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Modification of Russia's Trade Pattern under External Shocks in 2014 and Beyond

Gleb V. Borisov[1], Liudmila V. Popova[1], and Ehsan Rasoulinezhad[2+]

[1]*Saint Petersburg State University, Russia*
[2]*University of Tehran, Iran*

Abstract This research examines the impact of macroeconomic shocks and political measures, including sanctions, imposed by western countries on trade flows, commodity compositions, and import-export flows to the Russian Federation. To this end, we use 2012-2016 panel date to produce gravity equations containing the determining features of Russia's import-export volumes of agricultural, raw material, and industrial goods. Our results confirm that macroeconomic shocks led to a significant reduction in trade. A conservative estimate of the marginal impact ranges between 9% and 34%, depending on the sector and the direction of trade. This study also shows that trade-restrictive measures made a significant contribution to trade reductions. Open diplomatic conflicts had a particularly negatively strong impact on Russia's trade with Ukraine and Turkey, and the marginal effect was in the range of 30%-50%. The introduction of a food embargo by Russia resulted in a significant reduction in agricultural imports from developed countries, although the decrease in Russian trade with this group in other sectors can largely be explained by the negative impact of macroeconomic shocks. These findings demonstrate that Russia's trade in some product groups has been reoriented to countries in Asia, Africa, Latin America, and the Eurasian Economic Union.

Keywords: Economic Sanctions, International Trade, Gravity Theory of Trade, Russia

JEL Classifications: F14, F15, C51

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I. Introduction

Between 2014 and 2016, Russia's foreign economic relations experienced a deep decline conditioned by several negative external political and economic shocks (Rasoulinezhad et al.,

+Corresponding Author: Ehsan Rasoulinezhad
Assistant Professor, Department of Russian Studies, Faculty of World Studies, University of Tehran, Tehran, Iran; Email: e.rasolinezhad@ut.ac.ir
Co-Author: Gleb V. Borisov
Associate Professor, Department of Economics, Growth Laboratory, Saint Petersburg State University, Saint Petersburg, Russia, Email: g.borisov@spbu.ru
Co-Author: Liudmila V. Popova
Associate Professor, Department of Economics, Centre for Asia Economic Studies, Saint Petersburg State University, Saint Petersburg, Russia, Email: l.v.popova@spbu.ru

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2020). Two major open diplomatic conflicts significantly affected Russia's foreign trade. The first was with Ukraine, wherein relations deteriorated in February 2014, the subsequent entry of Crimea into the Russian Federation, and the outbreak of hostilities in the east of Ukraine. The conflict was followed by sanctions, originally introduced against Russia by the United States (US) and supported by the European Union (EU), Canada, and Japan. Around the same time, other countries allied with the EU as well as the US and introduced comparable measures. Russia responded with their August 2014 imposition of an embargo on food products from the EU, US, Canada, and other countries (Gladkov, 2015; Klinova & Sidorova, 2014, 2017; Morozenkova, 2017; Zagashvili, 2015).

In late 2015, there was an acute diplomatic conflict between Russia and Turkey following an incident involving a Russian warplane near the Turkey-Syria border. As a result, from January 2016, Russia's food embargo was extended to Turkey.[1] The embargo covered the supply of meat and dairy products, fish, vegetables, and fruits. With the enforcement of the Association Agreement between Ukraine and the EU, Russia abolished the free-trade regime with Ukraine and extended its food embargo.

Open political conflicts and the impositions of sanctions coincided with dramatic changes in the macroeconomic environment. The fall in oil prices beginning in 2014 prompted a sharp decline in the value of Russian exports. Because hydrocarbons comprised two-thirds of exports, this led to an overall decrease in export earnings, loss of capital outflows, a deep depreciation of the ruble, and increased inflation. The decline in real incomes and high interest rates reduced consumer and investment demand and opportunities for exports and imports. This then led to a subsequent decrease in domestic production of goods and services within Russia.

The unfavorable macroeconomic situation negatively affected intra-regional trade in the Eurasian Economic Union (EAEU), which, in addition to Russia, includes such post-Soviet economies as Belarus and Kazakhstan. After the collapse of the Soviet Union, these countries maintained close political, economic, and cultural ties with Russia, which grew after the creation of the Customs Union in 2010: an important step in the formation of a single economic space (Sherov-Ignatev, 2019; Valovaya, 2018; Vinokurov, 2017). The foreign-policy events of 2014 and later did not interfere with the deep political and economic integration of these countries with Russia. However, owing to their high dependence on the Russian economy, the general deterioration of Russia's economic conditions led to local currency devaluations, declines in investment, and an economic downturn, which, in turn, negatively affected foreign trade.

With the backdrop of sanctions and unfavorable external economic conditions, the nature of Russia's foreign trade changed in both direction and composition. External shocks caused the disruption of supply chains and economic ties between Russia and its partners. From 2014 to 2016, Russia's foreign trade shrank with virtually all country groups, significantly impacting

1) Restrictions on imports from Turkey were partially eliminated as early as October 2016.

Ukraine and Turkey. Sanctions also affected Russia's foreign trade with countries with which it was not in conflict. Because of financial restrictions, international financial markets became less accessible to Russian companies, which then experienced shortages of financial resources (Gurvich & Prilepsky, 2016; Orlova, 2014). Sanctions reduced the propensity for foreign partners to conduct business with large Russian firms because of increased risks. Simultaneously, sanctions encouraged Russian authorities and firms to search for new partners and markets, contributing to the regional diversification of Russia's foreign trade.

To minimize the negative effect of sanctions, Russia announced a partial redirection of its trade and investment flows from Europe to Asia and proclaimed an import substitution policy with export support programs (Obolensky, 2016, 2017). Against the background of general decline in trade from 2015 to 2016, evidence shows that Russia replaced its traditional sources of imports and reoriented toward new export markets. The significant devaluation of the ruble with the continuing decline in oil prices enhanced the competitiveness of non-energy goods, whose shares increased both in Russian exports and as a portion of its gross domestic product (GDP). Russian exports also became more diverse as new export items emerged, including agricultural goods, electrical machinery, and other equipment. In 2016, Russia became the largest exporter of wheat; its exports of meat, oils, and other food products rapidly grew.

The regional pattern of Russian foreign trade gradually diverged from the EU to the Asia-Pacific region, although trade with Asian partners from 2015 to 2016 also dropped, albeit to a lesser extent. In addition to the Asia-Pacific region, Russian exports grew to other destinations, including Africa, Iran, the Middle East, India, and Latin America.

After 2014, several external factors influenced Russia's foreign trade, some of which (e.g., the absolute and relative costs of doing business with various partners, exchange rates, oil prices, real incomes, interest rates) were of an economic nature, whereas others (e.g., direct diplomatic conflicts, sanctions, economic policies) were political in nature. This study focuses on three research objectives. First, it assesses the impact of political and economic factors on Russia's foreign trade after 2014. Second, it examines how western sanctions and Russia's retaliatory measures influenced the direction of Russian trade flows. Finally, the effect of foreign-policy measures on Russian trade is compared with the effect that similar measures had on the trade of countries whose economies were also under political pressures.

To achieve these objectives, we use the gravity model of trade, which, in addition to standard economic variables, such as GDP, distance, and common borders, includes dummy variables for the period and for trading partners of Russia. We use data on Russia's bilateral trade with its 40 largest partners, which are aggregated into four groups listed in Appendix Table A1. Among those are the first group of developed economies, including the US, members of the EU, and other countries that joined the anti-Russian sanctions. The second group comprises Ukraine and Turkey, which were in open diplomatic conflict with Russia from 2014 to 2016.

The third subset of countries includes Belarus and Kazakhstan, large economies within the EAEU. The fourth group includes other countries not specified elsewhere. Hereafter, we refer to these groups as "developed economies," "conflict-involved countries," "EAEU members," and "other countries."

The groups of countries selected are represented in the gravity model by separate dummy variables. Our approach of separating the influence of political and economic factors on Russian foreign trade is based on the premise that fluctuations in Russian trade with countries belonging to the EAEU were mainly caused by economic shocks and not by political events that occurred since 2014. We use estimates for this group of countries as values showing the effect of macroeconomic shocks on Russian trade with all countries after 2014.

Unlike the EAEU, trade with countries from our sample was affected by both economic and political factors. We estimate the effect of political factors on Russian trade with groups represented by developed countries, conflict-involved countries, and other countries as the difference between the effect of external shocks on trade with these countries and the effect of external shocks on trade with EAEU members.

Although the consequences of imposing sanctions on the Russian economy have been actively discussed in the academic literature (see Section II), as far as we know, nobody has used the gravity model or the approach described above to separate the effects of political measures on Russia's foreign trade from those of economic determinants of exports and imports. We also compare the obtained estimates of the impact of politics on Russian trade with those of the impact of sanctions on foreign trade available in the literature.

The remainder of this paper is organized as follows. The next section contains a review of theoretical and empirical literature on the impact of sanctions on a single economy and the global economic system as a whole. Then, in Section III, we consider the gravity theory of trade, we define the variables involved in gravity equations, and we briefly describe our data. Section IV presents our empirical results. We report statistics describing the changes in the pattern of Russia's foreign trade with its 40 largest partners. Then, using a series of tests, we determine the most appropriate method for estimating the gravity model. Afterwards, we present the results of gravity estimations. Finally, we explore the robustness of our findings. The last section provides conclusions and some guidance for policymakers.

II. Literature Review

The impact of sanctions is assessed from various angles in the literature. A large number of studies have considered their economic impact on the target economy. Dizaji and van Bergeijk (2013) studied the macroeconomic and political impacts on Iran after the oil boycott. Haidar

(2017) investigated the relationship between sanctions and export deflection in Iran over the period of 2006-2011. The main results showed that two-thirds of the Iranian export volume was deflected toward non-sanctioning countries. Taghizadeh-Hesary et al. (2013, 2019) showed that Iran and Russia benefited from a sharp increase in world oil prices, which improved trade flows with their main partners and reduced the negative effects of sanctions. Neuenkirch and Neumeier (2015) empirically assessed how economic sanctions imposed by the United Nations (UN) and the US affected the GDP growth in 160 countries over the period of 1976-2012. They found that the UN sanctions had a significant influence on the target state's economic growth. However, the effect of US sanctions was much smaller and more poorly defined.

The effects of economic sanctions are not limited to their intended targets. It extends to other countries as well. On the one hand, third-party countries can suffer from the negative effects of sanctions because of reduced incomes in the sanctioned country or import substitution policies that stifle bilateral trade. On the other hand, economic sanctions create favorable business opportunities for some third-party states, which may capture the gains of diverted trade (Caruso, 2003; Early, 2015). Finally, third-party countries can play a decisive role in weakening sanctioning efforts. They can do this by expanding their commercial relations with the sanctioned party to either seek profits or achieve political aims (Early, 2015).

Many researchers have used the gravity model to estimate the effects of sanctions on international trade flows. Hufbauer et al. (1997) included some of the first researchers who estimated sanctions' effects using gravity equations for 88 countries for years 1985, 1990, and 1995. Their findings showed that sanctions reduced bilateral trade flows by nearly 90%. Caruso (2003) employed a similar approach to estimate the impact of US sanctions on its trade with 49 target countries over the period 1960-2000. He described partial and limited sanctions against extensive trade and financial restrictions. The findings showed that extensive sanctions had a larger negative impact on bilateral trade than did limited and moderate restrictions. Yang et al. (2004, 2009) further developed the gravity model to explore whether the EU became an alternative market for nations subject to US sanctions. Their main finding showed that, after the imposition of sanctions by the US, the EU gradually captured trade flows from the targeted countries. Using a gravity model, Mehchy et al. (2015) estimated the impact of sanctions on Syrian exports between 1995 and 2010 and found that sanctions and deteriorating institutional factors had led to more than a 70% reduction in Syria's export potential. Popova and Rasoulinejad (2016) used the gravity model to analyze bilateral trade between Iran and its major trading partners between 2006-2013. Their findings showed that the introduction of various sanctions related to Iran's nuclear program had led to a reorientation of that country's foreign trade from the European region to countries in Asia. Findings along these lines confirm that sanctions significantly affect bilateral trade flows among countries. In many cases, the sanctioned countries redirect their economic transactions away from the sanctioners to other suppliers and markets.

Russian studies have suggested that sanctions adversely affect its economy and trade with traditional economic partners, mostly with the EU (Gladkov, 2015; Klinova & Sidorova, 2014, 2017; Morozenkova, 2017; Zagashvili, 2015). For Russia, sanctions from EU member countries that are Russia's strategic partners are more painful than those from the US, owing to these countries' greater trade volumes with Russia. The key problem in measuring the impact of these sanctions is that their imposition in these cases coincided with a deterioration in the macroeconomic environment and an economic recession in Russia. The limited availability of data made it difficult to separate the effects of economic sanctions per se on trade flows from the impact of other unfavorable factors that led the Russian economy into recession in 2014-2015. Of all the types of sanctions imposed on Russia, financial restrictions have had the most negative impact. Their consequences were analyzed by Gurvich and Prilepsky (2016), and Orlova (2014).

Regarding the ongoing discussion of Russia's "pivot east" policy, many authors, while recognizing the growth of the Asian countries' sharing in Russian foreign trade, considered this shift to be purely a statistical and temporary phenomenon. They argued that the increased contribution of Asian countries to Russian trade was in compensation for the reduction of its trade relationships with other entities, primarily with the EU. They also argued that there was no real reorientation of foreign economic ties to the East, and that, if the sanctions or the effect of the ruble devaluation ceased, Russia would switch its trade flows back to its traditional partners (Obolensky, 2016, 2017).

In contrast to other authors, we use the gravity model to consider the effect of external shocks, including sanctions on Russia's foreign trade. This provides us an opportunity to deepen our understanding of the problem in two aspects. First, the use of the gravity model allows us to separate the effects of sanctions and economic policies on foreign trade from the impacts of economic factors. As long as gravity equations include country dummies, it allows us to compare relative effects of external shocks on trade with different countries and to make further conclusions about the mechanisms lying behind these shocks. Second, the gravity estimation also allows us to assess how significant and long-term the changes in Russia's trade are with Asian countries.

III. Modeling Approach and Data

To study the effect of external shocks on Russia's bilateral trade, we apply the widely used gravity model (Rasoulinezhad, 2018, 2020; Rasoulinezhad & Jabalameli, 2019) to analyze the patterns of bilateral trade. The gravity equation was first proposed by Tinbergen (1962), who argued that the volume of bilateral trade flows between any two countries was a function of

their GDP and distance.

Following standard analytical practice, we add a joint GDP equation, defined as Russia's GDP, Y_R, multiplied by the GDP of its partner (j), Y_j, both denominated in current US dollars. It is broadly assumed that a country's economic size, as expressed by its GDP, is positively correlated to its export capabilities, because a larger country can produce and export more. Economic size is also a proxy for consumption and demand for imported goods, which suggests a positive correlation between GDP and imports. With the above arguments, using GDP denominated in current US dollars has an advantage in that it accounts for changes in the exchange rate and real gross domestic income. Thus, the introduction of this variable in the gravity equation captures the effects of economic size, real gross domestic income, exchange rate, and other external shocks that correlate with GDP.

Regarding absolute distance variable, which captures the effect of trade barriers, transport costs, cultural differences, etc., a negative sign of the distance coefficient is usually assumed in the literature. However, Anderson and Van Wincoop (2003) showed the importance of relative distance as a determinant of bilateral trade. They argued that two neighboring countries would trade more intensively if they were far from other major economies, compared with a situation wherein they were close to other large countries. Multilateral trade resistance represents average trade barriers faced by a country. Because the nonlinear estimation technique for the multilateral resistance factor in Anderson and Van Wincoop (2003) is complex, Baier and Bergstrand (2007) proposed using the GDP weighted average of distance from trading partners, or remoteness, as a proxy for the multilateral resistance term. In this paper, we use both the absolute distance and remoteness in our gravity equations. We define remoteness as Russia's average weighted distance from its trading partners, wherein the weights are ratios of trading partners' real gross national income (GNI) per capita to the world's real GNI per capita. Using real GNI per capita as weights follows the findings of Bergstrand (1989), who showed that a trading partner's income levels were significant determinants of bilateral trade flows:

$$REM = \sum_{j=1}^{N} \frac{DIS_j}{y_j / y_W}, \tag{1}$$

where index j represents Russia's trading partner, j; $N = 40$ is the number of Russia's importers or exporters included in the samples; DIS_j is the distance between Russia and its trading partner, j; y_j and y_W are the country j's and the world's real per capita GNIs respectively. Regarding remoteness, we have no preliminary assumptions about its sign, owing to its complex structure.

Augmenting the equations with a dummy variable for the common geographical border between Russia and its trading partner accounts for common trading infrastructure, long-lasting history of bilateral relationships, and geographical and cultural proximities that neighboring

countries are likely to have. The *BORD* variable takes 1 if Russia and its trade partner have a common geographical border and 0 otherwise. We expect a positive sign of the common border variable.

Although the gravity model arose by analogy to Newton's law of gravitation, subsequent studies have shown that the gravity equation is compatible with various theories of trade. Bergstrand (1989) showed that a gravity equation could arise from a differentiated product model. Deardorff (1998) then formulated the conditions under which the Heckscher-Ohlin model theoretically agreed with the gravity equation.

To identify the theory underlying the equation, Sohn (2005) complemented the gravity model using the Trade Complementarity Index (TCI), measuring the extent to which one country's exports overlap that of the other country's imports. He argued that the positive *TCI* coefficient, indicating cases when trade volume increases with rising trade structure complementarities, represented the Heckscher-Ohlin trade model of dominant inter-industry trade. On the contrary, a negative *TCI* coefficient implies that the trade volume increases with increasing competitive trade structures. The latter cases represent the differentiated product model of dominant intra-industry trade.

To identify the theory behind Russia's trade pattern, we augmented the gravity equation by the *TCI* calculated as follows:

$$TCI_{ij} = \frac{\sum_{k=1}^{K} X_{ki} M_{kj}}{\sqrt{\left[\left(\sum_{k=1}^{K} X_{ki}^2\right) \times \left(\sum_{k=1}^{K} M_{kj}^2\right)\right]}}, \tag{2}$$

where indices i and j stand for a country and its trade partner, i and j = 1, 2, …, N; k refers to sector; K = 3 is the number of sectors, including agricultural, industrial and raw material; X_{ki} is the share of sector k in the exports of country i; and M_{kj} is the share of sector k in the imports of country j.

Russia demonstrates special trade patterns with developed economies. On the one hand, these markets are primary destinations for Russian natural-resource exports. On the other hand, they are main origins of industrial goods consumed in the country. The fixed effects for developed economies are captured by the *WEST* variable, which takes the value of 1 for the EU member states, the US, Japan, Canada, and Switzerland over 2012-2016, and 0 otherwise.

Country-specific dummies for conflict-involved countries and EAEU members are not included in the equations to prevent multicollinearity between them and the variables representing country-specific effects of external shocks. The omission of dummy variables for these countries is unlikely to lead to biased estimates, because most of these states have a common border with Russia. Thus, the appropriate fixed effects are captured by the *BORD* variable.

We include in the equations several dummy variables that account for the effects of external

shocks on individual countries and separate them from the shocks affecting Russia's trade as a whole through joint GDP. The *OTHR* variable is a period dummy that takes the value of 1 in 2014-2016 and 0 in 2012-2013 for all those trading with Russia. Given that our equations also include special dummy variables accounting for relative effects of external shocks on trade with developed economies, conflict-involved countries, and EAEU members, the *OTHR* variable represents the effect of external shocks on Russia's trade with other countries. Because all the countries included in our samples are selected, the *OTHR* variable captures some of the total effects of external shocks on trade with developed economies, conflict-involved countries, and EAEU members. The *OTHRWEST* variable, defined as a product of the *OTHR* and *WEST* variables, accounts for presumably negative changes in trade between Russia and developed economies relative to the reference category, including other countries. The *DIRCONF* variable captures a presumably negative effect of open diplomatic conflicts on bilateral trade with conflict-involved countries relative to other countries. It takes value of 1 for Ukraine over 2014-2016 and Turkey in 2016 and 0 otherwise. The effect of external shocks on trade between Russia and EAEU members relative to the base category of other countries is captured by the *EURAS* variable, which is equal to 1 for Belarus and Kazakhstan over 2014-2016 and 0 otherwise. Anticipatory assumptions regarding the sign of the *EURAS* estimate are hampered by the complexity of economic relations determining trade between EAEU members.

The impact of some external shocks, such as decreased oil prices, the agro-food embargo, etc., is likely to be heterogeneous, depending on the sector or direction of trade flows. Considering this, and by using the separability property of the gravity equation (Anderson & Van Wincoop, 2004), we fit the equation to the data on imports and exports in each of the three sectors:

$$\ln IM_{jt}^{k} = a_0^k + a_1^k \ln(Y_{Rt} Y_{jt}) + a_2^k \ln DIS_j + a_3^k \ln REM_t + a_4^k BORD_j + a_5^k \ln TCI_j + a_6^k WEST_j + a_7^k OTHR_t + a_8^k DIRCONF_{jt} + a_9^k EURAS_{jt} + a_{10}^k OTHRWEST_{jt} + \varepsilon_{jt}^k, \quad (3)$$

$$\ln EX_{jt}^{k} = b_0^k + b_1^k \ln(Y_{Rt} Y_{jt}) + b_2^k \ln DIS_j + b_3^k \ln REM_t + b_4^k BORD_j + b_5^k \ln TCI_j + b_6^k WEST_j + b_7^k OTHR_t + b_8^k DIRCONF_{jt} + b_9^k EURAS_{jt} + b_{10}^k OTHRWEST_{jt} + \omega_{jt}^k, \quad (4)$$

where IM_{jt}^k and EX_{jt}^k are Russia's imports from and exports to country j in sector k in year t; ε_{jt}^k and ω_{jt}^k are error terms; the indices, j, t, and k, refer to a Russia's trade partner (i.e., country), year, and sector (e.g., agricultural, raw material, and industrial), respectively.

The $a_7^k - a_{10}^k$ coefficients from Eq. (3) and the $b_7^k - b_{10}^k$ coefficients from Eq. (4) represent country-specific effects of external shocks on bilateral trade flows. The a_7^k and b_7^k coefficients capture the impact of external shocks that affect Russia's trade with other countries over 2014-2016. These coefficients also represent some of the impact of external shocks on trade with developed economies, conflict-involved countries, and EAEU member states. The effects of the shocks

on these three groups of countries relative to the effect of the shocks on other countries are captured by the $a_8^k - a_{10}^k$ and $b_8^k - b_{10}^k$ coefficients. They represent the effects of external shocks on the specified countries, which are additional to the impact of external shocks captured by the a_7^k and b_7^k coefficients. The total impact of external shocks on developed economies, conflict-involved countries and EAEU members is the sum of the effects. Thus, the $a_7^k + a_8^k$ and $b_7^k + b_8^k$ represent the total effects of external shocks on Russia's imports from and its exports to conflict-involved countries. Similarly, $a_7^k + a_9^k$ and $b_7^k + b_9^k$ are estimates of the total impact of the shocks on Russia's imports from EAEU members and its exports to them, whereas $a_7^k + a_{10}^k$ and $b_7^k + b_{10}^k$ are the corresponding effects on Russia's trade with developed economies.

Assuming that political measures do not significantly affect Russia's trade with EAEU countries, the effect of external shocks on imports from and exports to EAEU countries equals $a_7^k + a_9^k$ and $b_7^k + b_9^k$, respectively. This we consider the estimate of the impact of economic factors on Russian trade.[2] Regarding the influence of political factors on trade with developed countries, conflict-involved countries, and other countries, we found differences between the impact of shocks on trade with these countries and the effect of shocks on trade with the EAEU. Thus, the effect of political measures on Russia's imports from developed countries is $\left(a_7^k + a_{10}^k\right) - \left(a_7^k + a_9^k\right) = a_{10}^k - a_9^k$, whereas the effect of politics on exports to developed countries is equal to $b_{10}^k - b_9^k$. The effect of political measures on imports from conflict-involved countries and exports to them is calculated in the same way as $a_8^k - a_9^k$ and $b_8^k - b_9^k$. The effect of political shocks on Russia's imports from other countries is thus $a_7^k - \left(a_7^k + a_9^k\right) = -a_9^k$, whereas their effect on exports to other countries is $-b_9^k$.[3]

We estimate Eqs. (3) and (4) using panel data on Russia's bilateral sector flows with the 40-largest trading partners listed in Appendix Table 1 over the period of 2012-2016. Annual GDP, imports, and exports are measured in current US dollars, whereas geographical distance between capital cities is in kilometers. The data are taken from the World Development Indicators online database, the Trade Map, and the GlobeFeed Distance Calculator. Wherever possible, we use trade statistics collected by Russia's partners to calculate the volumes of Russian exports and imports. The sectors are defined on the base of the two-digit HS product codes as follows.

2) Because Eqs. 3 and 4 include GDP, distance, and other variables, $a_7^k + a_9^k$ and $b_7^k + b_9^k$ amount to a conservative estimate of the effect of economic factors on Russia's trade.

3) The described methodology for estimating the impact that policy has on trade is valid to the extent that economic shocks have the same effect on trade with different countries. If this condition is not met, then a special consideration of the situation is required, as explained in Section IV when discussing gravity estimates for agricultural products imported from EAEU countries.

Table 1. Sector product composition

Sector	HS product codes included
Agro-food	1-24
Industrial	28-40, 42, 48, 49, 54, 55, 57-70, 73, 82-97
Raw material	25-27, 41, 43-47, 50-53, 56, 71, 72, 74-81

The TradeMap statistics for certain years contain significant values of exports and imports of goods belonging to the HS99 product group, which include commodities not specified elsewhere. To control for the consistency of data collected during different years, we divided the values of the HS99 product group between sectors in proportion to their shares in Russia's total annual volumes of exports or imports.

The three-sector aggregation that we use provides a reasonably detailed pattern of trade flows and generally ensures their non-zero magnitudes. To decrease the number of zero values in our sample, we replaced Ecuador, the 40th-largest source of Russian imports in 2016, with Argentina, ranking 41st, owing to the zero value of Ecuador's raw-material exports to Russia. The only zero observation remaining in our data, which is the export of Russian agricultural goods to Malta in 2014, is considered a measurement error and is recoded into the missing value.

IV. Empirical Results

A. Russia's trade pattern in 2012-2016

An unfavorable external environment and economic recession in Russia from 2014 to 2016 negatively affected its foreign trade. The total volume of Russian exports to 40 major partner countries in 2012-2016 declined by almost 48%, with the largest decrease of 51% observed in raw materials because of a decline in energy prices. Export of industrial goods declined by 30%, whereas the export of agricultural commodities fell by only 10%. Developed economies' shares of Russian exports in 2012-2016 decreased by 6% from 0.65 to 0.59, whereas the share of other countries, by contrast, expanded by the same percentage points, rising to 0.23. Although this redistribution of the share of developed economies in favor of other countries was largely caused by the redirection of Russian primary commodity exports, developed markets were still the main destination for two-thirds of Russia's commodity exports in 2016. Changes in the distribution of agricultural and industrial exports between country groups were less significant.

The total volume of Russia's imports from its 40 leading partners during 2012-2016 shrank by 45%, with the import of all commodity groups (e.g., agricultural, raw material and industrial) declining equally, indicating a similar effect of the ruble devaluation on domestic consumption

of goods belonging to different commodity groups. The import shares of both developed and conflict-involved countries decreased by 7% and 4%, respectively, whereas the contribution of other countries increased by 10%. The expansion of the share of EAEU members was insignificant.

Particularly dramatic changes occurred in the regional structure of Russian imports of agricultural products, in which the aggregate share of conflict-involved countries and developed economies dropped by almost 23%. Instead, Russia's agricultural imports reoriented toward other countries and EAEU members; their import shares increased by 15% and 8%, respectively. For agricultural products, the effect of Russian countermeasures against developed economies and the impact of the replacement of former suppliers with new sources of imports were most evident. Under the conditions of a food embargo and a conflict with Turkey (one of Russia's main suppliers of textiles, vegetables, and fruits), many domestic companies reoriented toward markets of EAEU, Latin America, and others. A similar trend was observed for Russian industrial imports, although the substitution effect was not so obvious. The total share of developed economies and conflict-involved countries in Russian industrial imports fell by 8%, whereas the contribution of other countries grew by 7%, reaching a value of 0.31. Regarding the import of primary commodities, the share of developed economies and conflict-involved countries decreased by 13%, whereas the share of other countries expanded by the same amount. The share of EAEU members remained unchanged.

For a more detailed examination of the long-term prospects for Russia's foreign trade, we studied the indices of trade complementarity, which reflect several long-term determinants of a country's trade (e.g., factor endowments, international competitiveness of domestic enterprises, and domestic demand patterns). TCI was calculated separately for exports and imports for each group of Russian partners as a weighted average of complementarity indices of trade between Russia and each partner from a particular group, where weights were the shares of partners in the total annual volume of goods exported from or imported to Russia.

Table 2 shows the growing import complementarity between Russia and most countries, with the exception of countries involved in conflicts. The most significant decrease in TCI from 0.75 to 0.59 occurred in trade with Ukraine, mainly because of a change in its export mix in 2012-2016, which manifested in an increase in the share of agricultural products with a reduction of industrial goods.

Table 2. Average import complementarity, by country, group, and year

Sources of import	2012	2013	2014	2015	2016
Developed economies	0.977	0.974	0.981	0.986	0.986
Conflict-involved countries	0.806	0.805	0.782	0.784	0.733
EAEU members	0.651	0.653	0.626	0.653	0.748
Other countries	0.938	0.941	0.941	0.942	0.943

(Note) Authors' calculations based on the TradeMap data.

The growth of TCI between Russia's imports and exports with EAEU members was particularly remarkable. The import complementarity between Russia and Belarus has always been high and reached almost 0.9. However, between Russia and Kazakhstan, it was low. Careful analysis shows that the growing complementarity between these countries' exports and Russian imports was caused by an increase in the share of agricultural and industrial goods in their exports. In particular, in 2016 there was an upsurge in exports of engineering and transport equipment (HS 84,85,87), metal products (73), plastic (39), and meat and dairy products (02, 04) to Russia. Russia also increased its imports of textiles, clothing, and footwear from Kazakhstan.

It is noteworthy that the Russian complementarity on the export side was weaker than that of the import side(see Table 3). Moreover, Russia's export complementarity decreased in 2012-2016 for all groups of countries, and, in particular, for conflict-involved countries.

Table 3. Average export complementarity, by country, group, and year

Countries	2012	2013	2014	2015	2016
Developed economies	0.582	0.570	0.517	0.485	0.487
Conflict-involved countries	0.746	0.725	0.691	0.669	0.594
EAEU members	0.666	0.576	0.547	0.606	0.624
Other countries	0.665	0.656	0.641	0.611	0.607

(Note) Authors' calculations based on the TradeMap data.

The reduction in the complementarity between Russia's exports and imports of its trading partners contradicted the fact that, during 2012-2016, there was a decrease in the share of primary commodities in Russian exports. The dominance of primary commodities is a distinctive feature of Russian exports. Thus, in 2012 the share of primary commodities in Russian exports to the 40 largest trading partners was approximately 0.86, whereas the share of industrial and agricultural goods was only 0.11 and 0.03, respectively. The share of primary commodities was especially high for Russian exports to developed countries. The sharp decline in world oil prices, which occurred in 2014, led to a decrease in the share of primary commodities in Russia's total exports, which fell to 0.80 by 2016. Simultaneously, the share of industrial goods and agrarian products increased to 0.14 and 0.06, respectively. Because the share of

hydrocarbons in the imports of any Russian trading partner was less than the share of this commodity group in Russia's total exports, the decline in oil prices should equalize the imbalance between the composition of Russia's exports and imports of its partners.

We argue that the main reason for the reduction in the complementarity of Russian exports and its partners' imports was the one-third decrease in the value of Russian industrial exports during 2012-2016. Especially significant was the reduction of Russian industrial exports to conflict-involved countries, EAEU members, and some developed economies, such as Finland and Germany. The decline in Russian industrial exports to these countries may have been caused by the negative impact of conflicts and sanctions on bilateral relations. However, a possible explanation for the negative dynamics of Russian industrial exports was its partial transfer into a special category of goods under HS 9999, which significantly expanded in 2015-2016. During the period under review, this commodity group included dual-use goods, defense and aviation industry products, and natural gas. Lacking detailed information on the product composition of this group, we distributed the value of goods under code 9999 between the three sectors of Russia's total exports proportionally to the sectors' shares, which could lead to an underestimation of the true volume of industrial exports.

B. Preliminary tests

Before estimating the gravity equations, we applied a sequence of tests to determine the estimation approach appropriate to our models and the data used. To choose between panel- and pool-data methods of estimating Eqs. (3) and (4), the F Limer test, defined by Eq. (5), was applied (Shahiki Tash & Jahantigh, 2014):

$$F(N-1,\, NT-N-k) = \frac{\dfrac{R_{FE}^2 - R_P^2}{N-1}}{\dfrac{1-R_{FE}^2}{NT-N-k}}, \tag{5}$$

where N denotes the number of countries; T represents the number of time series observations; R_{FE} and R_P are the determination coefficients from the fixed-effect model and the pooled model, respectively; and k represents the degrees of freedom.

The values of the test statistics with corresponding significance levels are reported in Table 4. Because all F Limer statistics are significant at the 0.01 level, the panel data approach is more appropriate for all gravity equations.

Table 4. Results of the preliminary tests applied to Eqs. (3) and (4)

Equation	(3)	(4)	(3)	(4)	(3)	(4)
Sector	Agro-food	Agro-food	Industrial	Industrial	Raw materials	Raw materials
Direction of trade	Import	Export	Import	Export	Import	Export
F Limer test	70.83***	61.83***	55.42***	56.94***	69.04***	72.32***
Hausman test	9.34	6.17	0.00	0.00	0.00	9.06*
Breusch-Pagan LM test	1433.09***	1092.4***	1323.15***	1079.9***	1304.46***	1450.72***
Pesaran Scaled LM test	15.52***	6.89***	12.73***	6.58***	12.26***	15.96***
Pesaran CD test	5.06***	3.30***	16.73***	5.60***	12.56***	14.31***

(Note) * significant at the 0.10 level; *** significant at the 0.01 level.

In the next step, we applied the Hausman test to choose between fixed- and random-effect approaches to estimating Eqs. (3) and (4). Equation 6 defines the Hausman test statistic:

$$m = q'\left(var(\hat{\beta}_{FE}) - var(\hat{\beta}_{RE})\right)^{-1} q, \tag{6}$$

where $\hat{\beta}_{FE}$ and $\hat{\beta}_{RE}$ are coefficient estimates from the fixed-effects model and the random effects model respectively; and q equals $\hat{\beta}_{FE} - \hat{\beta}_{RE}$. The test statistic follows the Chi-squared distribution under the null hypothesis of random effects.

Because all Hausman test statistics shown in Table 4 are not significant at the 0.05 level, we cannot reject the null hypothesis of using random effects in estimating the gravity equations in this study. When a cross-section dimension, N, is not large, the residuals can be cross-sectionally dependent, even if the panel data model is correctly specified. This can be misleading, because ignoring cross-sectional dependencies in panel estimations are likely to lead to biased estimates. To ensure the estimate consistency, we applied three tests for residual cross-section dependence. The tests are defined according to Eqs. (7)-(9):

$$Breusch-Pagan\ \ LM = \sum_{i=1}^{N-1}\sum_{j=i+1}^{N} T\hat{\rho}_{ij}^{2} \rightarrow \chi^{2}_{\frac{N(N-1)}{2}}, \tag{7}$$

$$Pesaran\ \ Scaled\ \ LM = \sqrt{\frac{1}{N(N-1)}}\ \sum_{i=1}^{N-1}\sum_{j=i+1}^{N}(T\hat{\rho}_{ij}^{2}-1) \rightarrow N(0,1), \tag{8}$$

$$Pesaran\ \ CD = \sqrt{\frac{2}{N(N-1)}}\ \sum_{i=1}^{N-1}\sum_{j=i+1}^{N} T\hat{\rho}_{ij}^{2} \rightarrow N(0,1), \tag{9}$$

where $\hat{\rho}_{ij}$ indicates the correlation between the residuals i and j of the model; and indices i and j stand for countries i and j, respectively.

According to the results of these three tests, as shown in Table 4, the null hypothesis of

no cross-section dependence in residuals can be strongly rejected at the 0.01 level. This reveals that all our series had strong evidence for the cross-sectional dependence.

C. Gravity model estimations

Given the results of the preliminary tests, which prohibit the application of cointegrated panel methods (e.g., fully modified or dynamic ordinary least squares), the estimated generalized least square (EGLS) panel for cross-section random effects was implemented to estimate the parameters of Eqs. 3 and 4. The estimation results are reported in Table 5.

According to the estimates for the agricultural sector, a 1% increase in GDP accelerated agricultural imports to Russia by nearly 0.55%, whereas a 1% increase in geographical distance

Table 5. EGLS panel (cross-section random effects) estimation of Eqs. (3) and (4)

Equation	(3)	(4)	(3)	(4)	(3)	(4)
Dependent variable	Log of agro-food imports	Log of agro-food exports	Log of industrial imports	Log of industrial exports	Log of raw-material imports	Log of raw-material exports
$\ln(Y_R Y_j)$	0.5543***	−0.0426	0.4971***	0.1359*	0.6218***	0.3378***
	[0.078]	[0.091]	[0.080]	[0.072]	[0.114]	[0.070]
lnDIS	−0.4731*	0.1099	−0.8502***	−0.2909	−1.0570**	−0.1090
	[0.289]	[0.500]	[0.296]	[0.351]	[0.484]	[0.414]
lnREM	2.7665	−7.7003	2.4515	0.4935	−4.2822	0.1108
	[5.874]	[7.671]	[6.067]	[6.377]	[7.719]	[5.859]
lnTCI	0.4051	−0.4635	2.2934***	0.0280	1.0577*	1.1296***
	[0.403]	[0.440]	[0.415]	[0.353]	[0.587]	[0.336]
BORD	0.0885	1.5860**	1.2469**	0.8286*	2.0308**	0.5756
	[0.561]	[0.727]	[0.576]	[0.509]	[0.938]	[0.604]
WEST	−0.7156*	−1.1849*	0.4223	−0.7832*	0.1636	0.9932*
	[0.456]	[0.644]	[0.468]	[0.451]	[0.758]	[0.535]
OTHR	0.1006	−0.0891	0.0804	−0.2116**	−0.2472**	0.1137
	[0.094]	[0.126]	[0.097]	[0.104]	[0.124]	[0.096]
DIRCONF	−1.1266***	−0.2872	−0.7114***	−0.0846	−0.4145*	−0.4977***
	[0.238]	[0.274]	[0.246]	[0.227]	[0.315]	[0.209]
EURAS	0.0066	−0.1208	−0.4076*	0.1125	0.0102	−0.5311***
	[0.223]	[0.258]	[0.231]	[0.214]	[0.296]	[0.197]
OTHRWEST	−0.4737***	−0.1288	−0.3506***	0.1120	−0.0736	−0.2839***
	[0.098]	[0.118]	[0.102]	[0.098]	[0.129]	[0.090]
Constant	−46.3513	100.4723	−35.5043	2.6777	37.6509	−3.9018
	[69.538]	[87.832]	[71.830]	[72.947]	[91.333]	[67.120]
N of observations	200	199	200	200	200	200
F statistic (H_0: all variables are equal to 0)	18.07***	1.53	14.70***	3.30***	11.09***	13.40***

(Note) * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level. Standard errors are in brackets.

between Russia and its trading partners decreased agricultural import flows by approximately 0.47%. Country-specific factors determining agro-food imports from developed economies were statistically significant. Russia's imports of agricultural products from these countries were, on average, 51% fewer than imports from countries that are not classified as developed economies or those having a common border with Russia.[4] High production costs were likely to explain the relatively low contribution of developed economies to the Russian basket of agricultural consumption. The open diplomatic conflicts with Ukraine and Turkey decelerated agricultural import volumes from these countries by nearly 64.2%. External shocks, presumably the agro-food embargo imposed by Russia, negatively affected agricultural imports from the developed economies, which decreased by 31.1%. Russian agricultural imports from EAEU members and other countries were not significantly affected by the shocks.

For the case of agricultural exports from Russia to its trading partners, the findings showed a strong positive effect of the common border, which came to nearly 388.4%. Because of the high protection of agro-food markets in developed economies, particularly in the EU and the US, these countries were not significant export destinations for Russian agricultural goods. As a result, Russian exports of agricultural products to developed economies were, on average, 69.4% less than exports to countries, which were not classified as developed countries or having a common border with Russia. The results also revealed that the effect of external shocks on Russia's exports of agricultural goods to all destinations was negative but statistically insignificant.

According to the estimation results for the industrial sector, as presented in Table 5, a 1% increase in GDP and TCI led to an increase of Russian industrial imports by approximately 0.50% and 2.29%, respectively, whereas a 1% increase of geographical distance decreased industrial imports of Russia from its trading partner by nearly 0.85%. The existence of the common geographical border increased Russian industrial imports by about 248.0%. Open diplomatic conflicts reduced Russian imports from conflict-involved countries by about 46.8%. Sanctions and other external factors decreased Russia's industrial imports from EAEU members and developed economies by 27.9% and 23.7%, respectively. Industrial imports from other countries were not negatively affected.

Turning to Russian industrial exports, we found that a 1% increase of economic size raised Russian industrial export flows by about 0.14%. A common geographical border between Russia and its trading partners had a strong positive impact of 129.0% on Russian industrial exports. The results also showed that Russia's industrial exports to developed economies for entire whole period of 2012-2016 would normally have been less (by 54.3%) than export volumes destined

4) Hereafter, the percentage effect of a dummy variable is calculated as $e^x - 1$, where x is a coefficient estimate for this variable. The combined percentage effect of several dummy variables is calculated using a similar formula, with x being the sum of coefficient estimates for selected variables.

to countries that were not classified as developed economies or those having common border with Russia, presumably because of less demand for Russian industrial goods in the developed markets. External shocks decelerated Russia's industrial exports to other countries by 19.1% in 2014-2016. Industrial exports to conflict-involved countries slowed by 25.6%, even more than exports to other countries. The findings also demonstrate that external shocks had less of a negative effect on Russian exports of manufactured goods to EAEU countries and developed economies in comparison to other countries.

Finally, the results of the panel estimation of Eqs. 3 and 4 for the raw materials sector shown in Table 5 prove that a 1% increase of GDP and the TCI raised raw-material imports to Russia by nearly 0.62% and 1.06%, respectively, whereas a 1% increase of the geographical distance decreased the volumes of raw materials imported to Russia by about 1.06%. The common geographical border increased Russian imports of raw materials by about 662.0%. The external shocks decreased raw-material flows from all country groups. Although raw-material imports from other countries, members of the EAEU, and developed economies decreased more or less equally (21.9%, 21.1%, and 27.4%, respectively), imports from countries in a state of open diplomatic conflict shrank by approximately 48.4%.

In the case of Russian raw-material exports, a 1% increase in GDP and TCI enlarged raw-material flows that Russia exported to its trading partners by about 0.34% and 1.13%, respectively. The positive effect of TCI on raw-material exports and imports suggests that inter-industry trade was particularly pronounced in the case of primary commodities. This conclusion confirms the findings by Konno (2016), who found that inter-industry trade comprised the bulk of Russia's trade flow in raw materials and fuels. Russian exports of raw materials to developed economies were, on average, 170.0% larger than its exports to countries that were not classified as developed or having a common border with Russia. This confirms the conclusions based on descriptive statistics that developed economies were the main destinations of Russian raw-material exports.

The shocks had an uneven impact on trade with different countries. The fall in oil prices after 2014 as a whole had a negative impact on Russian commodities exports. This was exacerbated by a change in the regional distribution of its physical supplies. Over the 2012-2016 period, the physical volumes of Russian oil and raw-material exports to Ukraine, Belarus, and Kazakhstan decreased significantly. During the same period, the quantity of oil products in physical units exported by Russia to the developed countries remained approximately the same, whereas those supplied to other countries increased significantly. Consequently, the reduction in trade between Russia and the EAEU members was the largest and amounted to 34.1%. Export of raw materials to conflict-involved countries decreased by about the same extent, declining by approximately 31.9%, whereas exports to developed economies fell by a mere 15.7%. The shocks did not have any negative impacts on Russia's raw materials exported to

other countries.

From Table 5 it follows that economic variables (e.g., the size of partners' GDP and the distance between them) had a significant impact on Russian imports. Using the shares of each sector in Russia's total imports for the period 2012-2016 as weights, we arrived at weighted average elasticities of imports by GDP and distance. The corresponding values were 0.538 and −0.866, respectively. These elasticities were slightly less than the corresponding values in most foreign economies, which were on average 0.9 for GDP and −0.9 for distance (Head & Mayer, 2014, p. 160). However, their magnitudes were comparable with foreign estimates. On the contrary, the influence of partners' GDP and the distance between them on Russian exports was small, and, with the exception of commodity exports, did not statistically differ from zero at the 5% level. The available data did not give us an exhaustive explanation of the reason for the weak dependence of the direction of Russian exports on GDP (in US dollars) and trade costs. We can assume that the result obtained was the outcome of a combination of factors. First, the low elasticity of exports by GDP, expressed in current dollars, can be explained by the sharp depreciation of the ruble in 2014, which directly affected the value of Russia's GDP but did not significantly affect the value of its exports. Second, the result obtained may be the outcome of the policy of diversification of export markets pursued by the Russian authorities after 2014.

To summarize the obtained estimates of the impact of external shocks on Russia's bilateral trade, we calculated the total percentage changes in Russia's exports and imports caused by external shocks by sector and country group. The total percentage changes in trade with other countries caused by external shocks were equal to the percentage effect of the *OTHR* variable. The total percentage changes in trade with developed economies, conflict-involved countries, and EAEU members caused by external shocks were found to be the sum of the percentage impact of the *OTHR* variable and the percentage effects of the *OTHRWEST*, *DIRCONF*, or *EURAS* variables, respectively. Table 6 displays the findings.

Table 6. Percentage changes in Russian bilateral trade caused by external shocks

Countries	Russia's imports			Russia's exports		
	Agro-food	Industrial	Raw Material	Agro-food	Industrial	Raw Material
Developed economies	−31.1	−23.7	−27.4	−19.6	−9.5	−15.7
Conflict-involved countries	−64.2	−46.8	−48.4	−31.4	−25.6	−31.9
EAEU members	+11.3	−27.9	−21.1	−18.9	−9.4	−34.1
Other countries	+10.6	+8.4	−21.9	−8.5	−19.1	+12.0

Table 6 shows that direct conflicts between Russia and its partners had the most detrimental effects on bilateral trade. The conflicts led to an almost twofold decline in Russian imports

from these countries and a decrease in exports to these partners by about a quarter. The shocks also had a pronounced negative impact on Russian trade with developed economies. Owing to external shocks, the volume of Russian exports to and Russian imports from these countries decreased from 9% to 31%, depending on the sector, direction, and country group.

External shocks had a dual effect on Russian trade with other countries. Whereas agro-food, industrial imports from other countries, and the export of raw materials to these destinations in 2014-2016 increased compared with 2012-2013, the import of raw materials with agricultural and industrial exports, on the contrary, declined.

External shocks had a negative impact on trade with EAEU countries. The exception was food imports from EAEU members, which, during the period, grew by 11.3%. We can attribute the increase in food imports from the EAEU to the fact that these countries were not included in Russian counter-sanctions and, thus, became channels for supplying prohibited goods to the Russian market (Senotrusova & Svinukhov, 2016; Spartak, 2016). Because EAEU countries did not participate in western and retaliatory Russian sanctions, the changes in trade with them, with the exception of agricultural imports, was mainly caused by the influence of economic factors (e.g., lower oil prices, ruble devaluation, inflation, rising interest rates, lower consumer and investment demand, and other factors). If agricultural imports are not taken into account, economic factors that did not correlate with GDP, distance to partners, and other variables of Eqs. 3 and 4, led to a decrease in Russian trade from 9% to 34% at least, depending on the product group and direction of trade. The most significant decrease occurred in the export of commodities, the bulk of which were fuels, having a sharp fall in price in 2014.

Table 6 demonstrates that external shocks served to shift foreign trade flows in some sectors from traditional partners to new markets. The decline in imports of agricultural products from developed countries, Ukraine and Turkey caused by Russia's embargo on food supplies was partially offset by an increase in agricultural imports from EAEU members and other countries. Industrial imports from developed countries, EAEU members and countries involved in the conflict declined as a result of open conflicts, sanctions, and deteriorating financing conditions for companies in 2014-2016. However, simultaneously, industrial imports from other countries grew slightly. A similar pattern was observed for raw materials exports. However, the results of the gravity estimation presented in Table 5 show that, in cases where the impact of external shocks on Russia's trade was positive, it was not statistically significant. Thus, the data used in the study do not confirm that the Russian government's policy aimed at increasing regional diversification yielded tangible results. This conclusion is probably caused by the fact that the series of data we used in this study covered the period after the imposition of sanctions, which may not have been enough to determine the long-term consequences of the redirection of Russia's foreign trade toward new markets.

Assuming that changes in Russian trade with EAEU countries can be explained mainly by

economic factors, the effect of political measures on Russian trade with developed countries and conflict-involved countries can be found as the difference between the coefficients for the *OTHRWEST* or *DIRCONF* variables and the coefficient for the *EURAS* variable. The effect of political measures on Russia's trade with other countries had the opposite coefficient for the *OTHR* variable. For a rationale, see Section III. The results of calculations of the percentage impact of political measures on foreign trade are shown in Table 7.

Table 7. Percentage changes in Russian bilateral trade caused by policy

Countries	Russia's imports			Russia's exports		
	Agro-food	Industrial	Raw Material	Agro-food	Industrial	Raw Material
Developed economies	−38.1	+5.9	−8.0	−0.8	−0.0	+28.0
Conflict-involved countries	−67.8	−26.2	−34.6	−15.3	−17.9	+3.4
Other countries	−0.7	+50.3	−1.0	+12.8	−10.6	+70.1

Table 7 shows that politics had the greatest impact on trade with countries with which Russia was in open diplomatic conflict. A negative impact on trade was observed in almost all sectors, with the exception of Russian commodity exports. As expected, the political factor had the strongest negative impact on agricultural imports, for which the Russian food embargo was imposed. As a percentage, the marginal impact of politics on agricultural imports amounted to −67.8%. We believe that this estimate was overstated, because it was obtained by comparing imports from conflict-involved countries with the value of agricultural imports from EAEU countries, which also included re-exports of products from developed economies, bypassing sanctions restrictions. We argue, therefore, that the −50% indicator was probably a more accurate estimate of the marginal percentage effect of the political factor on agricultural imports from conflict-involved countries.

Table 7 shows that sanctions did not have a noticeable negative effect on trade with developed countries, with the exception of Russian agricultural imports, which were subject to the Russian food embargo. We also believe that the effect of policies on Russian agricultural imports from developed countries was overestimated for the same reasons as those in the case for agricultural imports from conflict-involved countries. A more reasonable estimate of the impact of political measures on agricultural imports from developed countries is −30%. Although external shocks adversely affected Russian trade with developed countries in all sectors (see Table 6), their impact on Russian imports of manufactured goods and raw materials from developed countries and exports of agricultural and industrial products to developed countries was about the same as on corresponding trade flows from and to EAEU countries. Thus, the effect of politics on Russian trade with developed economies in these sectors can be considered insignificant. Moreover, although the export of Russian raw materials to developed countries was affected

by price fluctuations, it did not face serious political restrictions. Finally, the Russian policy of diversifying trading partners brought noticeable results in the field of promoting the export of Russian raw materials to the markets of other countries, as well as expanding industrial import from these partners. Of particular note is the rapid expansion of trade with China, whose share in Russian trade during the reporting period increased from less than 11% to almost 16% in 2018 (Popova & Zhou, 2019). Trade with China was extremely complementary, because Russia exports to China mainly included raw materials (their share reached 87% in Russian exports to the country) in exchange for industrial imports, whose share in Russian imports from China exceeded 90%. Recent growth of industrial imports from China can also be attributed to the replacement of western sources of imports with Chinese suppliers.

On the whole, the estimates of the effect of politics on Russia's foreign trade coincided with the conclusions and estimates obtained in foreign studies (see Section II for details). Our analysis shows that sanctions in the form of trade embargoes significantly affected Russia's bilateral trade with Ukraine and Turkey. Estimates of the impact of the embargo (30%-50%) were slightly less than the results of Hufbauer et al. (1997) and Mehchy et al. (2015), although they were generally comparable with them. Sanctions did not have much effect on Russian trade with developed countries, with the exception of agricultural imports. The low effectiveness of western anti-Russian sanctions confirms the results obtained by other foreign researchers (Hufbauer et al., 2008; Morgan et al., 2014; Pape, 1997). Our data show that the Russian policy of reorienting trade to non-western countries had some success, thereby confirming the conclusions made by Caruso (2003), Early (2015), and Haidar (2017).

D. Robustness check

To check the robustness of our empirical results shown in Table 5, we applied the generalized method of moments (GMM) estimator to Eqs. 3 and 4. The GMM estimates are reported in Table 8.

Comparing the estimates presented in Table 8 with those estimated using the panel EGLS (cross-section random effects) estimator displayed in Table 5 reveals that all corresponding coefficients from Tables 5 and 8 had similar signs (+/−). The GMM estimates support that, in most cases, increased GDP, decreased distance, and common borders increased trade flows. The effect of external shocks on conflict-involved countries and developed countries captured by the coefficients at the *DIRCONF* and *OTHRWEST* variables was negative in most cases. Thus, the results of the GMM estimation of Eqs. 3 and 4 support the findings received on the base of the panel EGLS estimates.

Table 8. GMM estimation of Eqs. (3) and (4)

Equation	(3)	(4)	(3)	(4)	(3)	(4)
Dependent variable	Log of agro-food imports	Log of agro-food exports	Log of industrial imports	Log of industrial exports	Log of raw-material imports	Log of raw-material exports
$\ln(Y_R Y_j)$	0.14**	−0.11***	0.21**	0.19***	0.02***	0.41***
lnDIS	−0.09**	0.39	−0.08***	−0.11**	−0.00***	−0.14**
lnREM	0.11***	−0.92	1.80**	0.37	−1.42**	1.54***
lnTCI	0.26***	−0.21**	1.11**	0.19**	0.07**	0.09***
BORD	0.01	0.33***	0.01***	1.20***	0.72***	0.00**
WEST	−0.21***	−0.19***	0.31***	−1.05**	0.00	0.28**
OTHR	0.19**	−0.31**	0.00	−0.01**	−0.06**	0.01
DIRCONF	−0.98***	−0.01	−1.28**	−0.19***	−0.11***	−0.08***
EURAS	0.03**	−0.28	−0.03***	0.00	0.00***	−0.18***
OTHRWEST	−0.11***	−0.72**	−0.19**	0.15***	−0.31**	−0.41**
Arellano bond test			−2.83			
Sargan test			3502.93			

(Note) *** significant at the 1% level; ** significant at the 5% level.

V. Conclusions

We estimated the three-sector gravity model of the Russia's bilateral trade with its 40-largest trade partners over 2012-2016 and obtained results that are theoretically grounded and coincide with the expected values. As predicted by the gravity theory, an increase in a partner's economic size led to a rise in bilateral trade as a rule. A 1% increase in economic size of a partner led to a 0.50%-0.62% rise of Russia's imports. Elasticities of Russia's exports with respect to economic size were less pronounced, coming up to 0.34 in the case of raw-material exports. The elasticity of imports by GDP, expressed in current US dollars, as higher than the elasticity of exports, because joint GDP in current dollars also accounted for the effect of the exchange rate that did not have a direct effect on the value of exports.

A common geographical border had a strong positive effect. If we only consider statistically significant estimates, the effect of the common border on the Russian bilateral trade was in the range of 129% to 662%. As predicted by theory, increasing the distance between trade partners reduced the volume of exports and imports to Russia. The effect of distance to the trading partner had a more pronounced effect on Russian imports, whose elasticities with respect to distance were in the range of −0.47 to −1.06.

The data obtained allowed us to conclude that macroeconomic shocks had a significant negative impact on bilateral trade in Russia in 2014-2016 compared with the period, 2012-2013.

A conservative estimate of the decline in trade caused by economic factors ranged from 9 to 34%, depending on the sector and direction of trade.

Political measures had a pronounced negative impact on trade with conflict-involved countries in almost all sectors, except for the export of Russian commodities. Agricultural imports were particularly affected by the food embargo, with a marginal percentage effect of about −50%. In other sectors, trade between Russia and conflict-involved countries suffered less. Political measures led to a reduction in imports of industrial and raw materials by 15%-35%, as well as exports of agricultural products and manufactured goods. Data showed that Russian commodity exports to conflict-involved countries were not affected by political measures.

In trade with developed economies, a significant negative impact of the policy was revealed only in relation to imports of agricultural products (approximately −30%). In other sectors, western sanctions did not become a serious obstacle to trade with developed countries, and the decline in trade with them after 2014 could be associated with a negative macroeconomic context. Regarding the export of Russian raw resources, they did not suffer any serious restrictions in western countries.

According to data, sanctions did not have a noticeably negative effect on trade with other countries. Estimates confirmed that the Russian policy of diversification of trade partnerships yielded results, especially in imports of industrial goods (+ 50%) and exports of raw materials (+ 70%). To a large extent, this effect was achieved because of the expansion of trade integration with China, in which Russia acted as a supplier of raw materials, whereas China mostly exported industrial products.

The estimation of the gravity model showed that trade in raw materials and industrial imports grew with the complementarity of trade structures. The findings seem to confirm that the Heckscher-Ohlin trade model of dominant inter-industry trade can explain the bilateral trade of Russia with its partners in these sectors. The results also seem to argue that bilateral flows in other sectors do not correspond to any single trading model.

We also found that, although the trade complementarity of imports increased during the period of 2012-2016, the opposite trend was observed for complementarity of exports. The data showed that the contraction of Russia's industrial exports in 2014-2016 contributed to a reduction in the indices of trade complementarity for exports. Given the positive correlation between trade volume and trade complementarity, a low share of industrial exports was also an obstacle to the expansion of the Russia's exports.

Based on the results of our study, we can make the following proposals for economic policy. Our study confirms the findings of other researchers that, under certain conditions, political measures can have a devastating effect on trade and the economy. From this we can conclude that politicians should strive to find a compromise in resolving contradictions in international relations while avoiding the use of political measures that have a clearly destructive effect

on trade flows and the economy.

The second important conclusion for economic policy that follows from this study is that the decline in Russian foreign trade with most partners after 2014 was prompted not so much by sanctions as by macroeconomic shocks. The dominance of commodities in Russian exports made the Russian economy highly dependent on price fluctuations in world commodity markets. Achieving macroeconomic stabilization is an effective way to restore the country's foreign trade, and this is what the Russian authorities have been striving for in recent years. After experiencing the shock associated with the violation of traditional trade ties, the deterioration of foreign relations and the economic decline of 2014-2015, Russia is gradually adapting to new economic conditions. In 2016, the economic recession ended, and the Russian economy returned to modest growth amidst rising oil prices and growing macroeconomic stability. Russian foreign trade also stabilized, the drop in imports flattened, and the growth of foreign trade resumed with all groups of countries in 2017.

The strong dependence of Russian foreign trade on the macroeconomic environment increases the relevance of policies that contribute to the diversification of the commodity structure of Russian exports in favor of industrial goods. With the introduction of sanctions, Russia accelerated the development of industries with export potential with an export support system to increase the proportion of non-primary goods as a part of its export basket. However, this policy will be successful only if it is accompanied by structural economic changes, including an increase in labor productivity, an introduction of modern technologies in industry, a decrease in the share of raw materials in GDP, and similar actions.

The short duration of the period in question, a lack of data, and multicollinearity between the available variables did not allow us to assess the impact of political measures on Russia's trade flows without making a number of simplifying assumptions. As a result, our estimates are valid to the extent that the accepted premises are true. In this regard, the estimates of the impact of political events in 2014 and subsequent years on Russian trade should be clarified in future studies based on more complete data. Furthermore, in this paper, we did not aim to examine the effect of shocks on the welfare of economic agents. This will require a separate study. Also worthy of further study is the trend in the development of economic relations with China.

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Appendix

Table A1. 40 largest import and export trading partners of russia in 2016

	Russia's import trading partner		Russia's export trading partner
		Developed economies	
1	Austria	1	Belgium
2	Belgium	2	Bulgaria
3	Canada	3	Czech Republic
4	Czech Republic	4	Denmark
5	Denmark	5	Estonia
6	Finland	6	Finland
7	France	7	France
8	Germany	8	Germany
9	Hungary	9	Greece
10	Ireland	10	Hungary
11	Italy	11	Italy
12	Japan	12	Japan
13	Netherlands	13	Latvia
14	Poland	14	Lithuania
15	Romania	15	Malta
16	Slovakia	16	Netherlands
17	Slovenia	17	Poland
18	Spain	18	Romania
19	Sweden	19	Slovakia
20	Switzerland	20	Spain
21	United Kingdom	21	Sweden
22	United States of America	22	Switzerland
		23	United Kingdom
		24	United States of America
		Conflict-involved countries	
23	Turkey	25	Turkey
24	Ukraine	26	Ukraine
		EAEU members	
25	Belarus	27	Belarus
26	Kazakhstan	28	Kazakhstan
		Other countries	
27	Argentina*	29	Algeria
28	Brazil	30	Azerbaijan
29	China	31	Brazil
30	Ecuador	32	China
31	India	33	Egypt

Table A1. Continued

Russia's import trading partner		Russia's export trading partner	
Other countries			
32	Indonesia	34	India
33	Israel	35	Iran
34	South Korea	36	Israel
35	Malaysia	37	South Korea
36	Serbia	38	Singapore
37	Taipei, Chinese	39	Taipei, Chinese
38	Thailand	40	Uzbekistan
39	Uzbekistan		
40	Viet Nam		

(Note) * Argentina, the 41st-largest source of Russian imports in 2016, replaced Ecuador, ranked 40th, because of the zero value of Ecuador's raw-material exports to Russia.