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Analysis Of Statistical Indicators Of Demographic Processes Using The Method Of Mathematical Modeling

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Abstract: This scientific article describes the analysis and evaluation of statistical indicators related to demographic processes, including population growth, marriage, family, divorce, birth, sex composition, etc., using the method of mathematical modeling.
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1. Introduction

In general, high demographic rate, population and high rate of marriage growth in any country can create a number of problems in this direction along with increasing the pressure on its economic parameters. In the previous section, when the impact of demographic processes on social spheres was analyzed, it was found that almost all of them involved aspects related to the development of the economy of Uzbekistan, that is, the creation and further improvement of infrastructures in any social spheres is primarily based on the increase in the population. if increased, the impact on the country's economy will be noticeable. A number of countries of the world, first of all, countries with poorly developed economies, are distinguished by the fact that the population grows at a high rate, and the economic development is inversely proportional to it.

These aspects can be seen in a number of countries located in southern Asia and sub-Saharan Africa. But despite all this, if the country carries out a correct and effective socio-economic policy, demographic processes, including population growth, may have a positive result. An example of this can be a positive result from demographic pressure through the effective use of human capital. For information, according to the research conducted by the World Bank in 192 countries, in the modern economy, physical capital is 16% of total wealth, natural capital is 20%, and human capital is 64%. In Japan, Germany and Sweden, the share of human capital reaches 80%, while in Russia it is only 14%. In the above-mentioned underdeveloped countries, the level remains even lower.

In today's rapidly growing population, the analysis of some statistical indicators of demographic processes (population, growth, marriage, family, divorce, birth, death, natural reproduction, age-sex composition and migration) is of great scientific and practical importance. Because the analysis of statistical indicators by simple mathematical methods (model) reveals the laws of development of demographic processes and creates the possibility of conclusions and predictions. For example, the territorial location of the population (density-demographic capacity) $S_z = \frac{Sm}{l}$; where S_z – population If the density indicator, Sm-number of existing, l-population area is calculated according to the conditional mathematical model according to the information of the State Statistics Committee of the Republic of Uzbekistan on January 1, 2015, its results lead to the following conclusions: the population of the republic is 31.5 million people, area (territory) - 448.9 thousand sq km; $S_z = \frac{Sm}{l} = \frac{31500000}{448900} = \frac{315000}{4489} = 70{,}2$ person/km.sq. Analytical indicators lead to an opinion, reflection and prediction that the needs and well-being of the population of the republic can be provided by its natural, economic, social opportunities and the level of intellectual development.

If it is necessary to calculate the growth rate of the population in certain years, it will have a solution using the following simple formula. $S = \frac{S_1}{S_0} * 100$; where S is the population growth rate, S_0 is the number of the population in the current year. In particular, the growth rate of the world population is equal to the period 1900-2008 (108 years) $S = \frac{S_1}{S_0} * 100 = \frac{6705}{S_0} * 100 = \frac{6705 * 100}{1617} = 414{,}6$ in terms of percentage and times 41,4 ra. This analysis indicator should be taken into account in planning and forecasting the socio-economic needs of the world's population.

2. Materials and Methods.

Demographic processes are based on birth, death and natural reproduction, which is measured in units of per thousand. The unit of measurement per mille is one thousandth of the visible magnitude, which is calculated using the following formula: $R_t = \frac{N * 1000}{ST}$; where R_t = work rate, N-number of births, S-average absolute number of inhabitants of the territory or settlement at a certain time (year), T-period, time (in years). For example, as of January 1, 2013, the relative birth rate of the population of Namangan region (coefficient K_t = % per thousand) or K $\frac{50603 * 1000}{2458{,}7 = 1йил} = \frac{50603 * 1000}{2458700} = \frac{506030}{24587} = 20{,}6$ $_t$ =20.6 per thousand (people) was born in the region in 2012 .

As of January 1 of this year, the death rate in the region is $K_{o'} = \frac{M * 1000}{ST}$; (where $K_{o'}$ is the death rate, M is the number of deaths (2012)) based on the formula $K_{o'} = \frac{11551 * 1000}{2456{,}700 * 1йил} = \frac{115510}{24587} = 4{,}69$ %.

So, $K_{o'}$ = 4.69 % or people died in 2012 in Namangan region.

The population growth rate (K_{tk}) is equal to the difference between the birth rate (K_t) and the death rate ($K_{o'}$) $K_{tk} = K_t - K_{o'}$, i.e. K_{tk} =20.6-4.6=15.9 per thousand or a natural increase of 15.9% (people) per thousand people in the region.

The stable development of the birth process among the population depends on the ratio of the number of men and women who have reached the age of puberty and the level of marriage. The following simple mathematical methods are used to calculate marriage rate indicators $K_n = \frac{B * 1000}{ST}$: where K_n is the marriage rate, V is the number of married people, S is the annual average number of residents of the region or population center, T is time (in years). In 2012, 23,100 pairs of men and women were married in Namangan region. Here it is noted that the marriage rate is $Kn_{= 9.4}$ marriages $\frac{23100 * 1000}{ST} = \frac{23100000}{2458700 = 1йил} = \frac{231000}{24587} = 9{,}4\%$ per thousand population.

On the other hand, divorce (dissolution) of marriage has the following solution: $K_{AJ} = \frac{R * 1000}{ST}$; where K_{aj} is the separation coefficient, R is the number of separations. In particular, 16,000 divorces (R) were recorded in Namangan region in 2013. Its coefficient $K_{aj} = \frac{R * 100}{ST} = \frac{1600 * 1000}{2458700 = 1йил} = \frac{1600000}{2458700} = 0{,}6\%$ is equal to 0.6 divorces per thousand population. How many percent (part) of the total marriage ended in divorce $R_{aj} = \frac{R}{B} * 100 = \frac{160000}{23100} = 6{,}9\%$ or K_{aj} = 6.9 percent.

Among the indicators of demographic processes, it is very important to analyze the age structure of the population and its strata that can participate in social production (men aged 15-59, women aged 15-54) and those that cannot (children aged 0-14 and women and men over 55-60). . Its indicator is called [1]the demographic load, and it is explained by the number of children and elderly per hundred population aged 15-59. On the other hand, the indicator of demographic loading is characterized by effective social and economic development of the country and its regions, social protection of all age groups of the population, provision of full jobs for the working age, and improvement of the standard of living of the population.

The population of the Namangan region has the following demographic load: $K_{children} = \frac{S_{0-14}}{S_{15-59}} * 100$, that is, the number of children aged S_{0-14} as of January 1, 2013 is 686,648 people, S_{15-59} number is 1733936 people, the burden of children is as follows: $K_{болалар} = \frac{686648}{1733936} * 100 = \frac{68664800}{1733936} = 39{,}6\%$, that is, 39.6% or almost 40 children correspond to every hundred people aged 15-59. This method $K_{уй} = \frac{S_1 60ёшваундан.юкори * 100}{S_{15-59}}$ can be used to determine the indicator of the load factor of the elderly.

In the study of demographic processes, the analysis of indicators of population migration (population changing its place of residence and moving from one place to another) is of special scientific and practical importance. Because this process is very complicated, as a result of which the population of a certain area grows or decreases rapidly. Its age, sex composition, weight and quality of labor resources change, which is reflected in the quantity and marketability of products in production. Therefore, migration balance (balance), volume (sum), speed (intensity), co-efficient (migration usefulness) and others. In particular, the balance of arrivals and departures to a certain area is calculated as follows: Mg=Pv; where Mg-migration balance (residue), P- arrivals, V- departures. For example, in 2012, the number of arrivals from other regions to Namangan region was P=4328, and the number of departures was V-4428. Its solution is equal to Mg=PV=4350-4428=- 78 га, that is, the migration balance has a negative indicator. In this year, the volume of migration $M_{jk} = P + X = 4350 + 4428 = 8778$ was one person.

The migration coefficient is $M_{jk} = \frac{P + V}{S} * 100;$ here M_{jk} -migration speed coefficient, S-region's total population; $M_{jk} = \frac{4350 + 4428}{2379500} * 100 = \frac{877800}{237900} = 0{,}36\%$, that is, 0.36 percent of the total population of Namangan region participated in the migration process.

The co-efficient of migration $M_{o'k} = \frac{P}{V} * 100 = \frac{4350}{4428} * 100 = \frac{435000}{4428} = -98{,}2\%$, that is, 98.2 people came to the region and 100 people left, confirms the negative co-efficient of migration.

The analysis of indicators of demographic processes should be completed with short-, medium- and long-term population forecasting. Because the population is the main producer and consumer of the society. Therefore, it is important to predict demographic processes based on the study of future numbers and growth in order to plan the socio-economic development of the country.

several methods of population forecasting in demographic research (simple mathematical, economic-mathematical, extrapolation, etc.), the most important and simple one is forecasting taking into account the coefficient of population growth. It has a solution using the following formula: $S_J = S_0 \left(1 + \frac{K}{1000}\right) J;$ where S_j is the number of prospective (predicted) years of the population, S_0 is the natural growth rate of the population in the predicted year (period), J is the population forecast period (year). In particular, the population of Uzbekistan was 30.0 million people as of January 1, 2013, S_j = 30.0 million people. The natural growth rate of the population in the forecast year (period) is K-17 per thousand, the forecast period is 2020, i.e.

S_j - in the predicted year will be as follows:

[1] It is also called economic load from an economic point of view.

$S_J = S_0\left(1+\frac{K}{1000}\right)^7 = 30*\left(1+\frac{17}{1000}\right)^7 = 30*1{,}017^7 = 30*7{,}745 = 3{,}33 \text{млн.киши};$ S $_J$=30 million + 3.33 thousand 33.33 thousand people, the population of Uzbekistan in the predicted year (J=2020) will be 33.33 thousand people.

5. Conclusion/Recommendations.

These methodological goals and instructions are devoted to the analysis of indicators of demographic processes using simple mathematical methods (models) to enrich the knowledge and thinking and skills of students of upper grades of general secondary schools, students of academic lyceums and vocational colleges and universities, as well as employees who are engaged in population studies for the first time. and it will undoubtedly help in some way to the effective completion of scientific observations.

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