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FACTOR MODEL OF RATING ASSESSMENT OF SOCIO-ECONOMIC AND DEMOGRAPHIC DEVELOPMENT OF RURAL AREAS OF RUSSIAN REGIONS

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Abstract

The purpose of the research is to work out a model of socio-economic and demographic development of rural areas in the Privolzhskiy Federal District (PFD) of the Russian Federation. When preparing the article, the scientific works of domestic and foreign scientists on the topic under research, information from the Federal State Statistics Service of the Russian Federation and the Ministry of Agriculture of the Russian Federation were used. Research methods – statistical and economic, computational and constructive, economic and mathematical, modeling, monographic, abstract logical, etc. The research developed a four-stage deterministic factor model of socio-economic and demographic development of rural areas, based on the calculation and interpretation of the integral depending on the objectives of the study, to assess the level of socio-economic and demographic development of rural areas, taking into account the impact of various indicators on the demographic indicators of population reproduction and social processes in terms of material conditions and the quality of life of rural residents, to identify the most successful rural areas to study their experience, conduct analysis of changes in the value of the integral indicator, taking into account the identified reserves for stabilizing the level of socio-economic and demographic development of rural areas and improving the life quality of the population in the Privolzhskiy Federal District.

Key words**:** *deterministic factor model, socio-demographic development, Privolzhskiy Federal District, rural areas, Russian Federation*

INTRODUCTION

The modern socio-economic and demographic situation in the rural areas of Russia is diverse. There are leading regions (Moscow, Belgorod, Samara regions, the Republic of Tatarstan), where the quality of life of the rural population and the infrastructure of the village have a fairly high level. In rural settlements of these regions, demographic growth is observed – the birth rate and migration inflow of the population are increasing [5]. However, in most of the administrative-territorial units of Russia, the standard of living of the rural population is not high – a lack of jobs, low incomes force people to leave villages, moving to cities or other regions. The current unstable socio-demographic situation in several constituent entities of the Russian Federation served as the basis for the development of a deterministic factor model of the socio-demographic development of rural areas.

The theory and methodology of socio-economic processes influencing the development of demography are disclosed in the works of many Russian and foreign scientists-economists, sociologists and demographers.

Theories of changes in fertility and mortality under the influence of various conditions were studied by G. Becker [1], D. Van de Kaa [14], R. A. Easterlin [6], J. Coleman [4], A. Landry [9], R. Lesthaeghe [10], A.G. Vishnevsky [15]. Problems of migration dynamics taking into account socio-economic aspects were studied by G. Borjas [2], W. Zelinsky [16], E. S. Lee [11], W. A. Lewis [12].

MATERIALS AND METHODS

The historical process of the evolution of economics, sociology and demography has led to their inevitable diffusion process in theoretical, methodological and empirical aspects. The existing interaction made it possible to research demographic processes in a qualitatively changing society and to give them a quantitative perspective assessment.

To construct a deterministic factor model of the socio-economic and demographic development of rural areas of the regions, the theory of the second demographic transition by R. Lesthaeghe [10] and D. Van de Kaa [14] was used, in which they prove that a key feature of the modern demographic situation is a decrease in the birth rate to the limit values that ensure simple reproduction of the population, which is a consequence of changes in the economic and cultural conditions of life. The authors come to the conclusion that it is necessary to shift the emphasis from measuring economic production to measuring the well-being of the population [3].

The socio-economic and demographic development of rural areas is influenced by many different factors, without a deep and comprehensive study of which it is impossible to draw conclusions about trends, identify ways and reserves for improvement, justify plans, forecasts and management decisions, therefore, the basis for creating a model is the use of deterministic factor systems and factor analysis described in the works of G. Harman [7] and H. Hotelling [8]. Deterministic modeling proceeds from the possibility of constructing an identical transformation of the initial formula of an economic indicator according to the theoretically assumed links of the latter with other indicators-indicators.

Changes in economic and social conditions are major determinants of demographic trends. The use of a mathematical apparatus based on deterministic modeling makes it possible to systematize indicators that have a direct impact on social (material conditions and quality of life of the rural population) and demographic (indicators of reproduction of the rural population) processes in dynamics, to assess the weight of the impact of each of them on the level of socio-economic and demographic development of rural areas of the regions.

RESULTS AND DISCUSSIONS

The territory of the Russian Federation, which includes 85 equal subjects (in legal aspect), is formally divided into 8 federal districts according to the geographical principle. The Privolzhskiy Federal District is located in the south-west of the country and includes the regions of the Volga, Ural and Ural regions, a total of 14 subjects. The area of the PFD is 1,036,975 km^2, the share of the rural population in the total number in 2019 was 27.81%, which is higher than the national average (Figure 1).

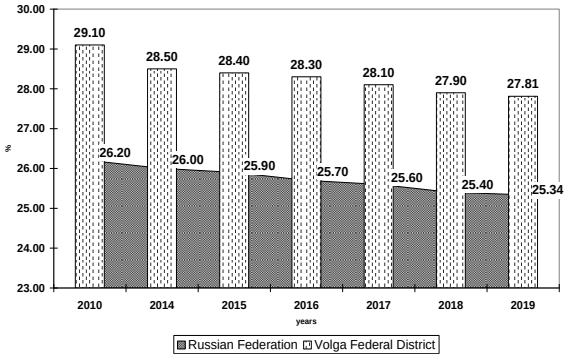

Fig. 1. Share of urban and rural population in the total, %

Source: calculated on the basis of data of [13].

Table 1. The main socio-economic indicators of the Privolzsky Federal District as a percentage of the values in Russia in 2019

Indicator	Value
The area of the land	6.06
Population	19.96
Per capita income	80.20
Consumer spending per capita	82.56
Average monthly salary of 1 employee	72.27
Gross Regional Product	14.67
Fixed capital investments	13.93
Fundamentals of funds in the economy	14.36

Source: calculated on the basis of data of [13].

19.96% of the population of Russia live on the territory of the Privolzsky Federal District, the share of the domestic regional product of the

Volga Federal District in the country's gross domestic product is 14.67%. The main socio-economic indicators of the district are below the national average (Table 1).

To research the level of socio-economic and demographic development of rural areas of the PFD, a deterministic factor model has been developed.

Modeling the socio-economic and demographic development of rural areas consists of several successive stages. The first of them selected indicators that affect the demographic indicators of population reproduction and socio-economic processes from the point of view of material conditions and the life quality of residents of rural settlements. The numerical values of the indicators are taken in dynamics over five years (from 2015 to 2019). Values of socio-economic and demographic indicators of rural settlements of the PFD are presented in Table 2.

Table 2. Average values of indicators of socio-economic and demographic development of rural areas of the PFD for 2015–2019

PFD subject	Indicators									
	availability of secondary education institutions, units for 1000 people	availability of medical institutions, units for 1000 people	disposable resources of households (on average per household member per month), rub.	employment rate of the population aged 15–72, %	number of crimes, units for 1000 people	Housing provision, thousand m2 / 1000 people	emissions of pollutants into the air in the region, thousand tons	population density, people / km2	migration growth of the population, people	natural population growth, people
Republic of Bashkortostan	0.6	1.5	24,085	57.3	4.4	27.6	448.0	352.0	–2.3	–4.068
Mari El Republic	0.7	1.1	17,626	61.6	3.5	23.6	33.6	397.7	–9.7	–671
The Republic of Mordovia	0.8	1.6	19,372	65.5	2.1	28.2	43.2	259.0	–3.6	–3.030
Republic of Tatarstan	0.9	2.0	17,304	67.8	5.9	30.1	32.4	361.6	2.3	–4.976
Udmurt republic	0.8	1.1	26,288	63.3	5.2	23.4	162.0	370.5	–4.8	–501
Chuvash Republic	0.7	1.5	20,397	63.6	2.5	29.9	34.8	431.1	–11.0	–2.970
Permian edge	0,7	1.1	17,082	56.5	8.5	22.0	301.0	313.7	–4.0	– 1.3670
Kirov region	1.1	2.0	20,412	60.9	7.2	27.0	95.2	169.4	–14.2	–2.715
Nizhny Novgorod Region	0.4	1.1	20,639	65.3	7.5	27.1	137.6	258.0	2.6	–6.181
Orenburg region	0.7	1.2	18,738	63.4	3.8	23.4	487.4	302.6	–4.7	–1.261
Penza region	0.4	1.3	20,744	58.7	2.9	30.8	35.0	249.5	–4.6	–3.386
Samara Region	0.5	1.0	24,267	61.8	7.9	27.9	247.4	337.2	7.3	–2.700
Saratov region	0.9	1.4	23,625	57.8	5.5	30.5	117.8	250.0	–7.4	–3.519
Ulyanovsk region	0.7	1.4	19,117	56.4	5.4	24.5	31.8	261.9	–5.9	–2.894

Source: calculated on the basis of data of [13].

Due to the fact that the proposed indicators to varying degrees affect the socio-economic and demographic development, the next stage of the research was to determine the weight coefficients of each of them. The calculation of the weighting coefficients was carried out on the basis of individual expert assessments obtained by interviewing 30 respondents – employees of rural administrations and specialists of enterprises of the agro-industrial complex. The experts were asked to rank the indicators by assigning the most important

factor, in their opinion, the highest rank on a scale from 1 to 10 (Table 3).

Table 3. Distribution of expert assessments and calculation of weight coefficients

Indicators	Significance of the indicator rank										Sum of ranks	Weight coefficient value
	1	2	3	4	5	6	7	8	9	10		
	the number of experts who assigned this rank to the indicator											
availability of secondary education institutions, units for 1000 people	0	1	0	0	3	5	10	6	5	0	210	0.127
availability of medical institutions, units for 1000 people	1	0	0	3	1	5	4	10	3	3	213	0.128
disposable resources of households (on average per household member per month), rub.	0	1	1	0	0	2	3	1	12	10	254	0.153
employment rate of the population aged 15–72,%	3	2	3	3	15	4	0	0	0	0	127	0.077
number of crimes, units for 1000 people	2	2	1	2	2	7	3	6	3	2	185	0.112
housing provision, thousand m2 / 1000 people	5	3	6	8	4	0	2	1	1	0	112	0.068
emissions of pollutants into the air in the region, thousand tons	3	10	9	3	2	0	1		1	1	98	0.059
population density, people / km2	10	5	2	3	2	2	1	0	0	5	117	0.071
migration growth of the population, people	0	1	1	2	1	5	1	4	5	10	232	0.140
natural population growth, people	6	3	6	5	4	2	3	1	0	0	111	0.067

Source: calculated by authors.

The degree of consistency of expert assessments was determined by calculating the Kendall coefficient of concordance. The resulting value of the coefficient of concordance was 0.43, which indicates the average agreement of the opinions of experts. The calculation of the weight coefficients (K_x) based on the obtained expert judgments was made by the formula (1):

$$k_x = \frac{\sum_{i=1}^{n} a_{ix} r_n}{T} \quad \text{..... (1)}$$

where:
a_{ix} is the score of the i–th expert assigned to the x–th indicator;
n is the number of experts;
T is the number of performance indicators.
According to experts, the most important factors in the socio-economic and demographic development of rural areas include such indicators as the size of the available resources of households, the availability of general education and treatment-and-prophylactic institutions, the employment of the rural population and the provision of housing.
Among demographic indicators, experts single out the factor of migration. In order to bring the units of measurement of the selected indicators under one basis, we standardized the factor values (by correlating the actual values with the best ones).
Based on the results of the calculations of the weight coefficients at the third stage of modeling, a deterministic factor model is built with the help of which the current demographic situation in the rural areas of the region is analyzed according to the formula (2):

$$y = \sum_{x=1}^{n} P_x^S \,/\, P_{x\max}^S \times k_x \quad \text{..... (2)}$$

where:
y – level of socio-economic and demographic development of rural areas;
x_j– indicators influencing the socio-economic and demographic development of rural areas to varying degrees;
k_x – weight coefficient;
where:
P^s – standardization of indicator values (by correlating actual values with the best);
n – numbers of indicator.
The last stage of modeling is the interpretation of the integral indicator, depending on the purpose of the study:
– assessment of the current level of socio-

economic and demographic development of rural areas;
– identifying the most successful rural areas in the PFD by the level of socio-economic and demographic development to study their experience.
The results obtained made it possible to compile a rating of rural areas of the PFD by the level of socio-economic and demographic development in the context of subjects and divide them into three groups – stable, unstable and tense (Table 4).

Table 4. Rating of the subjects of the PFD by the level of socio-economic and demographic development of rural areas

Ranking place	PFD subject	Level of socio-economic and demographic development
1	Republic of Tatarstan	0.762
2	Udmurt republic	0.711
3	Republic of Bashkortostan	0.692
4	Chuvash Republic	0.677
5	Samara Region	0.675
6	Nizhny Novgorod Region	0.656
7	Penza region	0.650
8	The Republic of Mordovia	0.638
9	Kirov region	0.637
10	Orenburg region	0.631
11	Mari El Republic	0.629
12	Ulyanovsk region	0.605
13	Perm region	0.597
14	Saratov region	0.590

Source: calculated by authors.

The group of stable settlements included 2 regions, the index of which was higher than 0.7, and the group of tense settlements included the last 2 subjects, the index of which was below 0.6. The remaining 10 subjects are located in the group of unstable rural areas.
The Perm Region and the Saratov Region are distinguished by high rates of unemployment and population migration and are centers of socio-economic and demographic disadvantage in the PFD (Fig. 2).

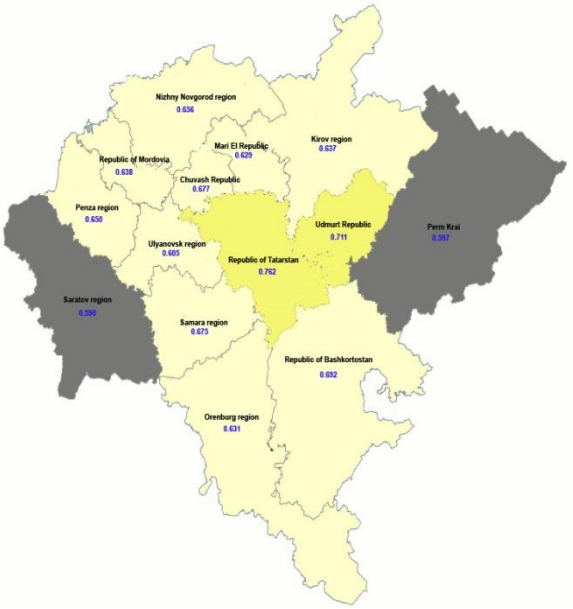

Fig. 2. Distribution of rural settlements of the PFD by region by level of socio-economic and demographic development
Source: made by authors.

Recommendations for stabilizing the level of socio-economic and demographic development of rural areas and improving the quality of life of the population are proposed on the example of the Saratov region, as the region that has the worst indicator in the ranking (14th place). For this, the base of vacancies at agricultural enterprises in the region was investigated, and the reserve for increasing employment of the rural population was calculated. Also, according to the Strategy for Socio-Economic Development of the Saratov Region until 2030, next year the incomes of the population in the region will grow by 3.5%, which will have a positive effect on the level of well-being of households.
According to the results of the model modification, the Saratov region, taking into account the identified reserves, will be transferred to the group of unstable regions. And with an integral indicator value of 0.608 it will take 12th place among the subjects of the PFD. Thus, the calculations confirm the possibility of increasing the level of socio-demographic development by an average of 3%.

CONCLUSIONS

The research developed a deterministic factor model describing the relationship between the level of socio-economic and demographic development of rural areas and its indicators. By calculating weight coefficients based on expert assessments, a rating of 14 subjects of the PFD of the Russian Federation was compiled with their subsequent distribution into three groups – stable (the Republic of Tatarstan and Udmurtia) with an integral indicator value above 0.7, unstable (10 regions) with an indicator 0.6– 0.7 and tense (Perm Territory and Saratov Region), where the indicator is less than 0.6. The group of tense regions is represented by centers of socio-demographic disadvantage, where high rates of unemployment and population migration are observed.

The developed rating will help the leadership of the specialized departments of Russia to make competent management decisions – to redistribute state support funds, to adopt regional programs for the development of rural areas, to influence the migration flows of the rural population. Knowing the weight of the influence of each factor on the quality of life of the villagers, take quick targeted support measures.

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