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SIMULATION MODELING OF LABOR MARKET FORECASTING

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ABSTRACT

Currently, in the Republic of Uzbekistan, special attention is paid to increasing employment of the population. In this process, an important role belongs to employment in the service sector.

On this issue, at many meetings of the Cabinet of Ministers of the Republic of Uzbekistan, dedicated to the results of the socio-economic development of the country that the services sector and service in all types of economic activities grew at a faster pace. For information: as of January 1, 2019, 213.1 thousand enterprises and organizations were involved in the service sector. In the overall structure of operating enterprises and organizations that provide services, most of them were occupied by trade services (33.3%), accommodation and food services (9.3%), transportation and storage (6.2%), information and communication (3, 3%), healthcare and social services (3.2%), other types (44.7%). The growth of operating enterprises belonging to small businesses has had a positive effect on the increase in the total number of operating enterprises and organizations engaged in the service sector. So, as of January 1, 2020, compared to the same period last year, their number increased by 46.2 thousand units. and amounted to 199.9 thousand units, and the growth increased by 30.0%. According to preliminary data, the volume of market services provided in January-December 2019 reached 190 356.0 billion soums, the nominal volume of which increased by 39 466.2 billion soums. Compared to 2018, the growth was 12.5%. Services - in total, including the main types ... According to the World Bank, Uzbekistan is ranked 117 in the Logistics Performance Index (LPI) among 167 countries with an index of 2.50. In this rating, the level of infrastructure development in Uzbekistan is 2.44, which allowed our country to take 98th place.

Despite this, the problems of the functioning of the labor market in the sphere of services and services have received insufficient attention in science. In addition, with the transition of the Republic of Uzbekistan to market relations, fierce competition in the labor market, freedom of choice of the type of labor activity, the problems of the functioning of the labor market become a complex and difficult task.

The increasing complexity of the system of labor relations leads to an increase in the regulatory role of the state in the national labor market. Regulation of the processes of structural formation, movement and professional adaptation of labor resources by the state seems to be an inevitable stage in the development of the republic's heap market. The labor market is a regulating factor of the economy, therefore, state regulation of the national labor market is one of the conditions for the formation of a market environment in the country's economy.

The employment of the population is one of those socio-economic phenomena that cannot be planned:

The state cannot establish how many and in what positions a person should be in particular or the entire population as a whole.

The problem of state regulation of the labor market is relevant not only in theoretical terms, but also in practical terms. For the management and effective regulation of the labor market, it is necessary to have complete, timely and reliable information about the state of the labor market. Therefore, the development of a model that provides such forecasting of the labor market is of current importance.

Forecasting is the process of developing forecasts in order to predict the dynamics of changes in phenomena in the near future. The essence of forecasting the labor market lies in the development of forecasts for the employment of the population and management of its formation and development. Obviously, the essence of forecasting the labor market in the sphere of services and services is determined by the very specifics of employment of the population as an object of forecasting. Forecast calculations of employment of the population serve as the starting point on the basis of which the entire system of measures to manage the employment of the population is built. In this case, the task of forecasting is reduced in this case also to determining how to influence the employment of the population with certain socio-

economic indicators.

In modern predictive science, there are many different methods for developing labor market forecasts, which can be classified into a number of groups, depending on the original formulation of the problem. They boil down to the following:

• Methods for forecasting the employment of the population, based on the use of the method of expert estimates;

• Normative forecasting methods;

• Methods of economic and mathematical modeling of population employment.

Using the first two groups of methods allows you to determine the change in the structure of labor resources. In the practice of economic planning, quantitative forecasts are of great importance, with the help of which an estimate of the size of the future employment of the population can be given. This estimate is most accurately achieved using economic and mathematical forecasting methods.

The entire set of methods for forecasting the labor market, based on its economic and mathematical modeling, can be subdivided into analytical and simulation methods, which differ mainly in the nature of the models used and the applied mathematical apparatus.

For forecasting the labor market in conditions of inaccurate and incomplete statistical information, it is inappropriate to use combined methods that combine various economic and statistical methods. The simulation model (MI) for forecasting the labor market is a type of methods that I use in this work.

Labor market indicators are divided, depending on the timing, into statistical and dynamic. Statistics studies the state of the labor market related to a certain moment or period of time, without taking into account changes in their parameters over time. In dynamic tasks of labor forecasting, not only the dependence of variables on time is reflected, but also their relationship in time.

Dynamic analysis is based on the concept of trajectory. The trajectory describes the state of the studied object (or the value of the studied indicator) as a function of time:

$$T = Y(t), t \in [0, T],$$

Where [0, T] is the time interval on which the t trajectory is determined.

In this case, the time t can be taken into account both in moments (or intervals) and continuously. In the first case, it is also called a dynamic (time) series. According to the time criterion, economic indicators are divided into instant and interval. Continuous time is convenient for modeling, as it allows using the apparatus of differential calculus and differential equations. Discrete time is convenient for applications, since statistical models are always discrete and refer to specific moments or time intervals. For discrete time, the apparatus of difference equations can be used.

Characteristics of the speed and intensity of changes in the dynamic range.

The absolute increase per unit of time characterizes the rate of level change.

The growth rate characterizes the intensity of the change.

Growth rate is the relative rate of change.

Indicators of changes in the dynamic range of the labor market can be calculated on a constant and variable basis. One level of the time series is taken as a permanent base, as a rule, the initial one. The variable base is the previous level. Indicators on a permanent basis are called basic, and on a variable - chain.

индекс	Indicator base	
	Constant (baseline)	Variable (chain exponent)
Absolute gain	$\Delta_{t/0} = Y_t - Y_0$	$\Delta_{t/t-1} = Y_t - Yt - 1$
Growth rate	$y_{t/0} = Y_t/Y_0$	$\eta_{t/t-1} = \frac{Y_t}{Y_{t-1}} = Y/Y_{-1}$
Rate of increase	$y_{t/0} = (Y_t - Y_0)/Y_0$	$y_{t/t-1} = (Y - Y_{-1})/Y_{-1}$

Limit (continuous) absolute and relative gains.

Continuous absolute gain:

$$\Delta(t) = \lim_{\Delta t \to 0} \frac{Y(t+\Delta t) - Y(t)}{\Delta t} = \frac{dY(t)}{dt} = Y.$$

Continuous growth rate:

$$y(t) = \frac{\Delta(t)}{Y(t)} = \frac{dY(t)/dt}{Y(t)}$$

The relationship between continuous and discrete growth rates.

Let the continuous growth rate

$$y = \frac{\frac{dY(t)}{dt}}{Y(t)} = B = const$$

Then $lnY(t) = \int Bdt = Bt + C, \quad C = const,$

By potentiating, we have: $Y(t) = Ae^{at},\ A = e^{C}$

The discrete growth rate is

$$y = \frac{Y}{Y_{-1}} - 1 = \frac{Ae^{Bt}}{Ae^{B(t-1)}} - 1 = \mathrm{e}^{\mathrm{B}} - 1 = \mathrm{e}^{\mathrm{y}} - 1.$$

Thus, the relationship between continuous and discrete growth rates is:

$$\mathrm{y} = \mathrm{e}^{\mathrm{y}} - 1, \quad \mathrm{y} = \ln(\mathrm{y} + 1).$$

Let the exponent S (t) be the sum of A (t) and B (t), growing at a constant non-breakdown rate α and β, respectively. Consider the case when α> β. Then

$$\mathrm{S(t)} = \mathrm{A(t)} + \mathrm{B(t)} = \mathrm{A(0)e^{\alpha t}} + \mathrm{B(0)e^{\beta t}} = \mathrm{A(0)e^{\alpha t}}\left[1 + \frac{\mathrm{e^{(\beta+\alpha)t}B(0)}}{\mathrm{A(0)}}\right].$$

Since β-α <0, the value in square brackets tends to unity, and the rate of increase of the sum approaches the rate of the faster growing component.

Let the exponent P (t) be the product of A (t) and B (t) with continuous growth rates α and β: $\mathrm{P(t)} = \mathrm{A(t)B(t)} = \mathrm{A(0)e^{\alpha t}B(0)} \quad \mathrm{e^{\beta t}} = \mathrm{P(0)e^{(\beta+\alpha)t}}$, that is, the growth rate of the product is equal to the sum of the growth rates of the factors.

In the case of discrete growth rates α and β of indicators A (t) and B (t), we have:

$$\mathrm{P(t)} = \mathrm{A(t)B(t)} = \mathrm{A(0)}(1+\alpha)^{\mathrm{t}}\mathrm{B(0)}(1+\beta)^{\mathrm{t}} = \mathrm{P(0)}(1+\alpha+\beta+\alpha\beta)^{\mathrm{t}}\ .$$

For small α and β, the value of αβ is negligible and the growth rate of the product is approximately equal to the sum of the growth rates of the factors. If α and β are significant, then the growth rate of the product cannot be approximately considered equal to the sum of the growth rates of the factors.

In the work, using the above mentioned mathematical devices, an imitation of the development of the able-bodied population of the Republic of Uzbekistan is made and after that it is possible to obtain the predicted values of the labor market.

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