ECONOMETRIC ANALYSIS OF INFORMAL EMPLOYMENT IN THE LABOR MARKET OF THE REPUBLIC OF UZBEKISTAN.

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Abstract: In the course of the study, the approaches to the analysis of the labor market considered above, and the directions of modeling that can be used in the regulation and development of the labor market of our country, were studied. Also, in the analysis of the labor market today, complex methods of analysis are used, that is, analyzes that combine cognitive, program-targeted and theoretical game methods. One of the important steps in achieving predictability and control of movement towards sustainable economic growth is short-term and long-term forecasting of socio-economic development. In this sense, in the article, in addition to concepts and ideas, the scale and intensity of individual processes and situations, their interrelationship and degree of dependence, as well as quantitative assessment are of fundamental importance in the article, as a non-traditional method, which today includes the following: employment, inflation, unemployment , taking into account labor force and population income. At the end of the article, suggestions and recommendations for reducing the informal sector operating in the country in the future are presented.

Key words: labor resources, inflation, unemployment, correlation, regression, factor analysis

INTRODUCTION

At the current stage of the development of the world economy, the role of not only the economic indicators, which have gained priority for a long time, but also the indicators of the social description, which show the standard of living and the quality of the population, is increasing in the assessment of the level of development of countries. Considering that the main part of these indicators is made up of indicators related to population employment, the importance of population employment and related relations becomes more evident if we take into account that in developed countries today emphasis is placed on "human capital" as the main factor of economic growth. According to forecasts of the International Labor Organization, by 2023 there will be 3.7 billion of the world's population. 3.5 billion of the working-age population. people and the number of unemployed is 0.2 billion. constitutes a person.

If it is taken into account that by this period, about 55% of the employed population of the world will be informal jobs, it is necessary to regulate the

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employment situation in the international labor market on the basis of multi-factor analysis, and to optimize the level of employment, its modern features should be sufficiently taken into account. These data show that, based on the study and analysis of the employment situation in the labor market, it is necessary to adequately take into account the modern features of employment in the processes of its regulation and management.

As a result of rapid reforms in Uzbekistan in recent years, a new system aimed at ensuring effective employment in terms of quality and quantity was formed. In the action strategy, "creating new jobs and ensuring employment of the population, first of all, graduates of secondary and higher educational institutions, ensuring the balance of the labor market and infrastructure development, and reducing the level of unemployment" are defined as one of the important directions. Especially in the context of the global coronavirus pandemic, special attention is paid to supporting the population by increasing the level of employment and income, encouraging new forms of self-employment.

Scientific research works on various models of ensuring population employment, changes in the description and content of factors affecting employment, characteristics and development trends of socio-economic relations in different conditions of the world labor market, improvement of labor market regulation and management mechanisms by various scientific centers, scientists and specialists of the world. Econometric research of population employment in the national labor market of the Republic of Uzbekistan, improvement of models and mechanisms of employment regulation based on the management of multifactorial effects are considered as urgent issues of today.

LITERATURE REVIEW.

A number of scientific research works have been carried out in foreign countries on the nature of population employment, employment models, the influence of factors on employment, improvement of employment indicators and modeling of population employment based on econometric research. In this regard, the scientific works of foreign scientists J. Keynes, J. Forrester, M. Porter, R. Dornbush, S. Fisher, G. Menkiw, Hernando de Soto and others are of special importance. Including the neoclassical model of employment by J. Keynes, J. Forrester developed models of world economic growth, M. Porter, R. Dornbush, S. Fisher and G. Menkular founded economic growth models that include population employment, Hernando de Soto and informal employment was included as a socio-economic category, and the factors causing it were explained.

Factor analysis of employment processes in the labor market in the countries of the Commonwealth of Independent States and theoretical aspects of their regulation V.V. Adamchuk, A.I. Rofe, Yu.D. Odegov, S.A. Aronova, A.M. Moiseev, S.G. Rezinkina, E.V. Semerikova and other scientists have studied it in detail. In these studies, scientists theoretically studied employment and its characteristics, forms and types, conditions of occurrence (V.V. Adamchuk, A.I. Rofe, Yu.D. Odegov), the influence of factors on employment (S.A. Aronova, E.

V.Semerikova), modeling of the employment process based on factor analysis (S.G. Rezinkina), development of the labor market and improvement of regulatory mechanisms (A.M.Moiseev) focused on practical evaluation.

Development of the labor market in Uzbekistan, ensuring effective employment of the population, nature and characteristics of employment, forms and types, influence of factors on employment indicators, modeling of employment processes K.Kh.Abdurakhmonov, B.A.Begalov, T.Sh.Shodiev, B.K. It was reflected in the scientific researches of such scientists as Ghayibnazarov, Sh.R.Kholmo'minov, Yu.K.Mukhamedov, H.T.Mukhitdinov.

DATA AND METHODOLOGY.

In the research work, we first perform economic, comparative and logical analyzes within the scope of the topic. After that, in order to perform an econometric analysis on the selected factors, first of all, the direction of the correlation of x and y and the linear coefficient of the pair correlation are as follows:

$$r_{xy} = b \frac{\sigma_x}{\sigma_y} \tag{1}$$

is calculated using the formula, and through this it is determined whether the factors are correctly selected and how and to what extent they are connected. Then the coefficient of determination of how the factors affect the resulting factor:

$$R^2 = r_{xy}^2 \tag{2}$$

It is determined by performing calculations using formula (2). After that, the parameters of the regression equation (model reflecting the process) of the selected factors (arbitrary variables) and the resulting factors are as follows:

$$b = \frac{\overline{y \cdot x} - \bar{y} \cdot \bar{x}}{\sigma_x^2}; \qquad a = \bar{y} - b \cdot \bar{x} \tag{3}$$

determined by formulas. It should be noted that the selected factors can be linear or non-linear depending on the measurement units. The model to be obtained in our study is non-linear, we logarithm all the factors to form the regression equation and the resulting

$$lny = lna + b \cdot lnx \tag{4}$$

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A process of exponentiation is carried out by logarithmizing both sides of this level model equation:

$$Y = C + b \cdot x \tag{5}$$

here $Y = lny, \quad X = lnx, \quad C = lna$.

x_i Using the actual values of , the resulting value of the regression equation is determined. Average approximation error – we find the value of $\bar{A}$ and check the equation with the first quality criterion.

$$\bar{A} = \frac{1}{n}\sum_{i=1}^{n} A_i = \frac{1}{n}\sum_{i=1}^{n}\left|\frac{y_i - \hat{y}_i}{y_i}\right| \cdot 100\% \tag{6}$$

The mean error of approximation of the regression equation determined by this method was checked, and in our study this error was reliably selected up to 8.0%. After that, the significance of the parameters of the equation is compared by t-Student's test for each parameter in the case of df=n-k-1 when $\propto$=0.01 or $\propto$=0.05 according to the temp>ttabl condition. It can also be determined on a computer using STYuDRASPOBR(0.05;df). Empirical value of t-Student's test with the following formulas:

$$t_{emp} = |X - Y \cdot Sd| \quad \text{бу ерда } Sd = \sqrt{S_x^2 + S_y^2} \tag{7}$$

can be calculated. In addition, the significance of the determined equation is checked by the following formula using Fisher's F-criterion R2 coefficient of determination:

$$F_{emp} = \frac{R^2}{1-r^2}(n-2) \tag{7}$$

The true value of this Fisher's F-criterion is checked with the critical values given in the table under the condition Femp>Ftabl, and the obtained value, the random character of the determined relationship and the statistical insignificance of the parameters of the equation indicate the need to accept the hypothesis H0 about the density of the relationship.

In order to carry out the research, the number of initial informal items determined as a result of the selective analysis carried out in the Republic of Uzbekistan in 2011-2021 - Y as the resulting factor and the real total income per capita affecting it - X1, the inflation rate - X2, per 100 thousand people open statistical data of the State Statistics Committee of the Republic of Uzbekistan for the years 2011-2021 of the factors of small enterprises -X3, unemployment rate - X4, average volume of GDP per capita -X5 and average volume of investment per capita -X6 were used.

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RESULTS AND DISCUSSION

In the field of studying socio-economic processes, the problem of informal employment and its application in the labor market began to be studied in relatively recent years. In different countries, it was recognized that informal employment does not exist in the labor market, but the territorial study of this phenomenon shows that informal labor relations exist in all forms of management to one degree or another, with the gradual expansion of the studied problem. Today, the informal economy includes about 90% of the world's micro-enterprises and small enterprises, and more than 50% of the world's labor resources are employed in it. According to the results of the study, employment in the informal sector is characterized by four main characteristics common to all market economy countries. The existence of these situations makes this issue one of the most pressing issues in the labor market today.

Based on this, we determine separate models based on regression analysis, using the factors we have selected for research above, based on the relationship of each influencing exogenous factors in the form of an ergodic time series, linking the level of informal employment to exogenous factors. First of all, due to the non-homogeneous nature of endogenous and exogenous factors, it is appropriate to transfer the obtained time series indicators to the logarithm form based on e, which in turn allows for the reliability and scientific justification of the obtained results (Table 1).

Table 1

Logarithmic values of the level of informal employment and socio-economic indicators affecting it

Years	Number of informal clauses	Real gross income per capita	Inflation rate	Number of small enterprises per 100,000 people, unit	Unemployment rate	Average size of GDP per capita	Average size of investment per capita
t	ln Y	lnX1	lnX2	lnX3	lnX4	lnX5	lnX6
2011	8,341196	7,912032	2,028148	6,54276	1,609438	8,165818	6,499185
2012	8,406128	8,09187	1,94591	6,534951	1,589235	8,362923	6,71101
2013	8,455254	8,269419	1,916923	6,551937	1,589235	8,530958	6,915922
2014	8,295848	8,405592	1,808289	6,569201	1,629241	8,711806	7,109879
2015	8,344695	8,542376	1,722767	6,573261	1,648659	8,863927	7,266618
2016	8,353544	8,680657	1,740466	6,554218	1,648659	8,989706	7,38312
2017	8,339381	8,807078	2,667228	6,609619	1,757858	9,190352	7,70877
2018	8,590406	8,957643	2,66026	6,722148	2,230014	9,464029	8,234724
2019	8,588248	9,160057	2,721295	6,950719	2,197225	9,665541	8,671561
2020	8,633873	9,281477	2,406945	7,142432	2,351375	9,775762	8,722629
2021	8,677508	9,497458	2,332144	7,303237	2,261763	9,954145	8,833608

Using the data from the table above, we will perform a correlation analysis in order to evaluate the density of connections between the endogenous factor and

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influencing (exogenous) factors. According to the results of the analysis, it was determined from the value of the pair correlation coefficients, that is, between the resulting factor and the selected factors, the average to strong connection density was determined. However, between the private correlation of factors LnX_3 and LnX_6 Factors condition multicollinearity with other factors ($r_{X_3,X_4} = 0,99127$, ..., $r_{X_3,X_5} = 0,8389$; $r_{X_3,X_6} = 0,8804$; $r_{X_1,X_6} = 0,9715$; $r_{X_2,X_6} = 0,7465$; $r_{X_4,X_6} = 0,9356$; and $r_{X_5,X_6} = 0,9913$) because he was not satisfied, $r_{x1,x2} < 0.8$ by condition, these exogenous factors are excluded from the model. We continue the work to determine the regression equation that represents the process, taking into account the values of the density of the correlation between the remaining influencing factors and the resulting factor. It should be noted that the non-linear relationship model was used to create an econometric model reflecting the effect of the above-mentioned factor indicators on the number of informally employed population.

The coefficients of the multivariate regression equation and the significance of the regression equation and the coefficients in the non-linear association view using the Eviews software show that this association is within the limits based on the established criteria (Table 2).

Table 2

Results of determining the coefficients of the regression equation and checking the equation based on the criteria [1]

Dependent Variable: LnY				
Method: Least Squares				
Date: 29/11/22 Time: 9:26				
Sample: 2011 2021				
Included observations: 11				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LnX_1	-0.026902	0.673010	-0.039972	0.0497
LnX_2	-0.019638	0.098277	-0.199818	0.0395
LnX_4	0.534942	0.282921	1.890783	0.0072
LnX_5	-0.059085	0.786559	-0.083636	0.0366
C	8.318126	0.999694	8.320671	0.0004
R-squared	0.836839	Mean dependent var		8.434000
Adjusted R-squared	0.706310	S.D. dependent var		0.125892
S.E. of regression	0.068225	Akaike info criterion		-2.225155
Sum squared resid	0.023273	Schwarz criterion		-2.073863
Log likelihood	16.12578	Hannan-Quinn criter.		-2.391123
F-statistic	6.411130	Durbin-Watson stat		2.181217
Prob(F-statistic)	0.033250			

Based on the coefficients in the table, the multifactor regression equation looks like this:

$$LnY = -0,0227 LnX_1 - 0,02 LnX_2 + 0,535 LnX_4 - 0,0591 LnX5 + 8,318 \qquad (1)$$

If we pay attention to the significance of the parameters of regression equation 1 according to the criteria of t-Statistic, the insignificance of all the

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[1] Developed by the author using the Eviews 10 software package.

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factors selected for the study from the equality of tJad=2.4469 with a=0.05 and df=6, but Prob. Significance comes from the indicator. In this sense, it is necessary to check the significance of the parameters with retrospective forecast quality criteria MAPE (Mean Absolute Percentage Error) and TIC (Tail inequality coefficient) - an alternative measure of the accuracy of the Tail forecast (Fig. 3).
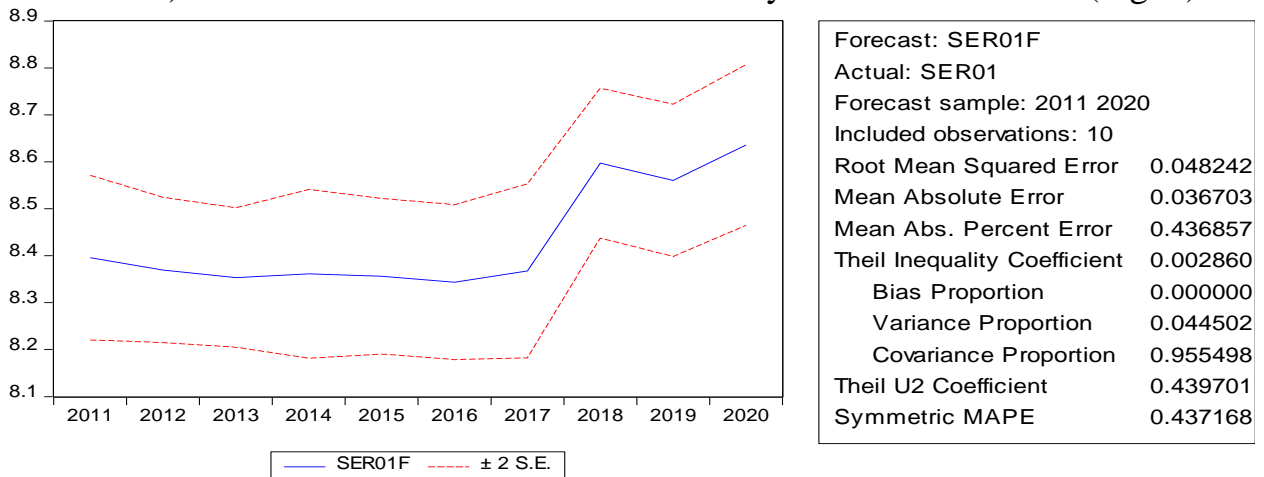

Forecast: SER01F	
Actual: SER01	
Forecast sample: 2011 2020	
Included observations: 10	
Root Mean Squared Error	0.048242
Mean Absolute Error	0.036703
Mean Abs. Percent Error	0.436857
Theil Inequality Coefficient	0.002860
Bias Proportion	0.000000
Variance Proportion	0.044502
Covariance Proportion	0.955498
Theil U2 Coefficient	0.439701
Symmetric MAPE	0.437168

Figure 3. Results of estimation of regression equation by MAPE and TIC criteria [2]

Based on the data presented in Figure 3, it can be noted that MAPE=0.44, which in turn means that MAPE=0.44<10% has a high forecast accuracy and TIC=0.003<1 coefficient tends to zero so that all the parameters of regression equation 1 are significant. In order to simplify the mathematical rules and calculation processes and to achieve the accuracy of the results, the regression equation 1 created above is potentiated and the following equation is created according to it:

$$Y = \frac{X4^{0,535} * e^{8,318}}{X1^{0,0227} * X2^{0,02} * X5^{0,0591}} \tag{1*}$$

The created 1*-regression equation is statistically significant at a=0.05 and k1=6; Taking into account that FJad=0.22057 when k2=4, the Fisher value calculated from Fhis=452.6, the significance of the 1*-regression equation under the condition FJad<Fhis and DW=2.18, due to the absence of autocorrelation, the equation is reliable and adequacy arises. It can be seen from the results that the level of reliability of the model determined by the multifactorial change of exogenous factors affecting the number of informally employed population in the economy of the Republic of Uzbekistan is high.

The socio-economic nature of this determined equation 1* can be explained as follows. If the country's real total income per capita, inflation rate and average GDP per capita increase by 1%, the number of informal jobs in the economy will increase to 1.4 thousand units, 11.2 thousand people and 3.6 thousand people, respectively. an additional decrease was found. From this, it can be said that the low wages paid to formal jobs in the economy forces the population to work

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[2] Муаллиф томонидан ишлаб чиқилган.

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informally. If measures to reduce unemployment among the population are implemented without deviation, it was determined that a 1.0% decrease in unemployment will lead to an additional 32,000 reduction in the number of informal workers among the population.

Using the models of change of exogenous factors under the influence of the time factor and the above 1*-model of the endogenous factor, the resulting factor (number of informal items) and the forecast indicators of the influencing factors in the medium term (2021-2025) are determined:

real gross income per capita – $X_1=233,6+1190,2*t$;

inflation rate – $X_2=2,6+0,7*t$;

unemployment rate – $X_4=1.9+0.7*t$;

average GDP per capita – $X_5=-1192,8+2021,1*t$ using the system of equations (when t=13) the results of the multifactor forecast of the number of informally employed population in the economy in the near future (Table 4).

Table 4

Forecasts of the number of informally employed population and factors influencing it in the Republic of Uzbekistan in 2023-2028 [3]

Years	Number of informal jobs, thousand people	Real total income per capita, thousand soums	Inflation rate, %	Unemployment rate, %	Average GDP per capita, thousand people
2023	6208,6	15706,2	11,7	11	25081,5
2024	6369,6	16896,4	12,4	11,7	27102,6
2025	6525,6	18086,6	13,1	12,4	29123,7
2026	6676,9	19276,8	13,8	13,1	31144,8
2027	6823,9	20467	14,5	13,8	33165,9
2028	6967,0	21657,2	15,2	14,5	35187

It can be seen from the table that by 2028, compared to 2023, the number of informally employed population in the Republic of Uzbekistan is expected to increase by 10.9% to 6,967,000 people. This, in turn, is expected to increase inflation to 15.2% and unemployment to 14.5%. To conclude from the results, it is appropriate to control the fulfillment of the tasks defined in the normative documents issued to ensure the stability of the inflation level in the country and, most importantly, to reduce unemployment.

Forecast indicators based on trend models show that the level of informal employment and indicators of factors affecting it will have a tendency to increase in the near future. These changes are caused by qualitative changes observed in the main territorial and macro-level socio-economic indicators considered in the analyzes we performed above (Fig. 5).

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[3] Муаллиф томонидан ишлаб чиқилган.

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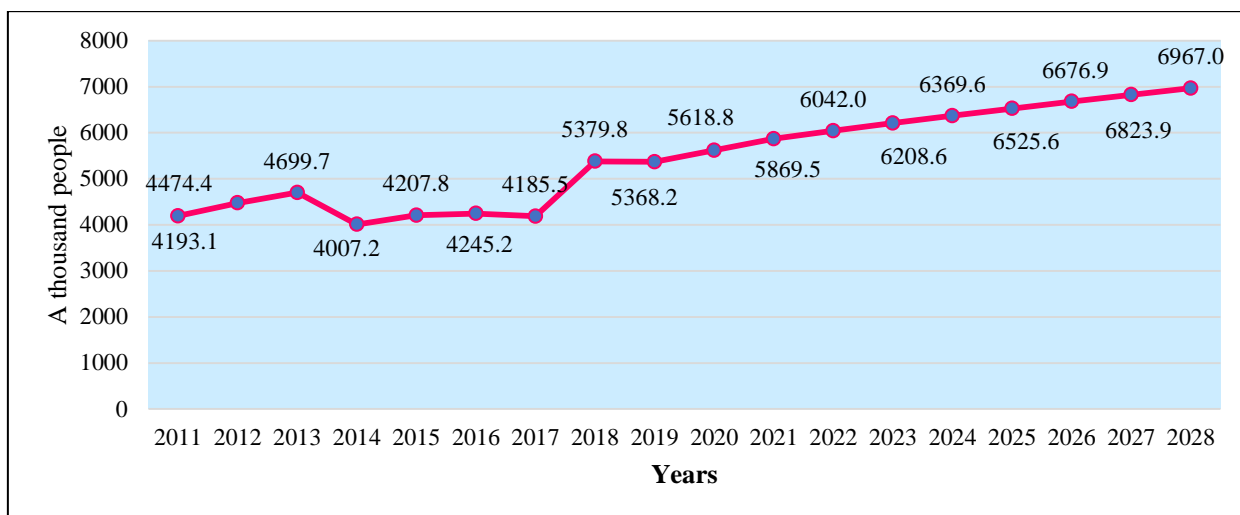Eur. Chem. Bull. 2023, 12 (Special Issue 4), 18706-18718

Figure 5. Indicators of change in the number of informal jobs in the Republic of Uzbekistan

If we pay attention to the change indicators of the number of informal jobs in the Republic of Uzbekistan presented in Figure 5, it can be seen that it will increase in the future. In order to legalize the situation of informal employment existing in the labor market of our country, the following activities are required:

1. Legalization of the status of informal employment by improving the current legal and regulatory documents;

2. Encouraging the transfer of informal jobs to the formal sector by expanding benefits in the tax and pension system;

3. To strengthen the economic and administrative sanctions applied to cases of informal recruitment of labor for enterprises with the status of a legal entity;

4. Application of a differentiated and flexible approach, taking into account the differences between regions, in the implementation of the state policy in the field of informal employment;

5. To ensure the migration of informal workers to the formal labor market by effectively managing the factors directly and indirectly affecting informal employment in the regions. As a result of activities in the specified directions, the legalization of informal employment in our country will be accelerated to a certain extent.

CONCLUSION

To sum up, to study the process of collection and analysis of the existing indicators of the social and labor sphere, the necessary reporting indicators are not fully collected, the methodology used in data collection and summarization is not in accordance with the generally accepted international standards of employment measurement, the scale of covering enterprises and employees in statistical research is insufficient, showed that there are systemic problems such as limited access to statistical data. In the analysis of the labor market today, it is recommended to use a complex method of analysis, that is, analyzes that combine cognitive, programmatic and theoretical game methods. With the help of the model determined as a result of this research, the state of the labor market and the trends

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of changes in it are studied on the basis of correlation-regression analysis, and various scenarios can be developed by identifying trends. The second component of the complex model of labor market development - the program-target model - will be formed and implemented on the basis of the most optimal option based on the developed scenarios, based on the available opportunities and potential.

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