MODELLING OF EQUILIBRIUM ECONOMIC DYNAMICS IN GLOBAL SYSTEM OF EXPORT-IMPORT COOPERATION

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Abstract

Based on statistical signify dependence import from volume gross domestic product, are build the model of correlated increase balanced indicators gross domestic product, is constructed multifactor multiplication of acceleration economical dynamics country-partners dynamics in the global system of international cooperation. The proposed methodology of modeling and assessment of indicators of economic equilibrium dynamics tested evidence functioning of the economies of Belarus, the Russian Federation and Ukraine for 2000-2010.

1 Introduction

Now before national economy there is a problem of ensuring sustained economic growth in the conditions of limited internal possibilities of the country [1]. At the present stage sustainable dynamic development of economy of Republic of Belarus can be provided at the expense of attraction of resources from the outside and developments of the export-import economic relations[2]. In the conditions of the multilateral economic relations the total amount of export of the country (1) is equal to an aggregative indicator of an import of the partner countries, i.e. the amount of an import of the countries (2), (3), , (n). In turn, an import of the country (1) is equal to the amount of export sales of the countries (2), (3)..., (n) to the country (1). As factors of import volume of the partner countries on economic cooperation their indicators of physical amount of gross domestic product are other things being equal hypothetically accepted.

2 Modeling of the multilateral intercountry export-import relations

Within the formulated problem definition development of the equations of regression of the Belarusian import $M_{12}(t), M_{13}(t), M_{1n}(t)$ the goods and services from other countries (the second interlinear figure - sequence number of the country of the exporter of the goods to Republic of Belarus) on amount of gross domestic product of Republic of Belarus $X_1(t)$ is necessary. Export of the Belarusian goods and services to other countries of the world, i.e., $E_{12}, E_{13}(t) ... E_{1n}(t)$ it is equivalent it is equal to an import of these countries from Republic of Belarus $M_{21}, M_{31}(t) ... M_{n1}(t)$ it is modeled depending on amount of gross domestic product of these countries: $X_2, X_3(t) ... X_n(t)$.

The equations are developed on initial indicators in real terms some basic period in currency of one of the countries or in US dollars. In developing a model of multilateral economic relations between countries entered the indicator "Gross domestic expenditure." Gross domestic expenditure in authoring is designed as the difference between gross domestic product and net exports, and its composition is the sum of final consumption expenditure and gross value of consolidated investments in fixed assets and an increase in inventories. With the regression of gross domestic expenditure on gross domestic product of each country are estimated equilibrium values of gross domestic expenditure , which are accepted as a starting point for modeling the gross domestic product $\chi_1^e, \chi_2^e ... \chi_n^e$ of each of the partner-countries with the import and export functions. In a general view they accept the following form of the expression: For gross domestic product of the country (1), for example, Republic of Belarus (1):

$$X_1(t) = \chi_1^e + [M_{21}(t) - M_{12}(t)] + [M_{31}(t) - M_{13}(t)] + ... + [M_{n1}(t) - M_{1n}(t)]$$

for gross domestic product of the country (n) (2):

$$X_n(t) = \chi_n^e + [M_{n1}(t) - M_{1n}(t)] + [M_{n2}(t) - M_{2n}(t)] + ... + [M_{n.n-1}(t) - M_{n-1.n}(t)]$$

Functions of an import of the partner countries are provided by the equations of regression of their import purchases on physical amount of indicators of gross domestic product. So, for Republic of Belarus (the country (1)) we will have n of the equations of import purchases (3;4):

$$M_{12}(t) = m_{12} + k_{12} X_1(t)$$

$$M_{1n}(t) = m_{1n} + k_{1n} X_1(t)$$

By analogy it is required to develop the same quantity of the equations of export sales of Republic of Belarus [the countries (1)] in each of the countries - partners and on their basis to receive the estimated values of their import purchases of the Belarusian goods $M_{21}(t), M_{31}(t), ... M_{n1}(t)$:

in case of (5;6)

$$M_{21}(t) = m_{21} + k_{21} X_2(t)$$

$$M_{n1}(t) = m_{n1} + k_{n1} X_n(t)$$

where $m_{ij}, k_{ij} - parametersofthedynamicequationsofregression.$

By substitution of functions (3) - (6) in the equation (1) we receive the equation of gross domestic product of the country (1) taking into account parameters of economic development of the partner countries (7):

$$X_1(t) = \chi_1^e + [M_{21}(t) - M_{12}(t)] + [M_{31}(t) - M_{13}(t)] + ... + [M_{n1}(t) - M_{1n}(t)] = \chi_1^e +$$

$$+ [m_{21} + k_{21}X_2(t) - m_{12} - k_{12}X_1(t)] + [m_{31} + k_{31}X_3(t) - m_{13} - k_{13}X_1(t)] + ... +$$

$$+ [m_{n1} + k_{n1}X_n(t) - m_{1n} - k_{1n}X_1(t)].$$

As a result of disclosure of brackets and transfer of the similar members containing a variable, on the left side we receive (8):

$$X_1(t) + k_{12}X_1(t) + k_{13}X_1(t) + ... + k_{1n}X_1(t) = (\chi_1^e + m_{21} - m_{12} + m_{31} - m_{13} + ... +$$

$$+ m_{n1} - m_{1n} + k_{21}X_2(t) + k_{31}X_3(t) + ... + k_{n1}X_n(t)$$

in case of (8):

$$A_1 = \chi_1^e + m_{21} - m_{12} + m_{31} - m_{13} + m_{n1} - m_{1n}.$$

From the equation (8) we find the estimated value of the productive $X_1(t)$variable. In case of $(1 + k_{12} + k_{13} + k_{1n})$it will constitute (9):

$$X_1(t) = \frac{A_1}{\phi} + \frac{k_{21}}{\phi}X_2 + \frac{k_{31}}{\phi}X_3 + ... + \frac{k_{n1}}{\phi}X_n = A_1^* + \frac{k_{21}^*}{\phi}X_2 + \frac{k_{31}^*}{\phi}X_3 + ... + \frac{k_{n1}^*}{\phi}X_n$$

On the content the equation (9) represents the equation of regression of gross domestic product of the country (1) on indicators of gross domestic product of global system of intercountry economic cooperation. Its parameters, however, are estimated not on simple regression. The equation of regression (9), apparently, is synthesis of system of the equations (1) - (8). Free term A_1^* of the equation (9) is formed as the sum of the equilibrium value of gross domestic expenditure and independent estimates of GDP net exports (1).

By analogy to the equation (9) development of $n-1$ of the equations of regression of indicators of gross domestic product with reference to other countries of global system of intercountry cooperation matters. In total n of the equations represent system of the equations. It is stated below at number (10):

$$X_1(t) = A_1^* + k_{21}^*X_2(t) + k_{31}^*X_3(t) + ... + k_{n1}^*X_n(t)$$

$$X_n(t) = A_n^* + k_{1n}^*X_1(t) + k_{2n}^*X_2(t) + ... + k_{nn-1}^*X_n(t)$$

After transfer of members of the equations containing explaining variables, on the left side the system (10) will be transformed in (11):

$$1 \cdot X_1(t) - k_{21}^*X_2(t) - k_{31}^*X_3(t) - ... - k_{n1}^*X_n(t) = A_1^*$$

$$-k_{1n}^*X_1(t) - k_{2n}^*X_2(t) - k_{3n}^*X_3(t) + 1 \cdot X_n(t) = A_n^*$$

The received system in a matrix form of representation will register (12):

$$\begin{bmatrix} 1-k_{21}^*-k_{31}^*-...-k_{n1}^* \\ -k_{12}^*+1-k_{32}^*-...-k_{n2}^* \\ -k_{13}^*-k_{23}^*+1-...-k_{n3}^* \\ ..... \\ -k_{1n}^*-k_{2n}^*-k_{3n}^*-...-1 \end{bmatrix} \cdot \begin{bmatrix} X_1(t) \\ X_2(t) \\ X_3(t) \\ .... \\ X_n(t) \end{bmatrix} = \begin{bmatrix} A_1^* \\ A_2^* \\ A_3^* \\ ... \\ A_n^* \end{bmatrix}$$

or the reduced form of a matrix notation(12a):

$$C \cdot X(t) = A.$$

3 Assessment of equilibrium values of gross domestic product of the partner-countries

The decision of system (12) the joint animator amplifier of economic dynamics of the partner countries allows to receive and to find equilibrium values of their indicators of gross domestic product. For the decision of system (12) it is necessary to perform search of a return matrix C^{-1}. The return matrix $C^{-1}$is used for an assessment of equilibrium values of gross domestic product $X(t)$intercountry economic cooperation by means of the system (13) decision:

$$X = C^{-1} \cdot A,$$

where C^{-1} - a return matrix of C.

Algorithms of estimation of the equilibrium values of GDP, as well as the author's search for joint multiplier equilibrium values of the gross domestic product of the partner countries are deployed and analytically presented in the report.

4 Concluding remarks

Scientific novelty and practical value of equilibrium estimates of parameters of functions of the Belarusian commodity export and services to other countries and the Belarusian import purchases of the goods and services consists in an analytical assessment and transfer of parameters of economic cooperation of the partner countries to a point of new equilibrium values. The offered algorithms represent tools of analytical regulation of parameters of economic dynamics of the cooperating countries with an exit to new points of economic equilibrium as target standard rates of economic development.

References

[1] National strategy for sustainable Socio-Economic Development of the Republic of Belarus for the period up to 2020 [electronic resource] / - Mode of access: economy.gov.by. Date of access: 20.12.2012. (in Russian)