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Economic and Non-Economic Determinants of Interregional Migration Research in Russia

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***Abstract*—This paper studies interregional internal migration in Russia. Our study conduct a comprehensive assessment of the various factors that influence the migration processes in Russia.**

Our empirical research is based on gravity model of bilateral migration in Russia. To perform econometric estimation we employ various panel data estimation techniques. So, we provide both fixed effect and random effect estimation techniques. Our paper provides dynamic panel data estimation of extended gravity model as well. All of the procedures are applied in Poisson pseudo maximum likelihood (PPML) estimation. Economics Education and Research Consortium sponsored this study in the framework of the research project No. 14-044.

***Keywords*—migration, gravity model, Poisson pseudo maximum likelihood.**

I. Introduction

Most of earlier economic research explain the migration flows as a result of economic factors differentials such as: wage, unemployment, the gross regional product per capita. Undoubtedly, these factors continue to play a major role in explaining the causes of migration. However, in modern conditions there are significant changes associated with the widespread introduction of information and communication technology in the daily life of people. So these factors can influence on migration processes. Therefore assessing the impact of these factors have some scientific interest.

The majority of authors allocate socio-demographic [1, 2] and socio-economic [3, 4, 5, 6] factors as a basic factors. However, there are some studies that investigate the impact of socio-political factors [7], natural-climatic [8], environmental [9, 10, 11] factors.

As for modeling of migration processes, the first mathematical model of migration was proposed by Young, 1924 [12]. In the 40s of the XX century J. Zipf proposed gravity model of migration [13]. Lee E. (1966) proposed the model of migration factors. In addition, this model is called extended gravity model [14].

In the development of the theory of migration should be noted Harris-Todaro model. The basic model of the Harris-Todaro has made fundamental contributions to the theory of migration: migration is a response mainly on the expected differences between incomes in rural and urban areas [15]. The work of Andrienko and Guriev is interesting too, they tested the modified gravity model for Russia [16]. As for the results, the authors noted the applicability of the gravity model to the Russian data.

As analysis of the scientific literature has shown, there are practically no comprehensive studies determine the role of information and telecommunications environment in the explaining of migration flows. Moreover, the information gap is sufficiently large in the regions of Russia. Therefore, we can evaluate their impact on the migration flows in Russia.

The object of research is the internal interregional migration processes in Russia. The purpose of this study is detection, evaluation and ranking of factors that affect the population migration processes using econometric methods to make a prognosis of the migration flow dynamics and to develop recommendations for improving the state policy in the field of internal migration regulation.

The novelty of this paper is that we include in econometric model not only general socio-economic determinants but non-economic (information and telecommunications environment) determinants as well.

Our approach based on multi-regional model, which covers migration flows in all Russian regions. Thus, a couple of regions is supposed to be an observation unit in our model. Therefore, we analyze panel data sets of interregional migration flows in Russia in time period 2001-2012. The analysis covers panel data sets of 78 regions of Russian Federation. The Republic of Ingushetia and the Republic of Chechnya are excluded from consideration because of the data incompleteness on them. Hence, our data set consists of 72072 observations of bilateral migration flows in time period 12 years (78 X 77 X 12).

II. Theoretical Background and Model Specification

Due to the fact that we need to make an assessment of the impact of various factors on the migration processes, the most suitable for our case is the model of migration factors, or the so-called modified gravity model.

Our empirical research is based on the so-called “gravity-model”, which often is used by some researchers of migration. The traditional way to deal with the multiplicative form of gravity equation is to estimate log-linearized version of the gravity model. After such manipulation with gravity equation, the authors usually apply the traditional ordinary least squares (OLS) technique. Further, when researchers start to analyze the panel data, they usually apply the fixed effect or random effect estimation methods.

However, the recent studies of the estimation log-linearized version of the gravity model show its rather significant shortcomings; even if we use panel data for estimation. Namely, Santos Silva and Tenreyro [17] show that the general approach cannot be used for zero force of attraction between the countries or regions. Moreover, they argued that estimating the log-linearized equation by OLS could lead to significant biases. Thus, the estimation based on the logarithmic transformed model creates a potential significant risk to the properly estimated coefficients.

The general specification for expanded gravitational model with the fixed effect will be as follows:

$$M_{ijt} = e^{\alpha_{ij}X_{it}^{\alpha_1}X_{jt}^{\alpha_2}D_{ijt}^{\alpha_3}\theta_t}\varepsilon_{ijt}, \qquad (1)$$

where Mijt - is the migration flow from the region i to the region j in the year t; Xit - are the factors of the given region i; Xjt – are the factors of the arrival region j; variables θ t– shows time effect, Dijt – the distance between the two regions,α1, α2,α3 - are the parameters to be estimated; εijt– error terms. All εijt are independent and identically distributed. Constanta αij characterizes the fixed effect of pair of regions i and j. With the help of fixed effect unobserved variables model, which are unchangeable in time for the pair of region. We also use dummy variables in time row to control some events, which depend on time differentials such, as: crises, governmental programs, etc.

Recently, several authors have proposed a dynamic gravity equation in place of the traditional static gravity equation. However, at present the use of dynamic gravity equation is quite rare. Most of researchers stick to the traditional approach in the use of static gravity model.

At the same time, migration is a dynamic process, moreover past information has some impact on migration. In particular, if someone moved to another area he can create more favorable conditions for migration in subsequent periods for other migrants (relatives, friends). Thus, they may affect the choice of location for migration. Accordingly, migration flows are defined according to the last migration.

To perform econometric estimation of suggested equation, we can employ the generalized method of moment (GMM) approach [18].The ordinary least squares (OLS) estimator is biased and inconsistent because the lagged dependent variable is correlated with the error term. Moreover, usual econometric techniques for panel data (one-way fixed effect and random effect models) are not appropriate because they yield biased and inconsistent estimates [19].

In our case of using non-log-linearized dynamic gravity equation, we can employ Poisson random effect estimator. A random effects dynamic model is an extension of the static RE model that includes lagged Yit as regressors. However, the log-likelihood will depend on initial condition Yi0, this condition will not disappear asymptotically in a short panel, and most importantly it will be correlated with the random effect αi (even if αi is uncorrelated with xit). So it is important to control for the initial condition. Some authors [20] proposed a conditional approach, for a class of non-log-linearized dynamic panel models that includes the Poisson model, based on the decomposition.

$$f(y_{i1},\dots,y_{iT,}\alpha_i|X_i,y_{i0}) = f(y_{i1},\dots,y_{iT}|X_i,y_{i0},\alpha_i)f(\alpha_i|y_{i0}X_i). \qquad (2)$$

This simpler approach conditions on yi0 rather than modeling the distribution of yi0.Then the standard random effects conditional ML approach identifies the parameters of interest. One possible model for $f(\alpha_i|y_{i0}X_i)$ is the CCR model in with yi0 added as a regressor, so:

$$\alpha_i = \exp(\delta_0 y_{i0} + x'_i\lambda + \varepsilon_i), \qquad (3)$$

Where xi denotes the time-average of the time-varying exogenous variables, and εi is an i.i.d. random variable.

III. Results

The detail analyses deals with creating an econometric model. To perform econometric estimation we employ various panel data estimation techniques. We summarize the results using several panel Poisson estimators in table 1. The first column reports FE model estimates, the second – RE model estimates, the last - RE dynamic model estimates.

TABLE I. Comparative Estimation

Variable	**MIG_fe**	**MiG_re**	**MIG_Dyna~c**
M_i j			
LnD_i j		-.50890716	-.25082387
LnI_i	-.15569066	-.15512713	-.15858929
LnI_j	-.03948613	-.04266178	-.114529
LnU_i	-.04358681	-.04124391	-.05492277
LnU_j	-.03684997	-.03821863	-.02055772
LnP_i	.6938888	.77189186	.75220245
LnP_j	1.3577889	1.2486447	1.0420762
LnY_i	.05277064	.05733226	.08317374
LnY_j	.23980301	.23875409	.25926098
-	-	-	-
-	-	-	-
-	-	-	-
M_i j			
Ll.			.00001625
M_i j 0			.00237904
_cons	-9.9557398		-10.729808

In the first stage we perform fixed effect model. The model includes analysis of 6005 pairs of regions. The dependent variable is the volume of migration. It is expressed in levels. The independent variables are used in logarithmic form. There are distance between two regions (D), average income per month in rubles (I), the average unemployment rate (U), mid-year population in the region (P), the gross regional product per capita (Y) and others. To assess the gravity model parameters is used the matrix of the shortest distances between regional centers of Russia. This calculation procedure was offered by Abramov A. [21]. Zero migration flows observations represent about 2 percent of the sample. Further, we perform random effect model. The model includes analysis of 6006 pairs of regions. In the last stage, we perform dynamic panel data estimation of extended gravity model. We create a random effects dynamic model. It is an extension of the static RE model that includes lagged M_ijt as regressors. We also involve M_ij0 as additional regressors. Thus, the variable id is the individual indicator, and M_ij0 is the initial condition, this model can be estimated.

IV. Conclusions

In fixed effect model winter temperature does not influence on migration decision. For the region of arrival, the greatest elasticity has the coefficient of the population number. This is the basic characteristics of gravity model. Thus, at increase of population by 1% the inflow of migrants can increase by 1.36%.

Except the population number rather significant is number of physicians, gross regional product per capita, summer temperature, emission of air pollutants. So, at increase by 1% the inflow of migrants can increase by 0.71%; 0.24%; 0.14% and 0.14% respectively. All this determinants have positive impact on migration flows. Rather high impact has the determinant the number of students (-0.39), but it has negative impact, we expected the positive. In addition, negative impact has the determinant average income per month (-0.039), but we expected the positive.

We were expected that the sign of emission of air pollutants parameter were negative, but it positive. The regions with high level of pollution is rather preferable. We can give the following explanation. For migrants in Russia is more important socio-economic situation in the region, than environmental quality. More polluted regions have more develop industry, so low level unemployment and high level of salary.

As for the given region, the greatest elasticity also has the coefficient of the population number (0.69). Except the population number rather significant is number of physicians, gross regional product per capita, emission of air pollutants, summer temperature. So, at increase by 1% the inflow of migrants can increase by 0.41%; 0.05%; 0.07% and 0.21% respectively.

As for the information and telecommunication infrastructure determinants, their impact is rather low. For the region of arrival, we expect the positive impact on migration flow. The high level of development of information and telecommunication infrastructure causes the high level of migration. We have the opposite result, so our assumptions not confirmed. In our opinion, this result reflect not only the migrants' choice, but most likely depends on the quality of data in this sphere. The FE and RE parameters estimates of the models are quite similar.

In random effects dynamic model all the coefficients of the variable are significant. All the parameters of the model are rather similar to the parameters of the previous models. However, this model includes lagged M_ijt as regressors. The level of the coefficient is low, so if it increase by 1% the inflow of migrants can increase by 0.0000163%. As for initial condition, it impacts is about 0.0024%. The influence of these factors are positive, as we expected.

The p-values of the heteroskedasticity-robust RESET test shows that only the RE model is adequate.

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