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ECONOMETRIC ANALYSIS OF EXTERNAL LABOR MIGRATION

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Abstract: In this article, an econometric analysis of the factors affecting external megatric migration processes was carried out. The impact of the number of deductions on external labor migration, The Real total income per capita, the number of births and unemployed was scientifically analyzed, the dependencies were studied and relevant conclusions and suggestions were drawn.

Key words: external migration, unemployment, income, birth, divorce, model, variables, standard of living, family, factors, assessment.

INTRODUCTION

Migration processes are determined not only by objective factors but also depend on a range of subjective factors that can be anticipated in the region where migration occurs. Based on the analysis of these subjective factors, decisions are made to migrate to other provinces, cities, and districts.

Migration outcomes reflect planned and organized processes. Migration manifests in the economy only when vacant job positions are available in other regions where people can engage in activities. It is necessary to emphasize individual and unplanned migration situations, highlighting the limitations of collectively organized mobilization states.

E. Ravenstein, a representative of the classical school, identified economic factors as crucial determinants of migration, demonstrating that migration flows are directed toward economically developed regions with high levels of technological progress, communication, transportation, and social infrastructure [1].

Another scholar, E. Lee, conceptualized migration as a process based on the action of push and pull factors with economic, demographic, and social characteristics. He argued that individuals make migration decisions under the influence of various incentives and motivations [2].

This indicates that the primary objective of migration is economic—to earn more money and secure decent working conditions while considering social circumstances in conducting labor activities.

According to sociologists V.A. Yadov and A.G. Zdravomyslov, the efforts of unskilled or low-skilled workers to change jobs due to dissatisfaction with their personal and production activities should be positively evaluated [3].

This situation reflects an increase in society's social needs, a decline in the status of heavy manual labor, and the population's growing interest in creative and intellectually demanding work activities.

Interregional labor resource migration is an objectively explained process that embodies a set of laws governing labor resource movement. In this context, objective relationships emerge between material factors of production and the reproduction and migration of labor resources. This process is evidenced by the interrelationship of redistribution between labor resources and job positions [4].

First, the emergence of mobility necessity is explained by the creation of vacant job positions in a particular region or residential area, along with the establishment of housing funds, making it possible to place workers there. Simultaneously, in regions experiencing labor resource shortages, workers have greater opportunities to improve their qualifications and social status compared to regions with high labor supply. The complexity of finding interesting and well-paid work in regions with high labor supply serves as a factor explaining the population's tendency to leave those regions.

Second, there exists a mechanism regulating the volume of migration flows occurring in a particular region. When migrant flows exceed the quantity necessary to meet production process requirements, the working-age population arriving in this region cannot obtain the favorable conditions they sought, which reduces the migration flow of working-age population.

LITERATURE REVIEW

Contemporary approaches to migration analysis have emerged recently. Among scholars studying these processes, E.V. Vinogradova identified the following approaches to labor resource mobility [5]:

First, the process of labor resource allocation among job positions;

Second, readiness and capabilities for relocation;

Third, she proposed basing it on the economic mechanism for managing regional proportions of employed population in the economy.

N.M. Preobrazhenskaya notes that almost all states participate in migration processes, and their economic and political conditions and cultural life depend on migration. Migration flows, along with information and economic flows, play the role of external factors influencing the structure and system of state and public relations. The existence of migration today creates a range of problems and positive aspects that can often only be resolved at the international level [6].

Schmidheiny K. suggests that in modeling migration processes, panel data involves observing individuals (persons, firms, cities, etc.) at several time points (days, years, before and after treatment, etc.). These data are oriented toward panels with relatively short time periods (small T) and many individuals (large N) [7].

Park H.M. states that regression analysis of migration process panel data is one of the statistical methods used in analyzing data that includes cross-sectional and time-series dimensions [8].

In migration research, the GMM estimator includes a GMM estimator based on nonlinear transformation conditions present in dynamic error component models and has significant asymptotic efficiency gains. Using the system GMM estimator in modeling migration processes not only improves accuracy but also allows for significant assessment of the impact of constrained variables [9].

Blundell R. suggests that the fixed effects estimator in migration modeling allows this model to estimate the possibility of adjusting differences in data with various cross-sections [10]. The fixed effects estimator model is considered optimal for modeling migration processes.

In our opinion, to effectively organize migration regulation in our country, positive results in migration can be achieved by implementing organized or official migration through incentives, or by establishing a minimum consumer basket in our country and achieving price equality anywhere in the country through increasing wage rates. This could certainly cause several other problems but would serve as a step toward reducing informal migration.

RESEARCH METHODOLOGY

In conducting this research, we employed analytical analysis, statistical data analysis, comparative analysis of migration, and mathematical modeling methods based on statistical data. By analyzing factors affecting migration processes and making scientific observations, scientifically grounded recommendations and conclusions were presented. Uzbekistan's migration processes were taken as the research object.

ANALYSIS AND RESULTS

We developed econometric models of factors affecting migration based on panel data analysis.

In analyzing panel data regression, researchers use panel regression models to evaluate relationships between dependent and independent variables while controlling for individual and time-specific effects.

The use of econometric modeling based on panel data in our dissertation enhances its value as it enables control of unobserved individual factors and ensures the study of both dependency and the impact of independent variables on the main factor. Our scientific research can increase calculation accuracy and ensure statistical reliability.

Panel data can also be used to evaluate dynamic relationships over time, such as observing the impact of economic changes or the evolution of economic variables—how they change over time units.

In our research, econometric models of panel data are expressed as follows from a theoretical perspective:

Panel data represents a type of dataset that includes cross-sectional and time-series dimensions, allowing observation of individual behavior over a specific time period.

In modeling, the indicator X_it represents the impact of variable x for individual process i at time t, where i represents the cross-sectional unit and t represents time. In econometric modeling and statistical data analysis,

this provides researchers with the opportunity to individually control the impact of variable x on variable Y and evaluate the dynamic impact of inter-temporal results.

Based on these data, the main model for panel data analysis introduces the Pooled OLS estimator (POLSE) model, Fixed effects estimator model, and Random effects estimator (REE) model. The data does not cover what are called dynamic panel data models.

Panel data is useful when we suspect that the outcome variable depends on unobservable but related observation variables. If such omitted variables remain constant over time, panel data estimators allow consistent evaluation of the impact of observed explanatory variables.

The evaluation process conducted to verify the reliability and validity of econometric models used in the research includes several testing procedures. The relevance of the Gauss-Markov assumption was verified, emphasizing that model errors follow normal distribution with zero mean and constant variance and are not correlated with each other or with independent variables.

Durbin Watson, Shapiro Wilk, and Breusch-Pagan tests were used to evaluate the fulfillment of assumptions about autocorrelation, normality, and heteroscedasticity in errors. Additionally, the Hausman test was conducted to determine the appropriate model type—fixed or random effects.

Furthermore, the VIF test was used to check for multicollinearity, where high correlation exists among independent variables. Overall, these tests play a crucial role in ensuring the accuracy and reliability of econometric models, enabling precise and significant results.

Statistical Agency data were used for the variables in the econometric models developed for the research.

They were expressed as follows: Y - External labor migration indicators (dependent variable), x1 - Number of divorces (independent variable), x2 - Real total income per capita (independent variable), x3 - Number of births (independent variable), x4 - Number of unemployed (independent variable)

In the research, we conducted correlation matrix analysis between each observed case of the dependent variable and independent variables using Stata software. Using statistical analysis to check correlation increases the effectiveness of scientific efforts as it enables identifying relationships between various variables in the research and helps identify factors affecting migration process dynamics (see Table 1).

Table 1. Correlation matrix of relationships between dependent and independent variables

Variables	(1)	(2)	(3)	(4)	(5)
(1) Y	1.000				
(2) x1	0.539 (0.000)	1.000			
(3) x2	0.464 (0.000)	0.436 (0.000)	1.000		
(4) x3	0.511 (0.053)	0.130 (0.093)	-0.064 (0.408)	1.000	
(5) x4	0.819 (0.000)	0.695 (0.000)	0.350 (0.000)	0.033 (0.673)	1.000

Table 1 presents correlation coefficients between dependent and independent variables. The analysis shows that variables exhibit significant or moderately significant correlation, and in some cases, correlations are absent. Additionally, no multicollinearity is observed among the influential factors.

The absence of multicollinearity indicates that each independent variable provides separate information and does not duplicate the impact of other factors. The existence of strong relationships between dependent and independent variables in our research is a key factor demonstrating the reliability and validity of statistical analyses. The model's reliability level in the research was 72%.

We developed our model using panel data, and consequently used several models during the research.

We evaluated the effectiveness of our work through REE model, POLSE model, and FEE models to study regression model coefficients in presenting panel data.

Several statistical tests were conducted to evaluate the reliability of the research models. The Gauss-Markov test examined model error correlation, exogeneity, and normality through Durbin Watson test, Breusch Pagan test, and Hausman test.

The Hausman test helps determine which model fits the studied variables of panel data in our work, and this model is found to be most suitable.

Our research enables deep scientific approaches, econometric analysis of statistical data, reliability of results, revealing migration problems, paying attention to each factor affecting it, and general assessment of migration (see Table 2).

Table 2. Panel data coefficients of migration

№	Model indicators	Model 1	Model 2	Model 3
		POLSE model	FEE model	REE model
1	Y	*	*	*
2	x1	-0.23 (0.10)	0.55 (0.20)	0.16 (0.13)
3	x2	0.39 (0.08)	0.63 (0.17)	0.52 (0.09)
4	x3	-0.10 (0.09)	-0.06 (0.11)	-0.13 (0.10)
5	x4	1.51 (0.10)	0.77 (0.19)	1.14 (0.13)
5	F test	104.27 (0.0000)	114.35 (0.0000)	
6	R^2	0.71	0.75	0.73
7	**Chi-square**			414.14 (0.0000)
8	Adj R^2	0.71		
9	Breusch Pagan	0.32		
10	Durbin Watson	0.58		
11	Shapiro-Wilk	0.17		
12	Vif	1.61		
13	Hausman		0.0000	

Table 2 data analyzes econometric models based on panel data for each indicator and test.
Fixed Effects Estimator (FEE) Model Analysis
The econometric equation indicators for the Fixed Effects Estimator (FEE) model are presented in Table 5.

Table 5. Fixed Effects Estimator (FEE) Model Analysis

Y	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
x1	.553	.205	2.69	.008	.147	.959	***
x2	.634	.17	3.73	0	.298	.969	***
x3	-.068	.116	-0.58	.065	-.297	.162	*
x4	.775	.193	4.03	0	.395	1.156	***
Constant	-6.49	2.024	-3.21	.002	-10.489	-2.492	***
Mean dependent var	10.835		SD dependent var		1.075		
R-squared	0.753		Number of obs		168		
F-test	114.359		Prob > F		0.000		
Akaike crit. (AIC)	200.651		Bayesian crit. (BIC)		216.271		
*** p<.01, ** p<.05, * p<.1							

Mean dependent var | 10.835 | SD dependent var | 1.075 | | R-squared | 0.753 | Number of obs | 168 | | F-test | 114.359 | Prob > F | 0.000 | | Akaike crit. (AIC) | 200.651 | Bayesian crit. (BIC) | 216.271 |
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According to Table 5, the Fixed Effects Estimator (FEE) model results show coefficients of 0.55, 0.63, -0.06, and 0.77 for several factors with their standard errors of 0.20, 0.17, 0.11, and 0.19 respectively. These values explain the impact of independent variables on the dependent variable in the model. The F-value in the

ANOVA table is 114.35, which is high, and achieved R-squared=0.75.

The Fixed Effects Estimator (FEE) model developed for the research has the following form:

Y = 0.55x1 + 0.63x2 - 0.06x3 + 0.77x4 - 6.49 (7)

CONCLUSION

Based on the results, the Fixed Effects Estimator model was determined to be the appropriate choice for analysis.

Y = 0.55x1 + 0.63x2 - 0.06x3 + 0.77x4 - 6.49 is considered the optimal model.

Additionally, the choice between the Fixed Effects Estimator model and Random Effects Estimator (REE) model is determined through the Hausman test. This test evaluates the statistical significance of differences between estimates obtained from both models. If the test's p-value is below the predetermined significance level (typically 0.05), we can conclude that the Fixed Effects Estimator model is the correct choice.

Based on the Fixed Effects Estimator model analysis results:

To reduce divorces in our country, it is necessary to establish counseling departments in neighborhoods in collaboration with local administrators and neighborhood chairmen to preserve families through specifically targeted approaches;

To increase real total income per capita and ensure population welfare, subsidies should be allocated to internal migrants while supporting internal migration;

The reduction in divorces leading to increased births may result in excess labor resources; therefore, assistance should be provided for employment through organized forms of migration;

To reduce unemployment surplus, economic support should be provided to ensure virtual and digital employment of unemployed population in new occupations, namely through free training courses. We believe that if these tasks are implemented, labor migration processes could be regulated.

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