“The place and perspectives of Ukraine in international integration space”

AUTHORS	Vitalina Babenko https://orcid.org/0000-0002-4816-4579 http://www.researcherid.com/rid/E-6521-2018 Maryna Pasmor http://orcid.org/0000-0002-3788-5688 Juliia Pankova Mykhailo Sidorov

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Vitalina Babenko (Ukraine), Maryna Pasmor (Ukraine), Juliia Pankova (Ukraine), Mykhailo Sidorov (Ukraine)

The place and perspectives of Ukraine in international integration space

Abstract

The resulting indexes for integration processes state development analysis were formed. The integral indexes illustrating integration state were calculated on the basis of member countries of BRICS and Ukraine. It provided the possibility to evaluate socioeconomic state of the countries from the point of view of international integration and create integration processes development scenarios. The strategic directions of integration processes development for Ukraine and member countries of BRICS were formed.

Keywords: integration processes, international integration space, BRICS, the system of basis parameters, forecasting.
JEL Classification: J15, C53.

Problem statement

Socioeconomic and political processes that take place in Ukraine need implementation of approaches towards the integration into world economic space, in particular on the basis of international integration processes scenarios forecasting. In this regard, the relations between Ukraine and other countries are rather interesting. We will learn the relations with the countries of BRICS. The creation of integration union BRICS (Brazil, Russia, India, China and South Africa) initiated in 2006 was one of the greatest geopolitical events at the beginning of new century. In a short period of time, the association was able to become noticeable in world policy. That is why the question of integration of Ukraine and member countries of BRICS gains significance, and the change of positions of these countries witnesses about the importance of development scenarios forecasting.

Analysis of recent researches and publications. For today, great attention is paid to the learning of integration processes with the use of mathematic instrumentarium. Thus, Jim O'Neill conducted an expert analysis of comparing statistics on member countries of BRICS modern level of development, economic possibilities and perspectives of union countries integration and behind its borders [1]. S. Kozmenko, T. Savchenko, D. Kazarinov researched the question of integration of economies in different regions in the case of financial convergence of Ukraine with separate countries of post-Soviet space and basic sales partners of Eurozone [2]. A. Spitsyn researches the national economies importance question in the case of CIS and efficiency of their development on the basis of tackling global and regional integration questions [3]. B. Kheyfets examines the range of questions concerning the development of integration processes of BRICS union and Russia by widening of mutual trade, production, scientific and technical cooperation and development of economic relations, which produce synergy effect. The researcher proposed to concentrate efforts in terms of integration in strategic perspective on the basis of investment interaction between countries [4].

Many researchers are interested in applied aspect of economic and mathematic modeling of economic and integration processes. Thus, in the works of O. Dubrov, V. Mkhitarian, L. Troshyn [5], V. Ponomarenko and L. Maliarets [6], the measure of object features in economics and data analysis with the use of multivariate statistical methods is conducted. The theme of forecasting the results of integration processes is discussed in the publications of O. Michurina [7], the problems of development, analysis and choice of integration scenarios are highlighted in the works of O. Anisimov, O. Shyrov [8] and I. Burhanov [9], A. Matsumura researches the problems of regional integration on the basis of ecological goods trade [10], E. Latoszek, I.E. Kotowska, A.Z. Nowak, A. Stępniak analyzed the European integration process under new regional and global conditions [11], P. Robson conducted the research of economic component of international integration [12], R. Gilpin examines the question of global political 8 development process. It includes the determination of indexes list, which may serve as indicators for evaluation of state and perspectives of integration development; approaches to the analysis of development of integration processes in international integration space – system, cluster, factor; regression analysis for constructing the trends of economic character; comparative analysis for comparing socioeconomic level of development in different countries of the world and their integration unions and so on.

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Vitalina Babenko, Doctor of Economic Sciences, Candidate of Technical Sciences, Professor of the Department of International Business and Economic Theory, V.N. Karazin Kharkiv National University, Ukraine
Maryna Pasmor, Candidate of Economic Sciences, Lecturer of International Economy Department, V.N. Karazin Kharkiv National University, Ukraine.
Juliia Pankova, Lecturer of International Economy Department, V.N. Karazin Kharkiv National University, Ukraine.
Mykhailo Sidorov, Ph.D. Candidate of International Economy Department, Lecturer of the Department of Travel Business, V.N. Karazin Kharkiv National University, Ukraine.

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At the same time, the question of forecasting of international integration is actual, which creates the basis for taking decisions on the choice of vector of international economic activity of Ukraine.

The aim of the paper is the research of integration processes dynamics and forecasting of integration scenarios into international space in the case of Ukraine and member countries of BRICS union.

The findings of research. With the aim of forecasting there should be made the procedure of choice of international integration evaluation of basis indexes. Analysis of methodic approaches to the efficiency evaluation of integration processes lets to determine main components, which are characterized by macroeconomic indexes of socioeconomic state of member countries of integration unions [14]. On the basis of annual accounts, statistics digests for 2015 and official internet resources that include key socioeconomic data on member countries of BRICS and Ukraine [15-19], the system of macroeconomic indexes was formed (Table 1).

Table 1. The list of indexes characterizing socioeconomic state of countries in terms of integration processes

№	Name of index	Index symbol	Measurement units
Index components of national accounts			
1.	GDP	y_1	In current prices/bln US dollars
2.	GDP per capita	y_2	In current prices/bln US dollars
3.	Growth rate of GDP	y_3	% rate till the previous year
Consumer prices index in comparison with previous year			
4.	Consumer prices index	y_4	% rate till the previous year
Components characterizing industry of the country			
5.	Industrial production indexes	y_5	% rate till the previous year
6.	Energy production	y_6	bln. kWh
Components related to the basic industrial products production			
7.	Natural gas production	y_7	mln. t
8.	Coal production	y_8	mln. m^3
9.	Iron ore production	y_9	mln. t
10.	Steel	y_{10}	1 000 t
11.	Cars	y_{11}	1 000 pc.
12.	Household refrigerators	y_{12}	1 000 pc.
13.	TV sets	y_{13}	1 000 pc.
14.	Mobile communication products	y_{14}	1 000 pc.
15.	Household washing machines	y_{15}	1 000 pc.
16.	Mineral fertilizers	y_{16}	1 000 t
17.	Timber	y_{17}	1 000 m^3
18.	Paper and cardboard	y_{18}	mln. t
19.	Cement	y_{19}	1 000 t
20.	Cotton fabrics	y_{20}	mln. m^2
21.	Wool fabric	y_{21}	1 000 pc.
22.	Footwear	y_{22}	ths. pair
Components characterizing energy of the country			
23.	Total production of primary energy	y_{23}	mln. t a.e.
24.	Total energy consumption	y_{24}	mln. t a.e.
25.	Energy consumption per capita	y_{25}	kg a.e.
26.	Energy export	y_{26}	mln. kWh
27.	Energy import	y_{27}	mln. kWh
28.	Energy consumption	y_{28}	mln. kWh
Components characterizing agriculture			
29.	Grains production	y_{29}	mln. t
30.	Meat production	y_{30}	ths. t
Components characterizing main agricultural products production			
31.	Soy	y_{31}	ths. t
32.	Sugar cane	y_{32}	ths. t
33.	Wheat	y_{33}	ths. t
34.	Cotton	y_{34}	ths. t
35.	Oil crop	y_{35}	ths. t
36.	Turnip	y_{36}	ths. t
37.	Sunflower	y_{37}	ths. t
38.	Potato	y_{38}	ths. t

Table 1 (cont.). The list of indexes characterizing socioeconomic state of countries in terms of integration processes

№	Name of index	Index symbol	Measurement units
39.	Sugar beet	y_{39}	ths. t
40.	Tobacco	y_{40}	ths. t
41.	Fruit	y_{41}	ths. t
42.	Cattle	y_{42}	ths. animal units
43.	Sheep and goats	y_{43}	ths. animal units
44.	Milk production	y_{44}	ths. t
45.	Poultry eggs	y_{45}	mln. pc.
Components of society informativeness			
46.	Quantity of internet users per 1000 inhabitants	y_{46}	quantity
Components characterizing finance of the country			
47.	The structure of consolidated budget expenditures on education	y_{47}	%
48.	The structure of consolidated budget expenditures on science, technologies and information technologies	y_{48}	%
Components characterizing international relations of the country			
49.	The cost of import and export of products and commercial services	y_{49}	bln US dollars
50.	The cost of import of products and commercial services	y_{50}	bln US dollars
51.	The cost of export of products and commercial services	y_{51}	bln US dollars
52.	Surplus (+) / deficit (-) of current account in % to GDP	y_{52}	%
53.	Export and import products and commercial services correlation	y_{53}	%
54.	Export and import products correlation	y_{54}	%
55.	The inflow of foreign direct investments	y_{55}	bln US dollars
56.	The outflow of foreign direct investments	y_{56}	bln US dollars
57.	Foreign exchange reserves	y_{57}	bln US dollars
58.	External debt in % to GDP	y_{58}	%

With the help of defined components, complex socioeconomic characteristics on the case of Ukraine and BRICS countries were formed on the basis of annual statistics data for 2000, 2006-2015. Thus, we got the matrix of indexes 55x58 in size.

The next stage is the formation of socioeconomic development scenarios on the basis of quantitative components research that influence the process of their integration. To achieve this, the correlation analysis of indexes [20] is made with the help of Statgraphics program package (the case of integration union BRICS). For further analytical indexes research, there should be found multicolinear relations and such indexes linearly connected with other indexes should be excluded from the system [5].

As the next step of research factor analysis will be made, to shorten the index systems that will be related to factor features [6] in general system of indexes characterizing socioeconomic state of countries, and energy production index should be excluded. Similarly interrelated were found the indexes from the component of main kinds of industrial production, in particular: production indexes of iron ore, steel, production of cars, TV sets, production for mobile communication, mineral fertilizers, paper and cardboard, as well as footwear, then, we exclude them from the general indexes system. After using correlation analysis, the system of 58 indexes was shortened to 37 indexes, which also characterize socioeconomic state of countries in international integration space (Table 2).

Table 2. Integration processes development system, the case of BRICS countries

№	The name of index	Index symbol	Measurement units
Index components of national accounts of BRICS countries			
1.	Gross domestic product (GDP)	y_1	In current prices/bln US dollars
2.	GDP per capita	y_2	In current prices/bln US dollars
3.	GDP growth rates	y_3	% rate till the previous year
Consumer prices index in comparison with previous year in BRICS countries			
	Consumer prices indexes	y_4	% rate till the previous year
Component characterizing industry in BRICS countries			
4.	Industrial production indexes	y_5	% rate till the previous year
Components related to the basic industrial products production in BRICS countries			
5.	Natural gas production	y_7	mln. t
6.	Coal production	y_8	mln. m^3
7.	Household refrigerators	y_{12}	1 000 pc.
8.	Household washing machines	y_{15}	1 000 pc.

Table 2 (cont.). Integration processes development system, the case of BRICS countries

№	The name of index	Index symbol	Measurement units
9.	Timber	y_{17}	1 000 m^3
10.	Cement	y_{19}	1 000 t
11.	Cotton fabrics	y_{20}	mln. m^2
12.	Wool fabrics	y_{21}	1 000 pc.
Components characterizing energy in BRICS countries			
13.	Total production of primary energy	y_{23}	mln. t a.e.
14.	Energy consumption per capita	y_{25}	kg a.e.
15.	Energy export	y_{26}	mln. kWh
16.	Energy import	y_{27}	mln. kWh
Components characterizing agriculture of BRICS countries			
17.	Grains production	y_{29}	mln. t
18.	Meat production	y_{30}	ths. t
Components characterizing main agricultural products production			
19.	Sugar cane	y_{32}	ths. t
20.	Wheat	y_{33}	ths. t
21.	Cotton	y_{34}	ths. t
22.	Oil crop	y_{35}	ths. t
23.	Sunflower	y_{37}	ths. t
24.	Potato	y_{38}	ths. t
25.	Sugar beet	y_{39}	ths. t
26.	Cattle	y_{42}	ths. animal units
27.	Milk production	y_{44}	ths. t
28.	Poultry eggs	y_{45}	mln. pc.
Components of society informativeness in BRICS countries			
29.	Quantity of internet users per 1000 inhabitants	y_{46}	quantity
Components characterizing finance of the country in BRICS countries			
30.	The structure of consolidated budget expenditures on education	y_{47}	%
31.	The structure of consolidated budget expenditures on science, technologies and information technologies	y_{48}	%
Components characterizing international relations in BRICS countries			
32.	Surplus (+) / deficit (-) of current account in % to GDP	y_{52}	%
33.	Export and import products and commercial services correlation	y_{53}	%
34.	Export and import products correlation	y_{54}	%
35.	The outflow of foreign direct investments	y_{56}	bln US dollars
36.	External debt in % to GDP	y_{58}	%

On the next stage of research, to define the factors influencing the development of integration processes, the method of multivariate statistical analysis – factor analysis should be used. This analysis is meant for finding and quantitative description of generalizing characteristics, which are latent factors and describe enough the whole range of output and resulting indexes. It gives the possibility to determine the development law of integration processes and mechanisms of their inner relations [21].

On the basis of Statgraphics Centurion statistics package use latent factors, which characterize socioeconomic development of countries in each component were determined [22].

On the basis of factor analysis, it would be right to make the influence ranking of each from 37 interrelated indexes, which characterize integration processes, and find the most significant from them. It let to get the most influential index (latent factor), with the help of which development scenarios of integration processes are formed. That is why we will use it for further researches and determine it as a factor characterizing complex changes in integration processes. Its mathematical model has the following view:

$$\begin{aligned} F = {} & 0.0451y_1 + 0.5002y_2 - 0.2553y_3 + 0.4099y_4 - 0.0914y_5 - 0.0283y_7 + 0.9785y_8 - \\ & - 0.1467y_{12} - 0.1441y_{15} + 0.2566y_{17} + 0.4652y_{19} - 0.2492y_{20} - 0.3362y_{21} + 0.8451y_{23} - \\ & - 0.16y_{25} - 0.2527y_{26} - 0.517y_{27} - 0.0834y_{29} - 0.0995y_{30} + 0.1585y_{32} + 0.9414y_{33} - \\ & 0.3166y_{34} + 0.962391y_{35} + 0.9635y_{37} + 0.4764y_{38} + 0.9607y_{39} - 0.5342y_{42} - 0.122y_{44} + \\ & + 0.0693y_{45} + 0.4651y_{46} + 0.2039y_{47} + 0.8746y_{48} + + 0.5726y_{52} + 0.6991y_{53} + 0.6906y_{54} + \\ & + 0.3251y_{56} + 0.5318y_{58} \end{aligned} \quad (1)$$

Let's analyze the weigh coefficients of the indexes in (1). Leaving just the most significant from them, that is those that have factor loadings more than 0.5, we will get the basis of resultative (basis) indexes that complexly characterize integration development: y_2 – GDP per capita (in current prices/bln US dollars), y_8 – coal production (mln. m^3), y_{23} – total production of primary energy (mln. t a.e.), y_{27} – energy import (mln. kWh), y_{33} – wheat production (ths. t), y_{35} – oil crop production (ths. t), y_{37} – sunflower production (ths. t), y_{39} – sugar beet production (ths t), y_{42} – cattle (ths. animal units), y_{48} – the structure of consolidated budget expenditures on science, technologies and information technologies (%), y_{52} – surplus (+) / deficit (-) of current account in % to GDP (%), y_{53} – export and import products and commercial services correlation (%), y_{54} – export and import products correlation (%), y_{58} – external debt in % to GDP (%).

Received results give the possibility to execute the following research stage that is – forecasting of determined basis indexes that complexly characterize the development of integration processes of the countries. It is, in its turn, the basis for the finishing stage – taking decisions on strategic directions of development. Thus, the determined latent factor of development of integration processes should be taken as a basis for forecasting and construction of integration development strategies of researched countries. For forecasting development, the forecasting models are used, in particular – growth curves [6].

Thus, first, we got the growth curve equation for the basis indexes forecasting meanings that describe integration processes of Brazil (Table 3).

Table 3. Growth curve equation of socioeconomic development indexes of Brazil

Growth curves equation	Determination coefficient (R^2)	Fisher coefficient (F)	Darbin-Watson coefficient (DW)
$y_2 = \exp(8.17094 + 0.5451\ln(t))$	0.9489	167.24	1.3622
$y_8 = \text{sqrt}(1.4388 \cdot 10^8 + 0.5987 \cdot 10^8 \cdot t)$	0.9459	157.31	1.8104
$y_{23} = 1/(3.6 \cdot 10^{-3} + 3 \cdot 10^{-3}/t)$	0.9893	230.61.	1.3892
$y_{27} = \text{sqrt}(1.544 \cdot 10^9 + 3.701 \cdot 10^8/t)$	0.3153	4.15	1.84047
$y_{33} = 1/(0.13 \cdot 10^{-3} + 0.4 \cdot 10^{-3}/t)$	0.7656	29.4	2.9503
$y_{35} = \exp(7.6865 + 0.6074\text{sqrt}(t))$	0.9382	136.65	3.0758
$y_{37} = (44.8133 + 14.7625\text{sqrt}(t))^2$	0.8675	58.94	2.40329
$y_{39} = \text{sqrt}(2.6558 - 3.7721 \cdot 10^5 t^2)$	0.0172	0.16	1.7633
$y_{42} = 18.9181 \cdot 10^4 + 0.2523 \cdot 10^4 t$	0.4725	8.06	1.6991
$y_{48} = 1/(1.6899 + 0.806/t)$	0.5106	9.39	2.584
$y_{52} = -0.2096 - 0.032t^2$	0.4461	7.25	1.6296
$y_{53} = 1/(86 \cdot 10^{-4} + 0.38 \cdot 10^{-4} t^2)$	0.5496	10.98	1.6738
$y_{54} = 1/(76 \cdot 10^{-4} + 0.2 \cdot 10^{-4} t^2)$	0.4113	6.29	1.6738
$y_{58} = 9.2752 + 25.0584/t$	0.8982	79.36	0.7263

All constructed growth curves have relevant statistic quality. It is confirmed by the meanings of determination coefficient (R^2), Fisher statistics (F) and Durbin-Watson statistics (DW). The explanation of relevant statistical quality level of developed models is the fact that almost all of them have significant coefficients of equations in Student's t-criteria and adequately describe the process, which confirms Fisher statistics, have enough meanings of determination coefficients, and Durbin-Watson criteria proves the availability of autocorrelation surplus which negatively influences the forecasting abilities of the models. But consequent forecasting will provide us with relevantly true forecasting meanings [22].

With the help of provided growth curves equations with the use of Statgraphics Centurion program package [20], forecasting meanings of basis indexes were calculated for three year perspective period for Brazil (Table 4).

Table 4. Forecasting meanings of indexes of socioeconomic state of Brazil

Indexes	The first forecasting period	The second forecasting period	The third forecasting period	Tendency: increasing (↑), decreasing (↓)
y_2 – GDP per capita (In current prices/bln US dollars)	13705.7	14317.0	14907.2	↑
y_8 – coal production (mln. m3)	29364.2	30366.4	31336.6	↑
y_{23} – total production of primary energy (mln. t a.e.)	260.068	261.355	262.468	↑
y_{27} – energy import (mln. kWh)	39677.9	39648.0	39622.3	↓
y_{33} – wheat production (ths t)	6060.55	6161.68	6251.08	↑
y_{42} – cattle (ths. animal units)	219454	221977	224500	↑
y_{48} – the structure of consolidated budget expenditures on science, technologies and information technologies (%)	0.569105	0.570783	0.572229	↑

Table 4 (cont.). Forecasting meanings of indexes of socioeconomic state of Brazil

Indexes	The first forecasting period	The second forecasting period	The third forecasting period	Tendency: increasing (↑), decreasing (↓)
y_{52} – surplus (+) / deficit (-) of current account in % to GDP (%)	-4.81819	-5.61829	-6.48239	↓
y_{54} – export and import products correlation (%)	93.7483	89.3499	85.0408	↓
y_{53} – export and import products and commercial services correlation (%)	78.9404	74.7972	70.7849	↓
y_{58} – external debt in % to GDP (%)	11.3634	11.2027	11.065	↓

Let's analyze calculated forecasting meanings from Table 4. In spite of among all growth curves indexes for Brazil, only the equation describing cattle production is linear, we find firm tendencies in increase or decrease of researched indexes. Thus, have increasing tendency within 5% annually the GDP and coal production indexes have overall. Production volume of primary energy also increases, but approximately over 0.5% annually. Energy import is lessening each year in the forecast, which characterizes economic instability in the country. The forecast shows wheat production increases over 1-1.2% annually, cattle production also has rather significant growth rates - up to 10%.

As we can see, Brazil in not engaged in the production of oil crop, sunflower and sugar beet. That is why the integration with Ukraine in terms of export deliveries of these raw materials is useful for Brazil. In terms of Ukraine, it will get larger risk if it makes products from producing sunflower and other oil crop, as well as sugar beet. Processing products export from the defined kinds of agricultural raw materials will give the Ukrainian economy rather larger profit by adding value for the appropriate products. The index related to the structure of consolidated budget expenditures on science, technologies and information technologies also demonstrates increasing tendency. The deficit of current account operations is on the contrary, lessening. Indexes related to export import correlation have the same tendency. Approximately over 2% of each year forecasting the foreign debt of Brazil is lessening.

Conducted analysis of forecasting indexes shows that in next three years economic state of Brazil will get better and economy of this country has clear tendency for development. Also the analysis of types of export deliveries of this country found possibilities for cooperation with Ukraine, in particular, product positions on the basis of vegetable oil and derivatives from oil crop, as well as sugar and other food products on the basis of raw material from sugar beet.

To prove the received finding according to the development of integration processes of Ukraine and Brazil may be possible on the next stages of integral index calculation, which characterizes socioeconomic state of these countries and the development of their integration, as well as graphic interpretation of received results.

Similarly the growth curves equations for the forecast of indexes meanings for Russia, India, China and South Africa were found, as well as forecasting indexes meanings characterizing development of international integration for these countries for three years forecasting period were also found.

Due to received growth curves of these indexes for Russia, we will determine their forecasting meanings for the next three forecasting periods (Table 5).

Table 5. Forecasting meanings of indexes of socioeconomic state of Russia

Indexes	The first forecasting period	The second forecasting period	The third forecasting period	Tendency: increasing (↑), decreasing (↓)
y_2	13349.8	13543.0	13710.7	↑
y_8	655256.	655685.	656053.	↑
y_{23}	2784.94	2821.16	2859.76	↑
y_{27}	11.3709	12.0906	12.8226	↑
y_{33}	52814.5	52989.1	53139.6	↑
y_{35}	15349.6	16445.6	17552.6	↑
y_{37}	8104.82	8163.08	8213.69	↑
y_{39}	35946.6	36334.7	36674.1	↑
y_{42}	19662.1	19614.3	19573.3	↓
y_{48}	8.54607	8.43345	8.31511	↓
y_{53}	132.317	131.826	131.403	↓
y_{54}	152.819	152.109	151.497	↓
y_{58}	33.1357	33.1227	33.1116	↓

Let's analyze the forecasting meanings of socioeconomic state of Russia, which influence the development process of its integration. The forecast showed GDP per capita is increasing up to 2% annually, the

subtle tendency towards growth also has coal production. The overall volume of primary energy production also increases in between 2%. The index related to energy import also demonstrates subtle rates of growth, which shows the lack of own energy sources. Wheat production is growing in lesser volumes (near 0.2%). Production volumes of oil crop demonstrate larger growth rates – up to 10% annually. That is why the growing tendency of sunflower production looks naturally. The sugar beet production forecasting indexes meanings are increasing for about 1%.

All other indexes that demonstrate socioeconomic state in terms of integration for a three year period forecast of Russia, have subtle decreasing tendency. They include the following indexes, as cattle production (less than 1%), the structure of consolidated budget expenditures for science, technology and IT (up to 1%), export, import of products correlation (0.7-1%). External debt to GDP of Russia index has though not significant, but decreasing tendency.

On the basis of modeled growth curves of main indexes of socioeconomic state of India, which characterize the development of its integration in international integration space, we forecasted the meanings of these indexes for India (Table 6).

Table 6. Forecasting meanings of indexes of socioeconomic state of India

Indexes	The first forecasting period	The second forecasting period	The third forecasting period	Tendency: increasing (↑), decreasing (↓)
y_2	1528.81	1553.97	1576.21	↑
y_8	40355.5	40481.5	40590.1	↑
y_{23}	344.498	350.407	355.969	↑
y_{27}	5601.11	5624.74	5647.38	↑
y_{42}	194136	194203	194260	↑
y_{48}	0.70975	0.711236	0.712515	↑
y_{52}	-3.19591	-3.2851	-3.36767	↓
y_{53}	82.6437	82.5678	82.5026	↓
y_{54}	62.7686	62.5829	62.4233	↓
y_{58}	22.7003	23.4084	24.1498	↑

Analysis of forecasting meanings of main macroeconomic indexes of India for a three year forecast period showed the coal production, overall volume of primary energy production, energy import and cattle production have increasing tendency. The deficit of current account operations to GDP, export and import of products and commercial services are lessening, but the correlation of external debt to GDP is growing up to 5% annually. GDP per capita index has growing tendency about 2% annually, similar to the index "the structure of consolidated budget expenditures for science, technology and information technologies".

Such product positions of some kinds of agricultural raw materials – wheat, sunflower, and other oil crops, as well as sugar beet, are not presented by India on international trade markets. That is why the production of such crops, as well as products on the basis of these kinds of agricultural raw material for further export is perspective for Ukraine in the direction of integration development with BRICS member countries.

Similarly the growth curves equations are calculated to find the forecast of basis indexes for China country. Thus, calculated forecasting meanings of indexes in growth curves equations for each index for forward three years for China are presented in Table 7.

Table 7. Forecasting meanings of indexes of socioeconomic development of China

Indexes	The first forecasting period	The second forecasting period	The third forecasting period	Tendency: increasing (↑), decreasing (↓)
y_2	8296.87	8991.9	9686.69	↑
y_8	141692	152202	162792	↑
y_{23}	2673.95	2771.57	2865.87	↑
y_{27}	7893.72	8097.42	8280.58	↑
y_{39}	10039.3	10155.1	10265.3	↑
y_{42}	103289	103148	103027	↓
y_{48}	3.52009	3.51982	3.51959	↓
y_{52}	0.93438	0.474047	0.150651	↓
y_{53}	107.89	105.808	103.648	↑
y_{54}	118.735	117.449	116.045	↓
y_{58}	7.79708	7.55311	7.32	↓

Unlike other countries, China demonstrates worse situation in terms of quantity of that indexes, the meanings of which are lessening each next year of forecast. Whether it influences the worsening of country's positions in world integration space, whether such worsening will be compensated by "growing" indexes, will be demonstrated on the next stage of research. Thus, unlike other countries of BRICS, the cattle production has the decreasing tendency. Also the structure of consolidated budget for science, technologies and information technologies is lessened. Only in China we see surplus, not deficit in current account operations in % to GDP, which is lessened with the speed of up to 5% annually. Export and import of products and commercial services correlation is growing in a subtle way, while at the same time the correlation of export and import of products has the lessening tendency. There should be admitted unlike Brazil, Russia and India the index of external debt of China to GDP of the country is lessening. It is partly explained by the fact GDP per capita of China has a growing tendency, at the same time the largest growth among researched countries (6-7%). As it was already admitted, to graphically illustrate the change of socioeconomic position of China in integration space for a three year period will be possible on the next stage.

Thus, on the basis of growth curves the forecasting meanings of basis indexes were calculated in equations of growth curves, which characterize the development of international integration of SA, presented in Table 8.

Table 8. Forecasting meanings of indexes of socioeconomic state of SA

Indexes	The first forecasting period	The second forecasting period	The third forecasting period	Tendency: increasing (↑), decreasing (↓)
y_2	7502.72	7574.93	7637.93	↑
y_8	58579.1	60181.1	61703.4	↑
y_{23}	167.199	168.758	170.347	↑
y_{27}	12161.0	12291.8	12406.1	↑
y_{33}	1722.49	1699.09	1677.12	↓
y_{37}	647.693	648.665	649.496	↑
y_{42}	848.767	851.205	853.306	↑
y_{48}	5.53944	5.5957	5.64438	↑
y_{52}	-4.57037	-4.59802	-4.62173	↓
y_{53}	96.3054	96.2083	96.125	↓
y_{54}	97.784	97.6648	97.5624	↓
y_{58}	42.5574	45.2354	47.96	↓

The forecast of main macroeconomic indexes showed GDP per capita of SA has the growing tendency of about 1% annually in researched three year period. The coal production is growing in approximately 5% annually. The overall volume of primary energy production is growing in a subtle way, though these volumes are not enough for the country, though it has to enlarge the import of energy, though at rather smaller rate (about 1 a year). It should be admitted wheat production in SA, though in small volumes, but is lessening each forecast year, which is an export potential for Ukraine. Sunflower production in SA has growing tendency annually, but other oil crops production, such as sugar beet, is absent as product position in terms of international trade in this country that also may be the component of export potential for Ukraine.

In a three year forecast period, we observe the growing tendency of cattle production. Also the structure of consolidated budget expenditures for science, technologies and information technologies is growing. All other macroeconomic indexes have decreasing tendency, in particular: deficit of current account operations in % to GDP, export and import of products and commercial services correlation, correlation of export and import of products. Also each forecasting year the external debt in % to GDP of the country is lessened.

With the aim of comparative analysis with the member countries of BRICS taking into account strategic directions of socioeconomic development of Ukraine [19] on the basis of statistics data for 2000-2015, the growth curves of basis macroeconomic indexes of Ukraine were calculated (Table 9).

Table 9. Growth curves equations of socioeconomic development indexes of Ukraine

Growth curves equation	Determination coefficient (R^2)	Fisher coefficient (F)	Darbin-Watson coefficient (DW)
$y_2 = 1/(8.6 \cdot 10^{-5} + 124.8 \cdot 10^{-5}/t)$	0.91392	95.53	1.4348
$y_8 = 1/(1265.44 \cdot 10^{-5} + 0.58 \cdot 10^{-5}t^2)$	0.0519	0.49	1.4988
$y_{23} = \text{sqrt}(5.914t^3 + 6.57t^3)$	0.6446	16.33	1.4341
$y_{27} = \text{sqrt}(1.3596 \cdot 10^5 - 0.6118 \cdot 10^5 \ln(t))$	0.8728	61.76	1.0037
$y_{33} = 1/(4.4 \cdot 10^{-5} + 0.5.1 \cdot 10^{-5}/t)$	0.606	13.84	2.6129

Table 9 (cont.). Growth curves equations of socioeconomic development indexes of Ukraine

Growth curves equation	Determination coefficient (R^2)	Fisher coefficient (F)	Darbin-Watson coefficient (DW)
$y_{35} = \exp(7.6865 + 0.6074\text{sqrt}(t))$	0.9382	136.65	3.0758
$y_{37} = (44.8133 + 14.7625\text{sqrt}(t))^2$	0.8675	58.94	2.4033
$y_{39} = \text{sqrt}(2.6558 - 3.7721 \cdot 10^5 t^2)$	0.0172	0.16	1.7633
$y_{42} = \text{sqrt}(1.3709 + 7.4802/t)$	0.9785	309.42	1.5771
$y_{48} = \text{sqrt}(0.3981 + 1.1889/t)$	0.6243	14.96	2.3116
$y_{52} = 1.894 - 0.6622t$	0.6522	16.88	1.7669
$y_{53} = 4.03692 - 3.2296\text{sqrt}(t)$	0.5535	11.16	1.6952
$y_{54} = \exp(-0.1808 + 0.1151/t)$	0.1755	1.92	1.448
$y_{58} = \exp(3.4819 + 0.3929\ln(t))$	0.8907	73.30	1.9924

On the basis of received equations, forecasting meanings on each resulting index should be calculated, which characterizes integration processes of Ukraine for three forecasting periods (Table 10).

Table 10. Forecasting meanings of indexes characterizing integration processes of Ukraine

Indexes	The first forecasting period	The second forecasting period	The third forecasting period
y_2	5273.44	5505.73	5721.77
y_8	74.1302	73.3416	72.5086
y_{23}	123.995	130.45	137.081
y_{27}	173.329	160.143	146.996
y_{33}	20828.1	20971.2	21095.4
y_{35}	17861.5	19463.8	21141.2
y_{37}	9206.83	9611.92	10009.9
y_{39}	14534.9	14206.8	13843.7
y_{42}	4465.73	4411.71	4364.88
y_{48}	0.705135	0.699711	0.695027
y_{52}	-6.05218	-6.71436	-7.37655
y_{53}	-7.1509	-7.60773	-8.04731
y_{54}	0.842656	0.842035	0.841503
y_{58}	86.3272	89.085	91.7167

Forecasting meanings of basis indexes of socioeconomic state are characterized by quantitative heterogeneity and difference in measurement units. All indexes have different tendencies of development, both lessening and enlarging at the same time for every country from BRICS integration union.

It is proposed to calculate integral indexes for each country. An integral index means aggregated meaning of calculated 14 basis indexes and is calculated with the help of V. Pliuta design method of taxonomic development index of dynamic socioeconomic processes. The characteristic feature of integral index is its meaning is in the interval from 0 till 1, and it takes high meanings at the relevant meanings of indexes in the system of etalon and low meanings when far from it [6]. The interpretation of this index is the following: for a separate country, it takes the higher values, the higher the level of its socioeconomic state in terms of integration development [23] (Table 11).

Table 11. Forecasting meanings of integral index for Ukraine and BRICS member countries in three year perspective period

Country / Forecasting period	Ukraine	Brazil	Russia	India	China	South Africa
The first forecasting period	0.32933	0.45	0.71	0.41	0.55206	0.42575
The second forecasting period	0.32826	0.45	0.71	0.41	0.55206	0.42575
The third forecasting period	0.31137	0.4379	0.71	0.419	0.55099	0.4348

Graphic interpretation of calculations results of integral indexes meanings is presented in Figure 1.

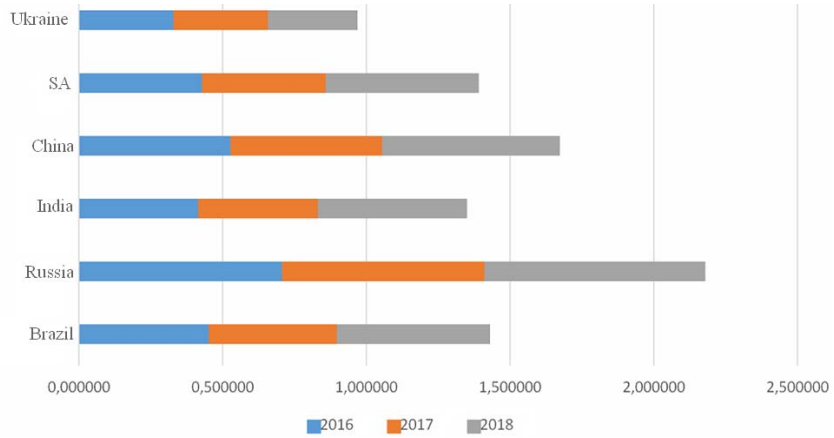


Fig. 1. Forecasting meanings of integral index reflecting integration development level of Ukraine and BRICS member countries in perspective period (2016-2018)

Positions of the countries are determined in the resulting factor space, which is GDP per capita, from other factors. The space is relatively separated into four sectors. Every sector is presented by scenario of appropriate strategic development in terms of integration.

Thus, it is appropriate to consider four strategic positions (development scenarios) of the countries in terms of integration processes development. Strategic positioning is proposed to present as a matrix of integration processes development scenarios, which includes four positions of strategic development in terms of international integration: I – low strategic position, II and III – middle strategic position and IV – high strategic position.

Under the first scenario the countries characterized by the smallest meanings of the resulting integral index, in particular GDP per capita under the lowest meanings of fractional indexes. Under the second one – high meaning of integral index under the smallest meanings of fractional indexes, under the third one – not high meanings of integral index under enough meanings of fractional indexes, under the fourth one – high meanings of integral index with significant meanings of fractional indexes.

Let's consider the scenario of countries development in terms of integration development in the first period of forecasting on the basis of their strategic positioning (Fig. 2).

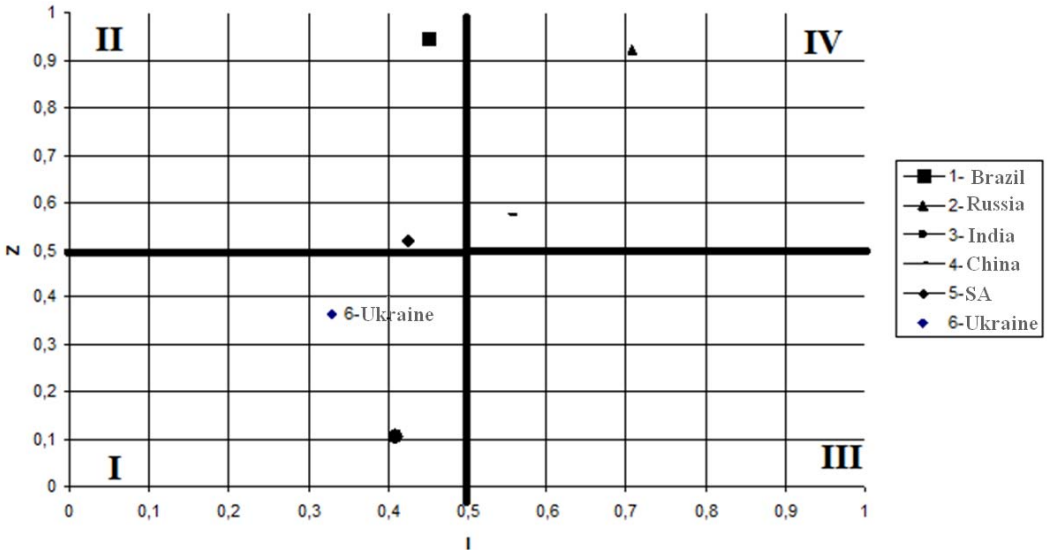


Fig. 2. Strategic positioning of Ukraine and member countries of BRICS in the first year of forecast

In the first perspective period of integration development scenario, Ukraine in its strategic position gets into the first group together with India. Closer placement is observed with the second group of countries, which include Brazil and SA that take middle strategic position. China and Russia are related to the most "developed" fourth group with high strategic position. In terms of indexes characterizing integration processes in international economic space, Russia is the furthest country from Ukraine. Thus, the smallest resources are needed for establishment of economic relations with the countries of the first and second group, in particular, with India, Brazil and SA.

Development scenario of Ukraine and countries of BRICS union in the second forecasting period is presented with the help of its strategic positions placement (Fig. 3).

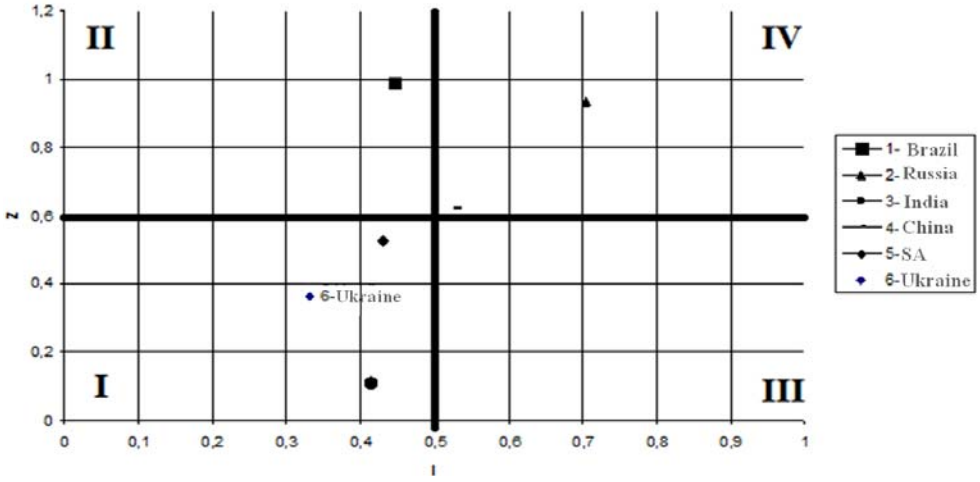


Fig. 3. Strategic positioning of Ukraine and member countries of BRICS in the second year of forecast

In the second forecasting year, we observe some changes in development scenarios of member countries of BRICS. Thus, India, taking into account lessening level of integral index has changed its strategic position and passed from the second group into the first one. At the same time, all other countries in spite of lessening meaning of integral index haven't left their strategic positions of the previous forecasting period and remained in their groups. That is the smallest resource-consuming development scenario of integration of Ukraine in the second forecasting period may be expected along with the representatives of the first group, in particular, with India and SA. The largest level of expenditures for economic relations formation in the second forecasting year is needed for integration with Russia.

Strategic positioning of Ukraine and member countries of BRICS in the third year of forecast is presented in Fig. 4.

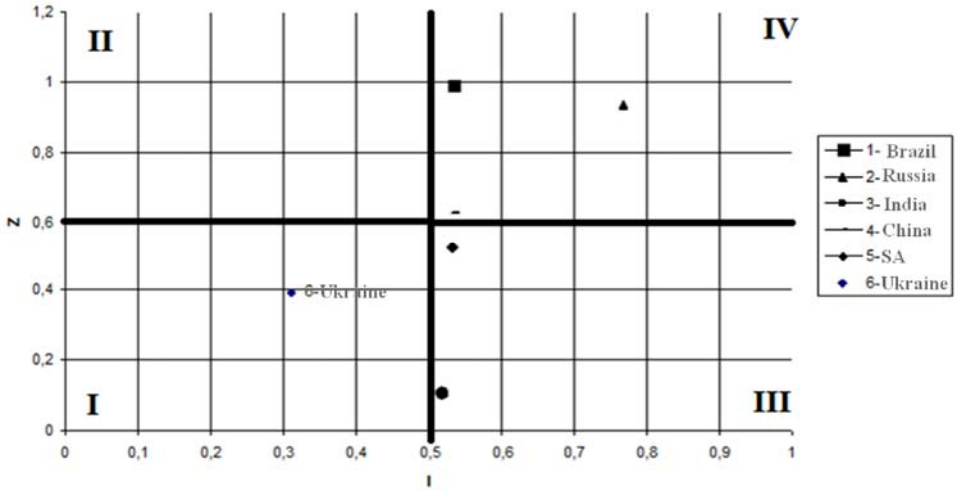


Fig. 4. Strategic positioning of Ukraine and member countries of BRICS in the third year of forecast

Let's analyze development scenario of Ukraine and member countries of BRICS in the last forecasting period. During the third year, we observe significant changes in strategic positions of researched countries comparing to the previous periods. Thus, in the first group, only Ukraine is left. India and SA have moved to the third group, and Brazil – to the fourth one. China and Russia didn't leave the forth strategic group. Thus, during the third forecasting year, the most profitable integration scenario was the cooperation with India and SA, and the least profitable – with Russia.

The improvement of strategic positions of researched countries may be done either by improvement of resulting index, in particular GDP per capita (graphically it is determined by placement of strategic position of the country in the axis of ordinates Z, that is up the vertical), or by the improvement of other basis indexes which means the movement to the right in the axis of absciss I.

For more definite recommendations in terms of improvement of integration development perspectives of Ukraine and member countries of BRICS additional research of mathematic model of latent development factor of integration processes (1) should be executed. Let's place in descending influence order on integration development of these indexes, which take part in the formation of meaning of strategic position of the country on the absciss axis I from the equation (1), that

is all basis indexes except resulting one (GDP per capita). It is possible to execute from the point of coefficients at the appropriate basis indexes. Thus, socioeconomic indexes, which characterize integration development in influence ranking, are placed in such order:

$y_8 > y_{37} > y_{35} > y_{39} > y_{33} > y_{48} > y_{23} > y_{53} > y_{54} > y_{52} > y_{42} > y_{58} > y_{27}$

Determined order of defined basis indexes analysis shows for transmission of Ukraine to the second strategic position, the GDP per capita index must be enlarged. Other basis indexes, in particular coal production, overall volume of premium energy production, energy import, wheat, oil crops, sunflower, sugar beet, cattle production, the structure of consolidated budget expenditures for science, technologies and information technologies, surplus (+) / deficit (-) of current account operations in % to GDP, correlation of products export and import and commercial services, products' export and import correlation, external debt in % to GDP may be unchangeable.

If for Ukraine there is a task to enter the third strategic position and get close with India and SA in socioeconomic development, which is possible in 2018, it needs, first of all, to enlarge coal production, sunflower, oil crops, sugar beet and wheat production. Also the structure of consolidated expenditures for science, technologies and information technologies should be made more effective, should be enlarged the overall volume of premium energy production, correlation of products and commercial services export and import, as well as export and import of products, correct surplus / deficit of current account operations in % to GDP. Also Ukraine needs to enlarge the quantity of cattle, though in insignificant volumes, lessen external debt in % to GDP and energy import.

For transmission of Ukraine to the developed fourth strategic position and in the next two years, "to be equal" with China and Russia, and in 2018 – with Brazil, our country needs to enlarge GDP per capita. Its integral index should exceed the level of 0.6, which is comparing to 2016 with the forecast level of 0.36, means GDP per capita should be enlarged twice. Besides, Ukraine needs to achieve more significant development level of that indexes, which were observed for the third strategic position, in particular: coal, sunflower, oil crops, sugar beet, wheat production enlargement; consolidated budget expenditures for science, technologies and information technologies; overall volume of premium energy production enlargement, correlation of products and commercial services export and import, products' export and import correlation, optimization of surplus (+) / deficit (-) of current account operations in % to GDP, cattle quantity enlargement, and external debt and import lessening.

Thus, on the basis of received forecast of integration development scenarios of Ukraine and member countries of BRICS in world integration space, as well as detailed transformation analysis of its strategic positions, we have possibility to be determined with the priority development scenarios of international cooperation with the countries of BRICS integration union. Thus, the stable tendency is observed – in the indexes that characterize integration process in international economic space in all forecasting periods Russia is the furthest country from Ukraine. In the first perspective forecasting period of Ukraine, the least resource-consuming is expected to be the international cooperation with India, in the second – with India and SA, in the third – also with India and SA, but with additional expenditures comparing to the first period.

Findings

On the basis of 2000-2015 data, the integral indexes for Ukraine and member countries of BRICS integration union were calculated, which gave the possibility to find comparing development evaluations of these countries in the processes of international integration and develop forecasting scenarios of development (2016-2018). It is determined that during all forecasting periods, Russia is the "furthest" country from Ukraine. In the first perspective forecasting period of socioeconomic development of Ukraine, the least resource-consuming is expected to be the international cooperation with India, in the second – with India and SA, in the third – also with India and SA, but with additional expenditures comparing to the first period. The forecasting scenarios of development of Ukraine and BRICS member countries in international integration space were calculated, which gave the opportunity to determine priority scenarios of its development in terms of international integration.

References

1. Anisimov, A.M., Shirov, A.A. (2013). Problemy razrabotki stsenariev otsenki dolgosrochnykh effektov integratsionnykh protsessov na postsovetskom prostranstve (tekst), *Problemy prognozirovaniia*, 5, ss. 3-14.
2. Atsuko, Matsumura (2016). Regional Trade Integration by Environmental Goods [Text], Tokyo International University, Saitama, Japan, 31 (1), pp. 1-40.
3. Babenko, V.O. (2016). Rozvytok intehratsiinykh protsesiv Ukrainy ta krain-chleniv BRIKS v umovakh hlobalizatsii (tekst), *Ekonomika. Upravlinnia Innovatsii*, Seriia: Ekonomichni nauky, 3. Rezhim dostupu: http://nbuv.gov.ua/UJRN/eui_2016_3_3.
4. Babenko, V.O., Pasmor, M.S. (2016). Prohnozuvannia stratehii mixhnarodnoi intehratsii Ukrainy u svitovomu intehratsiinomu prostori [Tekst]: monohr. Aktualni problem prohnozuvannia povedinky skladnykh sotsialno-ekonomichnykh system [Za red. O.I. Cherniaka, P.V. Zakharchenka], Berdiansk: Vydavets Tkachuk, O.V., 512 s., ss. 53-65.

5. Babenko, V.O., Petukhova, V.O., Sidorov, M.V. (2016). Doslidgennia stratehichnykh perspektyv rozvytku intehratsiinykh protsesiv Ukrainy u hlobalnii systemi mizhnarodnoi torhivli, *Mezhdunarodnui zhurnal "Tekhnologicheskii audit I rezervy proizvodstva"*, 3/5 (29), ss. 41-48.
6. BRICS Joint Statistical Publication (2015). *Brazil, Russia, India, China, South Africa* [Text] / Rosstat. M.: «Statistics of Russia», 2015, 235 p.
7. Burganova, I.N. (2015). Stsenarii mezhgosudarstvennoi integratsii na postsovetskom prostranstve v ramkakh SNG (Tekst). *Izvestiia Rosiiskogo gosudarstvennogo pedagogicheskogo universiteta im. A.I. Gertsena*, 22, ss. 27-31.
8. Derzhavna sluzhba statystyky Ukrainy (Elektronnyi resurs), Rezhym dostupu: http://www.ukrstat.gov.ua.
9. Dubrov, A.M., Mkhitarian, V.S., Troshin, L.I. (2000). *Mnogomernye statisticheskie metod:* Tekstbuk, M. Finansy I statistika, 352 s.
10. Ewa, Latoszek (2012). European Integration Process in the New Regional and Global Settings [Text], Latoszek Ewa, Kotowska Irena E., Nowak Alojzy Z., Stępniak Andrzej, Warsaw: Wydavnictvo Naukowe Wydzialu Zarzadzania Uniwersytety Warsawskiego, 420 p.
11. Gilpin, R (2001). Global Political Economy: Understanding the International Economic Order [Text], Princeton: Princeton University Press, 436 p.
12. Spitsyn A.T. (2014). Global transformation and innovative modernisation of economics in XXI century [Text] Moscow: Economics, 320 p.
13. Jim O'Neill (2014). The Growth Map: Economic Opportunity in the BRICs and Beyond. A New Geocivilizational Divide and Prospects for BRICS [Text] *International Scientific and Educational Journal Partnership of Civilization*, № 3-4.
14. Kheyfets, B.A. (2014). Russia and the BRICS. New Opportunities for Mutual Investments: Monograph [Text] / B.A. Kheyfets, M: Publishing and trading Corporation "Dashkov and K", 220 p.
15. Kozmenko, S., Savchenko, T., Kazarinov, D. (2012). Assessment of financial convergence of Ukraine with the CIS countries and the European Union [Text] *Banks and Bank Systems*, № 4, pp. 5-17.
16. Michurina, O.Yu. (2014). Prognozirovaniie rezultatov integratsionnykh protsessov na osnove imitatsionnogo modelirovaniia (tekst). *Vestnik Astrakhanskogo gosudarstvennogo tekhnicheskogo universiteta*, Ser.: Ekonomika, 2, ss. 55-62.
17. Plan zakhodiv z vykonannia Programy diialnosti Kabinetu Ministriv Ukrainy ta stratehii staloho rozvytku "Ukraina-2020" u 2015 rotsi: Rozporiadgennia Kabinetu Ministriv Ukrainy № 213, iz zminamy, vid 22 lypnia 2015 r., Ofits. Visn. Ukrainy, 60.
18. Ponomarenko, V.S., Maliarets, L.M. (2009). Analiz danykh u doslidgenniakh sotsialno-ekonomichnykh system (Tekst): monografia, Kharkivskii natsionalnii ekonomichnii un-t, Kharkiv: VD "INZHEK", 432 p.
19. Popov, L.A. (2006). *Analiz i prohnozirovaniie vremennykh riadov STATGRAPHICS Centurion* [Tekst]: Uchebnoe posobiie, M.: Izd-vo Ros. Ekon. Akad., 118 s.
20. Robson, P. (1998). The Economics of International Integration [Text], Ed. 4, London and New York: Routledge, 333 p.
21. Sigel, E.F. (2002). *Prakticheskaia biznes statistika*. Per. s angl., M.: Izdatelskii dom "Viliams", 1056 s.
22. Statistics South Africa [Electronic resource] // Official web-site. Available at: http://www.statssa.gov.za/.
23. The Global Competitiveness Report 2014-2015. [Text] (2015). Editor Prof. Klaus Schwab, Prof. Xavier Sala-i-Martín. Geneva: World Economic Forum. [Printed and bound in Switzerland], 565 p.