



Impact of U.S. sanctions on Russian trade: Firm-level evidence from the NTR act

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ABSTRACT

This paper examines the impact of U.S. sanctions on Russian trade following the Russia-Ukraine war in February 2022. The study focuses on the U.S. suspension of Normal Trade Relations with Russia and Belarus Act (NTR Act), which imposed higher tariff rates on Russian goods. Using firm-to-firm level transaction data from the Bill of Lading dataset and a difference-in-differences strategy, the analysis reveals a 67.3% decline in export value and a 62.3% drop in export quantity for Russian exporters following the sanctions. Moreover, there was a 16.6% decrease in the number of importers (consignees) from the U.S. and a 11.6% reduction in the number of Russian exporters trading with the U.S. The results are robust after accounting for the impact of other sanction packages, the pandemic, and the war. Furthermore, small Russian exporters, especially those serving a limited number of U.S. importers and managing multiple products in the U.S. market, were most adversely affected.

1. Introduction

Geopolitical tensions, reminiscent of the Cold War era, have resurfaced in the 21st century. The complicated relationship between Russia and the West is central to this changing landscape. This relationship reached a critical juncture on February 24, 2022, when Russian President Vladimir Putin authorized a war against Ukraine. This act was the culmination of a series of geopolitical manoeuvres and counter-manoevres that began with Ukraine's independence from the Soviet Union in 1991. As Ukraine moved closer to NATO and the European Union, geopolitical tensions with Russia intensified, eventually culminating in the annexation of Crimea in 2014.

The Russia-Ukraine war triggered a robust global response, particularly from the West. Led by the U.S. and its European allies, a comprehensive set of sanctions was imposed on Russia. These measures targeted key sectors of the Russian economy, including financial institutions, energy resources, transportation networks, and advanced technology industries (European Council, 2022). Among these, trade sanctions such as increased tariffs and embargoes emerged as one of the most important tools of economic pressure.¹ The effectiveness of trade sanctions on Russia, particularly their economic impact, following the outbreak of the Russia-Ukraine war in 2022 has attracted significant attention in the literature (e.g., Bachmann et al., 2024; Hausmann et al., 2022; Sturm

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¹ Based on the Global Sanctions Database (GSDB), approximately 37.2% of all sanctions programs involve trade-related measures (Felbermayr et al., 2020a; and Kirikakha et al., 2021).

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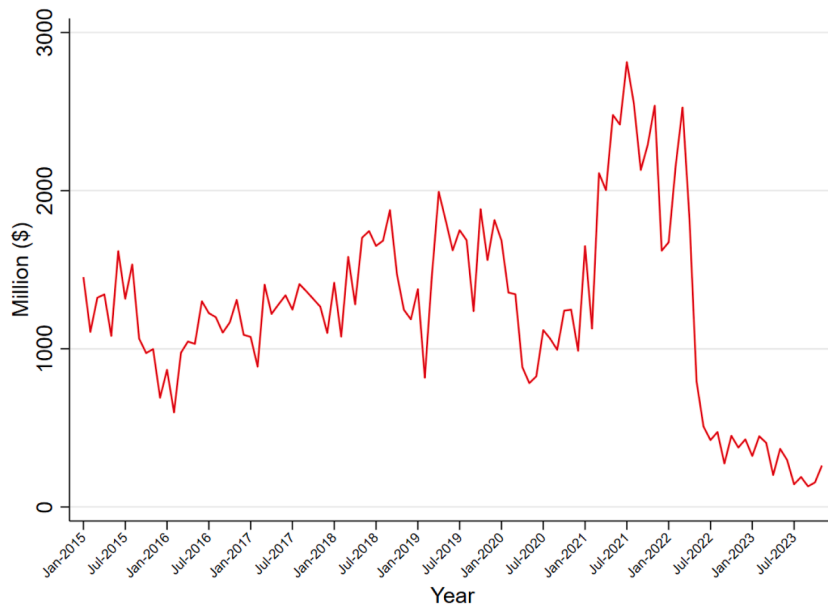


Fig. 1. Monthly values of U.S. imports of goods from Russia (2015–2023).

Notes: This figure illustrates the monthly values of U.S. imports of goods from Russia between 2015 and 2023. A notable surge in the import values occurred between the last quarter of 2020 and the last quarter of 2021, largely driven by the rising oil prices.

et al., 2022; de Lucio et al., 2024; Li et al., 2024; Corsetti et al., 2025; Egorov et al., 2025; and Smarzynska Javorcik et al., 2025).² However, the impact of trade sanctions on the target country, especially at the firm level, remains limited. This paper seeks to quantify the trade impact of these intensified measures, with a specific focus on the Suspending Normal Trade Relations with Russia and Belarus Act (NTR Act), which elevated the tariffs imposed on Russian goods from the most favored nation (MFN) tariffs to column 2 tariffs.³ To the best of our knowledge, this is the first study to examine the effects of recent U.S. tariff sanctions on Russia at a granular level, using highly disaggregated firm-to-firm data to provide direct evidence on how Russian exporters have been affected. In addition, it explores how the impact varies across exporters, depending on their size, product range, and the number of U.S. importers they serve.

In light of the escalating severity and scope of sanctions imposed on Russia following the Russia-Ukraine war in February 2022, this paper exploits the episode as a quasi-natural experiment to empirically estimate the effect of the sanctions. More specifically, on 8 April 2022, the U.S. President signed H.R. 7108, i.e., the NTR Act. With this legislation, imports from Russia and the Republic of Belarus became subject to the duty rates specified in column 2. As a result, the tax on imports from Russia increased significantly, from approximately 3.4 percent to approximately 31 percent on average (see Fig. 2 in the next section). This has led to a substantial decrease in Russia's trade with the U.S., as illustrated in Fig. 1. The trade value decreased from \$2,500 million in March to \$1,800 million in April, and then fell further to \$790 million in May 2022.

In our paper, we first identify column 2 and the MFN tariffs for each 6-digit HS product, where the latter represent the counterfactual tariffs if the NTR Act had not been signed. Second, we obtain firm-product-level transaction data between Russia and the U.S. from a nontraditional administrative trade dataset, i.e., the Bill of Lading (BoL) dataset collected by U.S. ports from S&P Panjiva. Finally, we apply a difference-in-differences strategy to estimate the impact of sanctions on the intensive and extensive margins of Russian trade at the firm level.

The findings from the econometric analysis indicate a notable decline in Russian trade margins following the U.S. sanctions against Russia. Products subject to higher tariffs witnessed a more pronounced reduction in their trade margins: a one percentage point increase in tariffs led to a 2.47 % reduction in export value. On average, export value and quantity decreased by 67.3 % and 62.3 % after the sanctions, respectively. Moreover, there was a 16.6 % reduction in the number of buyers in the U.S. (importers, more specifically the consignees in the data) and a 11.6 % decrease in the number of Russian firms exporting to the U.S. After accounting for the influence of other sanction packages, the pandemic, and the war itself, our findings remain robust. Furthermore, analysis on

² Another strand of literature has focused on the effects of financial sanctions (e.g., Besedeš et al., 2021; Itskhoki and Mukhin, 2022; Keerati, 2022; Balyuk and Fedyk, 2023; and Bianchi and Sosa-Padilla, 2024).

³ Column 2 tariffs refer to U.S. import duties applied to countries that do not have Normal Trade Relations (NTR) status, such as North Korea, Cuba and, more recently, Russia. The legal basis for column 2 tariffs is rooted in Section 1202 of the U.S. Harmonized Tariff Schedule (HTSUS), which originates from the Smoot-Hawley Tariff Act of 1930 and has been subsequently modified by legislation, including the Trade Act of 1974 and the Uruguay Round Agreements Act of 1994.

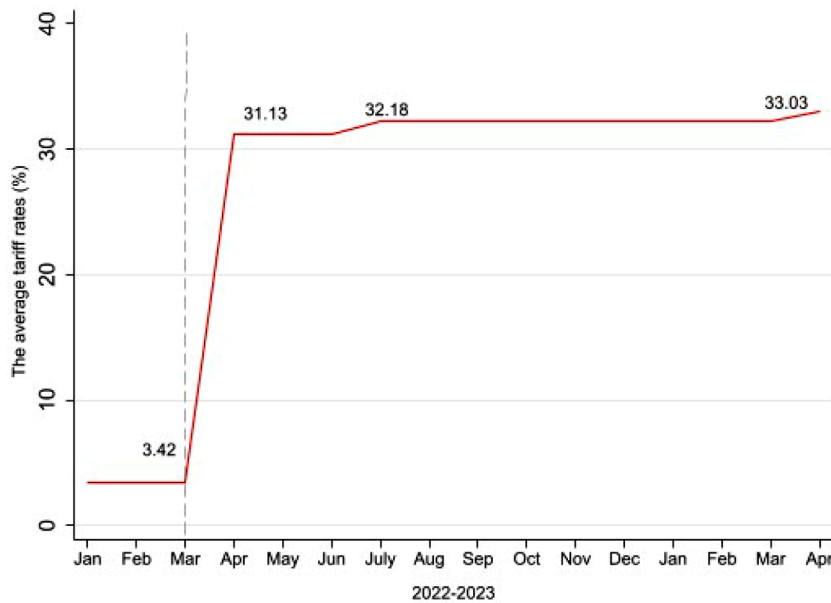


Fig. 2. Changes in average tariffs imposed by the U.S. on imports from Russia (2022–2023).

Notes: This figure illustrates the simple average tariff rates for all HS-6 products from 2022 to 2023. Until the end of March 2022, the average MFN tariff was 3.42 %. In April 2022, the average tariff surged to 31.13 % as column 2 tariff rates were applied to all Russian products. Modest adjustments to the average tariff were observed in July 2022 and April 2023, reflecting additional increases for certain products to as high as 35 %, 70 % from the column 2 tariffs.

firm heterogeneity in the impact of sanctions demonstrates that small exporters, along with exporters serving a limited number of U.S. importers and those managing multiple products, experienced larger negative effects of sanctions.

Economic sanctions have been extensively studied in the literature. Previous research has explored the motivations of sanctioning countries (e.g., [Eaton and Engers, 1992](#); [Whang et al., 2013](#); and [Felbermayr et al., 2021](#)) and how to design sanctions in the most cost-efficient and strategic way to minimize negative impacts on the sanctioning country (e.g., [Drezner, 2011](#); [Schropp and Tsigas, 2023](#); [Becko, 2024](#); and [De Souza et al., 2024](#)). Some other studies examine the effectiveness of sanctions by evaluating their impact on macroeconomic indicators in both targeted and sanctioning countries, such as GDP growth, international trade and welfare, regional inequality, stock market valuations, and investments (e.g., [Lee, 2018](#); [Felbermayr et al., 2020b](#); [Hinz and Monastyrenko, 2022](#); [Kwon et al., 2022](#); [van Bergeijk, 2022](#); [Draca et al., 2023](#); [Gutmann et al., 2023](#); and [Tyazhelnikov and Romalis, 2024](#)).

This paper contributes to the literature on the economic impact of trade sanctions on firms. Some studies evaluate the impact of sanctions on firms within sanctioning countries. For example, [de Lucio et al. \(2024\)](#), [Görg et al. \(2024\)](#), [Jäkel et al. \(2024\)](#), and [Kohl et al. \(2024\)](#) use firm-product level data from Spain, Germany, Denmark, and the Netherlands, and find a negative effect of sanctions on both intensive and extensive margins of exports. [Gullstrand \(2020\)](#) shows that Swedish firms targeted by Russian counter-sanctions experienced falling sales and market exits, especially among small or financially weak firms. Using French firm-product data, [Crozet and Hinz \(2020\)](#) highlight significant self-inflicted costs, including reduced entry into sanctioned markets and unintended losses from non-targeted products. Additionally, [Crozet et al. \(2021\)](#) find that the introduction of sanctions on Iran and Russia significantly reduced the probability of the entry of French firms, especially for those that rely on trade financing. However, most of these studies focus on export bans in the earlier rounds of sanctions.

A small number of studies examine the economic impact of sanctions on firms in sanctioned countries to evaluate their economic consequences. [Haidar \(2017\)](#) examines the impact of export sanctions on non-oil Iranian firms and finds that two-thirds of the exports disrupted by sanctions were redirected to third countries. This finding aligns with [Crozet and Hinz \(2020\)](#), [Babina et al. \(2023\)](#), and [Aytun et al. \(2025\)](#), which show that trade diversion can occur in response to sanctions. [Ahn and Ludema \(2020\)](#) leverage comprehensive data on sanctioned Russian firms and individuals from 2014 and reveal significant declines in operating revenue, asset values, and employment among sanctioned firms. In contrast, [Nigmatulina \(2022\)](#) finds that Russian firms targeted by sanctions in 2014 experienced increases in capital inputs and revenue, largely due to government support that helped offset the negative shock of sanctions. [Miromanova \(2023\)](#) studies firm-level effects of Russian embargoes, which have statistically significant negative impacts on both intensive and extensive margins of firm-level trade. Beyond direct effects of sanctions on firms in sanctioning and sanctioned countries, recent studies have also examined the impact on firms in neutral countries. For example, [Li et al. \(2024\)](#) investigate how firms in neutral countries adjusted their supply chains in response to sanctions, while [Corsetti et al. \(2025\)](#) show that non-sanctioning country Turkey increased its exports to Russia, with Turkish firms charging higher markups and prices.

Our paper contributes to the literature by providing a timely firm-level analysis from the Russian perspective, answering the question of how Russian exporters have been affected by the most severe trade sanctions by the U.S. following the Russia-Ukraine

war in 2022. Using unique firm-to-firm level data, we provide detailed evidence on the impact of sanctions on various trade margins, including export value, export quantity, export price, and the number of Russian firms exporting to the U.S. In addition, to the best of our knowledge, this paper is the first to estimate the impact of the sanctions on the number of U.S. importers associated with each Russian exporter-product pair, thereby capturing the changes in Russian exporters' trading relationships and export networks in response to sanctions.

The rest of the paper is organized as follows. In [Section 2](#), we introduce the background and timeline of the sanctions against Russia. In [Section 3](#), we present our empirical strategy and data. In [Section 4](#), we report the results and conduct a series of robustness checks. In [Section 5](#), we examine firm heterogeneity in the impact of sanctions. [Section 6](#) concludes the paper.

2. Sanctions against Russia

2.1. Background

Since late February 2014, the U.S., along with the European Union and other allies, has imposed several rounds of sanctions on Russia in response to the country's annexation of Crimea. Most sanctions imposed before 2022 were based on various executive orders, legislation, and regulations that were issued in 2014. These sanctions targeted key sectors of the Russian economy, including finance, energy, and defense.

Following the Russia-Ukraine war on 24 February 2022, the U.S. took the lead in imposing further economic costs on Russia. The sanctions aimed to exert significant pressure on Russia by disrupting its ability to sustain its military aggression and gradually undermining its economic stability over time. The scope and intensity of sanctions in this round expanded significantly, including setting travel bans on associated individuals, cutting off major Russian banks from SWIFT, freezing the assets of the Russian Central Bank, restricting exports to Russia, and increasing tariffs on certain Russian products. The next section provides the background and timeline of U.S. trade-related sanctions imposed on Russia after 2022.

2.2. The timeline of U.S. trade-related sanctions

The U.S. trade-related sanctions on Russia have been highly active and frequently adjusted. On March 8, 2022, President Biden issued Executive Order (EO) 14,066, banning the importation of Russian crude oil, petroleum, petroleum fuels, oils, and products of their distillation, liquefied natural gas, coal, and coal products into the U.S. These measures specifically applied to products originating from Russia and did not impact items that simply transit through Russian territory. Building upon EO 14,066 and EO 14,068, which was issued three days later, introduced a broader range of restrictions, including bans on: imports of fish, seafood, and preparations thereof; alcoholic beverages; and non-industrial diamonds; the exportation, re-exportation, sale, or supply, directly or indirectly, from the U.S. or by a U.S. person, wherever located, of luxury goods to any person located in Russia.

On 8 April 2022, President Biden approved another two pieces of legislation. The first, "Ending Importation of Russian Oil Act" (H.R. 6968) expanded the restrictions from certain energy products (see EO 14,066) to all products of Russia classified under Chapter 27 of the Harmonized Tariff Schedule of the United States (HTSUS). The second, "Suspending Normal Trade Relations with Russia and Belarus Act" (Suspending NTR Act, H.R. 1708), revoked the NTR status of Russia and Belarus. As a result, the U.S. could raise the tariffs imposed on Russian goods from MFN tariffs to column 2 tariffs in HTSUS. As shown in [Fig. 2](#), the average ad valorem tariff on Russian imports increased significantly, from approximately 3.4 % to approximately 31 % after column 2 tariffs were applied. Moreover, President Biden was granted the authority to impose further increases in the column 2 rates on imports from Russia. The President also retained the discretion to temporarily or permanently reinstate the MFN status, contingent upon the cessation of aggression in Ukraine and the fulfillment of other specified conditions.

Shortly after the imposition of column 2 tariffs, Presidential Proclamation 10,420 further increased the column 2 rates for certain products. On June 27, 2022, a higher tariff rate of 35 % was imposed on over 500 products from Russia, valued at approximately \$2,300 million. These measures targeted a wide range of non-energy products, including base metals, precious stones, chemical products, plastics, wood, paper, stone and cement products, machinery and electrical equipment, vehicles and parts, and consumer products. On February 24, 2023, Proclamation 10,523 further increased tariffs to 70 % on more than 100 products, including metals, minerals, and chemical products, valued at approximately \$2,800 million.⁴ Significantly, Russia's aluminum industry has been severely undermined, with the U.S. imposing an additional tariff of 200 % as in Proclamation 10,522. According to the White House, this measure reflects the strategic importance of the industry as a key component of Russia's defense industrial base and its critical role in the supply of weapons and ammunition for the ongoing war.⁵ They were designed to limit Russia's economic gains from sales to the U.S. and were carefully balanced to impose costs on Russia while minimizing the impact on U.S. consumers. [Fig. 3](#) summarizes the tariff rates for different targeted products based on various executive orders, legislation, and regulations that were issued after the Russia-Ukraine war.⁶

⁴ Proclamation 10,420 was signed on June 27, 2022, and became effective 30 days later. Proclamation 10,523 was issued on February 24, 2023, and took effect on April 1, 2023.

⁵ The report from the White House can be accessed at: <https://www.whitehouse.gov/presidential-actions/2025/02/adjusting-imports-of-aluminum-into-the-united-states/> (accessed on 2 September 2025).

⁶ See Online Appendix Table A1 for more details on the relevant legislative documents, including the applied tariff rates, the number and percentage of affected 6-digit HS products.

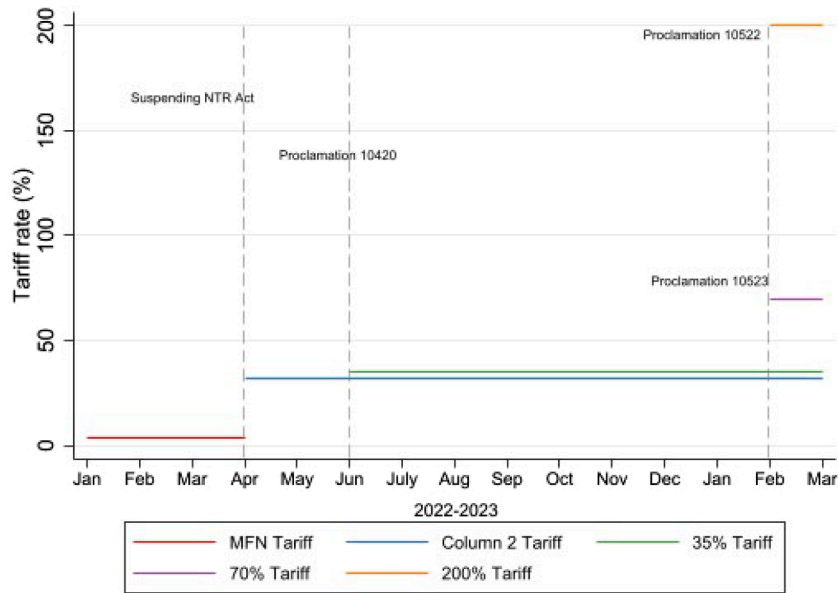


Fig. 3. Sanction packages on the goods imported by the U.S. from Russia (2022–2023).

Notes: This figure illustrates the timeline of various proclamations and the corresponding tariff rates they imposed. Initially, MFN tariffs were applied, after which column 2 tariff rates were introduced. Subsequently, 479 HS-6 products became subject to a 35 % tariff, 98 products were subjected to a 70 % tariff, and 35 products were assigned a tariff rate of 200 %.

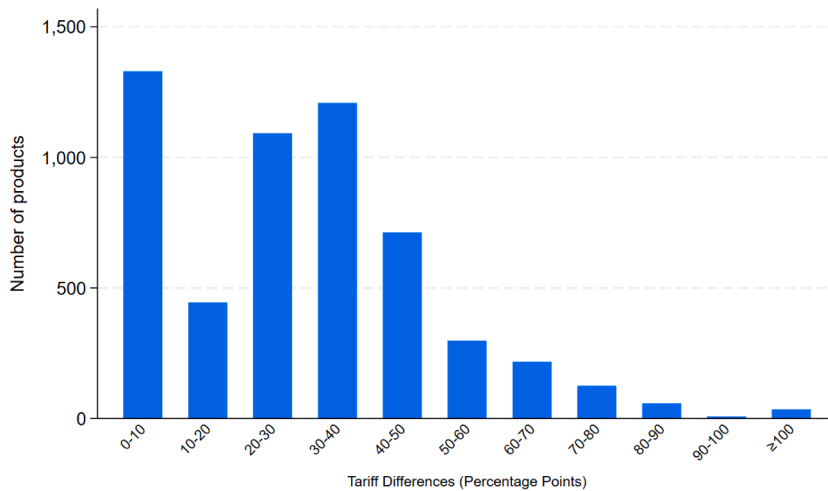


Fig. 4. Distribution of differences between column 2 and MFN tariffs.

Notes: This figure illustrates the distribution of tariff differences between column 2 and MFN rates, measured in percentage points. The number of products is calculated at the 6-digit HS level.

Following the transition from MFN to column 2 tariffs, the scale of tariff increases exhibited considerable variation across products and sectors, as shown in Figs. 4 and 5. Over 1300 6-digit HS products (24 % of all products) saw tariff increases of less than 10 percentage points, mainly affecting sectors such as animal and animal products, vegetable products, mineral products, and chemicals and allied industries. Around 1200 products (22 % of all products) experienced increases of 20–30 percentage points, with machinery and electrical products accounting for half of this group. Roughly 1000 products (20 % of all products) recorded increases of 30–40 percentage points, predominantly in chemicals and base metals. Another 400 products (8 % of all products) saw increases of 10–20 percentage points, including wood products and fibrous materials. The remaining 1400 products (26 % of all products) experienced the sharpest hikes, with tariffs rising by more than 40 percentage points, primarily in sectors such as textiles, arms and ammunition, miscellaneous manufactured goods, and precision instruments.

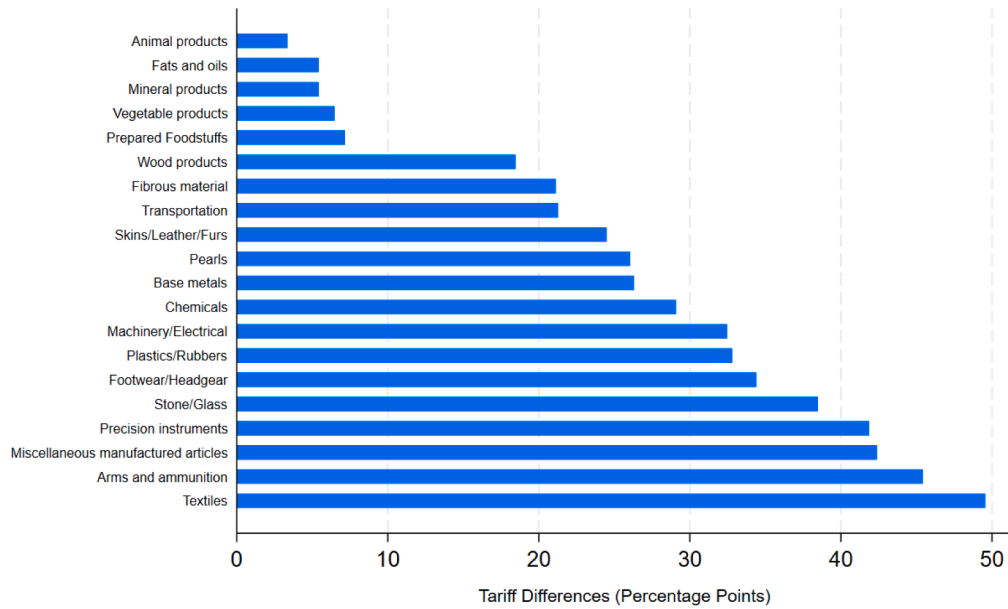


Fig. 5. Average tariff differences between column 2 and MFN rates across sectors.

Notes: This figure illustrates sector-level differences between column 2 and MFN tariffs (in percentage points)(see Online Appendix Table A7 for the definition of sectors).

3. Methodology and data

3.1. Empirical specification

This paper focuses on recent sanctions related to Ukraine, specifically the suspension of the NTR Act and its implications for Russian trade. The unprecedented scale and severity of these sanctions provide an unexpected and exogenous shock to the tariffs imposed on Russia's exports. As documented in Fig. 4, the suspension of the NTR Act caused a large variation in tariff changes across products. This paper exploits this variation to identify the impact of tariff changes on various export margins of Russian trade. More specifically, this paper estimates the following equation:

$$\ln Y_{f p j t} = \alpha + \beta \Delta \text{Tariff}_p \times \text{Postshock}_t + \kappa \text{Control}_{p t} + \gamma_{f t} + \eta_{j t} + \delta_p + \mu_{f p j t} \quad (1)$$

where f , p , j , and t denote the Russian exporter, 6-digit HS product, the industry to which the product p belongs, and time (year-quarter), respectively. $Y_{f p j t}$ represents four export margins at the firm-product-year-quarter level: export value, export quantity, export price, and the number of U.S. importers. It is worth noting that the data from the BoL dataset, which records the consignee for each export transaction, allows this paper to study the impact of sanctions on a new and unique export margin, namely the number of U.S. importers for each Russian firm exporting a given product to the U.S., a dimension that remains underexplored in the literature.

ΔTariff_p is the tariff change for product p at the second quarter of 2022 after the suspension of the NTR Act. More specifically, this paper uses the logarithmic difference between the MFN tariff and the column 2 tariff, i.e., $\Delta \text{Tariff}_p = \ln \left(\frac{1 + \text{column2}_p}{1 + \text{MFN}_p} \right)$.⁷ Postshock_t denotes the post-sanction period, taking a value of one if the time t is from the second quarter in 2022 (inclusive) onwards, and 0 otherwise. $\text{Control}_{p t}$ is the product-level U.S. import value from the rest of the world, used as the control variable for the U.S. demand conditions, as we would expect that the U.S. import from the rest of the world will respond to demand shocks in the U.S.⁸ $\gamma_{f t}$ denotes firm-time fixed effects, capturing firm-level time-varying factors such as firm size, productivity, employment, wages, market power, access to foreign markets, etc. This controls for supply-side factors that affect firm exports after the U.S. sanctions on Russia. $\eta_{j t}$ denotes industry-time fixed effects, controlling for industry-specific shocks (e.g., the industry-level impact of the pandemic), trends, or policies that affect Russian export. These two fixed effects also absorb time-specific shocks, such as fluctuations in the Russian

⁷ In Handley and Limao (2015) and Handley and Limão (2017), the differences between the MFN tariff and the column 2 tariff for China's products, together with trade elasticity, are used to measure trade policy uncertainty faced by Chinese firms when China's Normal Trade Relations(NTR) had to be renewed every year by the U.S. before China joined the WTO.

⁸ Note that this variable is not a perfect control variable for demand shocks in the U.S. if there is trade diversion from Russia to the rest of the world. However, given that Russia is a small import market for the U.S., accounting for less than one percent of its total imports before the sanctions from 2015 to 2021, it is unlikely that trade diversion from Russia played a role in imports from the rest of the world. Thus, we believe the variable is a reliable control for demand shocks in the U.S. Our results are robust without this control variable.

exchange rate. δ_p denotes product fixed effects capturing time-invariant characteristics specific to each product, e.g., whether a product is homogeneous or heterogeneous. μ_{fijt} is the error term and the standard errors are clustered at the firm level.

Moreover, this paper estimates the following equation to study the impact of sanctions on the number of exporters exporting a product to the U.S.:

$$\ln N_{pjt} = \lambda + \rho \Delta \text{Tariff}_p \times \text{Postshock}_t + \theta \text{Control}_{pt} + \eta_{jt} + \delta_p + \mu_{pjt} \quad (2)$$

where N_{pjt} is the number of Russian exporters that export product p to the U.S. at time t .

The coefficients of interest are β in Eq. (1) and ρ in Eq. (2), which approximately measure the elasticity of trade margins with respect to the tariff due to the use of the logarithmic difference between MFN and column 2 tariffs. Negative coefficients of β and ρ suggest that the sanctions, by increasing tariffs, reduced Russian export margins. Two points about our identification are worth noting. The first point is that the identification relies on the cross-product variations in tariff changes caused by the sanction. This is the difference-in-differences estimation typically used when all units (e.g., products in our context) are treated, but the intensity of treatment (e.g., tariff changes in our context) is different across units.⁹ The idea is that before the sanctions, all products experienced similar trends in export margins. However, after the sanctions, different products experienced different changes in trade margins due to their different exposure to the treatment. In an alternative specification, a third country or a combination of other countries that did not impose sanctions on Russia can be used as a control group, with the U.S. as the treatment group. While this specification has certain advantages, such as enabling product-time fixed effects to more accurately capture product-level demand conditions, it overlooks a key aspect of the sanctions: the substantial variation in tariff changes across products that they caused. In one of the robustness checks, we estimate this alternative specification and find that the results are generally consistent. The second point is that the tariff changes are plausibly exogenous in our analysis. The reason is that the column 2 tariffs were not designed in response to recent trade dynamics or the Russia-Ukraine war, but rather inherited from a historical and politically-motivated framework, namely the Smoot-Hawley Tariff Act of 1930.

3.2. Data

3.2.1. Bill of lading data

The data in this paper are obtained from the Bill of Lading (BoL) dataset collected by the U.S. ports from S&P Panjiva. It is a nontraditional administrative trade dataset, which consists of over two billion transaction records detailing the trade of goods across international borders. It includes comprehensive shipment-level information such as consignees' and shippers' details (importers and exporters, respectively), product descriptions, lading and unlading ports, vessels, quantities, estimated dollar values, and other trade details. This dataset covers firm-to-firm trade flows across major trading nations in the world, such as China, the U.S., and India, among others.¹⁰ In this paper, we focus on U.S. import data, particularly imports from Russia. Panjiva has provided the U.S. transaction records for imports from Russia since 2011 and updates the records several times per week.

Panjiva utilizes advanced machine learning techniques to extract crucial details from unstructured customs import and export shipping data, specifically bills of lading obtained from the U.S. Customs and Border Protection (CBP) through the Freedom of Information Act of 1966 (FOIA). A BoL is a formal document issued by a carrier (transportation company) to a shipper (exporter), detailing important information such as the type, quantity, and destination of the goods being transported. Furthermore, it serves as a confirmation receipt upon the delivery of the goods by the carrier to the designated destination.

In addition to raw data, Panjiva provides researchers with more insightful and comprehensive information not reported in BoL forms, such as the standard measure volume (twenty-foot equivalent units (TEUs)), Harmonized System (HS) product codes, dollar value of each transaction, and associated firms.¹¹ With this unique dataset provided by Panjiva, this paper can capture not only the product-level trade margins but also the firm-to-firm level relationships (e.g., the number of U.S. importers for each Russian exporter).

As its name suggests, the BoL dataset exclusively contains information on goods transactions conducted via sea transport. Therefore, its relevance diminishes when most trade occurs by land or air routes between two countries. Consequently, in the next section, we use data on the U.S. maritime imports alongside imports through land and air transport to show the significance of maritime imports from Russia to the U.S.

3.2.2. United states census bureau data

The U.S. Census Bureau regularly releases the latest reports on the U.S. international trade in goods and services. Fig. 6 illustrates the total customs value, vessel customs value, and air customs value imported from Russia to the U.S. between 2012 and 2023. Given the considerable geographical distance between the two countries, maritime shipping appears to be the most practical and cost-effective mode of transportation for such long distances. Moreover, the infrastructure for maritime trade between Russia and the U.S. is well developed, with established shipping routes, ports, and logistics networks that facilitate the movement of goods by sea. Notably, on average, more than 86 % of the customs value comes from maritime imports, which suggests that the BoL dataset is highly relevant and valuable for understanding the trade dynamics between Russia and the U.S. under sanctions.

⁹ In this setting, there are no clearly-defined treatment groups and control groups. See Chen and Zhou (2007), Qian (2008), Nunn and Qian (2011), and Chen et al. (2020) for a similar identification.

¹⁰ These countries include Bolivia, Brazil, Chile, China, Colombia, Costa Rica, Ecuador, India, Indonesia, Mexico, Panama, Pakistan, Paraguay, Peru, the Philippines, Sri Lanka, Uruguay, the United States, Venezuela, and Vietnam.

¹¹ Flaen et al. (2023) offer a comprehensive description of S&P Panjiva dataset. When shipment value is missing, it is imputed by applying average unit values from public trade data to the corresponding Bill of Lading (BoL) weights by S&P Panjiva.

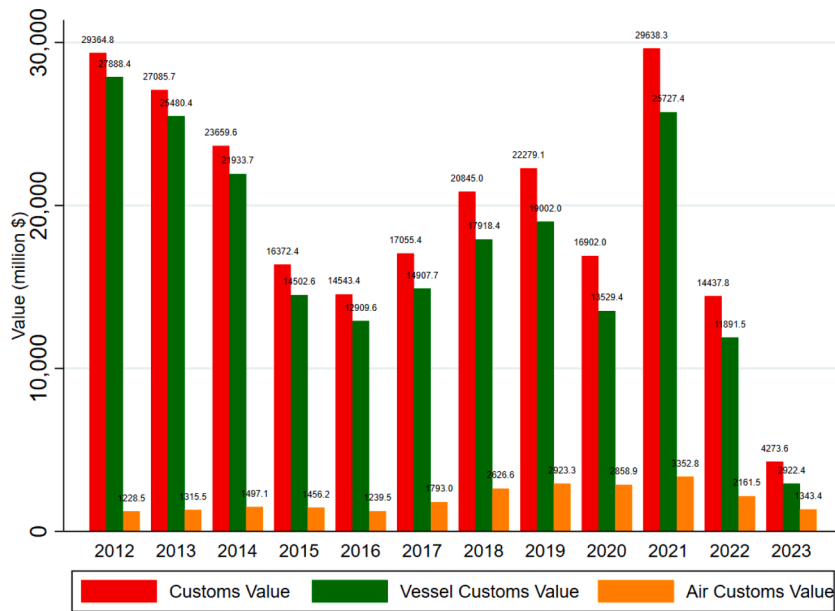


Fig. 6. The U.S. import values from Russia by sea and air (2015–2023).

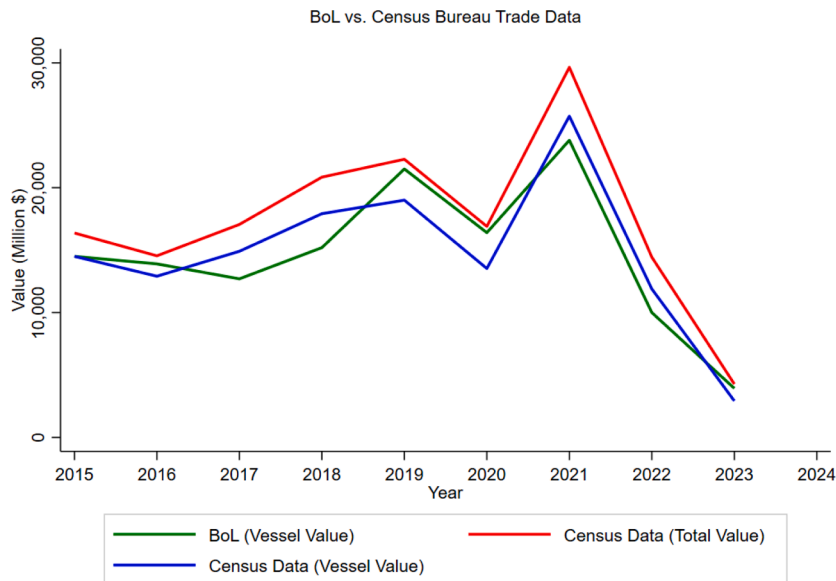


Fig. 7. The U.S. import values from Russia in BoL and Census Bureau data.

Second, to assess the accuracy and representativeness of the BoL data, we compare it with publicly available data published by the U.S. Census Bureau. Fig. 7 compares aggregate customs values reported by the U.S. Census Bureau and those derived from the BoL dataset. Since 2015, the BoL data has consistently aligned with official public trade statistics, capturing key events such as the sharp collapse in 2020 during the pandemic, the post-pandemic recovery in 2021, and the significant decline in 2022 driven by sanctions resulting from the Russia-Ukraine war.¹²

¹² There was a notable surge in the imports between the last quarter of 2020 and the last quarter of 2021, possibly due to the escalation in oil prices. We note that there is a large discrepancy between the U.S. Census Bureau data and the BoL data before 2015, which is also acknowledged by Flaaen et al. (2023).

Table 1
The impact of sanctions on trade margins.

Variables	Dependent variables: trade margins				
	(1) Value	(2) Quantity	(3) Price	(4) # Importers	(5) # Exporters
$\Delta \text{Tariff} \times \text{Postshock}$	-2.839*** (0.761)	-2.629*** (0.677)	-0.210 (0.714)	-0.702** (0.278)	-0.491** (0.200)
Controls	Yes	Yes	Yes	Yes	Yes
Firm-Time FE	Yes	Yes	Yes	Yes	-
Industry-Time FE	Yes	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.774	0.812	0.889	0.289	0.561
# Observations	9634	9634	9634	9634	10,847

The product level U.S. import value from the rest of world is included as the control for the U.S. demand conditions. Time is in a year-quarter frequency. ***, ** and * denote 1 %, 5 % and 10 % significance levels, respectively.

4. Results

4.1. Baseline results

Our difference-in-differences design relies on the parallel trends assumption: in the absence of sanctions, products with different tariff exposures would have followed similar pre-trends. Before presenting the results estimated from specifications (1) and (2), we conduct a test to ensure the condition is satisfied. Specifically, we replace $\Delta \text{Tariff}_p \times \text{Postshock}_p$ with the interaction terms between ΔTariff_p and a set of time dummies in specifications (1) and (2) and plot their coefficients with 95 % confidence intervals in Fig. 8. The positive (negative) numbers on the horizontal axis are the quarter after (before) the sanctions, while zero indicates the quarter in which the sanctions were imposed. As shown in these figures, the coefficients for the quarters before the sanctions are close to zero and insignificant at the 5 % significance level. This suggests that there was no significant difference in export margins across products before the sanctions. Thus, the identifying condition of the parallel trends across products prior to the sanctions is satisfied. At the same time, there is a divergence in the trends of trade margins after the sanctions, as evidenced by the larger negative and significant coefficients.¹³

Table 1 reports the results of our baseline models specified in Eqs. (1) and (2). In columns (1) to (4), we present the results for trade margins of export value, export quantity, export price, and the number of U.S. importers estimated from Eq. (1), respectively. In column (5), we present the results on the number of exporters estimated from Eq. (2). As Table 1 suggests, the U.S. sanctions on Russia, i.e., applying the higher column 2 tariffs, significantly deteriorated Russian trade margins in general. Products that were exposed to higher tariff increases experienced steeper reductions in their trade margins. For example, a unit change in the logarithmic difference between MFN and column 2 tariffs led to a 283.9 % reduction in export value. Given that the average value of the logarithmic difference in our sample is 0.237, this translates into an average reduction of 67.3 % (i.e., $0.237 \times 283.9\%$) in export value for a given exporter-product pair to the U.S. following the sanctions. This also implies that a 1 % increase in tariffs led to a 2.51 % reduction in export value, or a one percentage point increase in tariffs led to a 2.47 % reduction in export value.¹⁴

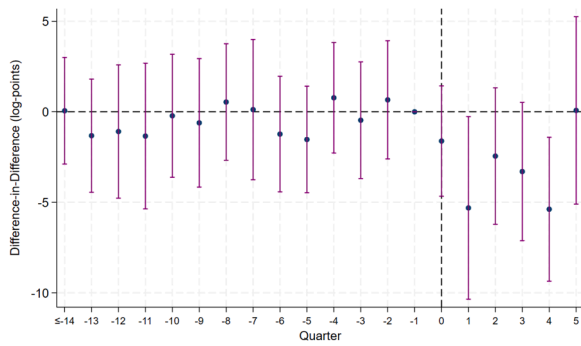
After breaking down export value into export quantity and export price, we find that the impact of sanctions was significantly negative for export quantity, but insignificant, though negative, for export price. Using the same method as in the analysis of export value, we find that the sanctions significantly reduced export quantity by 62.3 %, while reducing export price by 5 % insignificantly. This suggests that, despite the sanctions, export prices remained unchanged. A similar pattern is observed in the U.S.-China trade war, where, despite tariff hikes, exporters did not alter their export prices, instead passing the tariff burden to the U.S. (e.g., Amiti et al., 2019; Fajgelbaum et al., 2020 and Cavallo et al., 2021).¹⁵

Due to the unique firm-to-firm nature of the BoL dataset, we are able to investigate the impact of the sanctions on two additional extensive margins of Russian trade: the number of U.S. importers for a Russian exporter of a specific product and the number of exporters of a specific product to the U.S. As shown in columns (4) and (5), the coefficients are both negative and significant. Using the same method as in the previous analysis, our findings reveal a 16.6 % decrease in the number of U.S. importers purchasing a

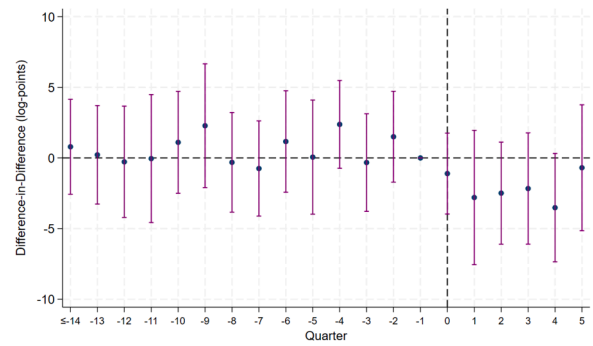
¹³ In the last quarter of our sample (the third quarter of 2023), the coefficient is relatively larger than the others, possibly reflecting delayed data coverage at the time we accessed the dataset in early 2024. To mitigate this concern, we exclude the fourth quarter of 2023 from the analysis.

¹⁴ The average tariff rate increased from 3.42 % to 31.13 % on average. This indicates that on average the tariff increased by 26.8 % (i.e., $(1 + 31.13\%)/(1 + 3.42\%) - 1$) or by 27.71 percentage points. As a result, a 1 % increase in tariffs led to a 2.51 % (i.e., $67.3\%/26.8$) reduction in export value, while a one percentage point increase in tariffs led to 2.47 % (i.e., $67.3\%/27.7$) reduction in export value. This is consistent with the trade elasticities estimated in the literature (e.g., Broda and Weinstein, 2006; and Head and Mayer, 2014).

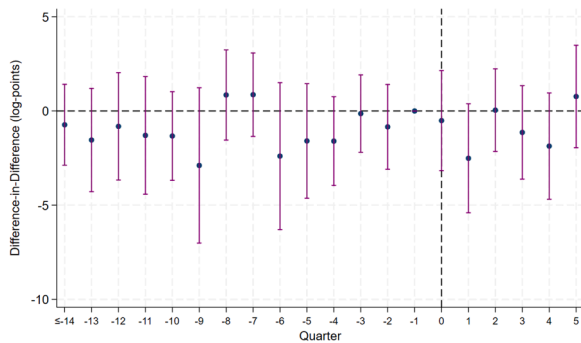
¹⁵ Note that trade value and price for some observations in the Panjiva database are estimated. For example, when shipment values are missing, S&P Panjiva imputes them by applying average unit values from public trade data. In such cases, the export prices of these observations may not be sensitive to the sanctions. Unfortunately, we cannot verify this, as the dataset does not indicate which observations are imputed.



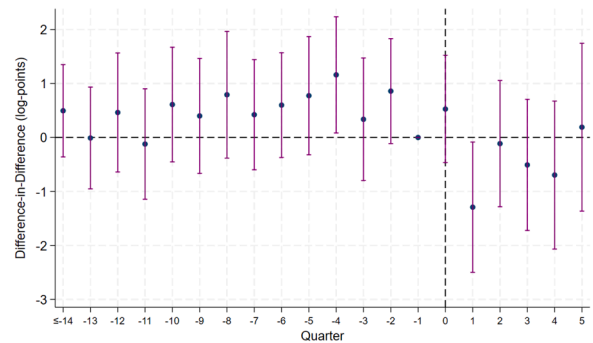
(a) Value



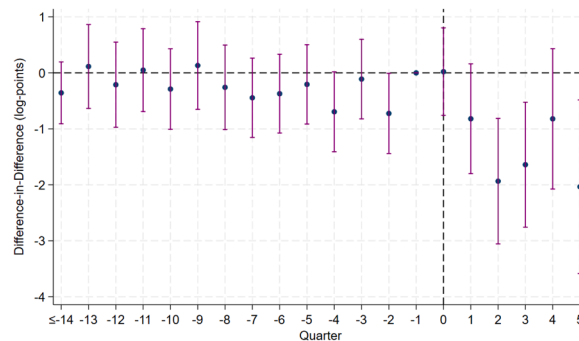
(b) Quantity



(c) Price



(d) # Importers



(e) # Exporters

Fig. 8. Parallel trend.

given product from a given Russian exporter following the sanctions. Moreover, there was a 11.6 % decrease in the number of Russian exporters that export a given product to the U.S. following the sanctions.

4.2. Robustness check

In this section, we present the results of various robustness checks.

Other sanction packages

There are concerns regarding the implementation of other policies during the same period. Since the conflict between Russia and Ukraine intensified at the beginning of 2022, the U.S. and other allies have continued to issue different types of sanctions such as travel bans, financial restrictions, and export and import controls. After signing the NTR Act, the President obtained the authority to further raise tariffs on Russian goods. For example, two months after the column 2 tariffs were applied, around 479 products (8 % of

Table 2
Robustness checks on other sanction packages.

Variables	Dependent variables: trade margins				
	(1) Value	(2) Quantity	(3) Price	(4) # Importers	(5) # Exporters
Panel A: use applied tariffs from June 2022 sanction package					
$\Delta Tariff \times Postshock$	-3.151*** (0.800)	-3.245*** (0.723)	0.094 (0.548)	-0.565** (0.232)	-0.445** (0.218)
Adjusted R^2	0.774	0.812	0.889	0.289	0.561
# observations	9634	9634	9634	9634	10,847
Panel B: exclude February 2023 sanction package					
$\Delta Tariff \times Postshock$	-2.787*** (0.769)	-2.650*** (0.691)	-0.137 (0.697)	-0.600** (0.285)	-0.552*** (0.209)
Adjusted R^2	0.770	0.816	0.889	0.287	0.566
# observations	8967	8967	8967	8967	10,329
Panel C: additionally exclude import bans					
$\Delta Tariff \times Postshock$	-2.597*** (0.756)	-2.541*** (0.677)	-0.056 (0.684)	-0.581** (0.283)	-0.565*** (0.206)
Adjusted R^2	0.771	0.818	0.889	0.301	0.559
# observations	8683	8683	8683	8683	9948
Panel D: additionally exclude export bans					
$\Delta Tariff \times Postshock$	-2.571*** (0.800)	-2.461*** (0.709)	-0.110 (0.727)	-0.589* (0.302)	-0.602*** (0.207)
Adjusted R^2	0.770	0.817	0.889	0.298	0.558
# observations	8415	8415	8415	8415	9740
Controls	Yes	Yes	Yes	Yes	Yes
Firm-Time FE	Yes	Yes	Yes	Yes	-
Industry-Time FE	Yes	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	Yes	Yes

The product level U.S. import value from the rest of world is included as the control for the U.S. demand conditions. Time is in a year-quarter frequency. ***, ** and * denote 1%, 5% and 10% significance levels, respectively.

all products) were subjected to a higher tariff (35 %) in June 2022.¹⁶ These products accounted for less than 8 % of total import value in 2021 and their impact on the average tariff was very small (from 31.13 % to 32.18 %) compared with the change from MFN tariffs to column 2 tariffs (from 3.42 % to 31.13 %), as shown in Fig. 2. Moreover, the column 2 tariffs have a strong historical basis and are therefore plausibly exogenous for identification. As a result, in the main analysis, we focus on the changes from MFN tariffs to column 2 tariffs. As a robustness check, we replace the column 2 tariffs of these products with 35 % and recalculate tariff changes $\Delta Tariff_p$ since these 35 % tariffs took effect in roughly the same quarter as the column 2 tariffs. Then we re-estimate the specifications (1) and (2). The results are presented in Panel A of Table 2 and are consistent with the baseline results.

Moreover, in February 2023, another sanction package was issued, raising some products' tariffs from column 2 rates to 35 %, and some other products' tariffs from 35 % or column 2 rates to 70 %. At the same time, a 200 % duty was imposed on Russian aluminum and all products containing Russian aluminum.¹⁷ As a robustness check, we exclude these products from the sample and estimate the specifications (1) and (2). The results are presented in Panel B of Table 2 and are consistent with the baseline results.

Furthermore, the U.S. has also gradually imposed import bans on different types of Russian products, including energy products, fish, seafood, alcoholic beverages, and non-industrial diamonds, since the war began in February 2022.¹⁸ As a robustness check, we additionally exclude these products from the sample and estimate the impact of the sanctions. The results are presented in Panel C of Table 2 and are consistent with the baseline results.

Lastly, the decline in trade between Russia and the U.S. may also have been influenced by Russia's own export bans. In March 2022, to maintain domestic market stability, Russia imposed an export ban on over 200 products, including technological, telecommunication, and medical equipment, vehicles, agricultural machinery, electric equipment, as well as railway cars and locomotives, containers, turbines, metal and stone cutting machines, video displays, projectors, consoles, and switchboards.¹⁹ As a robustness

¹⁶ See Proclamation 10,420.

¹⁷ See Proclamation 10,522 and Proclamation 10,523 for these tariff changes.

¹⁸ See Executive Order 14,066 and 14068, and Ending Importation of Russian Oil Act.

¹⁹ The Russian export bans can be accessed at: <http://government.ru/en/docs/44762/> (accessed on 2 September 2025) The list of the products affected by the export ban can be found at: <https://beawire.com/resources/regulatory/order-no.-311-by-the-ministry-of-health-of-the-russian-federation/> (accessed on 2 September 2025). In 2023, the Russian government adjusted its export bans or temporary restrictions several times on the export of petrol and diesel fuel, precious metal waste and scrap, durum wheat, rice and rice cereals, etc. The information can be accessed at: <http://government.ru/en/docs/> (accessed on 2 September 2025).

check, we additionally exclude these products from the sample and estimate the impact of the sanctions. The results are presented in Panel D of Table 2 and are consistent with the baseline results.

Alternative DID specification

The identification in the main specification focuses on bilateral trade between Russia and the U.S., and relies on cross-product variation in tariff changes following the sanctions. It is natural to consider an alternative specification, in which the countries that did not impose sanctions on Russia serve as the control group, while the U.S. serves as the treatment group. As a robustness check, we estimate the following two specifications:

$$\ln Y_{fpc,t} = \alpha_1 + \beta_1 Treat_c \times Postshock_t + \gamma_{ft} + \delta_{pt} + \eta_{pc} + \mu_{fpc,t}$$

and

$$\ln N_{pct} = \alpha_2 + \beta_2 Treat_c \times Postshock_t + \delta_{pt} + \eta_{pc} + \mu_{pct}$$

where $Y_{fpc,t}$ denotes the export value, quantity, price, and the number of importers of a Russian exporter f exporting a product p to a country c at time t . N_{pct} is the number of exporters of product p to country c at time t . $Treat_c$ is a dummy variable equal to one for the U.S. and zero for other countries. η_{pt} denotes product-time fixed effects, which can control for product-time-level supply and demand factors.²⁰ Following Li et al. (2024), we use four neutral countries - India, Pakistan, Vietnam, and Mexico- as the control group. These are the only non-sanctioning countries in our setting for which BoL data are available over the sample period and that trade substantially with Russia.

The results are presented in Panel A of Table 3, while the parallel trends test is presented in Online Appendix Figure A1. Relative to the neutral group, sanctions reduce the value of Russian exports of a given product to the U.S., primarily through lower quantities; export prices are not significantly affected. The magnitudes are close to the baseline. For example, the coefficient of -1.013 in column (1) suggests that the export value was reduced by 63.7% following the sanctions ($e^{-1.013} - 1$), which is close to the impact in the baseline results (i.e., 67.3%). Furthermore, the impact of sanctions on the number of exporters was significantly negative. The number of exporters experienced a 16.0% reduction following the sanctions ($e^{-0.174} - 1$), which is slightly larger than the reduction estimated in the baseline results (i.e., 11.6%). Being different from the baseline results, the impact on the number of U.S. importers is insignificant.

While this alternative specification has its merits, it also has potential drawbacks. On the one hand, using the bilateral trade between Russia and the U.S. and relying on the cross-product variations of tariff changes may not capture the impact of sanctions that are not through the increase of tariffs, e.g., travel bans and financial restrictions. On the other hand, using other countries as the control group may capture the impact through trade diversion, where Russian exporters may export more to these countries following the sanctions. Thus, we use the specification that highlights a key aspect of the sanctions, i.e., the substantial variation in tariff changes across products, for our baseline results while estimating this alternative specification as a robustness check.

Disaggregated firm-to-firm level data

In the main analysis, we aggregate the raw firm-to-firm data across U.S. importers for a given exporter of a specific product at a specific time. The reason is that for a given exporter of a specific product at a specific time, the number of U.S. importers is skewed. For example, in some cases, there is only one U.S. importer. Then, the inclusion of U.S. importer-time fixed effects will leave many observations out in the estimation. As a robustness check, we use the firm-to-firm level data and estimate the following two specifications:

$$\ln Y_{fpjkt} = \alpha_3 + \beta_3 \Delta Tariff_p \times Postshock_t + \kappa_3 Control_{pt} + \gamma_{ft} + \delta_{jt} + \eta_p + \mu_{fpjkt}$$

and

$$\ln N_{pjkt} = \alpha_4 + \beta_4 \Delta Tariff_p \times Postshock_t + \kappa_4 Control_{pt} + \delta_{jt} + \eta_p + \mu_{pjkt}$$

where Y_{fpjkt} denotes the export value, quantity, and price of Russian exporters f exporting product p to importer k in the U.S. at time t . j is the industry to which product p belongs. N_{pjkt} is the number of exporters exporting product p to importer k in the U.S. at time t .

The results are presented in Panel B of Table 3. They suggest that export value and quantity were significantly reduced following the sanctions. Although the impact was smaller, it is consistent with the baseline results.²¹ The impact on the number of exporters serving a given U.S. importer is not significant, possibly due to the small number of exporters exporting a given product to a given U.S. importer and the small variation in this variable.

²⁰ In the main specification, product-time fixed effects cannot be included. Instead, we rely on firm-time fixed effects to control for supply-side factors and a control variable to control for demand shocks.

²¹ Following the sanctions, the export value for a given exporter of a specific product to a given importer is reduced by 51.2%. Note that from the main specification, we know that for a given exporter of a specific product, the number of importers is reduced by 16.6%. If we add these two effects together, it is very close to the impact on the export value for a given exporter exporting a specific product estimated from the main specification, i.e., 67.3%.

Table 3

Robustness checks on alternative specification, more disaggregated data and anticipation.

Variables	Dependent variables: trade margins				
	(1) Value	(2) Quantity	(3) Price	(4) # Importers	(5) # Exporters
Panel A: alternative DID specification					
$Treat \times Postshock$	-1.013** (0.435)	-1.460* (0.835)	0.447 (0.998)	-0.038 (0.104)	-0.174*** (0.053)
Firm-Time FE	Yes	Yes	Yes	Yes	-
Product-Time FE	Yes	Yes	Yes	Yes	Yes
Product-Country FE	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.811	0.777	0.826	0.478	0.620
# observations	33,064	33,064	33,064	33,064	20,728
Panel B: disaggregated firm-to-firm level data					
$\Delta Tariff \times Postshock$	-2.159*** (0.668)	-1.716*** (0.551)	-0.512 (0.652)		0.006 (0.124)
Controls	Yes	Yes	Yes		Yes
Firm-Time FE	Yes	Yes	Yes		-
Industry-Time FE	Yes	Yes	Yes		Yes
Product FE	Yes	Yes	Yes		Yes
Adjusted R^2	0.734	0.801	0.935		0.194
# observations	15,394	15,394	15,394		10,847
Panel C: anticipation test					
$\Delta Tariff \times Postshock$	-2.822*** (0.787)	-2.668*** (0.708)	-0.154 (0.727)	-0.737*** (0.284)	-0.477** (0.201)
$\Delta Tariff \times \text{one quarter before}$	0.250 (1.420)	-0.589 (1.511)	0.839 (0.954)	-0.533 (0.437)	0.317 (0.276)
Controls	Yes	Yes	Yes	Yes	Yes
Firm-Time FE	Yes	Yes	Yes	Yes	-
Industry-Time FE	Yes	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.774	0.812	0.889	0.290	0.561
# observations	9634	9634	9634	9634	10,847

The product level U.S. import value from the rest of the world is included as the control for the U.S. demand conditions. Time is in a year-quarter frequency. ***, ** and * denote 1%, 5% and 10% significance levels, respectively.

Anticipation

Concerns may arise that Russian exporters could adjust their export behavior in anticipation of sanctions, prompted by ongoing threats and warnings issued by the U.S. and its allies. For example, as early as December 2021, the U.S. Secretary of State Antony Blinken warned Russia of 'severe consequences' if it invaded Ukraine.²² This anticipation effect could lead to non-parallel trends in trade margins prior to the sanctions, potentially biasing our estimates. However, we believe this concern is minimal, as the parallel trends in trade margins are confirmed in Fig. 8. To further safeguard our analysis, we include an additional control $\Delta Tariff_p \times \text{One quarter before}_t$ in the estimation, in which $\text{One quarter before}_t$ is a dummy variable equal to one in the first quarter of 2022 and zero otherwise. If there is anticipation close to the time of sanctions, we would expect the coefficient of this interaction term to be significant. The results are presented in Panel C of Table 3. The coefficients of the interaction terms in the estimations of all trade margins are insignificant, indicating that there is no anticipation effect prior to the sanctions. The coefficients of $\Delta Tariff_p \times \text{Postshock}_t$ remain significant and close to the baseline results.

Placebo test

To address the concern that the implementation of sanctions against Russia may be correlated with unobserved determinants of firms' export behavior, we conduct a placebo test by randomly assigning sanction status to products following the literature (e.g., Chetty et al., 2009; and Liu and Mao, 2019). Specifically, in our analysis, the tariff changes vary across different products following the adjustment from MFN to column 2 tariffs. As a placebo test, we randomly assign the tariff changes to products, constructing false tariff changes across products $\Delta Tariff_p^{false}$ and replace the true tariff changes $\Delta Tariff_p$ in the main specifications (1) and (2) with the false tariff changes $\Delta Tariff_p^{false}$. Such randomization ensures that the constructed false tariff changes are expected to have no effect on export margins. We perform this random data-generating process 500 times and plot the distribution of 500 coefficients in Fig. 9. As shown in the figure, the distribution is centered around zero, and the coefficients in the main estimations are clear outliers

²² See example at: <https://edition.cnn.com/2021/12/01/politics/antony-blinken-russia-sergei-lavrov/index.HTML> (accessed on 2 September 2025).

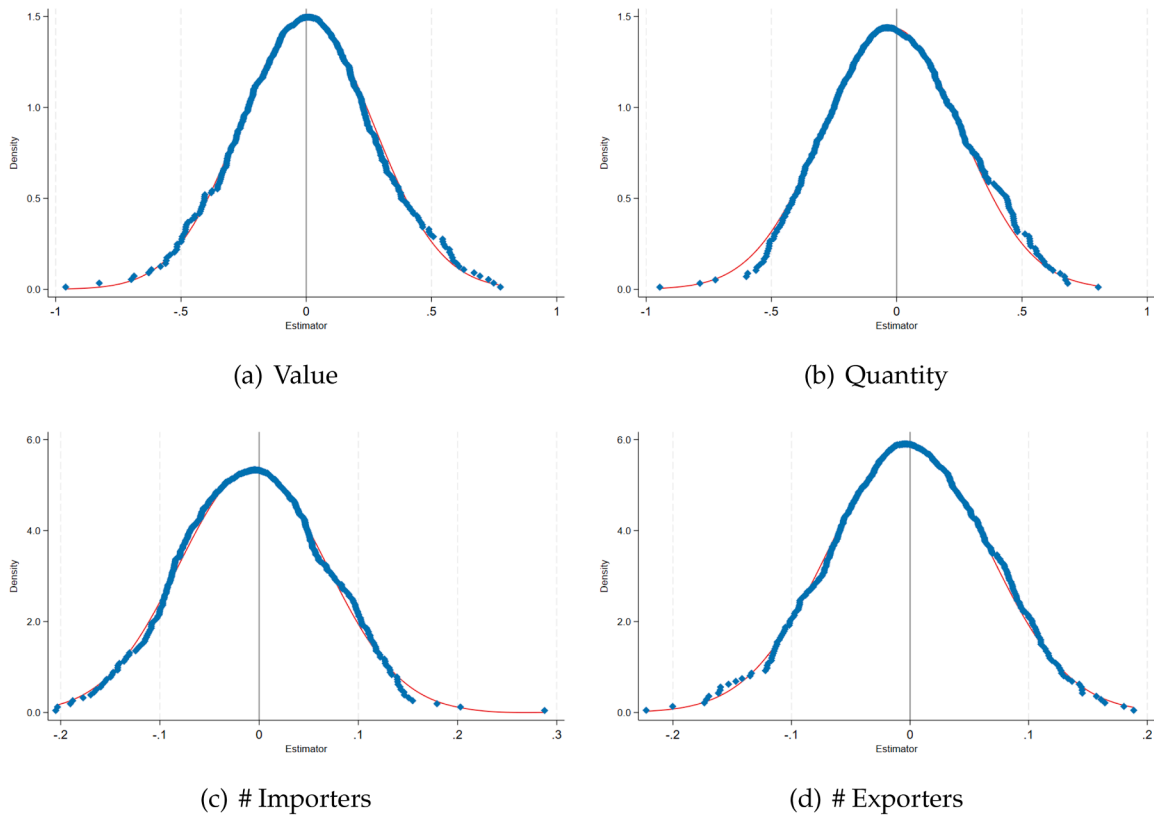


Fig. 9. Placebo test.

compared with these coefficients. This suggests that the impact of the sanctions estimated in the main specification using the true tariff changes is reliable.²³

The pandemic

In our main specifications, we include firm-time and industry-time fixed effects to mitigate potential firm- and industry-specific impacts of the pandemic. For instance, this helps address disruptions such as suspended production and supply chain disruptions to firms caused by lockdown, which can affect trade margins. However, some pandemic-induced product-level disruptions may not be fully accounted for by these fixed effects. For example, certain products may have experienced higher demand during the pandemic and a faster post-pandemic recovery compared to others, resulting in variations in trade patterns in 2022. These variations could cause potential bias when analyzing the impact of sanctions. However, to the best of our knowledge, there is no product-level measurement of the disruptions of the pandemic. Since pharmaceutical products displayed a contrasting trend during the pandemic, with rapid rebounds in both imports and exports, we exclude these products from our analysis.²⁴ The results are reported in Panel A of Table 4 and are consistent with the baseline results.

The war

There is concern that the decrease in trade with Russia may be attributed to the ongoing conflict between Ukraine and Russia - the war itself. For example, the conflict may have affected exporters that rely on Ukrainian ports to deliver their products to the U.S. Therefore, we exclude the exports to the U.S. that are through Ukrainian ports from our sample. The results are reported in Panel B of Table 4 and are consistent with the baseline findings. Additionally, the deterioration of relations between Russia and Ukraine due to the war may have had a detrimental effect on Russian products that are reliant on inputs from Ukraine, thereby affecting the exports of those final products to the U.S. As a robustness check, we calculate the input share from Ukraine using the 2020 OECD

²³ Following Topalova (2010) and Lu and Yu (2015), we also estimate the impact of tariff rates on trade margins using the pre-sanction sample (i.e., from the first quarter of 2015 to the first quarter of 2022) as another placebo test. Since tariffs were relatively stable during this period, the coefficients are statistically insignificant across export value, quantity, price, and number of importers.

²⁴ The pharmaceutical products are classified at: <https://www.gov.uk/guidance/classifying-pharmaceutical-products> (accessed on 2 September, 2025).

Table 4
Robustness checks on the pandemic and war.

Variables	Dependent variables: trade margins				
	(1) Value	(2) Quantity	(3) Price	(4) # Importers	(5) # Exporters
Panel A: pandemic effect exclude pharmaceutical products					
$\Delta \text{Tariff} \times \text{Postshock}$	-2.840*** (0.761)	-2.629*** (0.676)	-0.212 (0.715)	-0.702** (0.277)	-0.491** (0.200)
Adjusted R^2	0.774	0.812	0.889	0.290	0.561
#observations	9614	9614	9614	9614	10,832
Panel B: war effect exclude exports through Ukraine ports					
$\Delta \text{Tariff} \times \text{Postshock}$	-2.890*** (0.758)	-2.657*** (0.674)	-0.233 (0.712)	-0.709** (0.278)	-0.494** (0.200)
Adjusted R^2	0.773	0.812	0.890	0.289	0.561
#observations	9615	9615	9615	9615	10,824
Panel C: war effect exclude products relying on Ukraine					
$\Delta \text{Tariff} \times \text{Postshock}$	-3.695*** (1.086)	-3.292*** (0.861)	-0.403 (0.692)	-0.499* (0.299)	-0.253 (0.333)
Adjusted R^2	0.821	0.812	0.908	0.224	0.538
#observations	4199	4199	4199	4199	5521
Controls	Yes	Yes	Yes	Yes	Yes
Firm-Time FE	Yes	Yes	Yes	Yes	-
Industry-Time FE	Yes	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	Yes	Yes

The product level U.S. import value from the rest of world is included as the control for the U.S. demand conditions. Time is in a year-quarter frequency. ***, ** and * denote 1 %, 5 % and 10 % significance levels, respectively.

Inter-Country Input-Output (ICIO) Table as a measure of input reliance on Ukraine.²⁵ We then drop the products with input share above the mean value of all products, i.e., the products that are more reliant on Ukraine for their inputs. The results are presented in Panel C of Table 4. They are generally consistent with the baseline results, showing a strong and significant impact on export value and quantity, although the impact on the number of exporters becomes insignificant.

Sanction or reputation

The studies of Balyuk and Fedyk (2023) and de Lucio et al. (2024) point out that, in parallel to the process of a wide range of economic sanctions on Russia by the European Union, many multinational firms voluntarily decided to suspend their activities in Russia due to reputational concerns.²⁶ Leveraging a comprehensive dataset of firm exits from Russia compiled by the Yale School of Management (SOM), de Lucio et al. (2024) identify the exports and imports of products affected only by trade sanctions or only by voluntary suspensions, given that EU sanctions targeted specific products while leaving others unaffected. This allows them to isolate the distinct impacts of EU sanctions and firm suspensions on Spanish trade with Russia. However, since all products were affected by the U.S. sanctions (the column 2 tariffs are imposed on all products), it is not possible to apply this strategy in the context of U.S.-Russia trade.

However, Balyuk and Fedyk (2023) collect the announcement dates for each U.S. firm in the Yale SOM list, revealing that exit announcements were dispersed throughout March 2022, reaching a peak in mid-March and tapering off by the end of that month. It is reasonable to believe that firms announcing the exit of the Russian market before the U.S. government suspended NTR and imposed column 2 tariffs were primarily ethically motivated, as cutting ties abruptly could expose them to risk and financial losses.²⁷ Hence, to exclude the potential impact of firms' reputation concerns on Russia's trade margins, we drop the U.S. firms that announced their exit before the sanctions from our sample.²⁸ The results are presented in Panel A of Table 5 and are robust to our baseline results. Moreover, we additionally exclude the products exported by the U.S. firms that made exit announcements before the sanctions from

²⁵ The OECD Inter-Country Input-Output (ICIO) Tables can be accessed at: <https://www.oecd.org/en/data/datasets/inter-country-input-output-tables.HTML> (accessed on 2 September 2025). The latest edition of OECD Inter-Country Input-Output (ICIO) has 45 unique industries based on ISIC Revision 4. The tables are provided for 76 countries (and the Rest of the World) from 1995 to 2020.

²⁶ The list can be accessed at: <https://som.yale.edu/story/2022/over-1000-companies-have-curtailed-operations-russia-some-remain> (access 2 September, 2025).

²⁷ It is challenging to isolate the motives behind firms announcing their exit from Russia after the sanctions. However, given that the reputation damage is time-efficient, it is likely that firms leaving Russia after the sanctions are driven primarily by economic factors, e.g., tariff changes.

²⁸ According to Yale CELI list, over 1000 firms have curtailed operations in Russia, with U.S. firms accounting for around 32 %. We identified 30 U.S. importers in our sample that suspended activities in Russia from the list.

Table 5
Robustness checks on reputation, continuing exporters and PPML.

Variables	Dependent variables: trade margins				
	(1) Value	(2) Quantity	(3) Price	(4) # Importers	(5) # Exporters
Panel A: exclude reputation-related firms listed Yale CELI					
$\Delta Tariff \times Postshock$	-2.920*** (0.771)	-2.651*** (0.680)	-0.268 (0.731)	-0.711** (0.278)	-0.502** (0.201)
Adjusted R^2	0.775	0.810	0.889	0.290	0.562
# observations	9538	9538	9538	9538	10,751
Panel B: exclude reputation-related products					
$\Delta Tariff \times Postshock$	-2.946*** (0.896)	-3.111*** (0.818)	0.165 (0.755)	-0.661** (0.334)	0.007 (0.214)
Adjusted R^2	0.799	0.820	0.899	0.270	0.534
# observations	7560	7560	7560	7560	9636
Panel C: continuing exporters					
$\Delta Tariff \times Postshock$	-3.652*** (1.028)	-3.994*** (0.842)	0.342 (0.910)	-0.729* (0.428)	-0.748** (0.293)
Adjusted R^2	0.699	0.797	0.890	0.259	0.643
# observations	3977	3977	3977	3977	3755
Panel D: PPML estimation					
$\Delta Tariff \times Postshock$	-3.713** (1.490)	-4.724*** (1.301)		-0.937** (0.364)	-0.093 (0.308)
# observations	9,634	9,634		9,634	10,847
Controls	Yes	Yes		Yes	Yes
Firm-Time FE	Yes	Yes		Yes	-
Industry-Time FE	Yes	Yes		Yes	Yes
Product FE	Yes	Yes		Yes	Yes

The product level U.S. import value from the rest of the world is included as the control for the U.S. demand conditions. Time is in a year-quarter frequency. ***, ** and * denote 1 %, 5 % and 10 % significance levels, respectively.

our sample, considering that these products may be highly regarded as the products damaging their reputation (e.g., products that Russia typically produces).²⁹ The results are shown in Panel B of Table 5. The results are generally consistent with the baseline results, showing a strong and significant impact on export value and quantity, although the impact on the number of exporters becomes insignificant.

Continuing exporters

We also use continuing exporters, i.e., the exporters exporting to the U.S. both before and after the sanctions in the second quarter of 2022, to minimize the potential bias in our findings. By focusing on the exporters that continually export, we reduce the influence of sporadic or one-time exporters whose behavior might distort the analysis. Continuing exporters provide a more stable and reliable dataset, ensuring that the observed effects are more likely due to sanctions rather than irregularities or anomalies in trade patterns. The results are presented in Panel C of Table 5 and are consistent with the baseline results.

PPML estimation

Following Li et al. (2024), we also estimate a Poisson Pseudo Maximum Likelihood (PPML) model as a robustness check. The results are presented in Panel D of Table 5.³⁰ As shown in columns (1), (2) and (4), the coefficients are significantly negative, suggesting a strong and consistent impact of the sanctions on export value, quantity, and the number of U.S. importers. However, as shown in column (5), the impact of sanctions on the number of exporters becomes smaller and insignificant. Thus, we believe our baseline results are reliable.³¹

²⁹ The number of products imported by the firms that announced their exit from the Russian market before the sanctions is 102, with around 45 % (45 products) from the sector of Machinery, Appliances, and Electrical Equipment and 22 % (24 products) from sector of Chemicals, Allied Industries, and Base Metals. These categories include many of Russia's most recognizable exports. Products such as aluminum, fertilizers, and vodka have long been associated with Russia's industrial identity on the global stage. The withdrawal of the U.S. firms from importing these goods can thus be seen as a deliberate move to sever economic ties with Russia's most emblematic sectors, sending a strong reputational signal beyond the purely economic realm.

³⁰ Due to the non-counting nature of export price, we do not estimate a PPML model for export price.

³¹ We have also checked the results of all robustness checks using the PPML model and presented the results in Online Appendix Table A5. In general, the results about export value and export quantity are very robust to the baseline results.

Table 6
Firm heterogeneity in the impact of sanctions.

Variables	Dependent variables: trade margins			
	(1) Value	(2) Quantity	(3) Price	(4) # Importers
Panel A: heterogeneity in exporter size				
$\Delta \text{Tariff} \times \text{Postshock}$				
× Micro	−1.911 (3.819)	−3.564 (3.023)	1.652 (3.911)	0.955 (0.865)
× Small	−4.092** (1.822)	−3.865** (1.677)	−0.227 (1.377)	−0.050 (0.555)
× Medium	−1.142 (1.073)	−1.984 (1.421)	0.841 (1.594)	−0.427* (0.254)
× Large	−3.272*** (1.043)	−3.322*** (0.917)	0.051 (0.997)	−0.625 (0.401)
Panel B: heterogeneity in single-importer vs multi-importer firms				
$\Delta \text{Tariff} \times \text{Postshock}$				
× single-importer	−3.120** (1.371)	−3.477*** (1.150)	0.357 (0.898)	−0.521 (0.408)
× multi-importer	−2.618** (1.025)	−2.739*** (0.857)	0.121 (1.034)	−0.526 (0.402)
Panel C: heterogeneity in single-product vs multi-product firms				
$\Delta \text{Tariff} \times \text{Postshock}$				
× single-product	−1.464 (3.347)	−4.459 (3.375)	2.995 (2.415)	−0.555 (0.896)
× multi-product	−2.873*** (0.895)	−3.067*** (0.734)	0.194 (0.806)	−0.564* (0.332)
Controls	Yes	Yes	Yes	Yes
Firm-Time FE	Yes	Yes	Yes	Yes
Industry-Time FE	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	Yes
# observations	9470	9470	9470	9470

The product level U.S. import value from the rest of the world is included as the control for the U.S. demand conditions. Time is in a year-quarter frequency. ***, ** and * denote 1 %, 5 % and 10 % significance levels, respectively.

5. Firm heterogeneity

In this section, we examine the heterogeneous responses of exporters to sanctions. More specifically, we estimate the following specification to capture firm-level heterogeneity on export value, quantity, price and the number U.S. importers. Category_{*f*}^{*h*} is a dummy variable that takes the value of one (zero) if exporter *f* belongs to category *h*.³² In our analysis, the categories refer to exporter size and whether the exporter is a multi-product or multi-importer firm.

$$\ln Y_{fijt} = \alpha_5 + \sum_h \theta_h \Delta \text{Tariff}_p \times \text{Postshock}_t \times \text{Category}_f^h + \sum_h \theta'_h \Delta \text{Tariff}_p \times \text{Category}_f^h + \theta \text{Control}_{pt} + \gamma_{ft} + \eta_{jt} + \delta_p + \mu_{fijt}$$

Firm size. Micro and small firms are often financially constrained and may struggle to adjust their production promptly in response to economic shocks. For example, [Douch and Edwards \(2021, 2022\)](#) and [Douch et al. \(2022\)](#) find that micro and small exporters experienced the largest negative effect on the growth of all trade margins as a result of Brexit-related uncertainty. To investigate whether the impact of sanctions is heterogeneous across the firm size distribution, we use export values prior to the sanctions and categorize exporters into four groups, i.e., micro, small, medium and large, based on their quartiles in the distribution.³³ The results are presented in Panel A of [Table 6](#). The results suggest that, only small and very large Russian exporters experienced statistically significant reductions in trade value and quantity. The decline among small exporters was more pronounced than that among very large exporters. It also reveals that medium-sized firms experienced a significant drop in the number of U.S. importers.

³² Note that we do not include the term $\Delta \text{Tariff}_p \times \text{Postshock}_t$, so that we can have a coefficient for each category. We include additional interaction terms between ΔTariff_p , Postshock_t and Category_f^h and their individual terms. However, some interaction terms and all individual terms are absorbed by fixed effects. For example, $\sum_h \text{Postshock}_t \times \text{Category}_f^h$ will be absorbed by firm-time fixed effects.

³³ We use the average value between 2015 and 2021 to categorize exporters. In our other analyses of firm heterogeneity, we apply the same method. Online Appendix Table A6 reports the results based on values from one year prior to the sanctions to categorize firms, and the results remain robust.

Multi-importer firms. Exporters with multiple U.S. importers (i.e., a larger customer base) can mitigate risks associated with fluctuations in demand or economic downturns, making them less vulnerable to disruptions in a particular sector or geographic region. We categorize Russian exporters into single-importer and multi-importer firms based on how many U.S. importers they had before the sanctions and estimate whether their responses to the sanctions differ. The results are presented in Panel B of Table 6. It shows that the reduction in export value and quantity is larger for single-importer firms compared with multi-importer firms.

Multi-product firms. Multi-product exporters dominate international markets and have an additional internal margin through which they can reallocate resources when facing shocks (e.g., Bernard et al., 2011 and Mayer et al., 2021). To investigate whether the impact of sanctions differs between multi-product and single-product exporters, we classify exporters into these two groups based on the number of products they exported prior to the sanctions. The results are presented in Panel C of Table 6. As shown in the table, multi-product exporters experienced a larger reduction in export value and quantity. This may suggest that products within an exporter may be complementary to one another, or there are firm-level economies of scale so that the negative impact on a given product is larger when there are multiple products (which are all affected by the sanctions).

6. Conclusion

In recent years, sanctions have played a critical role in shaping international relations, particularly in the context of Russia. Following the Russia-Ukraine war in 2022, the U.S. has imposed unprecedented and severe sanctions against Russia. The goal of this paper is to examine the effect of the recent trade sanctions on Russia, with a specific focus on the Suspending Normal Trade Relations with Russia and Belarus Act (NTR Act) issued by the U.S., which increased import tariffs on Russian goods from Most Favored Nation (MFN) rates to column 2 rates. Studying the case of Russian sanctions, we find that products facing greater exposure to sanctions experienced larger declines in trade margins. On average, export value and quantity fell by 67.3 % and 62.3 % following the sanctions respectively, while export price remained unaffected. Moreover, there was a 16.6 % reduction in the number of U.S. importers and an 11.6 % decrease in the number of Russian exporters.

Considering that the U.S. sanctions changed frequently, this paper tries to isolate the effect of the NTR Act from other sanctions after 2022 by excluding other sanction packages and export/import bans. Furthermore, the influence of external factors such as the pandemic, the Russia-Ukraine war itself, and reputation concerns could potentially affect Russia's trade margins after February 2022. These factors are carefully addressed in the robustness checks to ensure a reliable estimation of the impact of sanctions on Russian trade dynamics. In addition, we show that firm size, the number of importers and the range of products matter for exporters' capacity to absorb the adverse impact of sanctions. Such heterogeneity is likely due to exporters' ability to divert trade and reallocate resources to mitigate risks associated with demand fluctuations and economic downturns.

Data availability

The authors do not have permission to share data.

Declaration of competing interest

None

Supplementary material

Supplementary material associated with this article can be found in the online version at [10.1016/j.jebo.2025.107314](https://doi.org/10.1016/j.jebo.2025.107314).

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