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GRAVITY MODEL: ANALYSIS OF FOREIGN TRADE WITHIN THE FRAMEWORK OF INTEGRATION ASSOCIATIONS

For many countries, not excluding Belarus, foreign trade activity plays an important role, being an instrument for acquiring competitiveness and economic viability. The changes continuously taking place in the world economy, connected with integration processes, liberalization of international markets, acceleration of scientific and technological progress, contribute to the process of international globalization. In turn, taking into account the impact of globalization on the economies of countries, at the micro and macro levels, and given the duality of these processes, countries have to analyze the current situation and try to make decisions that would only show positive effects.

Belarus actively participated in the development of the Common Economic Space (CES), the Customs Union, and was a member of the Central Asian Cooperation international organization, which united a number of former Soviet republics. He is currently a member of the Commonwealth of Independent States, the Union State of Russia and Belarus, the Eurasian Economic Community, and the Eurasian Economic Union. The above organizations often pursued various goals, not always coordinated among themselves. This led to a dispersal of efforts and resources [1], which entailed the formation of an ineffective structure of foreign economic activity.

The application of econometric modeling methods allows, to some extent, to empirically study the foreign economic activity of the Republic of Belarus, to identify its strengths and problems in terms of trading partners [2-3], and also check the stability of the interconnections and model parameters under the influence of the ongoing processes of integration and globalization [4]. The study was tasked of assessing the parameters of the gravity model to identify the degree of integration of Belarus with two economic unions, including regarding the assessment of differences between parameters, depending on the union in question. Models evaluation was carried out separately for two samples. The first examined the countries included in the Eurasian Economic Union: Belarus, Russia, Armenia, Kazakhstan and Kyrgyzstan, in the second – countries belonging to the European Union, with the inclusion of Belarus additionally. An analysis of empirical publications based on panel data showed that for Belarus it is possible to receive reliable results and conclusions both when used in a sample of CIS countries and the EU. Most of the publications studied are devoted to the analysis of foreign trade on the basis of the gravity model and other methods [1, 3], but there are other publications devoted to modeling and forecasting propensity to save [5], investment in fixed assets [6], etc.

For an econometric estimation of the gravity model of international trade of the CES member countries, the authors used data on bilateral trade from 2010 to 2018, expressed at the current exchange rate, presented in the databases of national statistical services, the Eurasian Economic Commission and the World Bank [7-8]. The econometric model of regional trade built during the study has the form:

$$ex_{ij,t} = 2.78 + 0.27gdp_{i,t} + 0.23gdp_{j,t} - 0.47r_{ij} + 0.76ex_{ij,t-1} \quad (1)$$

(0.097) (0.000) (0.001) (0.021) (0.000)

where $ex_{ij,t}$ – value volume export from country i to country j , in mln of USD; $gdp_{i,t}$ – GDP of country i (exporter), in mln of USD; $gdp_{j,t}$ – GDP of country j (importer), in mln of USD; r_{ij} – remoteness (distance) between capitals of countries i and j , km. According to the nonlinear relationships of the classical gravity model, all indicators, excluding the dummy variables in (2), were considered in a logarithmic form.

Econometric analysis revealed a significant autocorrelation component in the change in this indicator, which was reflected in equation (1). The coefficient of determination of the regression model (1) based on panel data was 0.902. In parentheses, under the coefficients of the equations, the P-value of the t-statistic of the coefficient estimation is indicated: all model variables are statistically significant.

Based on the second sample, including EU countries, the following econometric model was evaluated:

$$ex_{ij,t} = 0.39 + 0.022gdp_{i,t} + 0.021gdp_{j,t} - 0.063r_{ij} + 0.118f_{EU} +$$

(0.005) (0.000) (0.000) (0.000) (0.000)

$$+ 0.05f_{GR} + 0.95ex_{ij,t-1} \quad (2)$$

(0.002) (0.000)

where f_{GR} – dummy variable corresponding to the presence of common borders between countries i , j ; f_{EU} – dummy variable responsible for a country's joining the European Union. The significant autocorrelation component of the dynamics was taken into account by including the lag value of the simulated indicator in this equation (2). The coefficient of determination of model (2) is 0.99, the model parameter estimates are statistically significant according to the corresponding confidence probabilities

The constructed models (1)-(2) confirm that trade between the countries participating in the Eurasian Economic Union is subject to the general laws of the gravity model. The scale of the economies of partner countries has a positive effect on export volumes, and geographic distance – negative. At the same time, the elasticity coefficients for GDP are higher in the case of considering trade between the CES countries, as well as the elasticity of foreign trade by distance. According to model (2), the inertia of foreign trade is more characteristic of the EU countries. The introduction of dummy variables into model (2) did not significantly affect the above conclusions.

Using models (1)-(2), potential volumes of intra-regional trade were determined: quantitative volumes of exports were determined due to factors included in the model. The tables below show the relationships between the indicators of actual and potential volume of trade for 2018 developed using the constructed models.

This may be due to the economic and political situation in the world and in each of the countries under consideration: falling oil prices, devaluation of the national currency of all participating countries, and a decrease in economic growth rates have affected the volume of trade. And only in 2016 the values of the considered indicator for countries increase, which can be explained by the creation of the EAEU.

The data obtained on the ratio of the actual and potential volumes of exports of the Republic of Belarus to the EU member states show that the country's export potential in 2018 was realized with almost all the countries under consideration. Exceptions are the UK, Netherlands, Sweden and France.

Table 1. The ratio of the actual and potential trade volume of the EAEU member countries in 2018

Exporter	Importer	Ratio	Exporter	Importer	Ratio
Belarus	Russia	98.41%	Russia	Belarus	99.79%
Belarus	Kazakhstan	110.06%	Russia	Kazakhstan	101.07%
Belarus	Kyrgyzstan	119.15%	Russia	Kyrgyzstan	107.72%
Belarus	Armenia	101.00%	Russia	Armenia	101.65%
Kazakhstan	Russia	100.36%	Kyrgyzstan	Russia	108.63%
Kazakhstan	Belarus	98.15%	Kyrgyzstan	Kazakhstan	103.60%
Kazakhstan	Kyrgyzstan	107.91%	Kyrgyzstan	Belarus	140.54%
Kazakhstan	Armenia	76.14%	Armenia	Belarus	106.83%
Armenia	Russia	103.13%	Armenia	Kazakhstan	120.10%

Source: Own estimation.

The authors also built various versions of gravity models to study the impact of integration processes in the EAEU on the value of foreign trade potentials. For the study, the values of the potentials of Belarus's export to Russia were chosen, as the most capacious market of the EAEU, the use of various specifications was supposed to ensure the stability of the results with respect to changes in data and the model specification. The analysis showed that periods of potential growth fall on 2011-2015 or 2015-2017, depending on sample and the specification. Obviously, the first is evidence of the beginning of the implementation of the agreements that arose during the creation of the Customs Union and the coordination of the development of the Eurasian Economic Union on the basis of the Common Economic Space of Belarus, Kazakhstan and Russia.

Table 2. The ratio of actual and potential trade volume of the Republic of Belarus with the EU member states in 2015-2018

Exporter	Importer	2015	2016	2017	2018
Belarus	Poland	100.51%	99.60%	100.95%	101.03%
Belarus	Belgium	96.82%	99.58%	100.90%	100.79%
Belarus	Bulgaria	101.42%	97.92%	98.75%	104.88%
Belarus	United Kingdom	96.04%	99.92%	100.39%	99.72%
Belarus	Germany	101.25%	97.81%	100.01%	100.54%
Belarus	Italy	98.45%	97.14%	99.29%	100.08%
Belarus	Latvia	99.39%	97.42%	100.96%	100.98%
Belarus	Lithuania	100.43%	98.55%	99.40%	100.28%
Belarus	Netherlands	101.37%	100.55%	98.66%	99.65%
Belarus	Czech Republic	100.70%	98.20%	103.72%	101.79%
Belarus	Sweden	99.96%	98.10%	100.95%	99.98%
Belarus	France	97.03%	90.26%	100.90%	97.90%

Source: Own estimation.

The second period is directly related to the integration processes in the EAEU. Starting in 2015, the negative export trends of the slowdown in economic growth began to reflect on the export potential of Belarus. Similar conclusions for the period 2016-2017 can be obtained when considering the export potentials of Armenia (not a member of the CU, but a member of the EAEU from January 2, 2015) to Russia.

It can be concluded that the export potential of the Republic of Belarus to the EAEU and EU countries is fully realized. At the same time, in recent years, the trend of negative foreign trade balance has been maintained. On the one hand, a country can solve this problem by increasing export volumes (one cannot but take into account that the potential has been realized for almost all trading partners). For this, it is necessary to maintain the competitiveness of belarusian goods, increase the country's scientific and technological potential, and increase the level of integration of the country into international unions. On the other hand, it may be necessary to review the import substitution program taking into account current trends and make appropriate adjustments.

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МЕТОДИ ОЦІНЮВАННЯ ТА ВИЯВЛЕННЯ ТІНЬОВОЇ ЕКОНОМІКИ

Тіньову економіку можна описати як: «Економічна діяльність та прибуток отримуваний від неї, що обходить або уникає державного регулювання, податків, спостереження» [1]. Досліджуючи причини утворення тіньової економіки, можна не повторити цих помилок в майбутньому та дізнатися, які сфери суспільного життя необхідно поліпшити, проте для вже існуючої тіньової економіки існують методи виміру та встановлення рівня тіньової економіки в країні. Підходи до оцінювання тіньової економіки діляться на два типи:

- Мікрометоди (різниця між реальною та офіційною економічною діяльністю показує рівень тіньової економіки);