

# THE EFFECTIVENESS OF RUSSIAN IMPORT SANCTION ON THE INTERNATIONAL APPLE TRADE: NETWORK THEORY APPROACH

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## ABSTRACT

In August 2014, the Russian Federation imposed counter-sanctions against Western countries imposing restrictions against Russia following its aggression against Ukraine. It is worth examining to what extent the counter-sanctions have transformed the trade network between the countries. This study aims to show the impact of this embargo on apple import on the global trade network due to the Russian response to the Western countries' measures in 2014. We chose the methodology of network research to examine the changes in trade networks. We analyzed the apple trade network because this was one of the significant fields impacted by the trade restrictions and panic reactions from EU producers imposed on the sanction. This research shows that Russian import was also impacted negatively, but some third countries are quickly becoming the winners of the restrictions. Serbia and Azerbaijan were the clear winners of the sanctions. The research results show that network research methodology is suitable for examining the sanctions' effects.

**Keywords:** sanctions' impact; network analysis; Russia; global apple trade; invasion of Ukraine

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## INTRODUCTION

The Russian aggression against Ukraine has led the United States and its Western allies to impose diplomatic and economic sanctions against Russia. Initially, only targeted sanctions

were applied, and import bans were introduced. Russia responded by announcing an embargo on imports of entire categories of products from countries announcing economic sanctions against Russian entities and individuals. In light

of this, Russia imposed a complete ban on imports of some foodstuffs, including apples, from these countries. On 5 September 2014, the Minsk ceasefire agreement was reached, but it did not live up to expectations and fighting escalated further in January 2015 (Council of the European Union, 2022). The next turning point came in February 2022, when Russia started a war against Ukraine. Western countries initially imposed only targeted sanctions and extended them to cover access to capital and financial markets. On 24 February 2022, EU Heads of State and Government agreed on further restrictions covering a range of sectors. The measures were followed by a new package of sanctions, in which the EU excluded seven Russian banks from the SWIFT system (Council of the European Union, 2022). On June 3, 2022, EU decision-makers decided to ban the import of crude oil and certain petroleum products and introduce the "oil price cap" on October 6, 2022. It prohibited EU companies from participating in the maritime transport of Russian crude oil or petroleum products to countries outside the EU. Sanctions still apply to 1,473 individuals and 205 organizations.

### LITERATURE REVIEW

In recent years there has been a significant increase in the literature on the effectiveness of sanctions. Many authors argue that if a sanction achieves one of its foreign policy objectives, it can be considered effective. (Szép, 2015) The earliest studies on the effectiveness of sanctions basically conclude that the sole purpose of sanctions is to change the perceived inappropriate behavior of the target country (Galtung, 1967; Wallensteen, 1968; Doxey, 1972). The authors agree that sanctions have minimal political effectiveness. Barber and Lindsay have argued that sanctions may have not just one, but several different purposes (Barber, 1979), (Lindsay, 1986). As a result of the first large sample quantitative research, the authors conclude that one-third of the 174 sanctions they studied were effective (Hufbauer et al., 2007). David Pape has criticized the research findings of Hufbauer-Schott-Elliott-Oegg (Pape, 1997). In his view, sanctions should not be considered as a result of a case where any change is essentially the result of military intervention (Pape, 1997). David Baldwin argues that sanctions should be treated like any other diplomatic and economic

instrument. In his view, when considering effectiveness, the costs, risks and consequences of alternative options should be included in the analysis (Baldwin, 1985). Daniel Drezner makes the seemingly surprising and controversial observation in his study that although sanctions are imposed on hostile states, they are in fact much more effective against allies (Drezner, 1999). A similar argument is made by a pair of authors, who conclude that multilateral UN sanctions tend to have a stronger impact on GDP growth in the target country than sanctions imposed by a single country (Neuenkirch, & Neumeier, 2015). Larger scale and multilateral sanctions have a greater impact on financial stability due to the possibility of 'speculative attacks' based on the political risks associated with sanctions (Peksen, & Son, 2015). A study on the long-run effects concludes that trade sanctions can lead to protectionism, as the target country can strengthen its domestic production and maintain domestic market protection after sanctions are lifted (Pond, 2017). The sanctions imposed on North Korea before 2014 have 'deepened' business ties between North Korean and Chinese companies and have led to more effective economic cooperation (Park, 2014).

Due to the different methodological approaches used in studies on the impact of sanctions, it is very difficult to draw uniform conclusions. Some researchers build game-theoretic models of sanctions (Lacy, & Niou, 2004). Others use conflict management theory to analyze the effectiveness of sanctions (Garoupa, & Gata, 2002). Sanctions are more likely to be effective when greater interdependence exists between the target country and the countries issuing sanctions (Özdamar, & Shahin, 2021). Some previous studies have already applied the social network approach to explore the effects of economic sanctions (Cranmer et al., 2014), (Dorff & Minhas, 2017). Özdamar and Shahin argue in their paper that applying the network theory of interdependence can answer many of the limitations of the literature and provide a clearer analytical method for analyzing the effects of sanctions (Özdamar, & Shahin, 2021).

Sultonov demonstrates how sanctions have affected the Russian economy and foreign exchange market and how their impact may spill over to other CIS countries (Sultonov, 2022). The author used seasonally adjusted real quarterly time series, monthly nominal exchange rate time

series, exogenous dummy variables for sanctions, and a combination of the vector autoregressive model and the Granger causality test for estimations. In another study, the authors used a complex network theory methodology to analyze the global impact of sanctions against Russia on the fossil energy trade (Zheng et al., 2022). Klomp examined the impact of Russian sanctions on the return of agricultural commodity futures in the EU. (Klomp, 2020). The study examines whether investors already expected the retaliation sanctions taken by Russia. The results show that the publication of news related to the sanctions before the official announcement caused a significant drop in the futures yield of many banned agricultural commodities. Timofeyev argues that the sanctions introduced against Russia will not be effective enough for the countries that initiated them to achieve their political goals (Timofeyev, 2022). The sanctions did not change Russia's policy towards Ukraine, and for now, there is no chance that it will change. In addition, some damage is visible to the Russian economy. Although it avoided immediate collapse, the sanctions are affecting the performance of Russian companies.

### METHODOLOGY

In this study, Social Network Analysis (SNA) is used to analyze the impact of the Russian embargo on trade networks. Based on the data, the effects were examined on apple. Data for tariff heading 080810 was extracted from UN Comtrade (UN Comtrade, 2022) and FAO databases (FAO, 2022). UN Comtrade database provides key export and import data for global trade by year, trading partner, and commodity code. The FAO database contains key export and import data for international food trade by year, trading partner and product. The analysis covers the period from 2010 to 2020. Russia imposed sanctions in August 2014, so analyzing the trade network before and after the sanctions is possible. The international trade of the products under analysis can be described as a network, where the nodes are the countries that trade with each other, and the edges are the trade links between countries. The network is a directed graph, i.e., country A exports and country B imports apples. Therefore, the direction of movement is important. Weighted edges were

considered, i.e., the volume of exports from one country to another was taken into analysis. Network diameter, average clustering coefficient, and network density were calculated among the global network indicators. The following measures were calculated for the local network metrics and for each node: in-degree, weighted indegree, outdegree, weighted outdegree, eigenvector centrality, and modularity. Some previous studies have already applied the social network approach to explore the effects of economic sanctions (Cranmer et al., 2014), (Dorff & Minhas, 2017), (Özdamar, & Shahin, 2021).

Network visualization and network analysis software Cytoscape and Gephi were used to conduct the research (Shanon et al., 2003) (Bastian et al., 2009). First, we compiled the database and created the world apple trade network per year. The data was then cleaned. Next, the world apple trade data composition was analyzed using statistical indicators. We then calculated the network indicators, analyzed the data, and drew conclusions.

### DISCUSSION

This research aims to show the impact of Russia's 2014 embargo on apple imports in response to Western countries on the global apple trade. Our primary objective is to map how the sanctions imposed by Russia are reshaping the structure of the worldwide apple export network. Our secondary objective is to understand whether the countries targeted by the sanctions could establish alternative trade links and sell the volume destined for the Russian market. Our tertiary objective is to map which third countries have gained from the imposition of sanctions.

#### The international trade and production volume of apples and their evolution

Global apple production has grown by an average of 2.02% per year between 2010 and 2020 (FAO, 2022). China is the world's largest apple producer (Table 1). Based on 2020 data, it accounts for around 47% of world apple production (FAO, 2022). The second largest producer is the USA, which accounts for 5.4% of total production, well behind China. Turkey is the third largest producer with 5%.

**Table 1:** Largest apple producers in the world, share of global production in 2010, 2015, and 2020

Country	2010	Country	2015	Country	2020
CHN	46.7%	CHN	47.2%	CHN	46.9%
USA	5.9%	USA	5.5%	USA	5.4%
IRN	4.0%	POL	3.8%	TUR	5%
TUR	3.7%	TUR	3.2%	POL	4.1%
ITA	3.1%	IRN	3.0%	IND	3.2%
POL	2.6%	Italy	3.0%	ITA	2.8%

Source: FAO (2022).

If we analyze the global apple trade, China will be the leading international apple exporter in 2020, with 19.9% (Table 2). By looking at the European Union as a single market, it was the

second largest exporter of apples in 2013 and 2020. China's share in the global apple trade is not as significant as it is in production due to substantial domestic demand.

**Table 2:** Largest apple exporters in the world, share of global export in 2010, 2015 and 2020

Country	2010	Country	2015	Country	2020
CHN	13.8%	ITA	19.9%	CHN	19.9%
ITA	10.5%	USA	10.0%	ITA	13.2%
CHL	10.5%	POL	9.3%	USA	11.7%
USA	9.2%	CHN	9.2%	NZL	8.1%
POL	8.5%	FRA	6.6%	CHL	8.0%
FRA	8.1%	CHL	6.6%	FRA	6.6%
IRN	5.0%	BLR	6.4%	ZAF	5.6%

Source: UN Comtrade (2022).

Russia was still the world's largest apple importer in 2010. The import amount decreased significantly by 2015, but it still reached first place and fell back to second place by 2020. Germany was the largest global importer of

apples, followed by Russia and the UK in 2020 (Table 3).

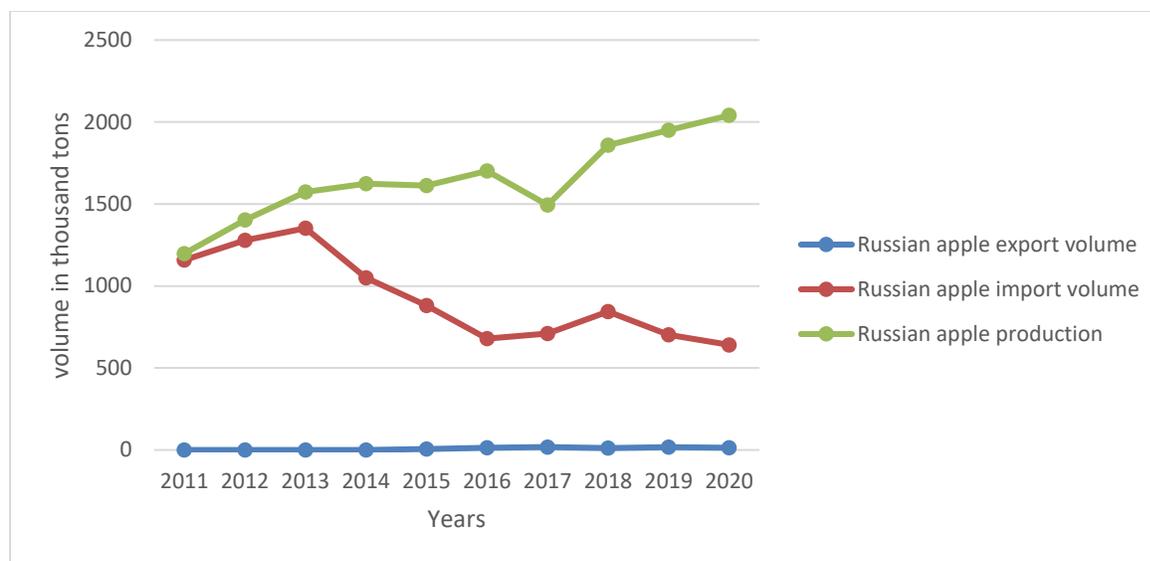
**Table 3:** Largest apple importers in the world, share of global import in 2010, 2015 and 2020

Country	2010	Country	2015	Country	2020
RUS	14.5%	RUS	9.2%	DEU	9.1%
DEU	7.5%	BLR	7.7%	RUS	6.6%
GBR	5.5%	GER	6.8%	GBR	6.1%
IRQ	5.4%	LTU	4.5%	IDN	4.5%
CHN	4.1%	CHN	4.4%	EGY	4.3%

Source: UN Comtrade (2022).

The Russian apple embargo significantly impacted Russian imports (Figure 1). The figure shows that after 2013, the volume of Russian apple imports dropped dramatically and has not returned to the 2011 level since then. Russian apple producers probably did well with the embargo because the amount of apples produced

by Russian producers increased almost in proportion to the decrease in imports, while Russian apple exports increased, but they were insignificant compared to the volume of production and imports.



**Figure 1:** Increase in Russian apple production, export, and import volume from 2011–2020. Data in a thousand tons.

Source: UN Comtrade (2022); FAO (2022a); FAO (2022b).

Before the sanctions were imposed, Poland was the biggest apple exporter to Russia, and by 2020 Moldova and Serbia had become the most significant exporters (Table 4). As a result of the apple embargo since 2015, Western countries no

longer export apples to Russia. Serbia, Moldova, the Republic of South Africa, Turkey, Chile, and Azerbaijan took their place.

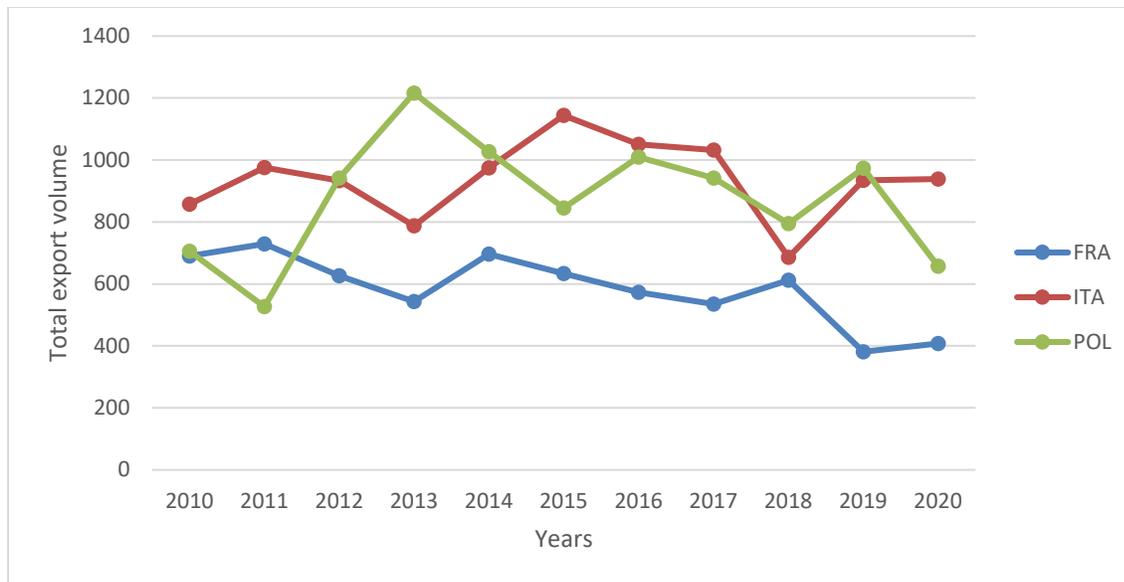
**Table 4:** Russia's biggest apple exporters. Percentage of Russian apple imports between 2013–2020

2013		2014		2015		2016		2017		2018		2019		2020	
POL	49.2%	POL	37%	SRB	30%	SRB	37%	SRB	32%	SRB	21%	SRB	30%	MDA	26.8%
MDA	8.9%	SRB	16%	CHN	15%	CHN	19%	MDA	22%	MDA	21%	MDA	27%	SRB	24.5%
CHN	8.7%	CHN	9%	BRA	6%	MDA	12%	CHN	15%	CHN	16%	AZE	9%	ZAF	8.8%
SRB	6.0%	BLR	8%	MKD	6%	AZE	6%	AZE	6%	IRN	7%	CHL	4%	TUR	7.3%
ITA	3.9%	ITA	6%	CHL	6%	MKD	5%	CHL	5%	TUR	7%	CHN	4%	CHL	6.3%
CHL	3.4%	FRA	4%	MDA	5%	BLR	5%	ZAF	4%	AZE	7%	ARG	4%	AZE	5.9%

Source: UN Comtrade (2022).

The Russian import restriction did not affect the largest supplier countries except France (Figure 2). As of 2015, no significant jump in apple exports can be observed in relation to the entire annual export volume. The reason is that

they were able to export to other countries, the surplus appearing due to the large decrease in Russian demand.



**Figure 2:** The largest western apple exporting countries to Russia sanctioned by Russia. Development of the countries' total export volume between 2010-2020. Data in a thousand tons.

Source: UN Comtrade (2022).

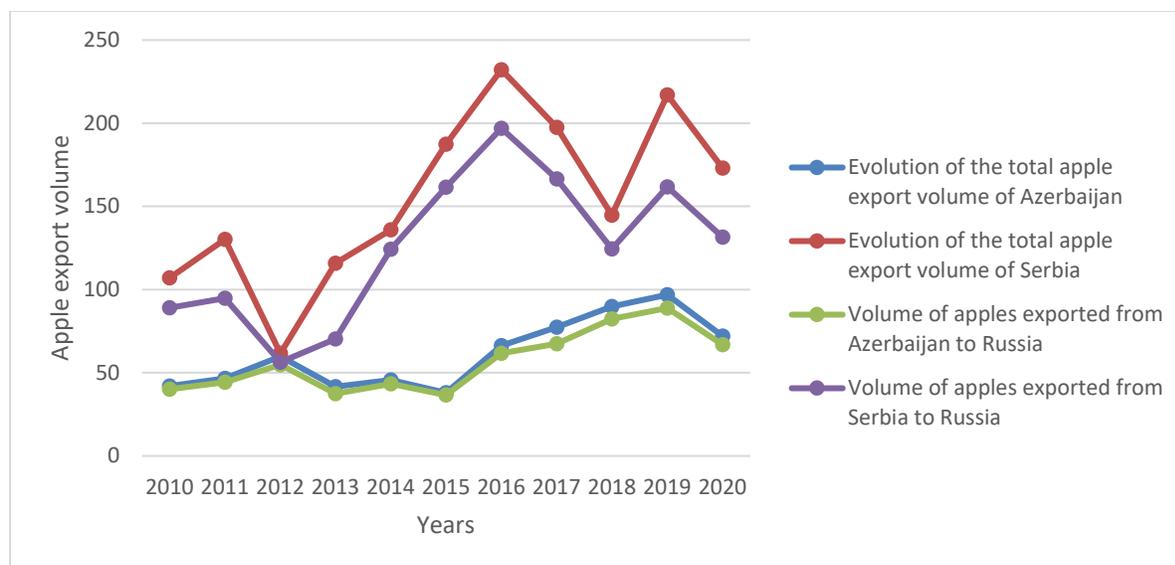
Since France is the only country where a substantial decrease in apple exports can be detected from 2015 onwards, we analyzed the evolution of France's apple export structure (Table 5). The export volume did not decrease due to the Russian sanctions but rather because of indirect effects. France was not the largest apple exporter of Russia before, and the Russian market did not account for a large proportion of French apple exports. The effect can be traced back to France's former trading partners buying less from France and more from the largest Western exporting countries. Presumably, the reason is the competitiveness of French apples, but further research is required for investigation.

The total export volume from Serbia and Azerbaijan increased after the embargo (Figure 3). In addition, the export volume from them to Russia also increased significantly and almost proportionally. At first glance, it seems that the two countries can be considered the winners of the sanction. We will return to this topic when analyzing the network indicators.

**Table 5:** France's largest export partners in 2010, 2015, and 2020

Ranking	2010	2015	2020
1.	GBR	GBR	GBR
2.	ESP	ESP	ESP
3.	NED	BEL	DEU
4.	ALG	DZA	NED
5.	DEU	DEU	BEL

Source: UN Comtrade (2022).



**Figure 3:** The evolution of the total apple export volume of Serbia and Azerbaijan and the export to Russia from 2010-2020. Data in a thousand tons.

Source: UN Comtrade (2022).

**Analysis of network indicators**

While Russia imposed an import ban from many Western countries, the global apple trade network became denser. By 2020 more potential connections were realized compared to 2010 and 2015. Thus, on average, the actors of the entire network have trade relations with several countries. The clustering coefficient shows the

extent to which the members of a country's network are connected and how many possible connections there are on average between all the direct partners of a nation. Between 2010 and 2020, the clustering coefficient value increased. This shows that more and more clusters were formed within the network during the examined period, members of which trade with each other more often (Table 6).

**Table 6:** Network indexes (2010, 2015, and 2020)

Network Index	2010	2015	2020
Network density	0.035	0.037	0.040
Network diameter	7.000	7.000	6.000
Avg. clustering coefficient	0.374	0.379	0.416

Source: author's work.

The in-degree indicator shows how many edges are directed to a node, meaning how many apples a country imports from other countries. Based on this, in 2010, Russia was the country with the most significant number of contacts in the world, and by 2020 it fell to 11th place (Table 8). The reason is that the volume of apple imports from Russia and, in parallel, the number of contacts also decreased drastically during this period. This also means that in 2010, Russia had the most diversified import relationship in the

world in apple trade. The embargo replaced it with a less diversified relationship system meaning vulnerability. These countries have a traditionally significant number of contacts: Germany, the UK, the Netherlands, the United Arab Emirates, Italy, France, and Saudi Arabia (Table 7). These have a diversified apple import portfolio and import relations with many countries.

**Table 7:** Countries' ranking in terms of indegree indicator in 2010, 2013, 2015, 2017, and 2020.

<b>Indegree ranking</b>	<b>Country (2010)</b>	<b>Country (2013)</b>	<b>Country (2015)</b>	<b>Country (2017)</b>	<b>Country (2020)</b>
1	RUS	ARE	ARE	ARE	GBR
2	DEU	DEU	DEU	ITA	DEU
3	GBR	RUS	SAU	DEU	ARE
4	NLD	GBR	NLD	GBR	ITA
5	ARE	FRA	RUS	RUS	SAU

Source: author's work

**Table 8:** Russia's ranking in terms of indegree indicator in 2010, 2013, 2017 and 2020.

	<b>2010</b>	<b>2013</b>	<b>2015</b>	<b>2017</b>	<b>2020</b>
Russia's Indegree ranking	1.	3.	5.	5.	11.

Source: author's work

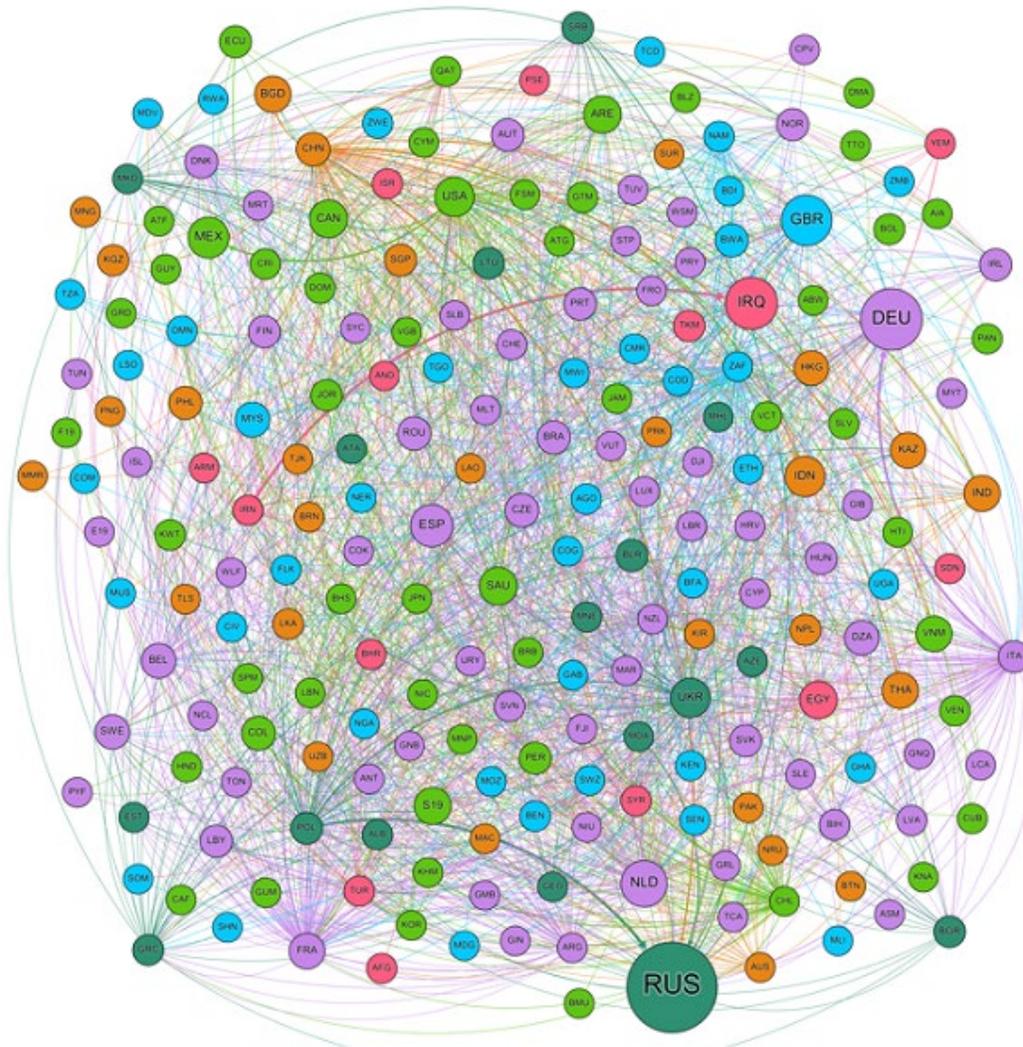
The weighted in-degree indicator considers the trade volume when calculating import relations. Those countries have a high weighted in-degree value that imports from many countries and in large quantities. The order of indegree mute differs from the weighted in-degree mute. The reason is that certain countries import from many countries, but in small quantities, because the country's size and population are small, but it has diversified international trade relations. Other countries are in trade relations regarding the same product, but import in large quantities,

because it has a large population and economy. Even after the sanctions, Russia established significant import relations with new countries, but the composition of Russian imports became less diversified because it imports from fewer countries but in larger volumes (Table 9).

**Table 9:** Countries' ranking in terms of weighted indegree indicator in 2010, 2013, 2015, 2017 and 2020.

<b>Weighted in-degree ranking</b>	<b>Country (2010)</b>	<b>Country (2013)</b>	<b>Country (2015)</b>	<b>Country (2017)</b>	<b>Country (2020)</b>
1	RUS	RUS	RUS	RUS	RUS
2	DEU	DEU	BLR	DEU	DEU
3	IRQ	GBR	DEU	BLR	GBR
4	GBR	NLD	GBR	GBR	EGY
5	NLD	MEX	MEX	IRQ	VNM

Source: author's work



**Figure 4:** Apple import network in 2010; node weights: weighted indegree; colors: clusters  
Source: author's work

The outdegree indicator shows how many countries a country exports apple in Table 10. It is worth paying particular attention to the outdegree indicator values of Serbia and Azerbaijan. From the first year of the sanction,

i.e., 2015, both countries' outdegree ranking improved significantly (Table 11). They were able to export apple to more countries, meaning that they won other markets in parallel to the Russian market.

**Table 10:** Countries' ranking in the outdegree indicator in 2010, 2013, 2015, 2017 and 2020.

Outdegree ranking	Country (2010)	Country (2013)	Country (2015)	Country (2017)	Country (2020)
1	FRA	FRA	FRA	FRA	FRA
2	USA	USA	ITA	ITA	ITA
3	ZAF	ZAF	USA	ZAF	ESP
4	ITA	ITA	ZAF	ESP	NLD
5	NLD	ESP	ESP	USA	USA

Source: author's work

**Table 11:** Serbia and Azerbaijan’s ranking in terms of outdegree indicator in 2010, 2013, 2015, 2017 and 2020.

	2010	2013	2015	2017	2020
Outdegree ranking of Serbia	35.	22.	17.	18.	16.
Outdegree ranking of Azerbaijan	60.	77.	56.	33.	66.

Source: author’s work

The weighted outdegree indicator also considers the trade volume when calculating export relations. So countries that export apple to a relatively large number of countries in large quantities have a high value. Comparing the

outdegree (Table 10) and weighted outdegree values (Table 12), China, Chile and Poland have a less diversified export composition than the USA, France or Italy.

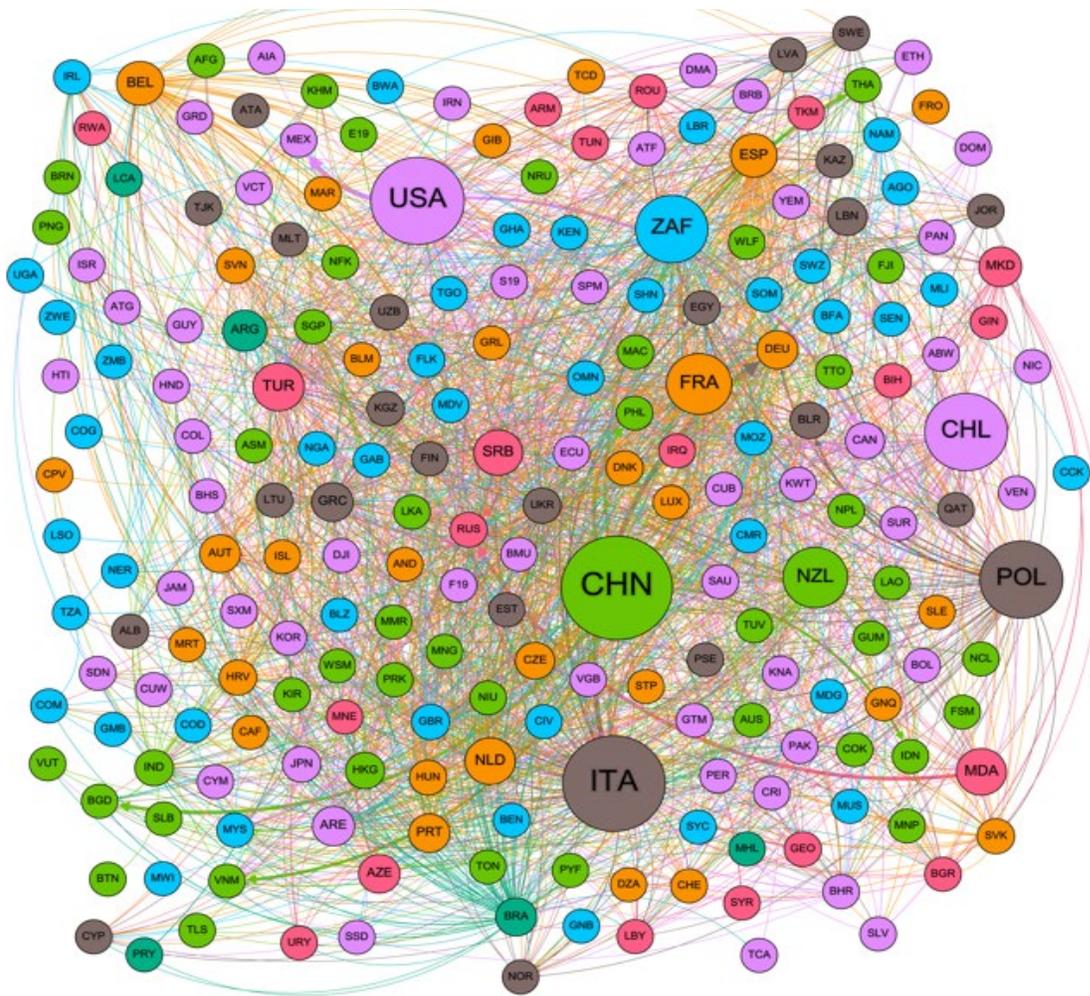
**Table 12:** Countries’ ranking in terms of weighted outdegree indicator in 2010, 2013, 2015, 2017 and 2020.

weighted outdegree ranking	Country (2010)	Country (2013)	Country (2015)	Country (2017)	Country (2020)
1	CHN	POL	ITA	CHN	CHN
2	ITA	CHN	USA	ITA	ITA
3	CHL	USA	POL	POL	USA
4	USA	CHL	CHN	USA	CHL
5	POL	ITA	FRA	CHL	POL

Source: author’s work

From 2015, the first year of sanctions, the outdegree values and weighted outdegree indicators improved for Serbia and Azerbaijan (Table 13). So, they were able to diversify their exports after the Russian embargo and export apple in larger quantities to one partner at the same time. In the case of France, the opposite

happened. Not only has France's apple export volume decreased since the sanctions, but it exports to fewer countries and fewer apples per partner on average.



**Figure 5:** Apple import network in 2020; node weights: weighted outdegree; colors: clusters  
Source: author's work

**Table 13:** Serbia, Azerbaijan, and France's ranking in terms of weighted outdegree indicators in 2010, 2013, 2015, 2017, and 2020.

	2010	2013	2015	2017	2020
Serbia's weighted outdegree ranking	15.	16.	14.	12.	12.
Azerbaijan's weighted outdegree ranking	27.	29.	29.	18.	19.
France' weighted outdegree ranking	6.	6.	5.	8.	7.

Source: author's work

The eigenvector centrality shows the extent to which nodes in the network can influence each other. A node with a high eigenvector centrality value is connected to many nodes through edges with a high eigenvector centrality score. If a country has a high eigenvector centrality value, then it exports apples to many countries with a high centrality index. 2010 Russia, Germany, the UK, the Netherlands, and Italy had the highest

eigenvector centrality values (Table 14). By 2020, Russia became the country with the world's 39th-largest eigenvector centrality index; in 2010, it was still in first place (Table 15). The reason is that Russia is partially isolated from the large western apple trading countries. As a result, it has lost its central role in trade because it does not maintain direct contact with countries that have significant apple trade.

**Table 14:** Ranking of the countries in terms of eigenvector centrality indicator in 2010, 2013, 2015, 2017, and 2020.

Eigenvector Centrality ranking	Country (2010)	Country (2013)	Country (2015)	Country (2017)	Country (2020)
1	RUS	ARE	DEU	ARE	GBR
2	DEU	DEU	SAU	DEU	DEU
3	GBR	RUS	ARE	POL	SAU
4	NLD	GBR	NLD	ITA	ITA
5	ITA	NLD	EGY	GBR	NLD

Source: author's work

Serbia was also able to improve its ranking after the embargo in 2015. Azerbaijan worsened its ranking. The reason is that Serbia was able to diversify its export markets so that it not only won the Russian market but also established

trade relations with many Western countries with large export and import relations, while Azerbaijan mainly exports apples to Russia, except for a few smaller countries (Table 15).

**Table 15:** Russia, Serbia, Azerbaijan, and France's ranking in terms of eigenvector centrality indicator in 2010, 2013, 2015, 2017, and 2020.

	2010.	2013.	2015.	2017.	2020.
Russia's Eigenvector Centrality ranking	1.	3.	13.	22.	39.
Serbia's Eigenvector Centrality ranking	38.	44.	28.	27.	32.
Azerbaijan's Eigenvector Centrality ranking	53.	62.	57.	88.	112.
France' Eigenvector Centrality ranking	12.	7.	25.	7.	8.

Source: author's work

### Modularity analysis

During the modularity examination, clusters and groupings were examined in the network. We looked at which country groups trade with each other more frequently and in larger volumes. We used the Louvain method (Blondel et al. 2008), a Gephi network analysis software module to explore the clusters. We can identify, analyze, evaluate, and display clusters with this. The developed algorithm detects clusters and generates a modularity class value for each grouping, which indicates the communities within the apple trade network. The examined years revealed an average of 6 sub-networks, each named after the country with the highest rank.

**Polish Community:** Before the sanctions, a large community existed, the countries with the highest rank being Poland, Ukraine and Russia. Asian countries neighboring Russia primarily belonged to this community. This cluster fell apart after the embargo. Russia joined the Turkish community, while Ukraine and Poland

joined the Italian community.

**French Community:** France is the country with the highest rank. Unsurprisingly, the sub-network mainly comprises Francophone countries and European Union member states. Before and after the sanction, the cluster consisted of the same members, so the embargo did not affect its composition.

**USA community:** The countries with the highest rank in this subnet are: USA, Chile, Argentina, and Canada. The community primarily consists of North and South American countries, but it also includes some Middle Eastern countries left out of the Egypt community. After the sanctions, a new cluster was formed, which strengthened to such an extent by 2022 that it had grown into one of the clusters with the largest member countries (Brazil community). So as a result, the number of countries belonging to the US community decreased.

**Chinese Community:** The country with the highest rank is China. Primarily Asian countries

neighboring China are members of this community. Before and after the sanctions, the cluster consisted of the same members, so the embargo did not affect its composition.

**Egypt Community:** The country with the highest rank is Egypt. The cluster consists almost exclusively of Middle Eastern countries. After the sanctions, this cluster disappeared, with Egypt integrated into the Italian community.

**Turkish Community:** After the sanctions, a new cluster was formed. The countries with the highest rank are Turkey, Russia, and Serbia. After the embargo, the community traded inside itself significantly. After the sanctions, the community had an average of 20 member countries.

**British Community:** This subnet's highest-ranking country is the United Kingdom. This primarily includes the countries of the British Commonwealth of Nations. Before and after the sanction, the cluster consisted of the same members, so the embargo did not affect its composition.

**Italian Community:** A new cluster was formed after the sanctions on apples. The countries with the highest rank are Italy, Poland, and Ukraine. After the embargo, the community members traded with each other significantly. After the sanctions, the community had an average of 25 member countries.

**Brazil Community:** After sanctions, a South American community formed, becoming independent from the United States. The country with the highest rank is Brazil. The cluster includes almost all South American countries.

## CONCLUSION AND RECOMMENDATION

In our study, we have used network analysis tools to illustrate the impact of Russia's trade-restrictive measures on apple imports in 2014 in response to Western countries (US, EU, Norway, Australia, and Canada) on the global network of apple trade.

Since Russia has never declared the purpose of the sanctions, we can only conclude. If we assume that Russia's purpose in imposing the sanctions was to cause serious trade losses to the target countries, the sanctions have not fulfilled their expectations. The vast majority of Western countries, except for France, were able to build new relationships and export apples to other countries instead of the Russian market, so they could even increase their export volume

following the sanctions. In addition, they were able to diversify their export markets further. However, if Russia aimed to put Russian apple producers in a more advantageous situation, the embargo probably turned out victorious, but further research is required. In the year before the sanction, Russian apple production increased significantly, and apple imports fell drastically as if Russia had prepared, and after the embargo, farmers could be compensated for the significant loss of exports easily.

After the Russian sanction, more and more clusters formed within the network, and the members traded with each other more often. This means that the line between certain groups of countries is getting sharper, and they sell less and less to outsiders. Regarding the composition of the individual clusters, three major countries changed clusters after the sanctions, so they broke many of their previous relationships and built new ones. These are Russia, Ukraine and Poland. Russia moved from the former Polish to the Turkish community, meaning that it primarily trades apples with Asian countries that border either Russia or Turkey. Ukraine and Poland were transferred from the Polish to the Italian community. The reason is that the Polish community broke, and these two countries primarily increased trade relations for apples with Western countries.

Serbia and Azerbaijan can be considered the winners of the Russian apple embargo. Serbia was not only able to multiply the volume of its exports after the sanction, but it was also able to diversify its export markets to such an extent that it entered into lasting trade relations with essential apple-trading countries. The case of Azerbaijan is different, as it was able to increase its export volume after the sanctions, but it remains vulnerable in terms of the composition of its export markets, as it predominantly exports to Russia. The loser of the Russian sanction is France, whose apple export volume has declined after the sanction and has export relations with fewer countries. Russia's vulnerability increased due to the embargo because its apple import relations became less diversified, i.e., it imports from fewer countries and significantly lost large apple trading partners.

The results show that network research methodology can be suitable for examining the effects of sanctions. In the course of further

research, looking at the impact of sanctions in terms of more complex product groups would be worthwhile. Further research is needed to examine to which extent Russian apple producers gained from introducing the embargo.

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