Doctoral (PhD) thesis

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Gödöllő
2024

HUNGARIAN UNIVERSITY OF
AGRICULTURE AND LIFE SCIENCES

THE IMPACT OF FOOD IMPORT RESTRICTIONS ON TRADE NETWORKS BETWEEN COUNTRIES

DOI: 10.54598/004370

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2024

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1. WORK HISTORY, OBJECTIVES

As a result of the destabilization of Eastern Ukraine, the United States of America and its Western allies decided to introduce diplomatic and economic sanctions against Russia. In the first round, only targeted sanctions were applied in 2014, when 21 Ukrainian and Russian officials were banned from entering the country and their assets were frozen. Later, the list of sanctioned private individuals was further expanded, and then the range of sanctioning tools used against Russia.

In response, Russia announced in 2014 food import restrictions on the import of product groups originating from countries that have announced economic sanctions against Russian organizations and individuals.

Russia has completely banned imports of beef, pork, fruits and vegetables, poultry, fish, cheese, milk and dairy products from the European Union (EU), the United States of America, Australia, Canada and the Kingdom of Norway.

Later, the range of target countries was expanded to include Albania, Montenegro, Liechtenstein, Iceland and Ukraine. The current Russian-Ukrainian conflict and the series of events that followed it also highlighted that examining the effects of sanctions is a current and important task.

In my research, I examine the effects of food import restrictions on international trade networks. I explore the network properties and topological characteristics with which the effects of sanctions can be well defined.

The main **goals** of my research can be summarized in the following points:

- To map the relevant literature dealing with the effects of import restrictions on agricultural products.
- To explore the topological characteristics of the international trade network of the product groups subject to the food import restriction measures introduced by Russia in 2014.
- To examine whether the food import restrictions introduced by Russia had an impact on the global trade networks in the case of the examined product groups.
- To examine which countries or country groups were the winners of the sanctions and which country groups were the losers.
- To explore in detail whether, following the introduction of the food import restriction measures introduced by Russia in 2014, a change can be observed in the export relations of the exporters of Russia's largest destination country in terms of the diversification of the relations.

The results of the research can help political decision-makers to develop the rule system of international trade policy.

My hypotheses are**:**

H1: The international trade network of the product groups affected by the food import restriction measures introduced by Russia in 2014 is characterized by low density and a wide degree distribution. These topological characteristics did not change even after the introduction of the embargo.

H2: Looking at the international trade network of product groups with customs tariff numbers 08 (fruits), 0202 (beef), 0203 (pork) and 0402 (milk and milk products), a significantly different slope can be seen in the number of connections in the period of 2014 and before compared to the period of 2015 and after.

H3: As a result of the food import restriction measures introduced by Russia in 2014, the exporters of Russia's largest destination country were able to diversify their export relations, but their export volume decreased significantly from 2013 to 2015.

H4: As a result of the food import restriction measures introduced by Russia in 2014, the export volumes of Belarus, Serbia, Uzbekistan and Belarus for the product group with customs tariff number 080810 (apples) and Serbia, Uzbekistan and Belarus for the product group with customs tariff number 080930 (peaches) increased significantly in the direction of Russia. This increase is not explained by the production of the mentioned countries, but by their import volume.

H5: Compared to 2013, the composition of the clusters in the international trade network of product groups with tariff numbers 08 (fruits), 0202 (beef) and 080810 (apples) and customs tariff numbers is determined by geographical aspects from 2015, and a unified European giant cluster has been created.

2. MATERIAL AND METHODS

I used the method of systematic literature review (SLR) to process the literature and used the Bibliometrix-Biblioshiny "R" program package to evaluate the data. During the processing of the literature, I explored the effectiveness of economic sanctions, the impact of trade sanctions and import restrictions on agricultural products, and studies examining interdependence between countries. The studies discovered during the literature search summarize the available and closely related publications in a well-documented system. I explained the objectives, results and conclusions of the studies in detail. During the research, I structured the studies published on the topic thematically and identified the areas and research topics that currently define the literature and provide additional opportunities for future research. **In connection with the research work carried out to verify the hypotheses, the source of the data is the UN Comtrade (UN COMTRADE 2023) and FAO (FAO 2023) databases,** which contain annual and quarterly data on international trade in an aggregated form. The UN Comtrade database contains the export and import data of almost 200 countries in an annual breakdown. More than 99% of the world's merchandise trade is covered by published data. The UN Statistics Division has been collecting trade data continuously since 1962. For the food product groups, I set up a search in the database based on the customs tariff number (HS code). In the research, I included those product groups for which Russian imports from the target countries can be said to be significant (Table 1). I conducted the research for the **period between 2010 and 2020.** For the sake of transparency, I used the ISO codes (ISO Alpha-3) of the countries in the tables found in my thesis and the network diagrams I prepared. Using the databases of UN Comtrade and FAO, I created a database that provides the basis of international trade networks, filtered by customs tariff number. After cleaning the databases, I built up the world's export networks by product, covering all countries, broken down by year. I created a database of 22,770 nodes and 198,030 edges (connections). After cleaning the data and creating the unified databases, I built the International Agricultural Trade Network (IATN) separately for each product group for each year. **I created a total of 99 networks. To analyze the data, I used Gephi 0.10.1 (BASTIAN et al. 2009) and NetworkX Python network analysis and network visualization program packages. I prepared the statistical analyzes with "R" and the SPSS program package.**

The nodes in the network represent the countries of the world that have trade relations with each other. Edges represent the trade relations between countries. I assigned weights to the edges, because the individual countries do not have the same volume of trade relations with each other. The weight of the edges is the volume (amount) of the product sold, or the value of the sale (expressed in US dollars).

Table 1: The food product groups included in the study

Customs tariff number (HS code)	Name of Product
08	fruits
080930	peaches, including nectarines
080810	fresh apples
0203	frozen pork
0202	frozen beef
0207	fresh, chilled or frozen meat, slaughter by-products and offal of poultry suitable for food purposes under customs tariff nr 0105
0402	milk and milk products
0701	potato
160100	sausages and similar meat products or blood products, including prepared food products.

Source: Own editing (2023)

I analyzed directed relations. The reason for this being that one country imports, while the partner country exports agricultural products. So, the direction of the relationships can be interpreted in the trade networks and it is advisable to calculate them and take them into account during the analysis.

The basic topological properties of networks include some indispensable global indicators that provide information about the network as a whole. These include **network density, average path length, network diameter and average clustering coefficient**. I also analyzed the local indicators, which provide useful information about individual countries and their role in the network. These include **weighted degree, betweenness centrality, closeness centrality, clustering coefficient and modularity** (WANG et al. 2023). I explored the general topological characteristics of the investigated networks and examined the differences in the years before the embargo compared to the years after the introduction of the embargo. (Table 2).

I analyzed the local indicators per node (per country) for each examined year and for each food product group. **To prove the fourth hypothesis, I used a two-stage regression model (2 stage least squares regression model). To prove the fifth hypothesis, I performed a modularity test.** The point of the Louvain method (BLONDEL et al. 2008) is the exploration, analysis, evaluation and visualization of clusters. The algorithm developed to detect clusters generates a modularity class value for each grouping, which is used to indicate communities within the network. During my investigations, I only deal with food import restrictions, I did not include other sanctioning measures in the research. Of course, export

restrictions or the application of targeted sanctioning measures have a completely different effect on the network as a whole, so their analysis requires further research.

Table 2: Network indicators included in the study during the research

Global network indicators		**Local network indicators**	
Hungarian name	**English name**	**Hungarian name**	**English name**
csomópontok száma	nodes	befok mutató	indegree
élek száma	edges	kifok mutató	outdegree
átlagos fokszám	average degree	fokszám	degree
átmérő	diameter	súlyozott befok mutató	weighted indegree
sűrűség	density	súlyozott kifok mutató	weighted outdegree
modularitás	modularity	súlyozott fokszám	weighted degree
átlagos klaszterezettségi együttható	average clustering coefficient	eccentricitás	eccentricity
átlagos úthossz	average length	közelség centralitás	closeness centrality
		közöttiség centralitás	betweeness centrality
			authority
			hub
			PageRank
		klaszterezettségi együttható	clustering coefficient
		eigenvektor központiség	eigenvector centrality

Source: Own editing (2023)

3. RESULTS AND DISCUSSION

3.1. Results of the general topological examination of food trade networks

It is typical of the international trade network of product groups affected by the food import restriction measures introduced by Russia in 2014 that **only a fraction of the possible connections were realized in reality.** To prove this hypothesis, I calculated a network density index for each year and network (Table 3). Overall, it can be concluded that **only 5.3% of the possible connections in global networks were realized on average**, which can be said to be low even in terms of commercial networks. Furthermore, I found that a **wide degree distribution is characteristic of all food trade networks**, which means that there are some countries with a significant number of connections and other countries with few connections (Figure 1). This topological feature did not change even after the embargo was introduced.

Table 3: Development of the density indicators belonging to individual product groups

HS code	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
0202	0,037	0,037	0,038	0,039	0,042	0,043	0,043	0,043	0,043	0,044	0,044
0203	0,037	0,037	0,038	0,04	0,044	0,042	0,041	0,041	0,043	0,043	0,043
0206	0,04	0,04	0,043	0,042	0,044	0,045	0,049	0,048	0,046	0,047	0,048
0207	0,05	0,05	0,051	0,053	0,056	0,055	0,056	0,056	0,056	0,056	0,057
0402	0,068	0,068	0,068	0,069	0,073	0,072	0,071	0,071	0,071	0,072	0,073
0701	0,036	0,036	0,037	0,036	0,038	0,036	0,037	0,037	0,038	0,038	0,039
160100	0,042	0,042	0,043	0,046	0,046	0,047	0,048	0,048	0,048	0,048	0,049
08	0,122	0,122	0,121	0,124	0,128	0,134	0,134	0,135	0,137	0,138	0,139
080810	0,034	0,033	0,034	0,035	0,037	0,038	0,034	0,035	0,037	0,038	0,036
080930	0,03	0,031	0,03	0,031	0,032	0,03	0,029	0,03	0,03	0,03	0,031

Source: Own research and edition (2023)

I examined whether the introduction of food import restrictions introduced by Russia in 2014 resulted in a global decrease in the number of trade relations and the density of networks for embargoed foods. It can be assumed that if a receiving market with a significant population (in this case, Russia) introduces import restrictions for some food product groups, the number of connections will decrease globally and the density of the network will also decrease in parallel.

Since Russia has introduced an embargo against 36 countries, it would be a "logical" conclusion that the number of export relations in international trade for each product group will decrease by at least that much.

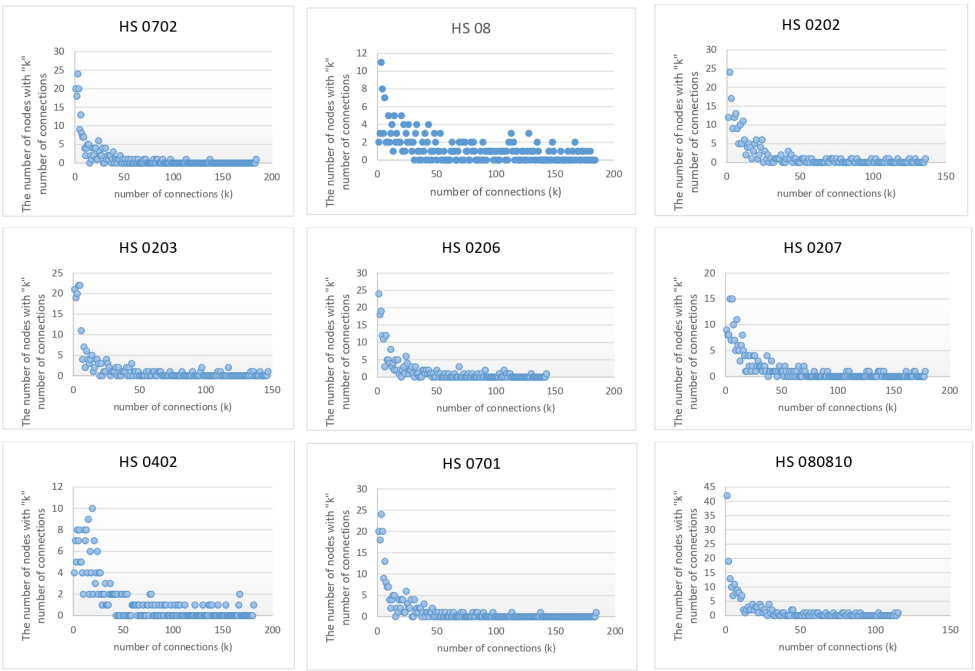

Figure 1: Degree distribution of the examined international trade networks

Source: Own research and edition (2023)

In my research, I explored in detail the evolution of the number of connections and the density in the food trade network between 2012 and 2020 (Table 4). **In the long term, the number and density of connections increased in each of the analyzed networks. An average increase of 13.3% in the number of connections can be observed from 2012 to 2020 and 4.6% from 2013 to 2015. The density index increased by an average of 11.8% in the long term, and a 5.1% increase in the short term from 2013 to 2015.**

The reason for the increase in the two examined indicators may be that the Western states under sanctions have established new trade relations with Russia's allies, which countries sell products to Russia. In addition, a significant number of the states subject to sanctions have established new trade relations with other Western states. The 2014 sanctions package introduced by Russia hit the target countries hard and in the short term meant a significant drop in export volume, so they were forced to explore new trade channels and diversify exports. This forced situation resulted in them being able to establish new permanent trade relations with countries that no longer sell food to Russia.

Table 4: Changes in the number of connections and the density index in the long and short term by product group

Examined indicator	08	0202	0203	0206	0207	0402	0701	160100	Av. change
	from 2012 to 2020								
Nr. of connections	12,8%	13,4%	13,2%	18,2%	13,2%	6,8%	14,0%	14,7%	13,3%
Density	14,9%	15,8%	13,2%	11,6%	11,8%	7,4%	5,4%	14,0%	11,8%
	from 2012 to 2015								
Nr. of connections	5,0%	9,9%	6,4%	7,1%	1,0%	3,8%	0,0%	3,4%	4,6%
Density	8,1%	10,3%	5,0%	7,1%	3,8%	4,3%	0,0%	2,2%	5,1%

Source: Own research and edition szerkesztés (2023)

Based on the above, it can be seen that the number and density of connections in the networks I examined increased from year to year, that is, a significant part of the target countries established new trade relations with Russia's allied and neighboring countries, so theoretically, a decrease in the average clustering coefficients should have occurred in all the networks examined. On the other hand, in the short term, the exact opposite happened, i.e. the clustering coefficients increased. The reason for this may be that if a receiving market with a significant population (in this case, Russia) introduces import restrictions against many countries, clustering will increase on a global level, as a kind of "blocking" process in food trade starts, so that certain groupings trade more frequently with each other and with each others' partners of trading countries also probably trade mainly within the cluster. During my research, I explored in detail the evolution of the global clustering coefficients in each examined year and in the commercial network of each examined product group. I came to the conclusion that the value of the indicator increased in all cases in the short term, but at the same time in the long term no clear increase can be established in all product groups (Table 5). In the short term, the value of the coefficient increased by an average of 4.1% from 2012 to 2015, but in the long term, a decrease can be seen in the case of feed-type products used for feeding poultry and potatoes (0206, 0207, 0701), and an increase in the other product groups.

Overall, it can be said that in the short term the target countries were hit hard by the introduction of import restrictions and could not immediately adapt to the changed market conditions, but in the medium and long term they were able to build new trade relations, which started processes that cross clusters. The reason for this is that the Western states established new trade relations with countries that previously belonged directly to Russia's group. Of course, these close relations remained in the Russian context, but the Western states diversified their relations across clusters. The same can be said for Russia and its allies.

Table 5: Changes in the average clustering index in the long and short term by product group

Examined index	08	0202	0203	0206	0207	0402	0701	160100	Av. change
	from 2012 to 2020								
Av. clast. coef.	7,3%	19,0%	6,6%	-33,8%	-0,6%	2,5%	-8,4%	6,1%	-0,2%
	from 2012 to 2015								
Av. clast. coef.	2,7%	2,1%	4,8%	4,8%	0,2%	6,0%	9,4%	2,9%	4,1%

Source: Own research and editing (2023)

3.2. Changes in the degree of international agricultural trade networks as a result of food import restrictions

For each product group, I examined the evolution of the degree of the networks as a result of the food embargo. **Looking at the international trade network of product groups with customs tariff numbers 08, 0202, 0203 and 0402, a significantly different slope can be seen in the number of connections in the period of 2014 and before compared to the period of 2015 and after.**

I introduced a dummy variable for the linear trend calculation. This dummy variable took the value 0 between 2010 and 2014 and then 1, indicating the entry into force of the embargo after 2014. **I supplemented the simple bivariate linear trend with the dummy variable and the interaction between the dummy variable and the trend.** This is how I modeled the effect of the embargo, which appeared in the trend of changes in relations.

Regarding the product group with customs tariff number 08, the results clearly show that a significantly different slope ($B=-76.021$; $t(7)=-3.001$; $p=0.020$) can be detected in the period of 2014 and before compared to the period of 2015 and after. So it can be assumed that the embargo had an impact on the development of the number of connections (Figure 2).

I also examined whether, in terms of the international trade network of the product group with tariff number 0203, a significantly different slope in the number of connections can be detected in the period of 2014 and before compared to the period of 2015 and after (Figure 3). The results clearly show that a significantly different slope ($B=-57.9$; $t(7)=-8.436$; $p<0.001$) can be detected in the period of 2014 and before compared to the period of 2015 and after. From 2015, the growth rate of the number of connections changed significantly. After a slight decline in 2016, the number of international trade relations started to increase again globally, but the growth no longer follows the same trend as was observed in the period before the introduction of the embargo.

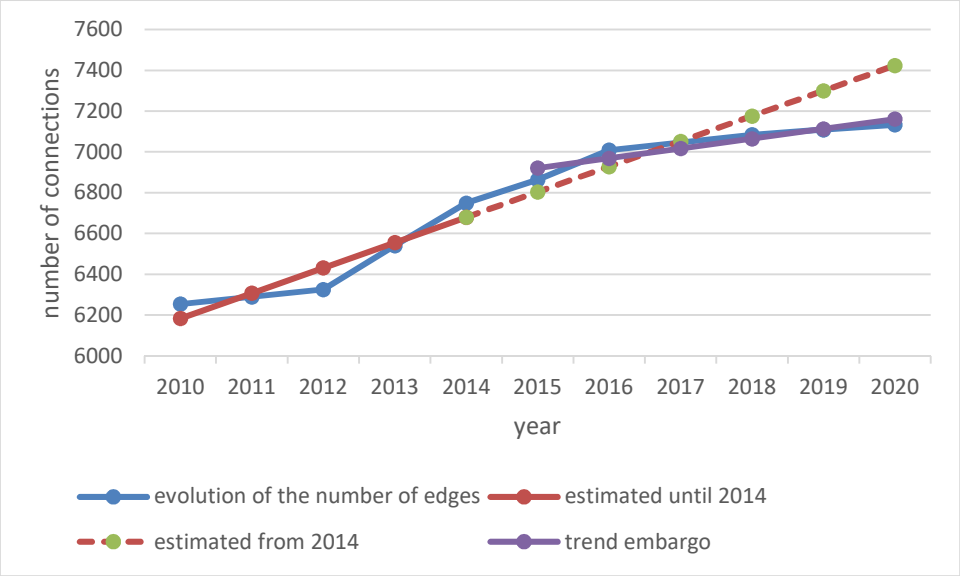

Figure 2: Development of the number of connections appearing in the international trade network of the HS 08 product group

Source: Own editing (2023)

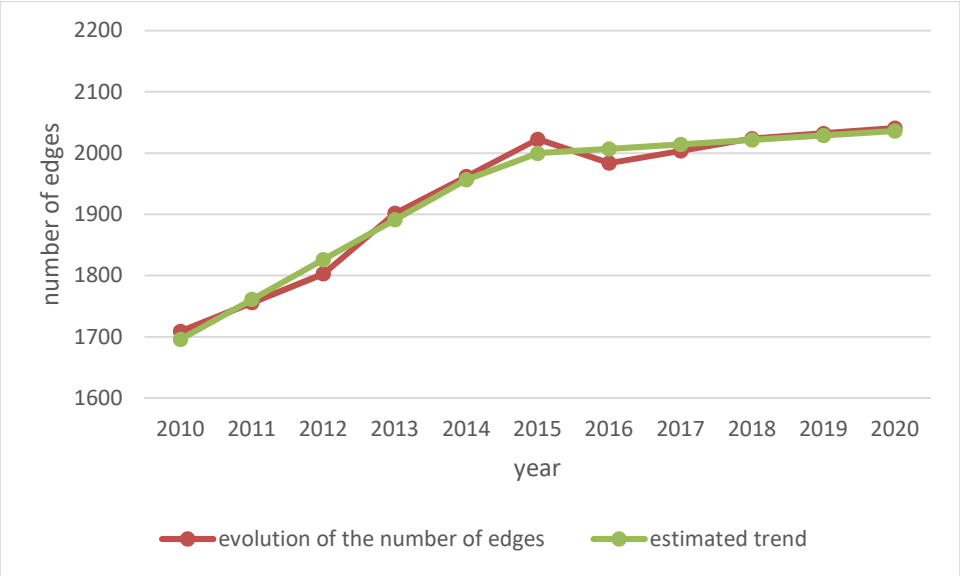

Figure 3: Development of the number of connections appearing in the international trade network of the HS0203 product group

Source: Own editing (2023)

Regarding the product group with customs tariff number 0202, the results clearly show that a significantly different slope (B=-42.857; t(degree of freedom)=-3.813; p=0.007) can be detected in the period 2014 and before compared to the period 2015 and after (Figure 4) .

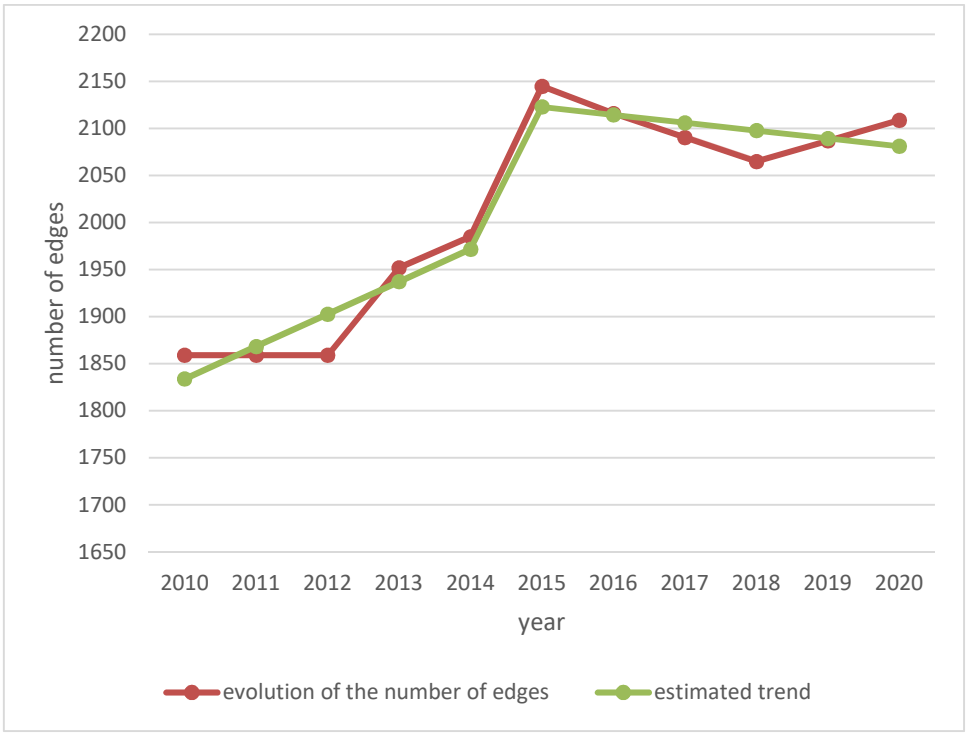

Figure 4: Development of the number of connections appearing in the international trade network of the HS 0202 product group

Source: Own editing (2023)

In the case of the product group with customs tariff number 0402, I also examined whether a significantly different slope can be detected in the number of connections in the international trade network of the product group before 2014 compared to the period after 2015 (Figure 5).

The results clearly show that a significantly different (B=-64.179; t(7)=-4.233; p=0.004) slope can be detected before 2014 compared to the period after 2015.

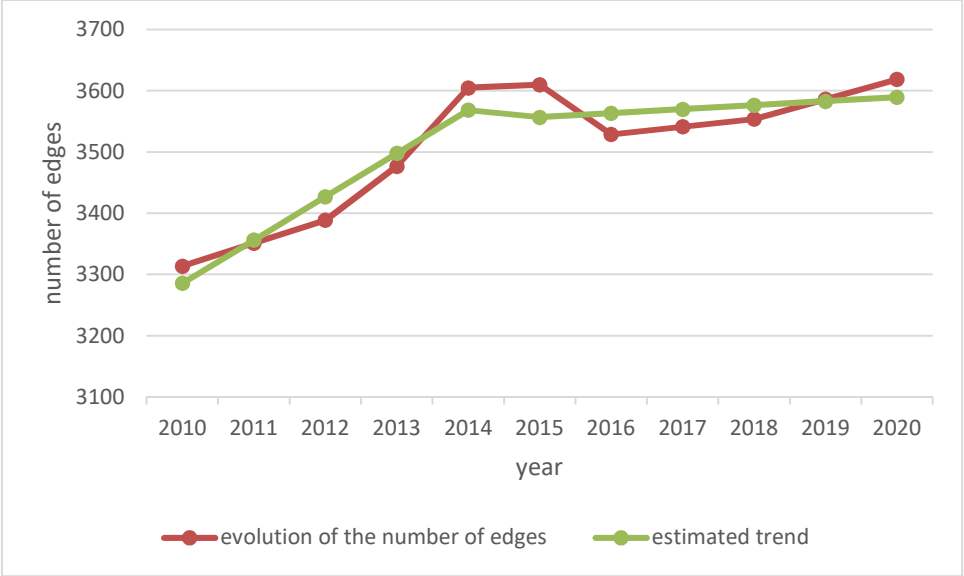

Figure 5: Development of the number of connections appearing in the international trade network of the HS 0402 product group

Source: Own editing (2023)

3.3. Examining the development of the outdegree indicator and the export volume

During my research, I examined how Russia's largest supplier destination countries were able to increase their export volume and the number of contacts from 2013 to 2015 (Table 6). **As a result of the food import restriction measures introduced by Russia in 2014 for product groups 08, 0202, 0203, 0207, 0402, 0701 and 160100, the exporters of Russia's largest destination country were able to diversify their export relations, but their export volume decreased significantly from 2013 to 2015.** The same can be said about the international trade network (Trade Network, TN) for peaches (080930) and apples (080810), as both the number of export connections and the export volume of the destination countries increased on average for the two product groups. So, with regard to these two product groups, the exporters in the destination country were not negatively affected by the embargo, because they were able to diversify their export relations and, in addition, they were able to increase the amount sold. With regard to the other product groups, without exception, the embargo had a completely different effect, since the exporters in the destination country were able to increase the number of contacts, but at the same time the export volume dropped significantly. This means that while the target countries diversified their export relations after the introduction of the embargo, this expansion of relations was not sufficient to maintain or increase the amount sold to the rest of the world.

Table 6: Change in export volume and export volume from 2013 to 2015 for product groups 08, 0202, 0203, 0207, 0402, 0701, 160100, 080930 and 080930

Product group	Change in indicator outdegree from 2013 to 2015	Change in export volumen from 2013 to 2015
08	12.4%	-17.6%
0202	30.2%	-10.7%
0203	9.6%	-22.5%
0701	21.3%	-32.6%
0207	7.9%	-21.6%
0402	10.3%	-19.0%
160100	8.4%	-23.2%
080810	29.0%	130.8%
080930	23.7%	109.7%

Source: Own research and editing (2023)

3.4. Exploration of re-exporter positions using a two-step regression model

In the case of hypothesis 3, for all product groups subject to the embargo, it was shown that the target countries could not increase or maintain their previous export volume after the embargo, except for the product groups with tariff numbers 080810 (apples) and 080930 (peaches and nectarines). therefore, I carried out more in-depth investigations regarding the two product groups. During my research, I came to the conclusion that in the case of the two product groups, after the introduction of the sanctions, some states allied with Russia will buy Western agricultural products and export them to Russia. Thus, Western states are able to export their products to Russia in the same way, only through the re-export activity of an intermediate state.

To explore the re-exporter positions, I used the two-stage least squares (2SLS) regression model. As a first step, I explored how exports to Russia are affected by production and imports. As a second step, I examined how the import volume of the affected country is affected by the embargo.

I identified three key countries in the international trade network of peaches (Belarus, Serbia and Uzbekistan), which presumably engaged in re-export activities, taking advantage of food import restrictions. In the case of Serbia, as the first step of the model, I examined how Serbia's peach exports to Russia are affected by Serbia's imports from all countries of the world ($F(2;13)=66.21$; $p<0.001$). The significance value of production is 7.9% (Table 7), which means that it is not a significant influencer of how the export volume to Russia develops, but imports have a significant effect on exports ($p<0.001$). So it can be assumed

that Serbia's imports from all countries of the world influenced Serbian exports to Russia. As a second step, I analyzed how Serbian imports were affected by the embargo introduced by Russia. ($F(3;12)=5.356$; $p=0.014$). Based on the results, it can be concluded that the food import restriction measures had a significant effect on Serbian imports ($p<0.001$).

Table 7: Results of the two-step regression model (Serbia, HS080930)

	Estimate	**Std. Error**	**t value**	**Pr(>|t|)**
(Intercept)	-1.965	4454	-0.441	0.6664
SRB_production_peaches	0.1189	0.06243	1.905	0.0792
SRB_import_from_WORLD_peaches	1.317	0.1291	10.196	<0.001
(Intercept)	290.3	361407.01	0.08	0.9373
trend	218.9	642.3	0.341	0.7392
embargo	36151	12885	2.806	0.0159
trend_embargo	-2270.3	1138.7	-1.994	0.0694

Source: Own research and editing (2023)

In the case of Belarus, I also examined how exports to Russia are affected by Belarus' imports from all countries of the world ($F(1;20)=401.4$; $p<0.001$). Import has a significant effect on export ($p<0.001$) (Table 8). So it can be assumed that Belarus's imports from all countries of the world influenced Belarusian exports to Russia. As a second step, I analyzed how Belarusian imports were affected by the embargo introduced by Russia. ($F(3;18)=52.97$; $p<0.001$). Based on the results, it can be concluded that the food import restriction measures had a significant effect on Belarusian imports ($p<0.001$).

Table 8: Results of the two-step regression model (Belarus, HS 080930)

	Estimate	**Std. Error**	**t value**	**Pr(>|t|)**
(Intercept)	-6326	2364	-2.676	0.0145
BLR_import_from_WORLD_peaches	0.8484	0.04235	20.035	<0.001
(Intercept)	-9970.1	835401.01	-1.193	0.2482
trend	3178.08	918.8	3.46	0.0028
embargo	554314.9	56136	9.874	<0.001
trend_embargo	-27804.8	304704.01	-9.124	<0.001

Source: Own research and editing (2023)

In the case of Uzbekistan, I also examined for the first time how Uzbekistan's exports to Russia are affected by Uzbekistan's imports from all countries of the world ($F(2;19)=87.65$; $p<0.001$). The significance value of production is 6.55%

(Table 9), which means that it is not a significant influence on how the export volume to Russia develops, but imports have a significant effect on exports ($p<0.001$).

So it can be assumed that Uzbekistan's imports from all countries of the world influenced Uzbek exports to Russia.

As a second step, I examined how Uzbek imports were affected by the embargo introduced by Russia ($F(3;18)=17.08$; $p<0.001$). Based on my results, it can be concluded that the food import restriction measures had a significant effect on Uzbek imports ($p<0.001$).

Table 9: Results of the two-step regression model (Uzbekistan, HS 080930)

	Estimate	**Std. Error**	**t value**	**Pr(>|t|)**
(Intercept)	-1564	1549	-1.009	0.3256
UZB_production_peaches	0.02409	0.01233	1.954	0.0655
UZB_import_from_WORLD_peaches	0.5262	0.04846	10.86	< 0.001
(Intercept)	> - 0.001	4963	0	1
trend	< 0.001	545.9	0	1
embargo	-115600	33350	-3.466	0.002758
trend_embargo	7350	1811	4.06	< 0.001

Source: Own research and editing (2023)

In the international trade network of apples, I identified a key country (Belarus), which presumably carried out re-export activities, thus taking advantage of food import restrictions.

In the case of Belarus, as a first step, I examined how exports to Russia are affected by Belarus' production and imports from all countries of the world ($F(2;19)=18.57$; $p<0.001$). The significance of production is 8.04% (Table 10), which means that it is not a significant influencer of how the export volume to Russia develops, but imports have a significant effect on exports ($p<0.001$). So it can be assumed that Belarus's imports from all countries of the world influenced Belarusian exports to Russia.

As a second step, I analyzed how Belarusian imports were affected by the embargo introduced by Russia. ($F(3;18)=39.59$; $p<0.001$). Based on the results, it can be concluded that the food import restriction measures had a significant effect on Belarusian imports ($p<0.001$).

Table 10: Results of the two-step regression model (with regard to Belarus and the product group with customs tariff number 080810)

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-11380	42610	-0.267	0.792
BLR_production_apple	-0.02836	0.1124	-0.252	0.804
BLR_import_from_WORLD_apple	0.4849	0.08177	5.93	<0.001
(Intercept)	-28673	41998	-0.683	0.50347
trend	16016	4619	3.467	0.00275
embargo	2413856	282209	8.553	<0.001
trend_embargo	-122713	15320	-8.01	<0.001

Source: Own research and editing (2023)

3.5. The results of the modularity tests

I conducted a modularity study for all the relevant international food trade networks. Based on my results, it can be concluded that in the case of the product groups with customs tariff numbers 08, 080810 and 0202, the composition of the clusters is determined by geographical aspects from 2015, and a unified European giant cluster was created from 2013 to 2015. In the years before the food import restrictions introduced by Russia in 2014, European countries did not belong to a single cluster in terms of the mentioned product groups, but were typically scattered members of different groupings in accordance with their own trade traditions. This situation was changed by the Russian embargo, because it forced the target countries to primarily determine their belonging to the network cluster by geographical considerations.

3.5.1. The results of the modularity test of the international trade network of the product group with customs tariff number 08

Overall, it can be said that the composition of the clusters in the international trade network of the product group with tariff number 08 is determined by geographical aspects from 2015. From 2013 to 2020, the number of clusters decreased significantly and a unified European giant cluster was created, which is interesting because European countries previously belonged to three large separate groupings. Cyprus, Latvia, Slovakia, the Czech Republic, Lithuania, Greece and Poland belonged to a group together with Russia in 2013, and by 2015 they were part of the unified European giant cluster (Table 11).

Table 11: Modularity test results in 2013 and 2015 (HS 08)

Ssz.	C1-2013	C2-2013	C3-2013			C4-2013	C1-2015		C2-2015	C3-2015		C4-2015	C5-2015
1	BHS	GIN	LAO	ZMB	PAN	MNG	LCA	LUX	BHS	TGO	HKG	CHN	DJI
2	JAM	UZB	NPL	TGO	SVN	ARM	BRB	PAN	JAM	MDV	VNM	ARM	TJK
3	NIC	BRN	BEN	PRY	DOM	ALB	ZMB	GEO	GIB	MNG		ALB	UZB
4	HND	KHM	KEN	LCA	LBY	KGZ	HTI	BGR	VEN	GIN		KGZ	BRN
5	SLV	TJK	YEM	HTI	KWT	CYP	KHM	BOL	NIC	MAC		MNE	SOM
6	VEN	MAC	QAT	MWI	BGR	AZE	SWZ	TUN	SLV	PRK		BHR	SDN
7	LUX	MDV	EST	PSE	TUN	MDA	PSE	SVK	URY	NPL		MKD	TKM
8	NOR	PRK	LKA	MRT	IRL	GEO	MDG	HUN	HND	BEN		HRV	YEM
9	GTM	TTO	OMN	ZWE	HUN	LVA	MWI	DOM	NOR	LAO		MDA	KEN
100	PER	SDN	TZA	MNE	ROU	DZA	MRT	IRL	GTM	BFA		AZE	OMN
11	CRI	TKM	LBN	BWA	SRB	SVK	PRY	FIN	CRI	QAT		SVN	LBN
12	MEX	BFA	AFG	SWZ	ISR	KAZ	BWA	ROU	PER	NGA		KAZ	DZA
13	CAN	SYR	BGD	MUS	MAR	BLR	AGO	SRB	CAN	GNB		LVA	JOR
14	CHL	BHR	NGA	ISL	DNK	UKR	ZWE	ISR	CHL	TZA		UKR	KWT
15	USA	SGP	MMR	AGO	CHE	CZE	MUS	CZE	MEX	LKA		BLR	IRQ
16		IRQ	JOR	MLT	PRT	LTU	TTO	DNK	USA	BGD		LTU	SAU
17		IDN	GHA	BLZ	COL	EGY	ISL	MAR		MMR		EGY	IRN
18		MYS	FIN	NAM	SWE	GRC	MLT	CHE		AFG		ECU	ARE
19		NZL	CIV	SEN	AUT	ECU	NAM	PRT		GHA		RUS	
20		SAU	PAK	BIH	ARG	POL	SEN	COL		PAK			
21		KOR	IRN	MOZ	BRA	RUS	BLZ	SWE		SGP			
22		AUS	ARE	CMR	ZAF		MOZ	ARG		CIV			
23		PHL	IND	MKD	BEL		CMR	AUT		MYS			
24		THA	VNM	URY	TUR		SYR	GRC		PHL			
25		JPN	HKG	HRV	GBR		BIH	BRA		IDN			
26			CHN	BOL	FRA		CYP	POL		KOR			
27				DEU	ITA		LBY	ZAF		NZL			
28				ESP	NLD		EST	BEL		AUS			
29							ITA	GBR		JPN			
30							NLD	TUR		THA			
31							DEU	FRA		IND			
32							ESP						

Source: Own research and editing (2023)

Russia also changed groups in 2015, as they previously formed a joint cluster with some European and Asian states, and then in 2015 became part of the group dominated by China.

The C1 cluster of 2013 corresponds to the C2 group of 2015. The composition of the module hardly changed (with the exception of the position of Luxembourg, as it was transferred to the European giant cluster) and remained relatively stable even after 2015. The largest importers of the grouping are Canada, Norway and Venezuela, and the largest exporters are the United States of America, Chile and Mexico.

In 2013, the C2 group is equivalent to an Asian giant cluster with the participation of some European and overseas states. The group's largest importers were China,

Hong Kong, Japan, Vietnam and India, while the largest exporters were China, Iran, Vietnam, India and Hong Kong. This cluster corresponds to the C3 and C4 clusters of 2015. From 2013 to 2015, the composition of the group changed to the extent that the European states were transferred to the European giant cluster, while Russia's separate group broke up and joined a common cluster with China.

The C3 group of 2013 was the unified European giant cluster with the participation of several other Asian and African countries. The largest importers in the cluster were Germany, the Netherlands, the United Kingdom, France and Italy, and the largest exporters were Spain, the Netherlands, Turkey, Italy and the Republic of South Africa. This cluster corresponds to the 2015 grouping C1. From 2013 to 2015, there were so many changes that instead of 56 countries, 62 countries belonged to the cluster. The joining countries were primarily European Union member states that previously belonged to other groupings.

In 2013, the C4 cluster was the Central Asian cluster dominated by Russia, which was supplemented by some European states. The composition of the cluster changed completely by 2015, so perhaps it corresponds to the C5 cluster of 2015. Russia has moved into the big Asian grouping dominated by China.

3.5.2. The results of the modularity test of the international trade network of the product group with customs tariff number 080810

Table 12 shows the results of the country-specific modularity test for the international trade network of the product group with customs tariff number 080810.

The C1 cluster of 2013 can be called the French community, because the highest ranked country in this community was France.

This cluster disintegrated after the introduction of the embargo and France became part of the single European giant cluster.

Unsurprisingly, the sub-network consisted mainly of francophone countries and European Union member states in 2013.

In 2013, the C2 community could be called the Turkish community, because the highest ranking country in the cluster was Turkey. The largest importer countries in the community were Iraq, Egypt, Turkmenistan, and Syria, while the largest exporters were Iran, Turkey, Lebanon, and Greece. From 2015, Greece became part of the unified European giant cluster.

Table 12: Modularity test results (HS 080810)

Ssz.	C1-2013	C2-2013	C3-2013	C4-2013	C5-2013	C6-2013	C1-2015	C2-2015	C3-2015		C4-2015	C5-2015	C6-2015
1	CYP	AFG	ZMB	HND	MNG	ALB	BWA	HND	QAT	SVN	KWT	AZE	MNG
2	MAR	JOR	GHA	BHR	PRK	EST	ZWE	PRY	MAR	SWE	SYR	MDA	KGZ
3	CHE	ISR	KEN	SLV	LKA	LVA	ZMB	SLV	CHE	HUN	PAK	SRB	LKA
4	HRV	KWT	ZWE	VEN	NPL	BIH	AGO	DOM	EST	MKD	TKM	KAZ	NPL
5	OMN	SYR	NAM	DOM	KGZ	BGR	SEN	CRI	ISR	PRT	AFG	LTU	PRK
6	FIN	TKM	SEN	CRI	SGP	AZE	KEN	GTM	ALB	LVA	TUR	RUS	MMR
7	SVK	GRC	BEN	GTM	PHL	SVN	NGA	BOL	OMN	GRC	IRQ	BLR	SGP
8	IRL	LBN	AGO	QAT	VNM	UKR	MYS	ECU	JOR	ROU	IRN		PHL
9	DNK	TUR	MYS	BOL	IDN	HUN	GBR	PER	BGR	DZA			IDN
10	LBY	EGY	ARG	PER	HKG	ROU	ZAF	COL	FIN	AUT			VNM
11	PRT	IRQ	BRA	NOR	THA	MKD		ARG	LBY	CZE			THA
12	SWE	IRN	GBR	ECU	BGD	LTU		HKG	CYP	EGY			BGD
13	DZA	ITA	ZAF	COL	KAZ	SRB		BRA	NOR	BEL			NZL
14	CZE			SAU	IND	MDA		SAU	BIH	ESP			CHN
15	AUT			CAN	NZL	BLR		CAN	HRV	NLD			
16	BEL			ARE	CHN	POL		IND	SVK	DEU			
17	ESP			MEX		RUS		ARE	LBN	FRA			
18	NLD			CHL				MEX	UKR	POL			
19	FRA			USA				CHL	IRL	ITA			
20	DEU							USA	DNK				

Source: Own research and editing (2023)

In 2013, the largest importers of the C3 community were the United Kingdom, Malaysia and Brazil, while the largest exporters were the Republic of South Africa, Argentina and Brazil. The composition of the cluster did not change significantly even after the introduction of sanctions and remained stable even after 2015. This grouping corresponds to the C1 community of 2015.

The largest importers of the C4 community in 2013 were Mexico, the United States of America, and Canada, while the largest exporters were the United States of America, Chile, the United Arab Emirates, and Canada. The community corresponds to the 2015 C2 cluster. The composition of the cluster did not change significantly after the sanctions and remained stable even after 2015.

The largest importer countries of the C5 community in 2013 were India and Kazakhstan, while the largest exporters were China, New Zealand and Hong Kong.

The C6 cluster of 2013 could be called the Polish community, because the member country with the highest rank is Poland. Before the introduction of sanctions, it appeared as a community representing a significant number of member countries. The highest ranked countries were Poland, Ukraine and Russia. The Asian countries neighboring Russia primarily belonged to this community. This cluster fell apart after the embargo. Russia joined the

community dominated by Turkey, while Ukraine and Poland joined the unified European giant cluster.

3.5.3. The results of the modularity test of the international trade network of the product group with customs tariff number 02

The composition of the clusters in the international trade network of the product group with customs tariff number 0202 is illustrated in Table 13.

Table 13: Modularity test results in 2013 and 2015 (HS 0202)

Ssz.	C1-2013		C2-2013		C3-2013		C4-2013	C5-2013		C6-2013	C1-2015	C2-2015	C3-2015	C4-2015	C5-2015	C6-2015	
1	IND	SLE	BRA	SMR	USA	GUY	AUS	URY	NOR	KEN	NAM	BRB	SVN	ABW	SEN	SVK	POL
2	THA	MMR	PRY	GNB	NZL	WLF	MEX	ARG	ZMB	UGA	OMN	JAM	PNG	SRB	SYR	GEO	DEU
3	PAK	LBR	NIC	DJI	CAN	TUV	CHN	POL	GRC	RWA	PAK	SLV	NOR	SDN	BRN	CHE	ITA
4	MYS	COM	ITA	HTI	HKG	TKL	JPN	DEU	LUX	TZA	ZAF	BHS	KHM	COL	TJK	CYP	NLD
5	JOR	YEM	BLR	CPV	CRI	NIU	SGP	NLD	CYP	SSD	KWT	PER	TTO	LBY	COD	EST	DNK
6	NPL	MDV	COL	CUB	PAN	DMA	KOR	IRL	MLT	SOM	ARE	PYF	KGZ	KAZ	MUS	HRV	SWE
7	QAT	ARM	UKR	CUW	ARE	MRT	SAU	ESP	ISL	SDN		PAN	MAC	PSE	AZE	ROU	BEL
8	LKA	GHA	LTU	ALB	TUR	ERI	KWT	AUT	LVA			BHR	IDN	UKR	COG	CZE	ESP
9	OMN	GNQ	RUS	TUN	BOL	ETH	FJI	GBR	SWE			GTM	THA	CHL	LBN	FIN	IRL
10	BHR	TJK	CHL	LBY	BGD	KNA	IOT	BWA	BGR			QAT	ARG	JOR	GAB	BIH	FRA
11	LBN	COD	MDA		GTM	BLZ	CCK	FRA	FIN			DOM	ISR	BLR	TKM	MLT	GBR
12	SEN	TKM	SRB		HRV	GRD	CXR	BEL	SWZ			CRI	CAN	IRN	LAO	LTU	
13	MUS	SYR	VEN		PHL	VCT	KIR	NAM	SVK			SGP	URY	PRY	AGO	UZB	
14	BRN	GAB	EGY		MAC	AIA	VUT	DNK	SVN			NIC	JPN	VEN	DZA	BGR	
15	VNM	LAO	PSE		WSM	PLW	GUM	ZAF				MEX	KOR	EGY	IRQ	HUN	
16	BDI	AZE	GEO		JAM	SUR	NRU	HUN				SAU	CHN	RUS	PHL	GRC	
17	CIV	COG	MNE		MDG	MNP	SLB	ROU				NZL	AUS	HKG	MYS	BWA	
18	TLS	IRQ	ABW		LCA	COK	SYC	CZE				USA		VNM	IND	PRT	
19	BEN	DZA	IRN		SLV	ASM	PRK	PRT						BRA		TUR	
20	TCD	AGO	KAZ					EST								AUT	

Source: Own research and editing (2023)

The C1 cluster of 2013 was a distinctly Asian community with a significant number of members. The largest importing countries were Vietnam, Malaysia, Thailand and Jordan, while the largest exporters were India, Thailand, Pakistan and Malaysia. This community corresponds to the C5 cluster of 2015.

The largest importers of the C2 community in 2013 were Russia, Venezuela, Egypt, Iran and Italy, while the largest exporters were Brazil, Paraguay, Nicaragua and Italy. By 2015, the composition of the community had completely changed. Russia became part of an Asian community, while Italy joined the large European giant cluster.

The largest importing countries in cluster C3 in 2013 were Hong Kong and the United States, while the largest exporters were the United States, New Zealand, and Canada. By 2015, this cluster had completely disintegrated and shrunk by half.

The largest importers in the C4 cluster in 2013 were Japan, China and South Korea, while the largest exporters were Australia, Mexico and China.

The largest importers of the C5 community in 2013 were Israel, France, the Netherlands and Germany, while the largest exporters were Uruguay, Argentina, Poland and Germany. By 2015, this cluster was transformed into a unified European giant cluster, which corresponds to the 2015 C6 cluster.

The C6 community in 2013 included countries with a small number of contacts and small trade turnover.

4. CONCLUSIONS AND PROPOSALS

In my research, I dealt with the effects of the import restrictions introduced by Russia in 2014. It can be concluded that Russia applied the sanctions as part of a complex import substitution economic policy (WEGREN – NILSSEN 2021). The purpose of this economic policy was not to introduce food embargoes per se, but to strengthen the domestic economy and to create an opportunity for Russian producers to gain market share in the domestic food market. Substantial subsidies were introduced for producers in order to increase their efficiency and thus their competitiveness. As a result of the introduction of Russia's self-sufficiency-seeking economic policy, producers gained a significant market share in the domestic market, and were able to significantly increase their production and export volume (TUKHKANEN et al. 2023). The primary reason for this is that the products of the target countries were pushed out of the Russian market and new, more expensive import products from mainly Asian countries appeared (SEIFULLAEVA et al. 2018). In addition, domestic producers received significant subsidies, which they could use for efficiency-enhancing investments. As a result of the measures, Russian food imports decreased significantly after 2014. Russian consumers were the clear losers of the introduction of sanctions, as consumer prices for food increased (BYKOVA et al. 2023). Russian producers and new export partners were also able to sell products at higher prices. The results of several investigations show that the real winners of the food embargoes were the Russian producers, as they made investments before the introduction of the sanctions by using significant state subsidies, so they were able to increase their production, and then, after the products of the target countries were displaced, they were able to satisfy the demand on the domestic market (SHAGAIDA – UZUN 2016; SEIFULLAEVA et al. 2018; TSUTSIEVA et al. 2019; VERTAKOVA et al. 2017).

During my research, I came to the same conclusion as stated in previous studies, that as a result of the introduction of food trade sanctions, Russia's international food trade diversification decreased with regard to the affected product groups (BORISOV et al. 2020; WEGREN - ELVESTAD 2018). I also came to the same conclusion as stated in the literature, that the embargo had a negative effect on the target countries in the sense that they lost the Russian market and overall their export volume decreased in relation to the affected product groups (SMUTKA – ABRHÁM 2022; WEGREN – ELVESTAD 2018).

During my investigations, I came to the conclusion that in the case of product groups 080810 (apples) and 080930 (peaches), some states allied with Russia will buy Western agricultural products and export them to Russia after the introduction of the sanctions. Thus, Western states are able to export their products to Russia in the same way, and Russian consumers get access to Western peaches and apples in the same way, since Russia always buys these food products, only through the

re-export activity of an intermediate state. These intermediate states can be considered the winners of the sanctions, because they were able to increase their export volume multiple times with regard to the affected product groups.

In the course of my research, I came to the conclusion that in the years before the introduced food import restrictions, European countries did not belong to a single connected European cluster in terms of product groups 08, 0202 and 080810, but were typically dispersed members of different groupings in accordance with their own trade traditions. This situation was changed by the Russian embargo, because it forced the target countries to primarily determine their affiliation to the network cluster by geographical considerations.

The results of the research can help political decision-makers to develop the rule system of international trade policy, as well as contribute to the understanding of the general topological characteristics of food trade networks.

Based on my research, I recommend not using food import restrictions when developing trade policy, because

- numerous scientific studies prove that the consumers of the sending country are harmed by the measure through several channels.
- numerous scientific studies prove that the food trade diversification of the sending country is decreasing.
- a "blocking" process starts globally, which has a detrimental effect on free trade.
- a part of third countries (which are neither the sending state nor the destination country) may have the opportunity to neutralize the goal that the sending state wants to achieve through re-export activities.

If political decision-makers nevertheless decide to introduce food import restrictions in order to have a negative economic impact on the target countries, such a measure can be successful if the following conditions are met:

- to prepare the domestic economy before the introduction of the sanction in order to avoid a shortage on the supply side.
- to prevent some third countries from being able to neutralize the effects of the sanctions through re-export activities.
- the destination country must be a significant import partner of the sending state.

Another possible direction of research is that the investigation could be extended to export restrictions and other trade policy measures, as well as to examine the effects of import restrictions in the case of product groups other than food.

The results of my hypothesis tests are as follows:

T1: Based on my research, I accept my first hypothesis, that the international trade network of the product groups affected by the food import restriction measures introduced by Russia in 2014 is characterized by low density and wide degree distribution. These topological characteristics did not change even after the introduction of the embargo.

It is typical of the international trade network of product groups affected by the food import restriction measures introduced by Russia in 2014 that only a fraction of the possible connections were realized in reality. To prove this hypothesis, I calculated a network density index for each year and network. Overall, it can be concluded that only 5.3% of the possible connections in global networks were realized on average, which can be said to be low even in terms of commercial networks. Furthermore, I found that a wide degree distribution is characteristic of all food trade networks, which means that there are some countries with a significant number of connections and other countries with few connections. This topological feature did not change even after the embargo was introduced.

T2: I accept my second hypothesis, according to which, looking at the international trade network of product groups with tariff codes 08 (fruits), 0202 (beef), 0203 (pork) and 0402 (milk and milk products), a significantly different slope in the number of connections can be shown in the period 2014 and before Compared to 2015 and beyond.

Analyzing the international trade network of some of the product groups affected by the food import restriction measures introduced by Russia in 2014, it can be observed that after 2014, the trend of global export relations has changed. Before 2014, the number of connections in the aforementioned networks increased dynamically, and after the embargo came into effect, this growth rate slowed significantly for some product groups, and turned into a decrease for other products. The effect of this trend change is not temporary, but permanent. No significant change can be observed between the period before 2014 and the period after 2014 with regard to the products with tariff codes 080810 (apples) and 080930 (peaches and nectarines).

T3: I partially accept my third hypothesis, that as a result of the food import restriction measures introduced by Russia in 2014, the exporters of Russia's largest destination country were able to diversify their export relations, but their export volume decreased significantly from 2013 to 2015.

As a result of the food import restriction measures introduced by Russia in 2014, the exporters of Russia's largest destination country were able to diversify their export relations for all examined product groups. Despite the fact that Russia has severed its export relations with many Western countries, these target countries have developed additional relations with other countries. The embargo forced the destination countries to look for a new receiving market after the loss of the Russian

market, but at the same time, I was able to show a significant decrease in their export volume only with the exception of the network of product groups with tariff numbers 080810 (apples) and 080930 (peaches and nectarines). In the case of the mentioned two product groups, the exporters of Russia's largest destination country were able to increase their export volume and the number of their export relations from 2013 to 2015.

T4: I accept my fourth hypothesis, that as a result of the food import restriction measures introduced by Russia in 2014, the export volume of Belarus for the product group with tariff number 080810 (apples) and Serbia, Uzbekistan and Belarus for the product group with tariff number 080930 (peaches) increased significantly towards Russia. This increase is not explained by the production of the mentioned countries, but by their import volume.

In connection with the verification of the third hypothesis, in the case of the embargoed product groups, it was shown that the target countries were unable to increase or maintain their previous export volume after the embargo, except for the product groups with tariff numbers 080810 (apples) and 080930 (peaches and nectarines), therefore I carried out more in-depth investigations of the two product groups. During my research, I came to the conclusion that in the case of the two product groups, after the introduction of the sanctions, some states allied with Russia will buy Western agricultural products and export them to Russia. Thus, Western states are able to export their products to Russia in the same way, and Russian consumers have access to Western peaches and apples in the same way. The reason for this is that Russia always buys the affected products, only through the re-export activity of an intermediate state. In order to map this activity, I used a two-step regression calculation. Based on the results, it can be said that the import volume of the mentioned countries from all other countries of the world has a significant impact on the exports of Belarus, Uzbekistan and Belarus to Russia for the product group with tariff number 080810 and for the product group with tariff number 080930 (peach and nectarine). The increase in production has no significant effect on the increase in exports. The Russian food embargo has a significant impact on the imports of the three mentioned countries in terms of product groups with tariff numbers 080810 and 080930. It can be assumed that the three countries concerned will buy and then resell a part of the embargoed foodstuffs to Russia after 2014. These countries can be considered the winners of the food import restrictions, because they used the opportunity provided by the restriction and were able to satisfy the demand of Russian consumers quickly and efficiently.

T5: I accept my fifth hypothesis, according to which the composition of the clusters in the international trade network of the product groups with customs tariff numbers 08 (fruits), 0202 (beef) and 080810 (apples) compared to 2013 is determined by geographical aspects from 2015, and a single European giant cluster.

I conducted a modularity study for all the relevant international food trade networks. Based on my results, it can be concluded that in the case of the product groups with customs tariff numbers 08, 080810 and 0202, the composition of the clusters is determined by geographical aspects from 2015, and a unified European giant cluster was created from 2013 to 2015. In the years before the food import restrictions introduced by Russia in 2014, European countries did not belong to a single cluster in terms of the mentioned product groups, but were typically scattered members of different groupings in accordance with their own trade traditions. This situation was changed by the Russian embargo, because it forced the target countries to primarily determine their belonging to the network cluster by geographical considerations.

5. NEW SCIENTIFIC RESULTS

I formulated the new and novel scientific results of my doctoral dissertation after processing the literature, based on the results of my research work and hypothesis tests.

1. The methodology of network theory and graph theory is suitable for exploring the effects of import restrictions through network topological characteristics.
2. During my research, I verified that the international trade network of the product groups affected by the food import restriction measures introduced by Russia in 2014 is characterized by low density and a wide degree distribution. These topological characteristics did not change even after the introduction of the embargo.
3. I have scientifically verified that, in terms of the international trade network of the product groups with customs tariff numbers 08, 0202, 0203 and 0402, a significantly different slope can be shown in the number of connections in the period of 2014 and before compared to the period of 2015 and after.
4. In the course of my research, I verified that as a result of the food import restriction measures introduced by Russia in 2014, the export volume of Belarus for the product group with customs tariff number 080810 (apples) and Serbia, Uzbekistan and Belarus for the product group with customs tariff number 080930 (peaches) increased significantly in the direction of Russia. This increase is not explained by the production of the mentioned countries, but by their import volume.
5. I have scientifically verified that the composition of the clusters in the international trade network of the product groups with customs tariff numbers 08, 080810 and 0202 is determined by geographical aspects, compared to 2013, from the year 2015, and a unified European giant cluster has been created.
6. During my research, I verified that as a result of the food import restriction measures introduced by Russia in 2014, the exporters of Russia's largest destination country were able to diversify their export relations, but their export volume decreased significantly from 2013 to 2015 in the 08, 0202, 0203, 0207, 0402, 0701 and with regard to product groups with customs tariff number 160100.

6. PUBLICATIONS

Book excerpts

published in Hungarian

Erdőháti-Kiss, A. – Erdeiné Késmárki-Gally, Sz. (2021): A kakaóbab nemzetközi kereskedelmi hálózatának a vizsgálata. 74-78. p. In: Szabó, P. – Simon, B. – Soós, A. – Faludi, G. – Fitos, G. (szerk.) *Kutatás-fejlesztés-innováció az agrárium szolgálatában II. kötet*. Budapest, Magyarország: Doktoranduszok Országos Szövetsége, 205 p.

Scientific journal articles

Scientific journal articles published in foreign language

Erdőháti-Kiss, A. – Naár-Tóth, Zs. – Erdei-Gally, Sz. (2023a): The Impact of Russian Import Ban on the International Peach Trade Network, In: *Acta Polytechnica Hungarica,* 20 (10), 181-198 p.

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