

HOW IMPORTANT IS THE FACTOR OF
THE TRADE WAR WITH RUSSIA IN
CHANGE OF UKRAINIAN EXPORT
TRADE FLOWS?

by

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LIST OF ABBREVIATIONS

CIS Commonwealth of Independent States

EU European Union

GDP Gross domestic product

HHI Herfindahl-Hirschman Index

HS Harmonized System

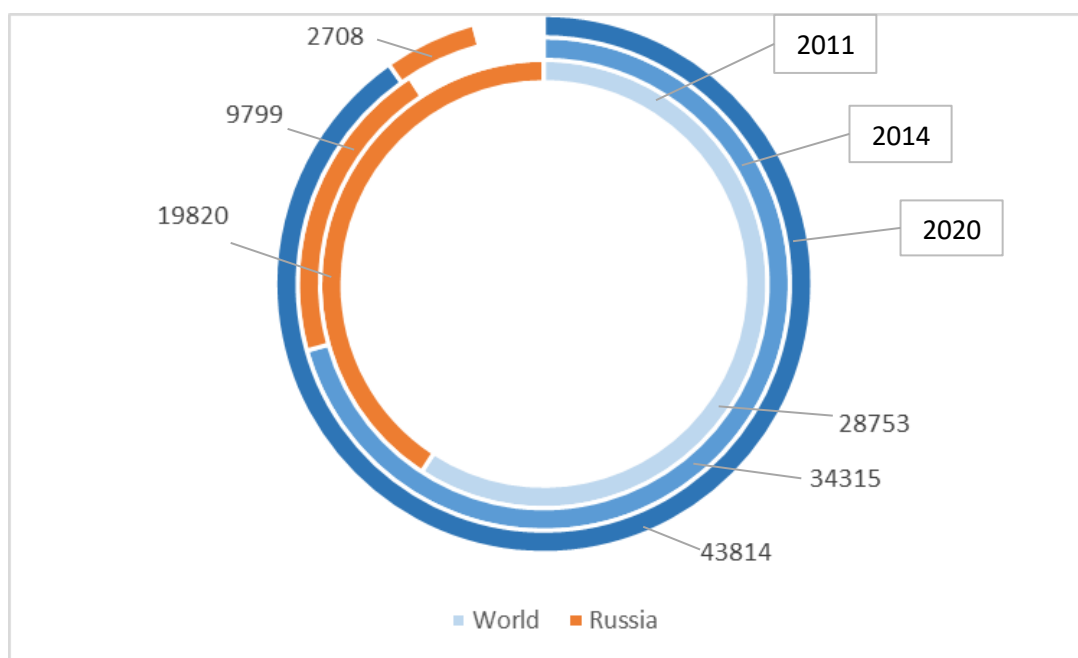
SPS Sanitary and phytosanitary

SSSU State Statistics Service of Ukraine

CHAPTER 1. INTRODUCTION

The events of the spring of 2014 were perhaps the biggest geopolitical shock in the history of our country's independence. The annexation of Crimea, the deployment of full-scale hostilities in the East, and the methods of hybrid warfare by the Russian Federation made further economic cooperation and interaction in general impossible from the point of view of common sense. But is it really so?

Figure 1. Commodity trade volumes between Ukraine and Russian Federation in 2011, 2014 and 2020, USD mln



Source: UN Comtrade

Figure 1 and Table 1 compare the volumes and dynamics of trade between Ukraine and the Russian Federation in 2011, 2014 and 2020, as well as the top 5 commodity groups. We see that, despite mutual trade and transit restrictions, trade between the countries did not stop, although the volumes before the trade conflict differed significantly. Trade with Russia accounted for almost a quarter of Ukraine's total foreign trade turnover in 2011. But in less than ten years, the volume of trade with the aggressor country has decreased by three times.

As for the product structure of trade between Ukraine and Russian Federation, we can see that it consists almost of the same top-5 commodities over the years. Ferrous metals and products from them, nuclear reactors, boilers, machines remained among mostly exported to Russia, while mineral fuels, oil and its products, nuclear reactors, machines and ferrous metals again were the most imported commodities.

The main reason for Ukraine's dependence on foreign trade relations with Russia can be considered the historical situation, as a result of which the neighboring state was the main buyer of most of the goods that were produced on the territory of our country.

2011 seemed to be the beginning of a long-term trade cooperation between Ukraine and Russia, which signed the Free Trade Area Treaty and began trading as members of the Commonwealth of Independent States (CIS).

However, the signing by Ukraine against the background of the aforementioned revolutionary events of the Free Trade Agreement with the European Union and its entry into force in 2016 led to the suspension by Russia of the Free Trade Agreement with Ukraine. This led to a number of import restrictions on the part of both countries.

These events also directly or indirectly affected Ukraine's trade with some countries of the former Soviet Union.

Table 1. Key trade items between Ukraine and Russian Federation in 2011 and 2020

	Category	Export, USD mln	% of total	Category	Import, USD mln	% of total
2011	Railway locomotives	3194.4	16.1%	Mineral fuels; oil and its products	19697.2	67.6%
	Mineral fuels; oil and its products	2786.7	14.1%	Ferrous metals	1277.5	4.4%
				Nuclear reactors, boilers, machines	1245.2	4.3%
	Ferrous metals	2428.2	12.3%			
	Nuclear reactors, boilers, machines	2186.9	11.0%	Electric machines	688.1	2.4%
2020	Products from ferrous metals	1393.8	7.0%	Means of land transport other than rail	615.2	2.1%
	Products of inorganic chemistry	554.9	20.5%	Mineral fuels; oil and its products	2573.0	56.7%
				Nuclear reactors, boilers, machines	343.8	7.6%
	Ferrous metals	466.0	17.2%			
	Nuclear reactors, boilers, machines	463.8	17.1%	Plastics, polymeric materials	217.4	4.8%
	Plastics, polymeric materials	153.4	5.7%	Ferrous metals	182.8	4.0%
	Products from ferrous metals	147.8	5.5%	Paper and cardboard	96.0	2.1%

Source: SSSU

However, despite the rapid negative dynamics of recent years, the following question arises: was the trade war after the critical year of 2014 the real reason for the

geographical changes of the Ukrainian exports structure in those sectors, the lion's share of production of which depended on demand from the Russian Federation.

Using the gravity model, we want to examine export's volume changes in each of sections according to HS Nomenclature 2017 edition and to determine, whether the impact of trade with Russia is significant in particular industries or not.

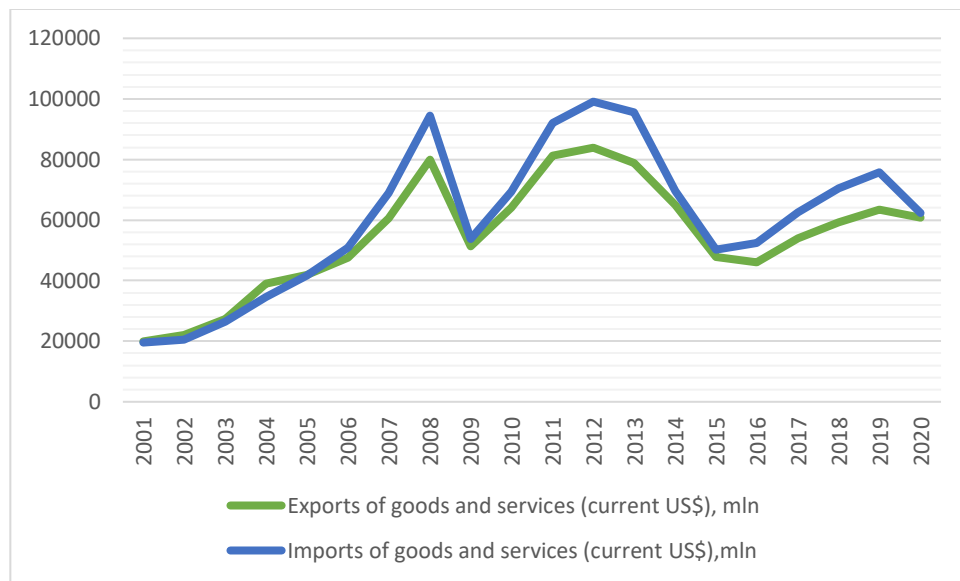
CHAPTER 2. INDUSTRY OVERVIEW AND RELATED STUDIES

2.1 Industry overview

Historically, the foreign trade activity of Ukraine, like its economy as a whole, is very sensitive to the influence of negative factors. The first significant shock since the early 2000s occurred in 2009, when there was a massive drop in export and import volumes during the global crisis.

As we can see on the Figure 2, the second wave of a sharp decline in Ukraine's foreign trade indicators began in 2011-2012, which was caused by a number of reasons: a drop in production volumes, a decrease in purchasing power, the devaluation of the hryvnia and, most importantly, the loss of sales markets.

Figure 2. Dynamics of Ukraine's foreign trade, 2001-2020



Source: World Bank Open Data

The loss of sales markets is predominantly connected with trade tension between Ukraine and our north neighboring country – the Russian Federation.

In July 2011, the Commission of the Customs Union, the greatest influence on which Russia had and still has, introduced duties on Ukrainian metal, pipes, synthetic nylon threads and other products of the metalworking industry. Earlier, duties were imposed on a number of products of the agricultural and food industries, such as caramel, sugar, potatoes, cabbage, milk and meat.

The escalation of the trade conflict was also facilitated by the conditions for the purchase of Russian crude oil by Ukrainian refiners - refineries in Russia, Belarus and Kazakhstan bought Russian crude oil at discounts without export duties.

A new round of the trade war occurred after the Russian military invasion in Crimea and Donbass in 2014, which led to an intensification of the trade confrontation:

- since August 2014, the import of agricultural products from Ukraine has been prohibited on the territory of Russia
- since 2015, a ban on imports of Ukrainian salt has been introduced
- since 2016 - meat, dairy products, fish, vegetables and fruits.

Since 2015, the Cabinet of Ministers of Ukraine has introduced sanctions on goods of Russian origin. In March 2021, these sanctions were expanded.

In the recent years there has been a slight increase in foreign trade volumes. As for now, according to State Statistics Service of Ukraine, during 2020 Ukrainian exports amounted to USD 60.4 billion with 8.1% decrease compared to 2019, imports - 59.3 billions with 12.5% respectively.

The growth in the volume of Ukraine's foreign trade in 2019 was caused by the introduction of preferential customs clearance of cars with foreign registration, high yields of agricultural crops and an increase in demand from China (against the background of the trade conflict with the United States) for food products from Ukraine.

Decrease in exports of metallurgical products in monetary terms was driven by the decrease in world prices for metals in 2019. The spread of COVID-19 and the decline in energy prices led to a decrease in imports and the formation of a positive trade balance. However, in 2020, the partner countries, as well as, the main items of export and import, did not change compared to the previous year (see Table 2 and Table 3 respectively).

Table 2. Major trade partners of Ukraine in 2020, % in total

	China	Russia	Poland	Germany	Turkey	United States	Italy	Belarus
Exports	12.0%	4.5%	6.1%	3.4%	4.3%	3.9%	3.2%	2.2%
Imports	14.3%	7.7%	7.2%	9.0%	4.8%	5.7%	3.6%	4.8%

Source: SSSU

The State Customs Service of Ukraine has recently reported that the three most exported goods from Ukraine include:

- grains - \$ 9.4 billion worth of exports;
- ferrous metals - \$ 7.7 billion worth of exports;
- fats and oils of animal or vegetable origin - \$ 5.8 billion worth of exports

The following categories of goods were imported to Ukraine the most:

- mineral fuels, oil and its products - \$ 8 billion worth of imports
- reactors, boilers, machinery, equipment and mechanical devices - \$ 6.1 billion worth of imports
- land vehicles - \$ 5.5 billion worth of imports

Table 3. Key trade items of Ukraine in 2020

	Key items
	Metals
	Grains
Exports	Machinery
	Vegetable oils
	Ores
	Machinery
	Energy resources
Imports	Chemicals
	Road vehicles
	Metals

Source: SSSU

2.2 Related studies

As for the related papers, it was decided to examine the particular trade literature, which is trying to explain trade flows of goods, that is relevant to the topic of this research.

The well-known neoclassical trade model was successfully used to describe the trade between countries with different level of income, however, it did not take into account the fact that countries, that have the similar level of income, may also participate in mutual trade. One possible explanation to that may be the fact, that authors did not take into account difference and variety among products.

So, according to the classical theory of international trade, there is an inverse relationship between the similarity of countries in terms of development and the volume of their mutual trade. Economists in the second half of the XX century tried to explain trade in the case of a similar endowment with factors of production, such as capital and labor.

The new theory of trade owes its origin to such scientists as James Markusen, Paul Krugman, Maurice Obstfeld and others. Imperfect competition, increased returns to scale, and differences in products have come to be seen as factors driving international trade, contrary to classical postulates.

Lower costs and higher productivity in the production of a particular product of a country that specializes in a narrow range allows it to participate in international trade even if there are countries with similar levels of technology development or the availability of resources (Krugman and Maurice, 2005).

One of the goals of this study is to identify the factors that determine the structure of exports to Ukraine, and therefore, it was necessary to focus on researches after the early 80s. The vast majority of the studies in our field of research are focused on export

diversification and expansion to new markets. Moreover, several authors are trying to investigate the causal effect between export expansion and economic growth.

Hinlo and Arranguéz (2017) examining the possible relationship of the economic growth and export geographical diversification on the dataset of 5 ASEAN countries for the period of 1980-2014 years. Key findings of this research include the discovery of generally decreasing trend for HHI of all sample countries. What's more, there mostly wasn't any relationship between the economic growth and how diversified export of these countries was.

Another relevant study in the field of this research was paper by Shepherd (2008). The author tried to examine what are the determinants of geographical export diversification of developing countries. As was expected, export costs and foreign tariffs affect the diversification the most. Useful methodological approach from this research is expressing all regression variables in terms of ratios with respect to a common comparator country in order to deal with endogeneity.

Syrotenko (2009) suggested to use gravity model in order to investigate Ukraine's export diversification and trade growth. The author found that in Ukraine intensive margin is the most important share of the trade growth, while in terms of extensive margin it was found that geographical extensive margin has more importance for the export growth compared to the product extensive. This research confirms gravity model by illustrating that the distribution of the total level of export is higher to the markets that are closer and larger. It was decided to delve deeper into the topic of the gravity model, as it could help find answers to our research and become its methodological basis.

Shepotylo (2010) in his research provides the methodological development for trade policy analysis of costs and benefits of alternative regional integration scenarios. For this purpose, he develops the disaggregated gravity model, in which he tries to assess the

impact of EU integration for non-members. What's more, he uses the Ukraine's case to analyze export volumes projecting them under the two scenarios – EU and CIS integration.

Besedina and Coupe (2015) studied the factors which affect the decisions of the Russian Federation about imposing SPS measures against the trading partners of this state. Authors found that the most important determining factors of SPS introduction is not only domestic producers protection, but also political pressure, which goes against the logic of imposing the non-tariff measures.

Another research, which estimated the effect of SPS measures on Ukrainian exports, was by Tsarevskyi (2019). Using the gravity model presented by Anderson and Wincoop (2010), the author analyzed the Ukraine-EU agricultural trade and found that the effect of such non-tariff measures as SPS is significantly negative only in 5 of 10 cases.

CHAPTER 3. METHODOLOGY

Among the variety of new trade theories, which are willing to provide reasons of different states to participate in the process of world trade, there is one that is used to estimate sizes of trade flows in an empirical manner. This theory is called the gravity model, and it owes its name to a powerful concept in the field of physics – the Newton law of gravitation.

In its canonical form the law of gravitation is stated as follows:

$$F_{ij} = G \frac{M_i M_j}{D_{ij}^2} \quad (1)$$

Where:

- F_{ij} is a force between two bodies i and j ($i \neq j$),
- M_i, M_j are the masses of these two bodies, which are inversely proportional to their geographical distance D_{ij} squared (Newton, 1729).

The first economist to suggest using gravity model is Jan Tinbergen (1962). He applied the abovementioned Newton's concept in order to provide a description to bilateral trade flows between countries. According to Tinbergen, these trade flows are proportional to the GNP of countries under the comparison and at the same time are inversely proportional to the distance between these countries' borders.

The further development of the gravity model concept was suggested by Anderson and van Wincoop (2003), which introduced the presence of so-called multilateral trade resistance. Simply speaking, this means how commutable the trade with the other country's partners is: if trade barriers with one country are reduced, bilateral trade flows from another tend towards more favorable terms of trade.

Anderson (2011) provided the simple explanation of the traditional gravity model:

$$X_{ij} = G \frac{Y_i^{\beta_1} Y_j^{\beta_2}}{d_{ij}^{\beta_3}} \quad (2)$$

According to his article “The Gravity Model”, X_{ij} denotes trade flows between $Y_i^{\beta_1}$ and $Y_j^{\beta_2}$, which mean the exporting and the importing country respectively. Usually, the GDP is used as mass in such type of models.

Having a similar interpretation logic with the first of equation (1), equation (2) means that the greater the GDP of the trading countries is and the smaller is the geographical distance between them, the bigger is the amount of trade between them.

It is a common practice to include different dummy variables into the gravity model equation. Back to the days when Tinbergen proposed to use Newton’s law to approximate bilateral trade flows, it was also found that the following factors can be added as proxies for trade costs:

- common language
- colonial links (as well as other historical backgrounds)
- political situation
- religion
- cultural similarities
- trade agreements etc.

Among the advantages of gravity model approach there are its high intuitiveness, structural nature along with strong theoretical foundations, reasonable environment with

general equilibrium, pliable structure and, more importantly, predictive power (Yotov et al., 2016).

The gravity model, however, was criticized by several authors. Particularly, some say that gravity model might be biased as it doesn't take into account transaction costs which occur between non-bilateral partners, i.e. it ignores the rest of the world, which is not involved in bilateral trade (Baier and Bergstrand, 2010; Baldwin and Taglioni, 2007). In order to overcome such type of bias it is suggested to include multilateral resistance (average trade barrier) terms in the gravity models (Wölwer et al., 2018).

Taking into account all of the above-mentioned, the baseline model specification of the gravity model including the standard variables takes the following form:

$$\ln X_{ij,t} = \beta_0 + \beta_1 \ln DIST_{ij} + \beta_2 \ln GDP_{i,t} + \beta_3 \ln GDP_{j,t} + \beta_4 CONTIG_{ij} + \beta_5 dR + \beta_6 dR_{post} + \varepsilon_{ij,t} \quad (3)$$

Where:

- $X_{ij,t}$ is the logarithmic transformation of the Ukrainian export to a country j at the time t ;
- $DIST_{ij}$ is the logarithm of bilateral distance between Ukraine and it's trading partner;
- $Y_{i,t}$ is the GDP of Ukraine at time t ;
- $Y_{i,j}$ is the GDP of Ukraine's trade partner at time t ;
- $CONTIG_{ij}$ represents an indicator of whether there is a contiguous borders between Ukraine and its trading partner;

- dR is a dummy equal to 1 if the importing country is Russia, dR_{post} is a joint dummy equal to 1 if the trading partner is Russia and the year of trade is between 2014 and 2020.

However, there remained several obstacles, that did not allow to directly estimate the equation (3). These obstacles included unobserved terms, such as price level and multilateral resistance term, which is simply defined as a measure of trade barriers between the trading country and its partners, according to Anderson and van Wincoop (2003). To deal with such bias, which is determined for all countries at the same time, it is a common practice to employ country fixed effects, according to Baldwin and Taglioni (2006).

Taking into account the common approach, it was decided to estimate our models with fixed effects and two different specifications.

In the first case, there were several joint dummies including the years 2014-2020 and the size of Russian export in the respective industry, being equal to 1 each time the destination country for exports is Russia.

In the second case, there was only one joint post-war dummy, being equal to 1 if the year of trade flow is one after 2014 included and the year is any between 2014-2020.

Within this research two model specifications were estimated separately for 10 industries. The classification of commodities to industries will be covered in the Data section of this research.

CHAPTER 4. DATA

The employed dataset was built on data from several sources and constructed to meet the requirements of the panel. Firstly, United Nations Commodity Trade Statistics Database was used to obtain yearly data on bilateral trade flows from 2011 to 2020, where Ukraine acted as reporter and other countries where the trade partners.

Table 4. Classification of export groups across industries

Industry	HS 2017 sections
Agriculture	Live animals; animal products (01-05); vegetable products (06-14); animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes (15)
Food	Prepared foodstuffs; beverages, spirits and vinegar; tobacco and manufactured tobacco substitutes (16-24)
Mineral products	Mineral products (25-27)
Chemical	Products of the chemical or allied industries (28-38); plastics and articles thereof; rubber and articles thereof (39-40)
Wood	Wood and articles of wood; wood charcoal; cork and articles of cork; manufactures of straw or of other plaiting materials; basketware and wickerwork (44-46); pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard; paper and paperboard and articles thereof (47-49)
Textile	Textiles and textile articles (50-63)
Metal	Base metals and articles of base metal (72-83)
Equipment	Machinery and mechanical appliances; electrical equip.; parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles (84-85)
Machinery	Vehicles, aircraft, vessels and associated transport equipment (86-89)
Others	Raw hides and skins, leather, furskins and articles thereof; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silk-worm gut) (41-46); articles of stone, plaster, cement, asbestos, mica or similar materials; ceramic products; glass and glassware (68-70); natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal and articles thereof; imitation jewellery; coin (71); optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; clocks and watches; musical instruments; parts and accessories thereof (90-92); arms and ammunition; parts and accessories thereof (93); misc. manufactured articles (94-96); works of art, collectors' pieces and antiques (97)

Source: World Customs Organization

More than 175k observations on commodities were obtained according to the HS4 level of the Harmonization System Nomenclature 2017 edition. The further compression of this data was made into export values for 10 respective industries as highlighted in the Table 4.

Partnering countries were chosen based on World Integrated Trade Solution data. According to WITS, Ukraine's top importing partners can be found in Table 5.

Table 5. Top-15 of Ukrainian export destinations (2011).

Rank	Country	Rank	Country	Rank	Country
1.	Russian Federation	6.	China	11.	Hungary
2.	Turkey	7.	Belarus	12.	Egypt, Arab Rep.
3.	Italy	8.	Kazakhstan	13.	Iran, Islamic Rep.
4.	Poland	9.	Germany	14.	United States
5.	India	10.	Lebanon	15.	Spain

Source: WITS

As for the 2020, the top importing partners of Ukraine have changed their rankings. Number one importer of Ukrainian commodities was China, accounting for more than 14% share in total imports. This country was followed by Poland with almost 7% of total imports and Russia with 5.5%. Compared to 2011 position of Russian Federation with 29% export partner's share, this indicates serious structural changes in geographical patterns of Ukrainian exports.

Gross domestic product data for Ukraine and its trading partners was taken from World Bank and is expressed in millions of US current dollars. The largest economies importing from Ukraine are United States, China, India and Germany. The smallest countries by GDP are Lebanon, Belarus and Hungary.

Another important part of our dataset, which was needed to meet the needs of gravity model nature was taken from *geo_dist* package in R built on the base of data from Centre d'Etudes Prospectives et d'Informations Internationales. Contiguity, shared language, ethnicity, distance, capital distance information was obtained from CEPII. Among the chosen countries only four are contiguous to Ukraine.

The descriptive statistics of our data is presented in Table 6.

Table 6. Descriptive statistics of the key model variables

Variable	Mean	Std. Dev.	Min	Max
<i>GDP_imp</i>	2903585.8	5088252.1	33383.2	21433224.7
<i>GDP_UKR</i>	139274.5	31081.2	91031.0	183310.1
<i>Export_Agro</i>	526.4	519.3	6.6	3046.8
<i>Export_Food</i>	108.6	177.0	0.00	1157.0
<i>Export_Mineral</i>	237.9	446.9	0.0	3191.0
<i>Export_Chemical</i>	162.0	314.1	0.1	1902.1
<i>Export_Wood</i>	87.8	150.6	0.3	1001.6
<i>Export_Textile</i>	31.3	56.6	0.0	250.8
<i>Export_Metal</i>	550.2	689.7	0.1	4079.1
<i>Export_Equip</i>	264.6	527.9	0.4	3430.3
<i>Export_Machinery</i>	105.9	452.4	0.0	3843.2
<i>Export_Others</i>	85.7	146.3	0.1	820.8
<i>dist</i>	2576.6	2063.7	433.5	7515.9

Source: CEPII, UN Comtrade, World Bank

As we can see from the Table 6, the largest export industries of Ukraine are metal, machinery production and equipment, while the smallest are textile, others, which is the aggregate name for categories including not very common goods, woodworking and food industries.

Hence it is necessary to see the impact of Russia on the biggest export groups. We also see that the lowest value of distance variable reflects the distance between Minsk and Kyiv, while the largest is the distance between Kyiv and Washington, D. C.

CHAPTER 5. RESULTS

To meet the goals of this research we were estimating the gravity model on the industry level data, which was obtained from aggregating the HS4 product data of Ukrainian export from 2011 to 2020. Section 5.1 of this chapter analyses the results of estimation for the whole Ukrainian export comparing pooled OLS and fixed effects methods, while section 5.2 is focused on the industry specific-results for our dataset.

The main hypothesis of this research is that the reason of geographical changes of Ukrainian export trade flows was the geopolitical conflict with the Russian Federation after 2014. However, if we do not see an impact of war with Russia, the possible explanation for that may be that the trade restrictions had been imposed much earlier and so Ukrainian manufacturers had time to diversify their export markets. Nevertheless, some empirical evidence should be acquired.

5.1 Non-specific results

Table 7 presents the results of both pooled OLS estimation and importers' fixed effects estimation specifications for the total export. The results show that there are negative and statistically significant coefficients on Year-Russia dummies only after 2016.

Therefore, there is no evidence that there is an impact of war with Russia on Ukrainian export trade flows volume. This may be an indicator of the total decrease in international trade and the market volatility amid a protracted crisis and an unstable geopolitical situation. The second specification with one dummy also shows strong negative statistically significant relationship between Ukrainian exports overall and exports to Russia since 2014.

An important notice can be that hereinafter other variables like distance and contiguity would be dropped from fixed effects estimation results as they remain time-invariant.

Table 7. Effects of Ukrainian-Russian trade war on total export

Variables	POLS (1)	POLS (2)	FE (1)	FE (2)
I(d14 * dR)	-0.40 (0.60)		-0.36 (0.34)	
I(d15 * dR)	-0.75 (0.61)		-0.39 (0.35)	
I(d16 * dR)	-1.04* (0.61)		-0.63* (0.36)	
I(d17 * dR)	-1.12* (0.60)		-0.87** (0.35)	
I(d18 * dR)	-1.30** (0.60)		-1.10*** (0.34)	
I(d19 * dR)	-1.53** (0.59)		-1.33*** (0.34)	
I(d20 * dR)	-1.67*** (0.59)		-1.37*** (0.35)	
dR_post		-1.13*** (0.36)		-0.88*** (0.22)
log(GDP_imp)	0.30*** (0.03)	0.30*** (0.03)	1.10*** (0.17)	1.11*** (0.17)
log(GDP_UKR)	0.61*** (0.18)	0.57*** (0.18)	0.57*** (0.11)	0.52*** (0.11)
log(dist)	-0.59*** (0.10)	-0.60*** (0.09)		
contig	-0.04 (0.16)	-0.04 (0.16)		
dR	1.49*** (0.32)	1.50*** (0.32)		
Constant	0.57 (2.26)	1.01 (2.21)		
R2	0.60	0.58	0.53	0.48
Adjusted R2	0.56	0.57	0.44	0.42
F Statistic	16.97*** (df = 12; 137)	33.57*** (df = 6; 143)	15.64*** (df = 9; 126)	41.09*** (df = 3; 132)
<i>Note:</i>			*p<0.1; **p<0.05; ***p<0.01	

For the further interpretations we would prefer FE models with importers' fixed effects as they let to control for multilateral resistance.

The interpretation of the dR_{post} is not straightforward and should be calculated as follows:

$$100 * (e^{\beta_6} - 1)(4)$$

Where β_6 – is the coefficient of dummy equal to 1 if the importing country is Russia and the year of trade is after 2014.

On average, holding other factors constant, export to Russia after 2014 was 58.5% lower than export to Russia in 2011-2013.

Other variables, such as GDP of importing countries and Ukraine, have the expected signs – the bigger the economy, the more it trades with the others.

However, looking only on the results of total export estimation does not provide an answer to the question in which industries the influence of Russia was noticeable since the war in 2014. That's why it is necessary to estimate the industry-specific results.

5.2. Specific results

Estimation results for the first model specification can be found in the Table 9 of Appendix. The biggest number of statistically significant coefficients can be observed in such industries as agricultural and food.

The other dummies are significant in the years 2019 and 2020. It is also compliant with the fact, that 2019 was the first year since 1991, when Ukrainian top trading partner was not the Russia, but China.

Second specification (see Table 8) gives us the opportunity to estimate the impact of trade war over the whole period after 2014, which can give us the more general understanding about the sectors, which have changed the most.

The statistically significant results appear in each industry apart from chemical and metal, so we can conclude that there is no evidence of impact of trade war with Russia on these sectors in the post 2014 period.

Another point worth emphasizing is how much trade volumes inside the sectors have changed before and after the military conflict.

Table 8. Effects of Ukrainian-Russian trade war on particular industries (specification with one dummy)

Variab les	Agro	Food	Mineral	Chemical	Wood	Textile	Metal	Equip	Machine ry	Other s
dR_po st	-2.90***	-1.81***	-0.90*	-0.05	- 0.89** *	- 0.77***	-0.13	-0.66*	-1.72***	- 0.84**
	(0.36)	(0.51)	(0.52)	(0.48)	(0.33)	(0.27)	(0.57)	(0.34)	(0.63)	(0.40)
log(G DP_i mp)	1.65***	2.52***	1.32***	0.28	1.37** *	0.55***	2.35***	1.63***	1.46***	0.59*
	(0.28)	(0.39)	(0.39)	(0.37)	(0.25)	(0.21)	(0.43)	(0.26)	(0.48)	(0.31)
log(G DP_U KR)	-0.22	-0.72***	1.59***	1.40***	-0.13	0.10	0.90***	0.32*	0.69**	0.45**
	(0.18)	(0.25)	(0.25)	(0.23)	(0.16)	(0.13)	(0.28)	(0.17)	(0.31)	(0.20)
R2	0.50	0.35	0.35	0.23	0.26	0.14	0.27	0.32	0.20	0.13
Adjust ed R2	0.43	0.26	0.27	0.13	0.16	0.03	0.18	0.23	0.09	0.01
F	43.34**	23.32**	23.66**	13.20***	15.48*	7.28***	16.30**	20.51**	10.82***	6.40**
Statisti c (df = 3; 132)	*	*	*		**		*	*		*
<i>Note:</i> *p<0.1; **p<0.05; ***p<0.01										

We can see that keeping other factors constant, on average, export volumes to the Russian Federation after 2014 has differed from the previous years (2011-2013) by the following amounts:

- agricultural industry – lower by 94.51%
- food industry – lower by 83.64%
- mineral products industry – lower by 59.36%
- woodwork industry – lower by 58.82%
- textile industry – lower by 53.54%
- equipment industry – lower by 48.53%
- machinery industry – lower by 82.18%
- others – lower by 56.71%

These results indicate that as a result of the conflict with Russia, sectors such as agricultural, food and machinery suffered the most. Due to the fact of domination of agricultural and machinery sectors' shares in total export we will be focusing mainly on these two industries in our explanations.

As for the beginning of 2011, machinery exports accounted almost for one third of export trade flows to Russian Federation. However, as for 2020, the decrease in volumes can be explained by the termination of exports consisting of various parts and equipment for the military-industrial complex. At the same time, this may indicate opportunities for Ukraine in expanding its cooperation with NATO alliance in the context of armament trade.

What is also interesting, is that Russia still remains number one importer of Ukrainian machinery, despite the dramatic decrease in volumes supplied. Ukraine keeps exporting to Russia railway, tramway locomotives, railway or tramway track fixtures and other vehicles.

Even so, Ukraine's share of exports in the machinery industry steadily have been growing, which may be an indicator of regular trade cooperation with some countries. It's about the integration of Ukraine into production chains with some countries of the European Union.

In the agricultural section there has been a logical impact of imposed tariffs since 2014, which banned the wide list of Ukrainian agricultural and food commodities. Significant results since 2014 indicate that the nature of tensions inside this industry has been continuous over the nearly decade.

What should also be assessed is the mineral production. As the Table 9 suggests, the Russian factor is significant since 2019, which is confirmed by 2019 mutual bans and restrictions for trade of coal, oil and oil products.

We should also discuss the non-significant results in chemical and metalworking industries. As the results suggest, we cannot say that export volumes in these categories have changed as a result of the armed conflict, but despite this, we can assume that earlier sanctions from Russia led to this.

That is, Ukrainian chemicals export to the Russian Federation was mostly consisting of fertilizers, production of which is closely connected with the gas supply from Russia itself. Overall, the share of chemicals in Ukrainian export fall from 9% in 2014 to around 5.5% in 2020.

The products of metallurgic industry have been one of major components of Ukraine-Russia trade flows in the recent years, accounting for more than 20% over the last years, so we can see a field for discussion there.

CHAPTER 6. CONCLUSIONS AND RECOMMENDATIONS

6.1. Conclusions

Having conducted this research paper, author managed to investigate how important is the factor of the trade war with Russia in change of Ukrainian export trade flows.

To obtain the necessary results there was used the empirical analysis and especially pooled OLS and fixed effects specifications of gravity model, which is the most common way of inspecting patterns of the international trade. The methodological basis of this research is the concept of gravity model itself, accounting for the multilateral resistance.

Main challenge of conducting this study was the wide base of export trade flows with on the 4-digit level of Harmonization System. In order to deal with this, it was decided to aggregate the data to the industry level, which would allow to study some general trends across the chosen industries.

Building a particular functional specification of the model was also a challenge, as there should had been included such terms, which would allow to compare the impact of trade war on the constrained data frame.

As was estimated, on average, holding everything else constant, export flows to the Russian Federation after 2014 were 58.5% lower than export to the same destination in 2011-2013.

Another important finding is that the corresponding coefficients for total export are negative and statistically significant coefficients on Year-Russia dummies only after 2016.

At the same time, there is no evidence that Russia affected Ukrainian export in chemical and metallurgical industries.

6.2. Recommendations

Taking into consideration the foregoing analysis, several recommendations could be made, mostly focused on business oriented implications of major findings.

It is obvious that in recent years Ukrainian exports have diversified significantly. A significant factor of influence in this context was the trade restrictions of the Russian Federation. Partly due to this, Ukraine no longer has a clearly defined top trading partner, whose share would be significantly different from others.

Changes in the commodity structure of Ukrainian exports reflect the strengthening of trade with the EU countries - after the signing of mutual agreements between our country and the regional association, the export of agricultural products increased against the background of a decrease in exports of metal products. This is partly due to increased demand for the significantly improved quality of raw materials from Ukrainian farmers.

The next important step should be to overcome Russia's economic presence in key sectors of the economy, which, unfortunately, is a problem despite a significant decrease in trade between the countries over the past decade. In particular, an analysis of the origin of capital in a number of key industrial enterprises can be a potential solution to the problem.

Another principal aspect that should be investigated includes an analysis of the volume of illegal export of goods to the Russian Federation and uncontrolled territories.

To maximize the efficient realization of the export potential of our producers in key industries, first of all, it is necessary to assess the conformity of products to the Directives and Harmonized Standards that apply to the product. This will allow filling export quotas in several sectors at once, including the food and agricultural industries. However, lobbying for an increase in quotas at the highest government levels should also be present.

Moreover, given the constant trade deficit in relations with the EU, it is necessary to change the commodity structure of Ukraine's exports by increasing the volume of exports of industrial goods.

In particular, we are talking about the potential for growth in the export of special equipment, railway locomotives and spare parts for them to the EU countries, which is still presented among valuable export items to Russia.

As for the further expansion of this research, there are several possible ways to delve into research.

Firstly, it would be a good idea to include in the sample not only top-15 trading partners of Ukraine, but also other countries.

Secondly, more years can be included in the research to obtain deeper understanding of factors which affect the Ukrainian foreign trade the most.

Thirdly, and more importantly, disaggregation of data into subgroups by 6-digit code or even more detailed would let to obtain results for some specific groups in order to assess the possibility of geographical diversification in them.

Fourthly, it may be necessary to change the model specification by adding the tariffs variable. However, this must be preceded by the analysis of tariffs in the particular commodity groups. The relevant information can be found on Market Access Map website.

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APPENDIX

Table 9. Effects of Ukrainian-Russian trade war on particular industries (specification with joint dummies for each year)

Variables	Agro	Food	Mineral	Chemical	Wood	Textile	Metal	Equip	Vehicles	Others
I(d14 * dR)	-0.91* (0.49)	-0.72 (0.83)	-0.43 (0.83)	0.10 (0.78)	-0.11 (0.51)	-0.22 (0.44)	-0.08 (0.92)	-0.15 (0.55)	-1.03 (1.03)	0.01 (0.65)
I(d15 * dR)	-1.06** (0.51)	-1.55* (0.86)	-0.14 (0.86)	0.46 (0.81)	-0.16 (0.53)	-0.45 (0.45)	0.62 (0.96)	-0.04 (0.57)	-1.51 (1.06)	-0.29 (0.67)
I(d16 * dR)	-3.54*** (0.52)	-1.71* (0.87)	-0.35 (0.87)	0.21 (0.82)	-0.41 (0.54)	-0.66 (0.46)	0.59 (0.96)	-0.29 (0.57)	-1.50 (1.07)	-0.79 (0.68)
I(d17 * dR)	-3.35*** (0.50)	-2.08** (0.85)	-0.60 (0.85)	0.06 (0.80)	-0.91* (0.52)	-0.44 (0.44)	-0.03 (0.94)	-0.67 (0.56)	-1.72 (1.04)	-0.90 (0.66)
I(d18 * dR)	-3.87*** (0.50)	-2.13** (0.84)	-1.16 (0.84)	-0.11 (0.79)	-0.94* (0.52)	-0.78* (0.44)	-0.41 (0.93)	-0.95* (0.55)	-2.09** (1.03)	-1.15* (0.65)
I(d19 * dR)	-3.91*** (0.50)	-2.48*** (0.84)	-1.61* (0.84)	-0.40 (0.79)	-1.77*** (0.52)	-1.29*** (0.44)	-0.64 (0.93)	-1.26** (0.55)	-2.02* (1.03)	-1.38** (0.65)
I(d20 * dR)	-3.72*** (0.50)	-2.07** (0.84)	-1.75** (0.84)	-0.52 (0.79)	-1.73*** (0.52)	-1.46*** (0.44)	-0.64 (0.93)	-1.11** (0.56)	-2.20** (1.04)	-1.34** (0.66)
log(GDP_imp)	1.54*** (0.24)	2.46*** (0.41)	1.34*** (0.41)	0.30 (0.38)	1.36*** (0.25)	0.52** (0.21)	2.42*** (0.45)	1.64*** (0.27)	1.43*** (0.50)	0.55* (0.32)
log(GDP_UKR)	-0.13 (0.15)	-0.69*** (0.26)	1.68*** (0.26)	1.45*** (0.24)	-0.05 (0.16)	0.15 (0.13)	0.98*** (0.28)	0.39** (0.17)	0.72** (0.32)	0.49** (0.20)
Observations	150	150	150	150	150	150	150	150	150	150
R ²	0.65	0.37	0.37	0.24	0.34	0.20	0.28	0.35	0.21	0.16
Adjusted R ²	0.59	0.25	0.26	0.10	0.21	0.05	0.15	0.23	0.06	0.01
F Statistic (df = 9; 126)	26.52***	8.06**	8.32***	4.42***	7.07***	3.46***	5.57***	7.54***	3.62***	2.71***
<i>Note:</i>							*p<0.1; **p<0.05; ***p<0.01			

