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THE FORMATION OF RUSSIAN AGRARIAN TRADE STRUCTURE: INTER-INDUSTRY VS. INTRA-INDUSTRY TRADE ACTIVITIES

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Abstract

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The paper is focused on specialization of Russia's foreign trade in agrarian products and foodstuffs in terms of inter-industry and intra-industry trade. The main objective of this study is to analyse the extent of intra-industry trade in Russia's foreign trade in agricultural products and to identify significant changes in trade patterns at the industry level over the transformation period (1996–2012). The results coming from individual conducted analyses provide a systematic decomposition of Russia's foreign trade into three trade types: inter-industry, intra-industry in horizontally and vertically differentiated products. Inter-industry type of trade dominates in Russian foreign trade in agricultural and food products and accounts for about a third of total trade flows. The analysis revealed significant differences in the intensity of intra-industry trade, depending on geographic region. The lowest level of intra-industry trade is observed in relation to Africa and South America, the highest - in relation to CIS countries. There were also found some trends, including the expanding intra-industry trade in relation to the CIS countries, as well as a decrease in relation to Asian and EU countries.

Keywords: Russian Federation, agrarian and foodstuff products and trade, inter-industry trade, vertical and horizontal intra-industry trade

INTRODUCTION

The process of economic transformation and trade liberalization in Russia that started with the collapse of the Soviet Union continues to this day.

Currently Russia has the foreign trade surplus mainly based on the advantages of possessing natural resources (natural fuel and metals). The raw materials orientation of Russia's export overshadows the development of exports of other sectors such as manufacturing and agriculture. Russia plays a significant role in the international market of agricultural products as importer rather than as an exporter.

Nevertheless, from the point of view of food security and long-term development (taking into account the exhaustibility of fuel resources) agriculture is of great importance for Russian economy.

The process of economic transformation is characterized, among other things, by significant changes of food consumption as well as foreign trade patterns.

This paper is focused on the changes in the patterns of Russian foreign trade in agricultural products and foodstuffs during the transitional period. Specifically, we aimed to investigate in detail the nature the trade. One of the tools that help us understand and analyze the structure of foreign trade is its division into intra-and inter-industry trade.

The importance of intra-industry trade arises from its character. This concept is one of the most important findings on international trade theory. It was developed by Helpman and Krugman (1985), and associated with factor endowments, product differentiation and increasing returns of scale.

Afterwards, intra-industry trade has been divided by Falvey (1981) into two types: horizontal and vertical.

Horizontal IIT refers to homogenous products with the same quality but with different characteristics, while vertical IIT means products traded with different quality and price. Horizontal differentiation is more likely between countries with similar factor endowments, while vertically differentiated goods occurs because of factor endowment differences across countries (Jambor, 2013).

For many countries intra-industry trade constitutes a significant part of the total trade tlows simultaneous export and import flows within industries. Many studies note that share of intra-industry trade in the volume of global trade increases. This leads to changing nature of international trade and its structure of goods. It means that intra-industry trade does not need to be based on comparative advantage.

Intra-industry trade occurs more frequently among countries that are similar in terms of actor endowments, similar per capita income, close geographical distance and low barriers to international trade etc.

Thus, the study of the share of intra-industry trade in the Russian agricultural trade will help to better understand its nature, and the analysis of its changes will help to identify the main trends in its structure. Moreover, a higher level of IIT between countries shows that a country is more integrated.

MATERIAL AND METHODS

The objective of this study is to consider the extent of intra-industry trade in Russia's foreign trade in agricultural products and to identify significant changes in trade patterns at the industry level over the transition period.

Thereby, in this paper we provide a systematic decomposition of Russia's foreign trade in agricultural products into three trade types: inter-industry, intra-industry in horizontally and vertically differentiated products, over the period 1996–2012. The analysis is performed in relation to individual regions (European Union, Commonwealth of Independent States, Africa, Asia and North and South America).

Disaggregated Russian and worldwide trade data have been collected from the UN Comtrade database. We used 4-digit level data classified according to the Harmonized System Classification (HS). The classification includes about 200 commodity groups.

The article adopts a range of methods for broader and more comprehensive analysis of the subject.

Firstly, we calculated the traditional Grubel-Lloyd index. Then we applied The Fontagne and Freudenberg (1997) methodology as well as Greenaway's method (1995) for the analysis of the bilateral trade with individual regions and countries.

The Grubel-Lloyd Index

To measure the extent of intra-industry trade (IIT), this study uses the most widely preferred traditional Grubel-Lloyd (G-L) index.

This index measures intra-industry trade as a percentage of a country's total trade which is assumed to be balanced, that is exports equal imports. For an individual product group or industry i the share of IIT is formulated as:

$$GL_i = 1 - \frac{|X_i - M_i|}{(X_i + M_i)}, \quad (1)$$

where X_i and M_i stand, respectively, for the exports and imports of industry *i*. The index of intra-industry trade takes values from 0 to 1 as the extent of intra-industry trade increases, that is, $0 \leq GL_i \leq 1$ (Koçyiğit, 2007).

The GL index in this equation can be modified to obtain the average level of intra-industry trade for a country j (for N set of industries).

$$GL_i = 1 - \frac{\sum_{i=1}^{N} |X_i - M_i|}{\sum_{i=1}^{N} (X_i + M_i)}. \quad (2)$$

Fontagné and Freudenberg Method

There is another method in the literature to distinguish inter- and intra-industry trade. Fontagné and Freudenberg (1997) categorized trade flows and computed the share of each category in total trade. They defined trade to be intra-industry when the value of the minority flow represents at least 10% of the majority flow. Formally:

$$\frac{Min(X_i, M_i)}{Max(X_i, M_i)} \geq 10\%. \quad (3)$$

If the value of the minor flow is below 10%, trade is classified as inter-industry in nature. If the opposite is true, the FF index comes formally as:

$$FF_k^p = \frac{\sum_j (X_{jk}^p + M_{jk}^p)}{\sum_j (X_{jk} + M_{jk})}, \quad (4)$$

where X and M denote export and import, respectively, while p distinguishes intra-industry trade, j is for the number of product groups and k is for the number of trading partners (Wang Jing, 2010).

Horizontal and Vertical Intra-industry Trade: Greenaway's Method

Intra-industry trade can take two forms: horizontal (HIIT) and vertical (VIIT). The latter considers the exchange of similar goods of different quality, while the former comprises exchange of similar commodities differentiated by characteristics instead of quality (Algieri, 2004).

According to the method of Greenaway *et al.* (1995), a product is horizontally differentiated if the unit value of export compared to the unit value of import lies within a certain range. Formally, this is expressed for bilateral trade of horizontally differentiated products as follows:

$$1-a \le \frac{UV_{ijt}^{X}}{UV_{ijt}^{M}} \le 1+a\,, \qquad (5)$$

where UV means unit values, X and M means exports and imports for goods i.

The most of studies use a unit value dispersion of 15 percent, i.e. $\alpha = 0.15$. (Abd-el-Rahman (1991), Greenaway *et al.* (1995), Aturupane *et al.* (1999), Blanes *et al.* (2000), Algieri (2004), etc.)

It should be noted that the coefficient is initially applied to 5-digit SITC classification. It seems possible to apply this coefficient value for our calculations with the four-digit HS classification, as it does not contradict the aims of the study and will not distort the results.

RESULTS AND DISCUSSION

The analysis is started with the traditional Grubel-Lloyd indicator (1975) in computing the degree of intra-industry trade in relation to the whole world. The calculation of the Lloyd–Grubel Index for the industries of Russia's economy (Fig. 1) has shown the intra-industry specialization movements for the period of 1996–2012 in the Russia's trade in agricultural products and foodstuffs with the world's rest.

During the analyzed period, noticeable fluctuations of the index value were observed. International trade in agricultural products is sensitive to factors such as government policies, fluctuations of tariffs and quota rates, import restrictions for sanitary reasons and other factors.

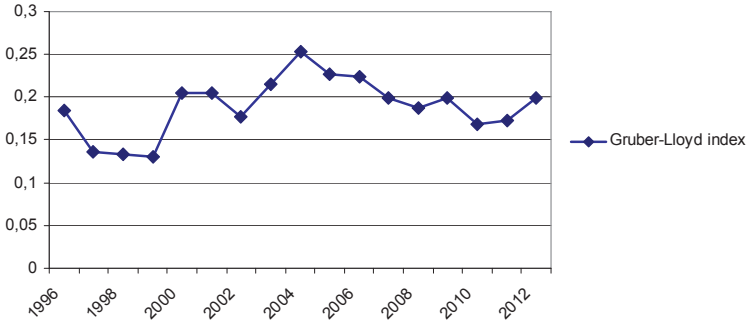
There is no any clear trend in the index value. Before 2004 the index increased, reaching its maximum and then started to decline steadily. The maximum value of G-L index was 0.25 in 2004; the minimum was 0.13 in 1999.

To better understand the phenomenon under study we distinguish three types using the method adopted by Abd-el-Rahman (1991), Greenaway *et al.* (1995), Fontagne and Freudenberg (1997). These types are inter-industry and intra-industry trade in horizontally and vertically differentiated products (Tab. I).

As can be seen in the Tab. I, inter-industry trade dominates in Russian foreign trade in agricultural and food products. Intra-industry trade accounts for about a third of all trade flows.

The results for Russia show that intra-industry trade increased from 25.46% in 1996 to 40.5% in 2006 and decreased during the following years. We can observe a growth of the share of HIIT relative to VIIT. Fluctuations in the level of intra-industry trade are primarily related to changes in the structure of exports as well as changes in unit values of individual products.

Vertical IIT is greater than horizontal IIT in Russia over the analyzed period. Mainly fluctuations in the level of intra-industry trade due to variations of horizontal intra-industry trade while vertical type of intra-industry trade is quite stable.



1: *Gruber-Lloyd index for Russian foreign trade in agricultural products and foodstuffs*
Sources: UN Commodity Trade Statistics Database, author's calculations (2013)

I: *Evolution of intra-industry trade in Russian foreign trade in agricultural products and foodstuffs (as a percentage of total trade)*

	1996	1998	2000	2002	2004	2006	2008	2010	2012
Inter-industry	74.54	79.35	69	72.23	64.38	59.49	68.61	72.85	63.55
One-way trade	0.01	0.04	1.22	1.61	0.90	0.80	0.64	1.24	0.37
Intra-industry	25.46	20.65	31.00	27.77	35.62	40.50	31.39	27.14	36.45
Horizontal IIT	7.34	6.57	14.12	7.67	12.90	19.44	16.33	16.12	17.16
Vertical IIT	18.12	14.08	16.89	20.10	22.72	21.06	15.06	11.03	19.29

Sources: UN Commodity Trade Statistics Database, author's calculations (2013)

Individual Regions

Before analyzing Russia's intra-industry trade with individual regions, we must say a few words in general about the development of trade in agricultural products and foodstuffs in relation to these regions.

As can be seen in the Tab. II, at the end of 90s, most of Russian agricultural exports went to EU countries. However, by 2010, CIS country had become the largest partner of Russia in terms of exports. They are followed by Asian and African countries.

The territorial structure of exports has changed significantly during the period. If at the end of the 90's most of the country's agri-food exports went to EU countries, in the last years the largest importers of Russian agricultural products and foodstuffs are Asian and CIS countries. However it should be noted that absolute value of export flows to EU was increasing during the whole period (in USD, in current prices). Its share declined due to the growth of exports to other regions.

The share of export to Africa in the total export value has increased extremely from 2.2% in 1998 to 20.3% in 2010. This was due to the growth of exports of wheat and barley, mainly to Egypt and some other African countries.

During the analyzed period, the largest increase in the value of Russian agricultural export was observed in relation to African countries, the lowest – in relation to EU countries.

During the analyzed period there were no significant changes in the structure of Russian agricultural import. Agricultural and food imports from EU are still more than a third of total imports.

II: *Territorial structure of the Russian agricultural export, %*

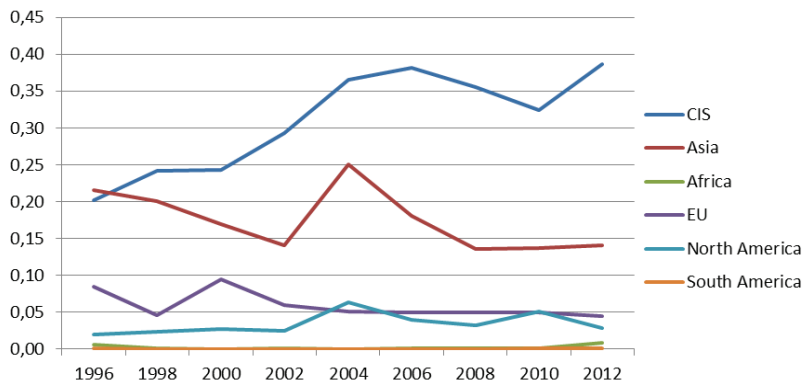
	1996	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
North America	4.5	4.5	1.9	2.4	1.3	1.1	1.3	0.9	0.9	0.9	0.8	0.6	1.0	0.6	0.4
CIS	28.7	26.7	32.1	32.7	25.1	35.1	43.0	40.5	41.4	35.1	41.7	31.2	23.3	20.6	27.0
EU	25.6	18.8	18.7	15.9	21.4	13.0	12.3	10.5	12.4	10.1	10.8	7.7	10.3	11.7	10.3
Asia	25.4	37.7	35.5	35.3	31.2	33.6	25.5	27.0	28.6	28.5	29.8	42.9	45.6	41.5	41.3
South America	0.3	0.1	0.0	0.1	0.1	0.5	0.0	0.0	0.0	0.0	0.3	0.3	0.1	0.4	0.3
Africa	0.4	0.8	3.3	4.0	13.7	7.2	10.2	14.4	10.1	20.1	12.0	13.3	14.8	18.5	15.2
Others	15.0	11.4	8.6	9.6	7.2	9.5	7.6	6.6	6.6	5.3	4.7	3.9	4.8	6.7	5.5

UN Commodity Trade Statistics Database, author's calculations (2013)

III: *Territorial structure of the Russian agricultural import, %*

	1996	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
North America	10.7	12.6	11.0	11.8	8.1	6.4	6.3	6.0	6.5	6.5	8.1	7.5	5.3	5.9	7.3
CIS	30.3	15.8	23.9	16.9	12.4	16.4	19.2	16.8	11.3	10.9	10.8	10.0	10.1	8.4	12.6
EU	26.2	28.4	26.4	27.5	29.7	27.5	27.1	24.9	27.9	28.7	27.8	26.9	29.9	30.6	28.8
Asia	11.3	12.5	12.2	11.0	14.1	14.0	13.4	14.4	15.3	15.8	16.5	17.0	17.5	18.2	16.7
South America	3.4	8.6	9.8	14.3	17.6	17.7	16.7	21.6	23.4	23.1	21.5	22.0	20.2	19.1	17.1
Africa	1.5	2.0	3.0	3.2	3.9	3.9	3.7	3.5	3.6	3.9	3.7	4.2	4.1	4.4	4.0
Others	16.5	20.2	13.7	15.4	14.1	14.0	13.6	12.7	11.9	11.1	11.7	12.4	12.9	13.4	13.6

Source: UN Commodity Trade Statistics Database, author's calculations (2013)



2: *The values of Grubel-Lloyd index in relation to individual regions*
Sources: Comtrade database, author's calculations (2013)

IV: *Fontagne and Freudenberg index of intra-industry trade in relations to individual regions*

	1996	1998	2000	2002	2004	2006	2008	2010	2012
CIS	0.528	0.375	0.476	0.436	0.497	0.636	0.564	0.542	0.684
EU	0.478	0.152	0.606	0.365	0.197	0.437	0.724	0.550	0.161
Asia	0.366	0.239	0.296	0.282	0.345	0.344	0.224	0.183	0.210
North America	0.019	0.055	0.044	0.043	0.110	0.061	0.058	0.077	0.074
South America	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Africa	0.015	0.001	0.000	0.002	0.000	0.001	0.002	0.002	0.012

Sources: UN Commodity Trade Statistics Database, author's calculations (2013)

Analysis of intra-industry trade in agricultural products in relation to individual regions begins with the calculation of the average value of the index.

As can be seen in this graph, the level of intra-industry trade in relation to individual regions differs significantly. With respect to the CIS we can observe the highest intensity of intra-industry trade.

We can also observe a significant and growing share of intra-industry trade with the CIS countries. With respect to Asia we can see a considerable jump in intra-industry trade in 2004 and its subsequent decline.

There can be also observed a decrease in the share of intra-industry trade with EU countries (15.65% to 5.04%). These changes were caused, for example, by the growth of imports of such products as prepared or preserved fish and caviar, fish fillets and other fish meat.

Fontagne and Freudenberg index (FF) showed the following tendencies. From 1996 to 2012, there was an increase of the share of IIT in Russian international trade, from 52.8 to 68.4 per cent according to the FF in relation to CIS countries.

For the countries of North, South America and Africa the index is close to zero which means that inter-industry trade dominates throughout the whole analyzed period.

In relation to North America the share of IIT varies from 1.93% in 1996 to 10.98% in 2004. These fluctuations in the index are associated with a change in the pattern of trade between Russia and the countries of North America. For example, the growth of intra-industry trade in 2004 and subsequent years was due to the increase in exports of milk products and preparations of vegetables, fruits, nuts.

It can be seen from the data in Tab. IV that almost whole trade flows with African countries is the inter-industry trade, particularly one-way trade (either exports or imports). It can be logically explained by the differences in climatic conditions for agricultural production as well as differences in factor endowments. Russia exports cereals to Africa (mainly feed wheat and barley). In recent years, sunflower oil export also increases. In turn, Africa imports in Russia predominantly fruits and vegetables. During the whole period the share of intra-industry trade does not exceed 2%.Growth trends were not observed.

Based on these observations it can be assumed that the geographical remoteness as the main factor that reduces the level of intra-industry trade.

The significant share of intra-industry trade was observed in relations to CIS countries and Asian countries. So it makes sense to consider these two regions in more detail.

CIS Countries

CIS countries are important trading partners of Russia in terms of both exports and imports. Economic relations between Russia and these countries evolved over time of USSR. These facts, as well as their geographical location determine their significant share in Russian foreign trade. CIS country had become the largest partner of Russia in terms of exports. For example, in 2010 export to CIS countries accounted 36.6% of Russia's agricultural exports and 11.3% of agricultural imports.

As we can see in the Tab. V, intra-industry trade prevails in relation to this region. The share of one-way trade in the structure of Russian trade with CIS countries is extremely low.

V: *Evolution of intra-industry trade in Russian foreign trade in agricultural products and foodstuffs in relation to CIS countries (as a percentage of total trade)*

	1996	1998	2000	2002	2004	2006	2008	2010	2012
Inter-industry	47.22	62.52	52.36	56.37	50.28	36.44	43.55	45.81	31.64
One-way trade	0.35	1.85	0.29	2.19	3.80	0.56	0.53	2.88	0.24
Intra-industry	52.78	37.48	47.64	43.64	49.71	63.56	56.45	54.18	68.36
Horizontal IIT	46.71	27.18	30.97	21.63	21.44	34.78	24.27	29.69	34.48
Vertical IIT	6.08	10.30	16.67	22.01	28.28	28.78	32.18	24.49	33.89

Sources: UN Commodity Trade Statistics Database, author's calculations (2013)

VI: *Evolution of intra-industry trade in Russian foreign trade in agricultural products and foodstuffs in relation to Asian countries (as a percentage of total trade)*

	1996	1998	2000	2002	2004	2006	2008	2010	2012
Inter-industry	63.4	76.07	70.44	71.79	65.47	65.61	77.6	81.69	78.97
One-way trade	0.77	1.22	9.43	2.75	1.19	0.66	1.79	11.29	0.65
Intra-industry	36.59	23.92	29.56	28.21	34.53	34.39	22.40	18.30	21.04
Horizontal IIT	23.86	4.67	16.73	16.04	9.96	19.97	11.49	9.56	8.80
Vertical IIT	12.73	19.25	12.83	12.16	24.57	14.42	10.90	8.75	12.24

Sources: UN Commodity Trade Statistics Database, author's calculations (2013)

In 2012, the following items were classified as horizontal IIT: Meat and edible offal; Chocolate and preparations; Bread, pastry, cakes, biscuits and other bakers' wares.

Examples of Vertical IIT are Milk and cream, concentrated or containing added sugar or other sweetening matter; Cheese and curd; Undenatured ethyl alcohol of an alcoholic strength by volume of less than 80% vol., etc.

The share of inter-industry trade is declining; the share of intra-industry trade is increasing. Thus, at the beginning of the period, horizontal type of intra-industry trade was dominated, but by the end of the period the levels of horizontal and vertical trade equalized.

Besides the geographical location, Russia and the CIS countries share similar processes of economic transformation and liberalization, the transition from a planned to a market economy, are still ongoing since the collapse of the Soviet Union. This determines the similar level of agricultural production development, similar standards of living, diet patterns (which determine the demand for food products) etc.

Asian Countries

Asian countries are also important trade partners for Russian Federation in term of trade in agricultural products and foodstuffs. About 20–30% of Russian agricultural exports and 15–20% of imports are associated with the Asian countries. Turkey, Vietnam, Thailand, Pakistan and China are the main Russia's trade partners in this region.

Intra-industry trade, measured with the Fontagne-Freudenberg method, accounts for around 36.59 per cent of total trade in 1996 and 21.04 per cent in 2012.

The most important items realized under the vertical type of intra-industry trade are Fish fillets and other fish meat: Crustaceans; Bread, pastry, cakes, biscuits and other bakers' wares.

Vertical intra-industry trade flow includes such items as Molluscs; Fruit, nuts and other edible parts of plants; Fruit juices (including grape must) and vegetable juices.

There was observed a reduction in the level of intra-industry trade. The decrease mostly resulted from the reduction of trade in horizontally differentiated goods (i.e homogenous products with the same quality but with different characteristics). These trends are caused by changes in the trade patterns in relation to individual commodity groups, such as reduction in imports of milk and milk products from Asian countries in recent years compared with the end of the 90s etc.

CONCLUSION

The analysis presented in this paper provides a systematic decomposition of Russia's foreign trade in agricultural products into three trade types: inter-industry, intra-industry in horizontally and vertically differentiated products, over the period 1996–2012.

As it was found, inter-industry type of trade dominates in Russian foreign trade in agricultural and food products. Intra-industry trade accounts for about a third of all trade flows.

Analysis by regions showed that the highest level of intra-industry trade is in relation to CIS countries. More than half of trade flows refers to the type of intra-industry trade. Besides the geographical location, Russia and the CIS countries share similar processes of economic transformation and liberalization, the transition from a planned to a market economy, are still ongoing since the collapse of the Soviet Union. This determines the similar level of agricultural production development, similar standards of living, diet patterns (which determine the demand for food products) etc. These results are consistent with existing literature at the point that the higher the degree of integration among countries and the low in trade barriers, the higher its IIT index.

In relation to Asian countries, the share of intra-industry trade in lower but it exists. However, there was observed a reduction in the level of intra-industry trade in relation to this region.

Almost whole trade with African countries is the inter-industry trade, particularly one-way trade (either exports or imports). It can be logically explained by the differences in climatic conditions for agricultural production as well as differences in factor endowments. Russia exports cereals

to Africa (mainly feed wheat and barley). In recent years, sunflower oil export also increases. In turn, Africa imports in Russia predominantly fruits and vegetables.

In the trade flows between Russia and the countries of North and South America inter-industry trade dominates throughout the whole analyzed period. The share of intra-industry trade is negligible, close to zero.

The increase in the share of intra-industry trade occurred only in relation to the CIS countries. This is evident from comparing the intensity level of the intra-industry trade in the case of Russia's foreign trade in agricultural products that increase in intra-industry trade simultaneously with the process of trade liberalization was not observed.

During the analyzed period, there are noticeable fluctuations of the index value. International trade in agricultural products is sensitive to factors such as government policies, fluctuations of tariffs and quota rates, import restrictions for sanitary reasons and other factors, the study of which is beyond the scope of this study.

In the coming years, Russia's accession to the WTO will increase the level of its integration into the world trading system. Therefore it is reasonable to assume that changes in the level of intra-industry trade will be more significant.

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