tikhookeanskaya Street, 680042
E-mail: naidensvetlana@mail.ru

Anna V. BELOUSOVA
Economic Research Institute of Far Eastern Branch of RAS
Khabarovsk, Russian Federation, 153, Tikhookeanskaya Street, 680042
E-mail: belousova@ecrin.ru

Abstract. The experience of domestic and foreign studies demonstrates a growth of interest in the problem of rational distribution of public financial resources as social investments in human capital development, which is described in our paper with the help of demographic development parameters; this corresponds to the modern tradition of considering the relationship of economic and social dynamics in extreme regions through the prism of demographic changes. In this context, the perspective estimates of public spending on the social sphere in relation to the Far East, a region that was proclaimed a strategic priority of Russia in the 21st century, are of particular value. The goal of our study is to develop and test the tools that allow us to quantify the scale and structure of public spending on education, healthcare and social policy, and that promote the achievement of the target values set out in the concept of demographic policy of the Far East for the period up to 2025. Using the model constructions built on the basis of

dynamic data for 2000–2017, we obtain the estimates of the impact of social investment on demographic development parameters on the example of Khabarovsk Krai. In the framework of traditional approach to the quantitative analysis of regression dependences we also use distributed lag models that take into consideration cumulative effects. We find out that the growth of public spending and the increase in social investment in the economy of the Far East do not lead to positive changes in demographic indicators. The region continues to lose its population despite high unit costs and social support. We reveal that large-scale public expenditures influence demographic indicators in different ways, depending on the period of "lagged effect". We substantiate an optimal structure of distribution of social investments, which can ensure the achievement of target indicators of demographic development in Khabarovsk Krai, proceeding from objective conditions and potential opportunities of the region. Our findings reflect the real situation adequately and can be used to assess the effectiveness of state demographic and social policy measures. A promising direction for further research can be the adaptation of the proposed tools and obtaining integral estimates based on an expanded set of factors describing the system of demographic and socio-economic processes in the Far East.

Key words: demography, social sphere, budget expenditures, social investments, Far East.

Introduction

In theory, the act of spending budget funds means that the state carries out a market exchange of tax revenues for relevant social benefits, which provide the necessary vector of social and economic progress in society [1–5]. At the same time, the costs of producers of socially significant services are covered by revenues from the relevant budget allocations and from individual consumer fees (if there are any) [6]. The state's expenses in this case, according to A.Ya. Rubinshtein, are considered "not as gratuitous aid from a patron, but as social investment in human capital" [7]. This position is consistent with the views of other authors. For example, European scientists C. Lennartz, R. Ronald [8], B. Nolan [9] note that in the last decade social investment is again considered as an integral part of the policy of the "welfare states". Until the middle of the 2000s in North-Western Europe the development of social policy was in line with reduction, deregulation and rejection of traditional forms of social protection as a function of the state (N. Gilbert [10], R. Starke [11]), and social policy focused attention on

particular issues to promote employment, social benefits and support public pension systems (A. Hemerijck [12]). As for the second decade of the 21st century, it was marked by the return of countries to the expansion of public social spending (J. Hudson, S. Kühner [13]). Despite the forecasts of researchers (P. Pierson [14]) on the fact that European countries copy the U.S. low-cost social policy model that limits the opportunities for providing social support to the general population, in fact, the function of the state changed from providing assistance mainly to the poor to the formation of the national "social investment strategies" (P. Taylor-Gooby, J.M. Gumy, A. Otto [15]). In the framework of such strategies the state directs budgetary funds not only to the solution of current tasks, for example, protection of citizens in adverse social or economic situations, but also forms strategic vectors of budget investments in the modernization of human capital through increased access to social benefits. The estimated effect is expected in the form of higher national educational level, saturation of labor markets through

the acquisition of additional professional skills by citizens and addressing housing issues, distribution of the social standards of healthy lifestyles, etc. Researchers (G. Esping-Andersen [16], N. Morel, B. Parlier, J. Palme [17], F. Vandenbroucke, K. Vleminckx [18]) say that one of the main effects of the implementation of social investment strategies is the development of a mechanism that reduces the possibility of material and social risks in society and the economy; this remains relevant for the Russian reality, as well.

Since domestic and foreign researchers interpret the concept of social investment in different ways – as a "form of corporate social responsibility", and "as an investment of financial resources in addressing social problems with the expectation to gain profit from invested funds" [19], we consider social investment solely as the process of spending budget funds on the development of social spheres of economic activity, ensuring the growth of human capital. Indicators of the growth of human capital [20] are the parameters of demographic development, the change of which demonstrates the potential impact of financial instruments on social dynamics.

The search for relationships between financial flows and socio-demographic parameters of the development of countries and regions remains a permanent research task. Demographic indicators are usually considered as part of other indicators of territorial socio-economic development; and the change in the indicators is estimated depending on the size of public spending. For example, L. Sinevičienė [21] investigates the relationship between the expenditure of the European Union countries and the economic dynamics of their sustainable development (using statistical methods: hierarchical and cluster analysis, descriptive statistics, correlation and regression analysis) and finds out that public spending, the share

of which in the national and regional budgets is considerable and which is directed to social assistance and healthcare, has the positive impact on the socio-economic development of territories. Perhaps, therefore, the indicators of population health and factors that reduce mortality become the subject of attention of scientists. A group of researchers (S. Budhdeo, J. Watkins, R. Atun, C. Williams, T. Zeltner, M. Maruthappu [22]) who assessed the relationship between European Union expenditure on healthcare[1] and changes in mortality rates[2] based on multivariate regression analysis, prove that the reduction of state expenditure on health has a direct impact on the growth of mortality, increasing the negative effect over time to a greater extent for the adult population. Still earlier, J. Nixon and P. Ulmann [23] used panel data, econometric analysis and a model with fixed effects and demonstrated that the increase in healthcare expenditures has the maximum effect on reducing infant mortality, but has virtually no effect on the change in life expectancy. This affects the age structure of the population and the opportunities for human capital growth, which is important for the countries of the Old and New World. Given the demographic shifts in the population structure and the growing need for social support of the older generations, researchers from the University of Chicago (J.B. Shoven, M. Topper, D.A. Wise [24]) estimated that the implementation of social programs in the United States requires about 40% of expenditures of the consolidated budget of the country. Countries with high fertility and the predominance of young generations find

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[1] Healthcare expenditures are accounted for in three ways: as a share of total government expenditures, as a share of gross domestic product, and as expenditures measured by purchasing power parity per capita.

[2] Five types of mortality are considered: neonatal, post-neonatal, lethal in children under five years of age, in adult men, in adult women.

it important to take into account not only the impact of public spending on health, but also the impact of spending on education, culture, social infrastructure, etc. Researchers from India (Pranab Kumar Das and Saibal Kar [25]), the second most populous country in the world, assess the role of fiscal policy of the state as a socially necessary intervention in the processes of redistribution of finance against the background of progressive population growth, focusing on endogenous growth models. They distinguish two different effects of social investment: increased health spending has a positive impact on the quality of the working population and increases productivity, and higher spending on education and training diverts workers from the labor market in a country with high demand for unskilled labor and employment opportunities in the informal sector. The above conclusions are supplemented by research findings of Russian scientists linking economic and financial indicators to social and demographic results of the development of the country and regions [26–29].

Academician A.G. Aganbegyan notes that the reduction in budget expenditures on education and healthcare, the narrowing of social assistance channels, coupled with the general economic instability, stimulate the population to refuse to give birth to children [30, 31]. Despite the implementation of national projects and significant social investments, Russia is far from achieving the goals of the demographic development strategy[3].

Thus, obtaining reliable estimates of the effects of the state budget policy aimed at population growth remains a very important task both in theory and in practice.

Identification and quantitative analysis of changes in spatial and sectoral indicators

induced by government efforts through financial flows allow us to compare the goals and results and assess the effectiveness of the measures taken, and if necessary, determine possible directions for their adjustment. The distribution of social investments is of particular importance for the Far East[4] of Russia, since it is a macroregion, which is currently the object of close attention of the national government.

The strategic priority of the state regional policy in the Far East is the advanced development and creation of comfortable conditions for the life and activity of the population in the macroregion that has its own specifics of geographical location and geopolitical importance for the country[5]. Finding a solution to the set ambitious tasks for the accelerated development of the territory is faced with restrictions that constrain the pace of achievement of exogenously set parameters of socio-economic development [32–34]. The most significant barriers include demographic parameters, according to which the Far East has consistently ranked first among the outsider regions for more than two decades[6]. The area of 36% of the total territory of Russia is home to 4.2% of the country's population, 3/4 of which is concentrated in the southern zone along the Trans-Siberian Railway. The value of the birth rate (1.858) does not ensure the reproduction of the local population, and "the

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[3] On approving the Concept for demographic policy of the Russian Federation for the period till 2025: Decree 1351 of the President of the Russian Federation of October 9, 2007.

[4] In our paper, the Far East of Russia is considered within the borders of the Far Eastern Federal District, which includes nine constituent entities of the Russian Federation (Republic of Sakha (Yakutia), Kamchatka Krai, Primorsky Krai, Khabarovsk Krai, Amur Oblast, Magadan Oblast, Sakhalin Oblast, Jewish Autonomous Oblast, Chukotka Autonomous Okrug).

[5] State program of the Russian Federation "Socio-economic development of the Far East and the Baikal region": Resolution 308 of the Government of the Russian Federation of April 15, 2014 (as amended on March 30, 2017).

[6] *Demographic Yearbook of Russia*. Rosstat, 2017. Available at: http://www. gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/publications/catalog/doc_1137674209312 (accessed: 16.08.2018).

ratio of the number of deaths to the number of births exceeds the all-Russian figure by 2.1 times, which indicates the unfavorable demographic development of the region against the background of nationwide indicators" [35, p. 39].

The negative dynamics of the natural movement is aggravated by the large-scale outflow of the population from the territory of the macroregion, which in 1990−2017 lost almost a quarter of its inhabitants, including a significant part of highly skilled labor resources along with the younger generation of potential residents of the Far East. Among the main factors that motivating people to leave are the high cost of living and low wages along with dissatisfaction with the quality and availability of social services [36]. At the same time, it is the consumption of social benefits that contributes to the expanded reproduction of human capital, and their accessibility provides the necessary level of social security [37] and social mobility, which, according to some authors (Hickey [38], Barrientos [39], Benabou [40]), is consistent with the principles of justice and is an integral attribute of the social state or the welfare state.

Russia's long-term attempts to stop the rapid decline in the number of inhabitants of the Far East are largely associated with the use of traditional ways of solving problems. Such methods include institutional and organizational, financial: state budget expenditures on social sphere development of the regional economy (education, culture, cinematography, healthcare, social policy, physical culture and sport, mass media) or social investment. There is no doubt that if we want to reverse the negative trend and to reach a steady positive dynamics of natural and migration movements, then it necessary, for example, to have high-quality and well-functioning social infrastructure [41] and the appropriate personnel to provide the conditions

for demographic reproduction and migration inflow processes; all this requires significant financial resources.

For quite a long period of time, within the framework of institutional reforms taking place in the economy of the country as a whole and in the macroregion in particular, there was a purposeful saturation with social investments[7] from the budgets, which should contribute to the rapid modernization of the social sphere and its transition to innovative development. For 2000−2017, the share of expenditures for these purposes from the total expenditures of all consolidated budgets of the subjects of the Far East increased from 40.5% in 2000 to 55.6% in 2017; nominally, it increased in 16 times (from 27.8 to 442.9 billion rubles), accordingly) *(Tab. 1)*.

The 2017 indicators in the subjects of the Far Eastern Federal District vary from 36.4% in Chukotka Autonomous Okrug to 65.4% in the Jewish Autonomous Oblast; this is due to the heterogeneity of the structure of the relevant consolidated budgets and depends on the amount of funds the budgets receive, as well as on structural priorities. The ratios of social investment to gross regional product are no less diverse. Thus, according to this indicator, the leader is Kamchatka Krai (18.9% of GRP), and the outsiders are the Sakhalin Oblast (9.0%) and Primorsky Krai (8.9%). But if in the case of the leaders it is associated with high costs of production and provision of social benefits, then in the case of the outsiders − with the presence of high-yield economic sectors. Nevertheless, almost all the territories of the Far East allocate more than 50% of their expenses to the social sector of the economy (with the exception of Chukotka Autonomous Okrug and in some periods − the Sakhalin

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[7] In accordance with the budget legislation and the methodology of Rosstat, expenses are taken into account under the item "social and cultural activities".

Table 1. Proportion of social investments in the structure of consolidated budgets
and GRP of constituent entities of the Far Eastern Federal District, %

Region	Consolidated budget			GRP		
	2000	2010	2017	2000	2010	2016*
Russian Federation	39.0	54.9	59.7	7.0	9.7	8.7
Far Eastern Federal District	40.5	50.1	55.6	9.0	11.3	11.3
Republic of Sakha (Yakutia)	42.1	55.7	55.8	12.5	14.6	13.2
Kamchatka Krai	42.4	48.1	51.6	10.6	19.9	18.9
Primorsky Krai	40.2	37.9	59.3	6.7	8.4	8.9
Khabarovsk Krai	37.6	61.0	63.6	6.8	12.3	10.8
Amur Oblast	44.7	59.2	59.3	8.5	15.2	11.7
Magadan Oblast	35.2	50.5	50.8	10.3	16.9	12.8
Sakhalin Oblast	40.8	46.9	50.7	7.0	6.1	9.0
Jewish Autonomous Oblast	52.9	56.3	65.4	13.7	16.4	16.2
Chukchi Autonomous Okrug	29.9	35.2	36.4	15.5	15.4	15.6

* Data as of 2017 are not available.
Calculated with the use of: *Regions of Russia, Socio-Economic Indicators: Statistics Collection 2000–2017.* Rosstat. Available at: http://
www.gks.ru/ (accessed: 20.07.2018); Reports on the execution of the consolidated budgets of the RF subjects in 2017. *Official website of
the Federal Treasury of the Russian Federation*. Available at: http://www.roskazna.ru/ (accessed: 24.09.2018).

Oblast, where the expenditures on the national economy prevail). If we take into account the housing and utilities expenses, then we see that 2/3 of all expenditures from the consolidated budgets have had and continue to have a social orientation.

Taking into account price inflation, as well as territorial differences in the potential and scale of regional economies, we find it of interest to compare not the nominal, but the real expenditures of the consolidated budgets of the macroregion for social purposes per capita. The comparison of the estimates shows that according to the data for 2017 alone, the six leaders according to real (in the 2000 prices) social expenditures per capita include Chukotka Autonomous Okrug (45.8 thousand rubles per capita per year), Yamalo-Nenets Autonomous Okrug (36.0), Republic of Sakha (Yakutia) (37.5), Sakhalin Oblast (27.1), Kamchatka Krai (23.4), and Magadan Oblast (23.3). For comparison: on average in Russia, social spending from the consolidated budgets of the territories in 2017 amounted to only 8.7 thousand rubles per capita in the prices of 2000. That is, five of the nine regions of the

Far East located in the North-Eastern part of the macroregion, make the highest specific social investments and retain these positions almost throughout the entire analyzed period, which is due to the action of objective price-raising factors in the regions of the North and localities equated to them; at the same time, it is a consequence of the spatial features of the distribution of the small population in numerous settlements, many of which are located in remote and inaccessible areas. The latter makes it necessary for the regions to maintain an extensive and large-scale social infrastructure. Among the regions of the southern zone of the Far East, only Khabarovsk Krai is 10% ahead of the average Russian figure in terms of specific social spending per capita. The real expenditures of the budgets of Primorsky Krai and the Amur Oblast reach only 90% of the national average for Russia, and the traditional outsider — the Jewish Autonomous Oblast — reaches only 88%. The reason for this lag, in addition to the common problems concerning budget replenishment, is the lack of local initiative and the indifference of the authorities of these constituent entities

Table 2. Planned values of demographic development indicators in Khabarovsk Krai until 2025

Indicator	2017	2018	2019	2020	2025
Population (thousand people)	1335	1340	1350	1365	1464
Total fertility rate (number of children born to a woman of reproductive age: 15–49 years)	1.80	1.85	1.87	1.90	2.05
Mortality from all causes (cases per one thousand people)	12.7	12.3	11.9	11.5	10.2
Life expectancy, years	69.3	70.2	71.2	72.2	76.3
Source: our compilation with the use of the concept for demographic policy of the Far East for the period up to 2025: Resolution 1298-r of the Government of the Russian Federation of June 20, 2017.					

toward finding the opportunities to raise funds for the support and modernization of socially important sectors of the regional economy.

In general, for 18 years (2000−2017), the consolidated budgets of the subjects of the Far Eastern Federal District invested almost four trillion rubles in the social sphere. Despite this, the movement of the population of the macroregion, as we already showed above, has a negative trend. In this situation, a natural question arises: do social investments (budget expenditures) have an impact on demographic processes in the Far East?

In 2017, the Russian Government adopted the "Concept for demographic policy of the Far East for the period up to 2025" (hereinafter — the Concept[8]); it was the next step toward changing the current situation and forming the resources to promote accelerated economic development o in the federal district.

This document is a description of government initiatives aimed at stabilizing and increasing the number of population, with a quantitative assessment of the results of the initiatives in the context of individual indicators for each of the subjects of the Russian Federation that are part of the Far Eastern Federal District. In particular, in Khabarovsk Krai by 2025 it is expected that the population will increase to 1,464 thousand people, the total fertility rate − to 2.05, mortality from all causes will decrease to 10.2 cases per one thousand

people, and life expectancy will reach 76.3 years *(Tab. 2)*.

At the same time, despite the algorithmic nature of the Concept, it lacks numerical measurements of the drivers of positive demographic dynamics in the macroregion. For example, there are no parameters of financial support, but only streamlined wording about the sources of funding (from the state budget to charitable and extra-budgetary funds). The amount of public expenditures (regional consolidated budget expenditures) necessary to achieve the targets remains unknown although it is the budget expenditures on the social sphere that are considered as the main "regulator" of the demographic development of the Far Eastern macroregion.

Since the preliminary results show that the demographic trend (including both natural and mechanical components) is not related much to the growth of budget expenditures on the social sphere, it becomes necessary to find statistically significant model structures as applied to the economy of a particular region, including those built taking into account the effects that are "delayed in time".

The difficulties of quantitative analysis of the intermediate link represented by drivers of demographic dynamics in the transitive connection of state intentions with the results of their implementation are mainly associated with the lack of tools that would help formalize the subject of the study (the influence of certain factors on regional demographic dynamics) and obtain estimates of its components in the future.

[8] The concept for demographic policy of the Far East for the period up to 2025: Resolution 1298-r of the Government of the Russian Federation of June 20, 2017.

In this case, the "reliability of formalization" involves taking into account the main features of the formation and flow of the parameters and processes under consideration; this, in turn, minimizes the degree of entropy of forecast estimates.

Methodological aspects of the study and the initial data. The course of the research process, which determines the relationship between the size of public funding and the parameters of regional demographic dynamics, is presented by the following steps:

1) the features of dependencies between the parameters of demographic development of the region and the social expenditures of the region's consolidated budget are revealed;

2) the specifications of the above dependencies are considered using economic and mathematical analysis;

3) the structures designed are evaluated;

4) the volume and structure of the state expenses necessary for achievement of target values of demographic development parameters in the region till 2025 are estimated.

Based on the formulation of the research problem, the above algorithm can be applied to the territory whose operations on the formation and expenditure of funds are a structural element of the budget system of the Russian Federation. In other words, any unit of administrative-territorial division of the Russian Federation or their totality can be considered as a region.

Within the framework of our paper, all the calculations are carried out on the example of Khabarovsk Krai. The choice of this subject of the Russian Federation is explained by the presence of geographical, economic, social, and demographic characteristics typical of the entire population of Far Eastern subjects of the Russian Federation [42]. The corresponding circumstance allows us to consider the region as a model region.

The array of demographic development parameters includes four elements: population size, birth rate, death rate, and life expectancy.

Expenditures of the consolidated budget of the Russian Federation on the social sphere in our calculations are adjusted to the population size and are presented in the form of four indicators (one total and three of its components): expenditures on social and cultural activities, healthcare, education, and social policy per capita.

The period under study is 26 years and is divided into two segments: 2000−2017 − the "base", which is used to identify, formalize and analyze quantitatively the dependencies; 2018−2025 − "prospect" − the time range, for the points of which, equidistant for one year, the values of the effective signs of previously identified dependencies are forecasted.

In order to ensure the comparability of the data on the time period under consideration, all cost indicators are translated into the prices of a single year (2000).

The information base of our study is the official materials of the Federal Treasury[9], the Federal State Statistics Service[10], and a set of target indicators contained in the Concept[11].

The first two of the above steps that determine the course of the research process are "universal" in terms of "application objects". In other words, their implementation does not depend on the scale, administrative status and other characteristics of the region under study.

Step 1. Thus, it is obvious that each of the parameters of people's life in any territory, at least, appears to be a functional dependence on two components: the first component is formed under the influence of the external

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[9] http:// roskazna.ru/

[10] http://www.gks.ru

[11] The concept for demographic policy of the Far East for the period up to 2025: Resolution 1298-r of the Government of the Russian Federation of June 20, 2017.

environment (including state policy measures), and the second component is formed under the influence of internal (subjective) motivations (aspirations, beliefs, etc.) and personal characteristics (health groups, heredity, etc.). As a result, in order to minimize the degree of entropy of the results obtained, the specifications of the dependencies between demographic development parameters of the region and the expenses of the consolidated budget of the latter should take into account the actions and other factors, in addition to these components *(the first feature of the dependencies between demographic development parameters of the region and consolidated budget expenditures of the latter on the social sphere)*.

Since the objectives of spending consolidated budget funds of the region on the social sphere are long-term (expenditures made in the current year will affect the demographic indicators within a certain time interval), the next condition for the successful implementation of step 1 is to take into account the time lags and cumulative effects of the impact of the relevant social investments on demographic parameters. In other words, the required specifications of the dependencies between the indicators under consideration should assume the presence of the values of the independent variable for several consecutive moments of time *(the second feature of the dependencies between demographic development parameters of the region and consolidated budget expenditures of the latter on the social sphere)*.

Step 2. It is possible to register the above mentioned conditions of formalization of demographic dynamics (step 2) by using econometric modeling methods. The models used in this case are dynamic, they are called distributed lag models. The general specification of the latter is presented in (1):

$$y_t = a + b_0 x_t + b_1 x_{t-1} + b_2 x_{t-2} + \\ + b_3 x_{t-3} + \cdots \tag{1}$$

where y — demographic development parameters of the subject of the Russian Federation; x — expenditures of the consolidated budget of the subject of the Russian Federation; t — time.

The interpretation of the economic meaning of the coefficient a is associated with the assessment of the impact of all exogenous variables (the variables that are different from those present in the model) on the resulting feature. The corresponding interpretation in our paper allows us to take into account the first feature of the relationship between the demographic development parameters of the subject of the Russian Federation and the expenditures of its consolidated budget on the social sphere.

The presence of an infinite lag in the model ($t \to \infty$) means, first, the availability of opportunities to identify and assess trends and cumulative effects of public spending on regional demographic dynamics (the second feature of dependencies); second, it increases the objectivity of the study, allowing us, without introducing expert assumptions about the time "horizon" of the effectiveness of public policy measures, to identify the latter.

The value of the b_i coefficient is interpreted as a change in the average value of the demographic development parameter of the region at a single change in the volume of public spending on the social sphere at the *i-th* time. The tendency of the coefficient values to zero determines the time "horizon" of the influence of public spending on the demographic dynamics of the region.

Quantitative analysis of coefficients a and b_i is carried out on the basis of retrospective data on the dynamics of public expenditures and demographic indicators for the 2000−2017 period.

Estimates of the impact of budget expenditures on demographic indicators are determined by the formula (2). The upper index

t is given by the length of the time interval under consideration

$$k_i = \frac{b_i}{\sum_0^t b_i}. \quad (2)$$

The summation of b_i and k_i for successive moments of time allows us to get an idea of the cumulative effects of government spending on the demographic dynamics of the region.

Step 3. The simultaneous presence in the model (1) of the values of the same variable, represented by relatively equidistant moments of time, causes the problem of multicollinearity. This circumstance makes it impossible to estimate the coefficients of the model traditionally – using the least squares method – without prior special transformations. One of the latter is the Koyck transformation based on the geometric progression method [43].

We suggest that the degree of correlation between the demographic dynamics of the region and public spending on the social sphere decreases with the increase in the time span between the moment when the latter were carried out and the moment under cosideration (3):

$$b_i = b_0 \lambda^i, \ i = 0..\infty, \ 0 < \lambda < 1. \quad (3)$$

Substituting the values of b_i in (1), we obtain the following model (4):

$$y_t = a + b_0 x_t + b_0 \lambda x_{t-1} + b_0 \lambda^2 x_{t-2} + + b_0 \lambda^3 x_{t-3} + \cdots \quad (4)$$

If build a similar dependency for the previous point in time, multiply it by the parameter λ and subtract this dependency from the formula (4) term-by-term, we obtain the following autoregression model (5):

$$y_t = a(1 - \lambda) + b_0 x_t + \lambda y_{t-1}. \quad (5)$$

The coefficients of the equation (5) are estimated on the basis of the generalized least squares method using specialized software for PC – econometric package Eviews 5.0. The obtained estimates allow us to find numerical expressions for the coefficients of the model (1) by organizing the reverse of the transformations we have carried out: substitution of b_0 and λ in (3) helps calculate b_i; the coefficient a is calculated from the expression $a(1-\lambda)$, present in (5), provided that the value λ is known, after which it is sent directly from (5) to (1).

Step 4. Quantitative identification of the volume and structure of public expenditures that ensure the achievement of the target values of demographic development indicators in the region until 2025 (step 4) is carried out by organizing an iterative process of recursive calculations (6).

$$x_t = \frac{y_t - (a + b_1 x_{t-1} + b_2 x_{t-2} + b_3 x_{t-3} + \cdots)}{b_0}. \quad (6)$$

In this case, y_t – perspective values of demographic parameters of Khabarovsk Krai specified in the Concept for 2018–2025, and x_{t-1}, x_{t-2}, x_{t-3}, etc. – the amounts of public spending directed to the social sphere of the region in 2000–2024. In this case the values of x_t at t=2018...2025 are calculated sequentially: the effective feature in the dependency (6) built for the moment of time t becomes a factor variable in the "transition" to the moment of time t+1.

The maximum length of the lag under the influence of budget funds on each parameter of demographic development of the region is determined based on the values of coefficients b_i in the model (1) and the significance test of the latter, adopted in the study.

Research results and discussion. The quantitative analysis of the coefficients in the models of type (1) constructed for individual

parameters of demographic development for Khabarovsk Krai allowed us to obtain the following results *(Tab. 3)*.

It should be noted that the stopping of the iterative process of calculating the coefficients at one the same step (eighth step: estimation of the values of the coefficients $b_0 - b_7$) for all parameters of demographic development and directions of public expenditures is due solely to the desire of the authors to work with a single time "horizon". This circumstance is the reason for the artificial introduction of the latter (the specified number of model coefficients (1) corresponds to the period of implementation of the Concept − 2018−2025 − including the current year).

Meanwhile, in the case of interpretation of the values of the coefficients bi, , tending to zero, for example, when the inequation 0.1>is met (other conditions may be considered, which is determined by the objectives and extent of the study, etc.), we observe,as can be seen from *Table 3*, other boundaries of the effects generated by public expenditures for the demographic dynamics of Khabarovsk Krai. For example, budget expenditures on the implementation of social policy (line 4) influence the dynamics of population size in the region for seven years (coefficient b_7 in absolute value is less than 0.1); (line 8) birth rate dynamics − for three years (b_3 is less than 0.1), (line 12) death rate dynamics − for six years (b_6 in absolute value is less than 0.1). Along with this, we find out that the funds of the consolidated budget of the region (line 16) do not influence life expectancy of the population (absolute values of the coefficients $b_0 - b_7$ do not exceed 0.1); this fact is quite natural, since the formation of this parameter of the demographic process depends on a huge number of factors (including, for example, heredity) that act over a long period of human life.

Table 3. Assessment of the impact of social investments on demographic development parameters for Khabarovsk Krai

#	x	a	b_0	b_1	b_2	b_3	b_4	b_5	b_6	b_7
					Population size					
1	A	1482894.3	-5.472	-3.326	-2.021	-1.228	-0.747	-0.454	-0.276	-0.168
2	B	1489849.2	-14.922	-8.453	-4.789	-2.713	-1.537	-0.870	-0.493	-0.279
3	C	1293979.9	1.951	1.684	1.452	1.253	1.081	0.932	0.804	0.694
4	D	1457355.8	-22.662	-10.267	-4.651	-2.107	-0.955	-0.432	-0.196	-0.089
					Birth rate					
5	A	13478.2	0.206	0.113	0.062	0.034	0.019	0.010	0.006	0.003
6	B	12833.4	0.566	0.306	0.166	0.090	0.048	0.026	0.014	0.008
7	C	11024.9	0.558	0.459	0.378	0.311	0.256	0.210	0.173	0.142
8	D	13806.4	1.006	0.398	0.158	0.062	0.025	0.010	0.004	0.002
					Death rate					
9	A	28413.3	-0.336	-0.231	-0.159	-0.109	-0.075	-0.052	-0.035	-0.024
10	B	25831.4	-0.598	-0.411	-0.282	-0.194	-0.133	-0.091	-0.063	-0.043
11	C	27398.9	-0.682	-0.581	-0.495	-0.422	-0.359	-0.306	-0.261	-0.222
12	D	24060.7	-0.868	-0.563	-0.365	-0.237	-0.154	-0.100	-0.065	-0.042
					Life expectancy					
13	A	54.4	0.0003	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001
14	B	54.6	0.0007	0.0006	0.0005	0.0004	0.0003	0.0002	0.0002	0.0002
15	C	53.2	0.0008	0.0008	0.0008	0.0007	0.0007	0.0007	0.0007	0.0007
16	D	58.2	0.0011	0.0008	0.0006	0.0005	0.0003	0.0003	0.0002	0.0001

Note: A – expenditures of the consolidated budget of the region on social and cultural activities; B – expenditures on education; C – expenditures on healthcare; D – expenditures on social policy.
Calculated by A.V. Belousova.

Thus, the limitation of the lag infinity in the evaluation of the coefficients of the model (1) can be carried out expertly (for example, the case discussed above: exogenous determination of the boundaries of the period of influence of independent variables on the result) and by introducing additional conditions based on the economic sense and the values of the indicators involved in the study.

The data in Table 3 show that the total public expenditures on the social sphere (lines 5, 9, 13) have a positive impact on certain parameters of demographic development in Khabarovsk Krai: they contribute to an increase in the birth rate and life expectancy and lead to a decrease in the death rate. Thus, the increase in the corresponding expenditures of the regional budget for one thousand rubles per inhabitant of the Krai in the current year leads to an increase in the birth rate by 206 people in Krai on the whole (line 5, coefficient b_0) and to reduce mortality by 336 people (row 9, the coefficient b0). In a year, the effect of the funds invested is reduced and is already plus 113 people for the birth rate and minus 231 people for the death rate.

The situation is reverse with regard to the population size: the increase in the amount of budget funds allocated to the social sphere as a whole (line 1), education (line 2) and social policy (line 4), in particular, leads to a decrease in the population size in the region. Thus, each ruble of the regional budget per capita, spent on the social sphere in the current year, leads to a reduction in the population size by about five people ($b_0 = -5.472$). While maintaining the appropriate level of investment in the course of 8 years, the region could lose up to 14 people per each ruble of budget expenditures (the sum of coefficients b_0-b_7: -5.472; -3.326; -2.021; -1.228; -0.747; -0.454; -0.276; -0.168). The obtained estimates suggest that the negative impact of total social spending on the population size at a positive impact on the natural parameters of reproduction is most likely due to mechanical factors, namely, population migration, which is not considered separately in our study.

In general, public expenditures on education and social policy are also unable to overcome the negative population dynamics in the period under consideration; such dynamics are formed under the influence of a much wider range of indicators than the volume and dynamics of public spending for these purposes. Each thousand rubles of the budgetary funds spent for the specified purposes in per capita measurement promotes the process of reducing the number of inhabitants of the Krai in the first year by 14,922 people (line 2), in the second year − by 8,453 people, etc. In our case, it is explained, for example, by youth migration, when obtaining a certificate or diploma of secondary vocational education motivates graduates or young specialists to search for their place in life outside the Krai. The inverse reaction of population parameters to the growth of financial support in the framework of social policy is also not unique. Among the residents of the Far East who leave the region, there are many persons over the working age, who receive a wide range of social assistance services. At the same time, the growth of social spending against the background of the decline of the population size in the Krai, perhaps, demonstrates the inefficient targeting of certain budget items, non-specificity of the measures taken or the discrepancy between the set of social benefits offered by the regional authorities and the urgent needs of the inhabitants of the Krai.

The most adequate estimates are obtained for expenditures on healthcare (lines 3). However, the degree of sensitivity of demographic parameters to them is less intense. Thus, the application of the formula (2) to the

data in Table 3 allows us to demonstrate *(Tab. 4)* that in the case of population size, birth and death rates, the implementation of more than 50% of the effect generated by the expenses of the consolidated budget of the region on the entire social sphere and education occurs during the first two years, including the year of allocation of funds.

The allocation of public funds to the development of healthcare extends the scope of influence to three years. In the case of social policy, the effect of the influence of expenditures on the change in population size and birth rate is observed in the year in which the funding is granted and is realized by 55 and 60%, respectively.

Table 4. Extent of the impact of social investment on the parameters
of demographic development in Khabarovsk Krai

#	x	b_0	b_1	b_2	b_3	b_4	b_5	b_6	b_7
					Population size				
1	A	0.40	0.24	0.15	0.09	0.05	0.03	0.02	0.01
2	B	0.44	0.25	0.14	0.08	0.05	0.03	0.01	0.01
3	C	0.20	0.17	0.15	0.13	0.11	0.09	0.08	0.07
4	D	0.55	0.25	0.11	0.05	0.02	0.01	0.00	0.00
					Birth rate				
5	A	0.45	0.25	0.14	0.08	0.04	0.02	0.01	0.01
6	B	0.46	0.25	0.14	0.07	0.04	0.02	0.01	0.01
7	C	0.22	0.18	0.15	0.13	0.10	0.08	0.07	0.06
8	D	0.60	0.24	0.09	0.04	0.02	0.01	0.00	0.00
					Death rate				
9	A	0.33	0.23	0.16	0.11	0.07	0.05	0.03	0.02
10	B	0.33	0.23	0.16	0.11	0.07	0.05	0.03	0.02
11	C	0.20	0.17	0.15	0.13	0.11	0.09	0.08	0.07
12	D	0.36	0.24	0.15	0.10	0.06	0.04	0.03	0.02

Note: A – expenditures of the consolidated budget of the region on social and cultural activities; B – expenditures on education; C – expenditures on healthcare; D – expenditures on social policy. "Life expectancy" is excluded from the resulting features since it is not affected by social investment directly.
Calculated by A.V. Belousova.

Table 5. Estimated volume of social investments to achieve the target parameters of
demographic development in Khabarovsk Krai (in the prices of 2000), rubles per capita

#	x	2018	2019	2020	2021	2022	2023	2024	2025
					Population size				
3	C	16391.1	4534.9	4546.4	18615.3	12564.8	15452.9	27660.0	25177.3
					Birth rate				
5	A	103557.2	165398.6	138117.7	160090.0	155114.6	165003.5	166814.2	173135.4
6	B	76694.0	39258.0	40643.7	53376.4	48661.1	50090.0	53324.0	53815.4
7	C	98491.1	20904.7	21182.6	76014.9	33341.2	33988.1	64988.3	41751.6
8	D	79903.6	18264.4	19695.1	62792.7	28990.4	30278.5	54750.7	36449.1
					Death rate				
9	A	14407.0	14407.0	14390.1	14647.5	16691.7	15591.6	15750.2	15979.6
10	B	6732.5	5574.7	7072.6	3952.0	5980.0	4103.6	7278.1	5284.0
11	C	4604.8	4125.1	4360.2	4289.5	4083.4	4552.5	4457.6	4539.8
12	D	7273.3	4099.4	3923.6	5523.6	4722.8	4744.0	5253.9	5113.0

Note: A – expenditures of the consolidated budget of the region on social and cultural activities; B – expenditures on education; C – expenditures on healthcare; D – expenditures on social policy.
Calculated by A.V. Belousova.

Table 6. Structure of the distribution of expenditures on healthcare and social policy
to achieve the target parameters of demographic development in Khabarovsk Krai, %

#	x	2018	2019	2020	2021	2022	2023	2024	2025
					Population				
3	C	16.2	16.8	15.9	21.7	27.5	30.7	31.8	38.1
					Birth rate				
8	D	79.2	67.8	68.9	73.3	63.5	60.2	63.0	55.1
					Mortality				
11	C	4.6	15.3	15.2	5.0	8.9	9.1	5.1	6.8
Note: C – expenditures of region's consolidated budget on healthcare; D – social policy expenditures. Calculated by: A.V. Belousova.									

The target values of demographic development parameters in Khabarovsk Krai presented in the concept for demographic development of the Far East for the period up to 2025 allow us to quantify the amount of public spending necessary for the implementation of the program document *(Tab. 5)*, and it is done with the use of the data in Table 2 and formula (6).

Based on the data given in Table 5, we can compare different options for future expenditures and choose the most advantageous one for the regional budget. Thus, in order to reduce the death rate in Khabarovsk Krai by 29.8% by 2025 compared to 2018 (as planned in the Concept), the most effective option is to finance healthcare (line 11), the per capita expenditures on which will be the lowest in the course of eight years and will amount to 4000—4600 rubles per year (in the prices of 2000). As for the birth rate, expenditures on social policy are the most advantageous option (line 8).

Based on the estimates presented above, we can say that the optimal (less expensive) structure of social investments for Khabarovsk Krai, which will provide the achievement of target parameters of the concept for demographic development of the Far East for the period up to 2025, has the following form *(Tab. 6)*.

Thus, the estimates we have obtained allow us to simulate the optimal structure of the distribution of social investments that can provide the achievement of demographic development targets in Khabarovsk Krai on the basis of objective conditions and potential opportunities of the region.

The main volume of social investments allocated to healthcare and social policy is as follows: 79.2% of social expenditures are directed to social policy, the rest — to healthcare, with the majority (16.2%) — to the increase in population size and the smaller part (4.6%) — to the reduction in the death rate. By 2025, the basic positions will remain unchanged: social policy and the promotion of the birth rate will remain leaders (55.1%) losing 24 percentage points to healthcare (44.9%).

Conclusion

Modern studies in the field of economic theory, theory of public finance, social economics and social policy demonstrate a return to the discussion of the issues of social justice and social protection, among other things, through the expansion of state financial support. We are talking not just about an act of gratuitous assistance, but about a system-wide and purposeful process of formation of the state budget policy as social investment in the development of human capital.

Close attention of the state to the Far Eastern macroregion is due to the economic strategy for development of the Pacific borders, in the framework of which there is a demand for demographic resources for advanced socio-economic development; this attention is enshrined in the new concept for demographic policy approved by the Government of the Russian Federation in 2017.

The analysis of demographic and economic processes has shown that the growth of public spending and the increase in social investment in the economy of the Far East do not have an adequate impact on the positive change in demographic indicators. The region continues to lose its population despite high unit costs and the provision of support to the social sphere. The reason for this situation lies in the fact that the demographic dynamics, especially in terms of population migration, are determined not only (and in the case of extreme regions, not so much) by the development of the social sphere, at which social investments are mainly directed, but by a large number of other factors, including the specifics of the labor market, age and sex composition of the population, the value of alternative incomes and expenses of the population, the quality of municipal and transport infrastructure, etc.

We have formulated and solved the problem of finding statistically significant model structures as applied to the economy of a particular region; these structures take into account the "delayed" effects. Despite the use of well-known methods of analysis, the rationale for the feasibility and possibilities of their use for new research purposes, the transformation of traditional forms of model designs, the expansion of the potential use of the results obtained in this case allow us to assert that there exists the need to develop the authors' tools aimed at the quantitative identification of the scale and structure of public expenditures on the social sphere, ensuring the achievement of the target values of demographic development parameters in the region.

As a result of the applied experiment conducted on the example of the model region (Khabarovsk Krai), we have found out that, contrary to traditional expectations, public spending in the social sphere does not have a positive effect on the growth of population size as a whole, but provides positive changes in the natural movement of the population. The assessment of the scale and degree of influence of certain items of social expenditures of the regional budget on demographic parameters has revealed the most effective period (not more than three years) for social investment in human capital. We have substantiated the optimal structure for the distribution of social investments capable to provide achievement of target indicators of demographic development in Khabarovsk Krai, proceeding from objective conditions and potential opportunities of the region. The results we have obtained are original.

In the process of work, we have revealed the problems associated with the need to expand the set of factors describing the system of demographic and socio-economic processes in the Far East. Some issues are associated with the testing of the proposed tools separately for nine Far Eastern regions and the formation of the integral estimates for the whole macroregion. The search for adequate solutions to these problems is a promising area of research.

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Information about the Authors

Svetlana N. Naiden – Doctor of Sciences (Economics), Associate Professor, Chief Researcher, Economic Research Institute of Far Eastern Branch of RAS (153, Tikhookeanskaya Street, Khabarovsk, 680042 Russian Federation; e-mail: naidensvetlana@mail.ru)

Anna V. Belousova – Candidate of Sciences (Economics), Senior Researcher, Economic Research Institute of Far Eastern Branch of RAS (153, Tikhookeanskaya Street, Khabarovsk, 680042 Russian Federation; e-mail: belousova@ecrin.ru)