Forecast of trade and economic relations in the regions of Russia's Northwestern Federal District and the Republic of Belarus

The article is devoted to the topical issues of trade and economic integration of the Northwestern Federal District of the Russian Federation and the Republic of Belarus. It studies the trends in the development of trade and economic activity in their regions. The article describes the mathematical tool of gravity modelling of the trade and economic cooperation, approved by the materials of statistical reporting of NWFD regions and the Republic of Belarus. A forecast of development of trade and economic activity in these regions has been elaborated.

Trade and economic activities, integration, goods turnover, economic-mathematical modelling, forecasting.

**Tamara V.
USKOVA**
Doctor of Economics, ISEDT RAS Deputy Director
tvu@vscc.ac.ru

**Roman Yu.
SELIMENKOV**
Ph.D. in Economics, Deputy Head of the ISEDT RAS Department
rus_vscc@mail.ru

International integration processes, strengthening in the modern world and, one way or another, affecting all countries, had a direct impact on the post-Soviet space. The Creation of the Union State of Russia and Belarus on the basis of the formation of the Common Economic Space, ensuring the free movement of capital, labour, goods and services, made it possible to bring together the economies of the two countries and strengthen the processes of trade and economic integration.

It should be underlined that it would be impossible to achieve economic integration in the Union State without activating mutually beneficial cooperation at the regional level. Russian regions and Belarus have chosen the tactics of direct ties, having established business contacts and having signed cooperation programmes.

The results of the mutual trade of the Republic of Belarus with the federal districts of the Russian Federation in 2005—2011, are presented in *table 1*.

Table 1. The results of the mutual trade of the Republic of Belarus
with the federal districts of the Russian Federation

Federal District	Export, million US dollars			Import, million US dollars		
	2005	2011	Position	2005	2011	Position
Central FD	3409.7	7638.7	1	2607.7	4610.6	3
Northwestern FD	804.3	1644.2	2	766.7	2184.6	4
Southern FD	227.6	510.4	5	178	263.8	6
North Caucasian FD	115.2	208.8	7	25.7	86.3	7
Volga FD	618.7	1522.3	3	1292.1	4872.1	2
Ural FD	206.7	455.4	6	5091.7	12408	1
Siberian FD	296.5	970.5	4	155.9	332.4	5
Far Eastern FD	37.1	108.2	8	0.4	0.6	8
Russia in total	5715.8	13058.5		10118.2	24758.4	

Figure 1. Foreign trade relations of NWFD regions with the Republic of Belarus, million US dollars [11]
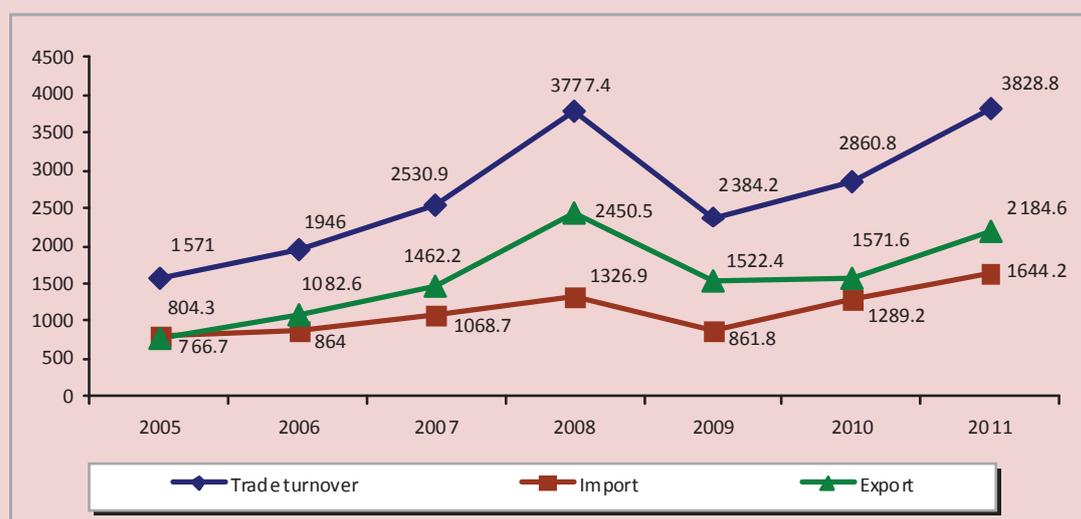
In Russia the leading position on turnover with Belarus is occupied by the Ural and Central federal districts (12 863.4 and 12 249.3 million US dollars in 2011, respectively). The northwestern regions are on the fourth place (3828.8 million US dollars).

Dynamic development of foreign economic activities of the regions of Russia's North-West and the Republic of Belarus is noted in the period under review. However, the global financial crisis in 2008 had a significant impact on the processes of their trade and economic interaction. In this period the trade turnover between the regions of the Northwestern Federal District and the Republic of Belarus fell by almost 40% in 2009 and amounted to 2.4 billion US dollars *(fig. 1)*. Moreover, the pre-crisis level of trade turnover was achieved only in 2011.

However, the level of trade and economic integration of NWFD regions and the Republic of Belarus in the post-crisis period (2008–2011) decreased. Foreign trade quota declined in five subjects of the Northwestern Federal District. Trade turnover growth with the partner country has been observed only in the Vologda, Novgorod and Arkhangelsk oblasts, and in the Komi Republic *(tab. 2)*.

Table 2. Regional foreign trade quota of NWFD regions and the Republic of Belarus, %

Region	2005	2006	2007	2008	2009	2010	2011	2011 to 2008, p.p.
Pskov Oblast	4.49	6.04	6.78	8.91	4.15	4.30	8.53	-0.38
Vologda Oblast	3.75	4.15	3.93	4.29	3.34	4.06	5.03	0.74
Novgorod Oblast	3.93	3.29	2.95	2.54	2.41	2.42	2.78	0.24
Komj Republic	0.88	0.53	1.01	1.05	3.78	2.18	2.37	1.32
Leningrad Oblast	2.13	1.94	2.24	2.97	1.79	1.84	1.93	-1.04
Kaliningrad Oblast	4.41	3.78	2.65	6.75	2.78	1.66	1.54	-5.21
Murmansk Oblast	0.87	0.97	0.86	2.19	1.47	1.56	1.28	-0.91
Republic of Karelia	1.01	1.49	1.08	1.13	0.74	0.77	0.73	-0.40
Arkhangelsk Oblast	0.32	0.32	0.32	0.58	0.59	0.68	0.64	0.06

Table 3. The share of export to the Republic of Belarus in GRP of NWFD regions, %

Region	2005	2006	2007	2008	2009	2010	2011	2011 to 2008, p.p.
Pskov Oblast	2.04	4.33	5.05	7.22	2.80	2.35	6.36	-0.86
Vologda Oblast	2.69	3.19	3.04	3.50	2.84	3.46	4.13	0.63
Komi Republic	0.69	0.37	0.90	0.94	3.70	2.09	2.27	1.33
Novgorod Oblast	1.73	2.09	2.01	1.52	1.47	1.43	1.22	-0.30
Leningrad Oblast	1.38	1.34	1.52	2.24	1.30	1.07	1.04	-1.20
Murmansk Oblast	0.65	0.63	0.54	1.75	1.16	1.17	0.78	-0.97
Kaliningrad Oblast	1.96	1.98	1.08	5.35	1.98	0.58	0.65	-4.70
Arkhangelsk Oblast	0.11	0.09	0.10	0.23	0.40	0.49	0.26	0.03
Republic of Karelia	0.40	0.92	0.52	0.58	0.39	0.31	0.18	-0.40

Table 4. Coefficient of regional export growth advancing GRP growth in NWFD regions

Region	2006	2007	2008	2009	2010	2011	2011 to 2008, %
Pskov Oblast	2.12	1.17	1.43	0.39	0.91	2.70	188.9
Vologda Oblast	1.18	0.95	1.15	0.81	1.32	1.20	104.0
Kaliningrad Oblast	1.01	0.54	4.96	0.37	0.32	1.11	22.5
Komi Republic	0.54	2.43	1.05	3.94	0.61	1.08	103.1
Leningrad Oblast	0.97	1.13	1.48	0.58	0.90	0.97	65.4
Novgorod Oblast	1.21	0.96	0.76	0.97	1.06	0.85	112.2
Murmansk Oblast	0.97	0.86	3.22	0.66	1.09	0.67	20.7
Republic of Karelia	2.3	0.56	1.13	0.67	0.87	0.57	50.3
Arkhangelsk Oblast	0.81	1.07	2.43	1.71	1.33	0.53	21.6

At the same time the production in NWFD regions remains highly dependent on the sales of the regions' products at the Belarusian markets *(tab. 3)*.

In 2011 the largest export potential with regard to the markets of the Republic of Belarus was observed in the Pskov (6.36%) and Vologda (4.13%) oblasts and the Komi Republic (2.27%).

Besides, the system of international division of labour in the post-crisis period involved fewer resources of regions, which is evidenced by a significant reduction of the coefficient of regional export growth advancing GRP growth in five NWFD regions *(tab. 4)*.

Comparative analysis of NWFD regions by the coefficient of regional export growth advancing GRP growth shows that the resources of the Pskov, Vologda, Kaliningrad oblasts and the Komi Republic are used more actively in the system of international division of labour than in other regions.

Despite the slowdown in integration processes within the Union State, the development of mutually beneficial trade connections between NWFD regions of the Russian Federation and the Republic of Belarus is extremely significant for the national and regional economies. In this regard, the important methodological problem is the modelling and forecasting of trade and economic activities that can be done by using gravity models [1, 2, 6, 13, 14].

The gravity models developed by Jan Tinbergen and Hans Linnemann can be used to simulate the trade turnover between the subjects of NWFD of the Russian Federation and the Republic of Belarus [2, 13, 14].

Jan Tinbergen's model appears as follows:

$$X_{ij} = \alpha_0 (Y_i)^{\alpha_1} (Y_j)^{\alpha_2} (D_{ij})^{\alpha_5} + \varepsilon, \quad (1)$$

where X_{ij} − the value of the trade flow from the country i to the country j;

Y_i, Y_j − the indicators, characterizing nominal GDP of the corresponding countries;

D_{ij} − distance between the economic centres of the countries i and j, km;

α_0 − absolute term of an equation;

ε − variable error.

H. Linnemann's model is of more general form:

$$X_{ij} = \alpha_0 (Y_i)^{\alpha_1} (Y_j)^{\alpha_2} (N_i)^{\alpha_3} (Nj)^{\alpha_4} (D_{ij})^{\alpha_5} \cdot$$
$$\cdot (A_{ij})^{\alpha_6} (P_{ij})^{\alpha_7} + \varepsilon, \quad (2)$$

where N_i, and N_j − the population size in the given state;

A_{ij} −any other favourable factor or constraint to the trade (for example, the presence of borders or anti-dumping regimes in one of the countries);

P_{ij} − trade preferences among the states (in the absence of preferential agreements) $P_{ij} = 1$; otherwise $P_{ij} = 2$);

α_1, α_2, α_3, α_4, α_5, α_6, α_7 − export elasticity coefficients according to GDP of the exporting country, GDP of the importing country, population size in the country i, population size in the country j, distance between the countries, any other factor, trade preferences;

α_0 − absolute term of an equation;

ε − variable error.

The initial data on the construction of a gravity model represents time series of member variables *(tab. 5)*.

Thus, in the result of calculations, the authors obtained the Jan Tinbergen's version of the gravity model equation, describing the dynamics of eternal turnover between the regions of the Northwestern Federal District and the Republic of Belarus for 2005−2011:

$$X_{ij} = 26.919 \cdot (Y_i)^{-0.145} \cdot (Y_j)^{1.096}, \quad (3)$$
$$R^2 = 0.976$$

Note that the accuracy of the model is rather high, as the determination coefficient makes up 0.976. The economic interpretation of this model enables the authors to conclude

Table 5. Initial data on gravitation model parameters [11]

Year	Turnover between NWFD regions and the Republic of Belarus, million US dollars (Xij)	GDP of the Republic of Belarus, billion US dollars (Yi)	GRP of RF NWFD regions, billion US dollars (Yj)	Population size of the Republic of Belarus, million people (Ni)	Population size of NWFD regions, million people (Nj)
2005	1571	30.110	64.232	9.698	13.716
2006	1947	36.937	77.910	9.630	13.665
2007	2531	45.298	104.417	9.580	13.631
2008	3777	59.674	138.351	9.542	13.612
2009	2384	54.336	105.136	9.514	13.604
2010	2861	56.145	132.140	9.500	13.626
2011	3829	52.363	157.136	9.481	13.660

that the turnover NWFD regions will increase by 1.1%, if their GRP grows by 1%; with the 1% increase in GDP of the Republic of Belarus, however, the trade turnover between the Republic and NWFD regions will reduce by 0.15%.

According to the authors, this dependence is caused by the peculiarity of the commodity structure of exports and imports of NWFD regions of the Russian Federation and the Republic of Belarus. Raw materials (ferrous metals, mineral products and chemicals) occupy significant part in the export structure of NWFD regions. Therefore, the increase in GRP of the regions depends directly on export deliveries to the world market.

Food products, vehicles, agricultural machines and units, refrigerators and freezers, chemical and mineral fertilizers, timber and building materials, petrochemical products, synthetic fibers are imported to NWFD regions from Belarus. In other words, in the conditions of the limited capacity of the market of the given products it is possible to increase GDP of the Republic of Belarus by expanding sales geography, thus resulting in the reduction in the trade turnover between NWFD regions and the Republic.

Somewhat different result is obtained when using Hans Linnemann's gravity model:

$$X_{ij} = 1.069\text{E-}20 \cdot (Y_i)^{0.167} \cdot (Y_j)^{1.388} \cdot$$
$$\cdot (N_i)^{22.151} \cdot (N_j)^{-1.262}, \ R^2 = 0.989 \quad (4)$$

The determination coefficient is higher than 0.99, as the given model considers a number of factors, affecting the turnover. However, the following conclusions can be made on the basis of the obtained equation: with the 1% increase in GDP of the Republic of Belarus, the trade turnover between the Republic and NWFD regions will rise by 0.17%; due to 1% increase in GRP of NWFD regions, the turnover will grow by 1.39%. In case the population of Belarus will increase by 1%, the trade turnover will rise by 22.2%, an increase of 1% of the population of NWFD regions will lead decline in trade turnover by 1.3%.

It is possible to forecast foreign trade turnover between NWFD regions and the Republic of Belarus based on gravity models, when constructing trends, describing the dynamics of member variables. The studied time series of the gross product and the population size of NWFD regions and Belarus are described rather accurately by power polynomial trends, as the coefficient of determination falls within 0.8–0.9 range *(fig. 2, 3)*.

The forecast values of variables, obtained on the basis of extrapolation of the trends, are likely to increase, except for the population of the Republic of Belarus *(tab. 6)*.

Thus, the forecast values of foreign trade turnover, obtained on the basis of gravity model equation of Jan Tinbergen and that of Hans Linnemann, shows strengthening of trade and economic integration of NWFD regions of the Russian Federation and the Republic of Belarus in the long view *(fig. 4)*.

A different number of factors, considered in the model, affects the indicators of foreign trade turnover, which explains the difference in the forecast values of the gravity models. In compliance with the theory of gravity models construction and their description, the gross product of the exporting country reflects production capabilities, while the gross product of the importing state determines its market capacity. In general, these two variables are directly proportional to the trade volume.

However, according to the authors, further development of trade and economic integration of NWFD regions and the Republic of Belarus both in the medium and long term can be polyvariant. Analyzing possible variants, it is possible to distinguish three possible scenarios of further development of the process at the current moment:

– 'no change' scenario, stipulating the continuation of trends and trade turnover

Figure 2. Dynamics of GDP of the Republic of Belarus and GRP
of NWFD regions of th Russian Federation, billion US dollars

$y = 62.726x^{0.4365}$
$R^2 = 0.8644$

$y = 30.907x^{0.3379}$
$R^2 = 0.8486$

- GDP of the Republic of Belarus, billion US dollars
- GRP of NWFD regions, billion US dollars
- Polynomial (GRP of NWFD regions, billion US dollars)
- Polynomial (GDP of the Republic of Belarus, billion US dollars)
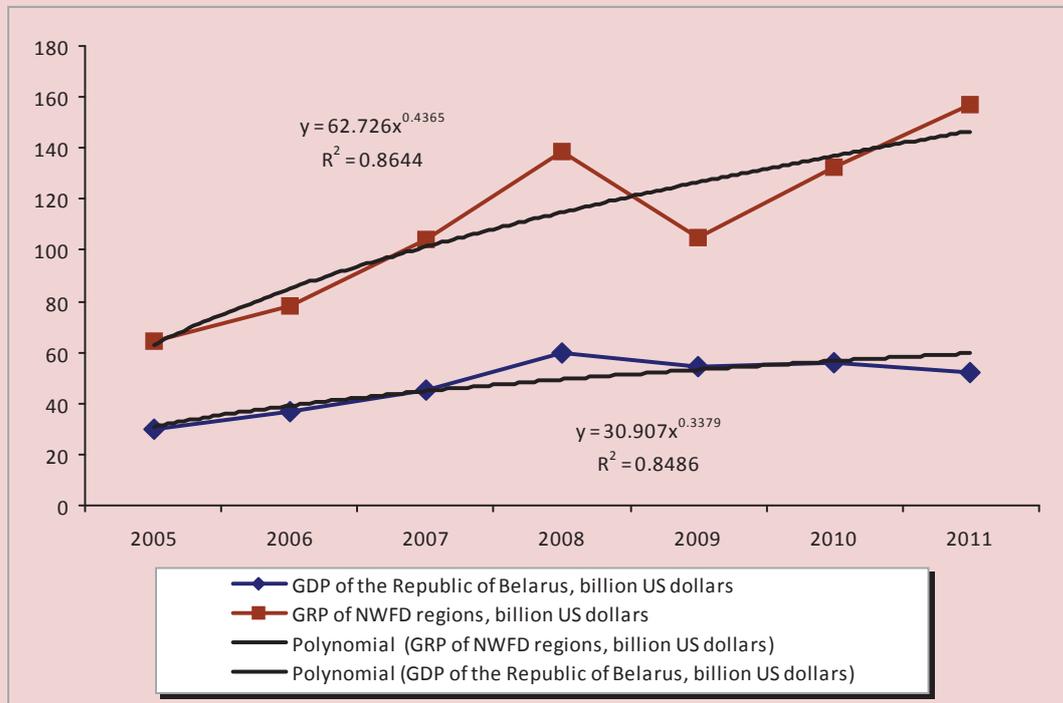
Figure 3. Dynamics of population of the Republic of Belarus and NWFD regions, million people

$y = 0.0087x^2 - 0.079x + 13.788$
$R^2 = 0.9957$

$y = 9.7022x^{-0.0118}$
$R^2 = 0.9967$

- Population size of the Republic of Belarus, million people
- Population size of NWFD regions, million people
- Polynomial (Population size of the Republic of Belarus, million people)
- Multinomial (Population size of NWFD regions, million people)
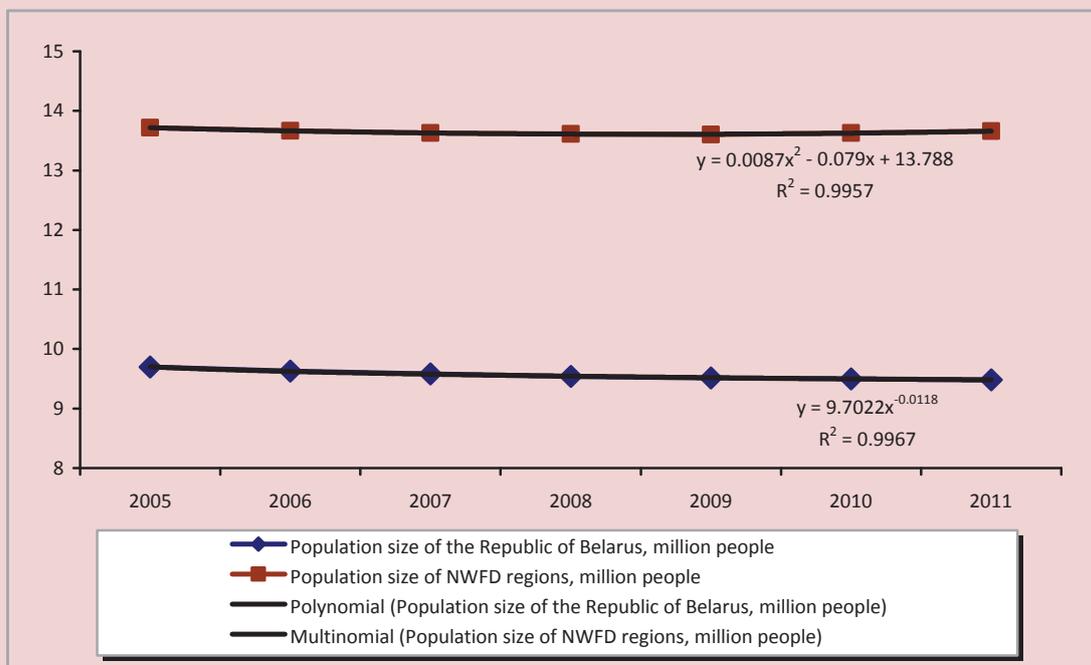
Table 6. Forecast of GDP and population growth of NWFD regions of the Russian Federation

Indicator	Forecast				Average annual growth rate, %
	2012	2013	2014	2015	
GDP of the Republic of Belarus, billion US dollars *(Yi)*	62.404	64.937	67.291	69.493	107.3
GRP of NWFD regions of the Russian Federation, billion US dollars *(Yj)*	155.470	163.672	171.375	178.655	103.3
Population size of the Republic of Belarus, million people *(Ni)*	9.467	9.454	9.442	9.432	99.9
Population size in NWFD regions, million people *(Nj)*	13.713	13.782	13.868	13.972	100.6

Figure 4. Forecast of the trade turnover between the Russian Federation
and the Republic of Belarus, million US dollars
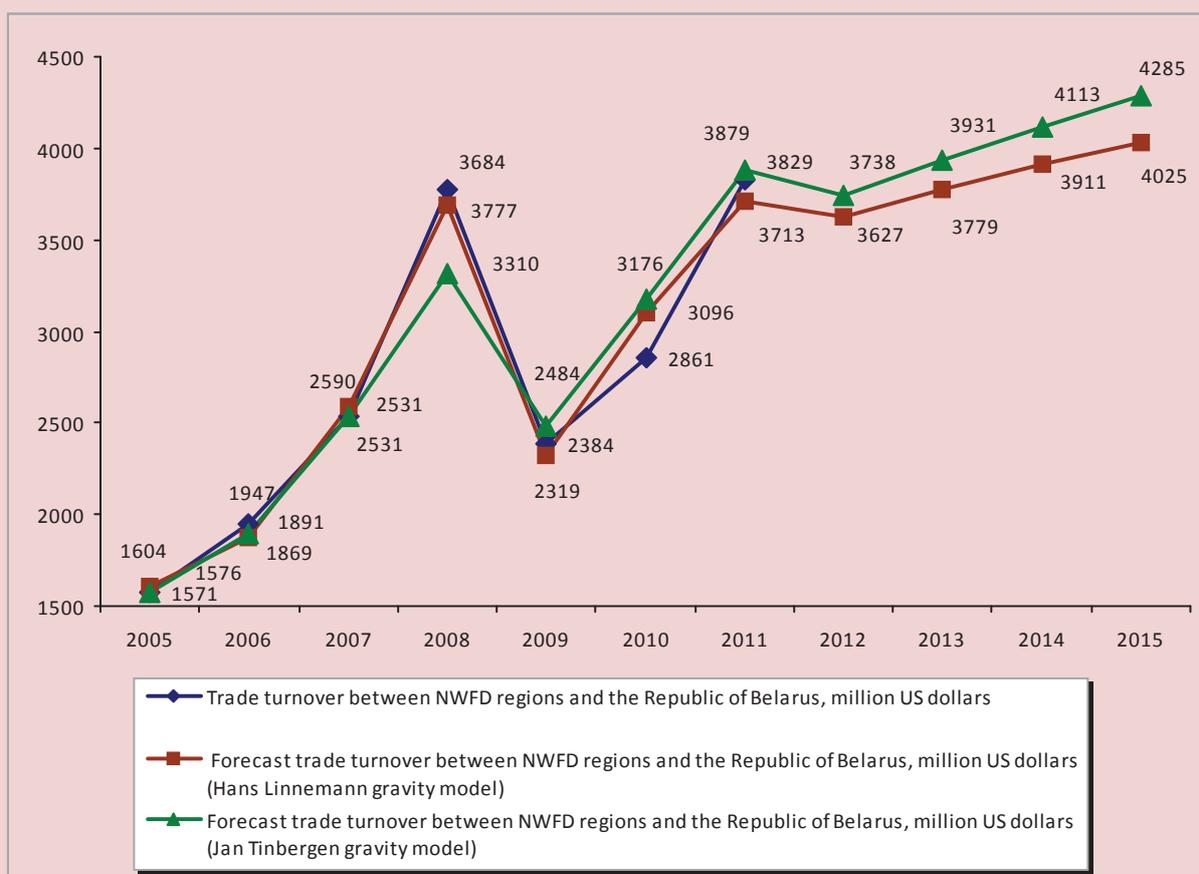
structure, existing in foreign trade relations between NWFD regions and the Republic of Belarus;

— scenario of trade and economic relations reorientation, the basic condition for implementation of which is the change of the sales markets for both NWFD regions and the Republic of Belarus;

— scenario of the further deepening of the economic integration of NWFD regions and the Republic of Belarus, stipulating the turnover increase due to the modernization of export-oriented industries and increase in volumes of competitive products with high added value.

However, at present, trade and economic integration of NWFD regions and the Republic of Belarus is aimed primarily at the efficient use of production potentials available in the regions, the development of specialization

and cooperation of enterprises, improvement of the previously existing economic ties.

Thus, in order to boost trade and economic integration in the system "country – regions of the other country", it is necessary to consider economic, political, and administrative-legal features of each party, factors affecting their development. It is possible to solve the given problem by using adequate methodological and, first of all, mathematical tools, which allow assessing the effectiveness of trade and economic relations on many factors. This will permit making timely changes to foreign trade policy and will contribute to the sustainable development of mutually beneficial cooperation.

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