

Shooting down trade: Firm-level effects of embargoes*

Uğur Aytun,[†] Julian Hinz,[‡] and Cem Özgüzel[§]

April 2024

Abstract

In November 2015, Turkey unexpectedly downed a Russian military jet in Syria. Russia retaliated by imposing a sudden and complete embargo on certain Turkish exports effective within a month. We exploit this quasi-natural experiment to estimate the supply side effects of imposing and lifting the sanctions. Using administrative data covering all Turkish exporters, we first document the trade effects on the intensive margin of firms. We consider the direct embargo impact, diversion effects to other destinations, and circumvention effects towards other products. Second, we investigate the broader consequences of sanctions on firms' domestic sales, purchases, and employment, uncovering significant and lasting impacts beyond trade outcomes. We find that firms are affected temporarily — shifting trade and adjusting domestic sales, purchases and employment — but do not suffer long-lasting effects after the lifting of the embargo.

Keywords: Sanctions, Embargoes, Firm-level effects, Gravity

JEL Classification: F10, F13, F14, F51

*We thank Seyit Mumin Cilasun, Lionel Fontagné, Ariell Reshef, Erol Taymaz, Yoto Yotov, and seminar/conference participants at the Paris School of Economics, 26th ERF Conference, 19th MEEA Conference, World Trade Forum 2023, 2023 IATRC Annual Meeting, and CEPII for useful feedback. We want to thank the Turkish Statistical Institute (TURKSTAT) and Ministry of Science, Industry and Technology for providing access to their datasets. The views expressed herein are those of the authors and do not necessarily reflect the views of their institutions.

[†]Dumlupınar Üniversitesi. E-Mail: ugur.aytun@dpu.edu.tr

[‡]Corresponding author: Bielefeld University & Kiel Institute for the World Economy. E-Mail: mail@julianhinz.com.

[§]Paris School of Economics & Centre d'Economie de la Sorbonne & IZA Labor Institute. E-Mail: cem.ozguzel@univ-paris1.fr

1 Introduction

On the morning of 24 November 2015, a Russian Sukhoi Su-24 fighter jet entered 2.19 kilometres inside the Turkish border, violating Turkish airspace for 17 seconds. After multiple warnings, a Turkish Air Force F-16 fighter shot down the Russian jet. A few days later, Russia retaliated by announcing an embargo on Turkish exports that would be effective within a month. The embargo covered 17 products and lasted 22 months, ending only when Turkish President Erdogan apologized to Russian President Putin.

Countries have long used economic sanctions to punish their adversaries as retaliation for such events.¹ Sanctions can take many forms, including restrictions on imports or exports, on bank activities and financial operations, travel bans or arms embargoes. Recent (and ongoing) examples include sanctions imposed on Iran, North Korea, and Russia. Given the frequent use of such tools as part of foreign policy, assessing the magnitude of economic costs and the channels through which sanctions may operate is crucial.

In this paper, we assess the consequences of trade sanctions on the receiving country's exporters, leveraging the unexpected embargo imposed by Russia on Turkey as a response to the military incident. First, building on structural gravity estimations, we use a triple difference estimation strategy to identify the impact of the embargo as an interaction of three margins: embargoed vs non-embargoed goods, exports to Russia vs. other countries, and pre-embargo and post-embargo periods. Distinguishing these margins allows us to identify three effects: first, we can measure the decline in exports of sanctioned products to Russia after the embargo. These declines constitute the *embargo effect*. Second, faced with sanctions, part of the exports that would have been sent to Russia were diverted to non-sanctioning countries with historical and geographical ties to Russia. This is the *diversion effect*. Finally, exports of non-embargoed and close substitutes to embargoed goods towards Russia could also be affected due to the tensions between the two countries, or because of relabelling or further processing of the embargoed products. These declines (or increases) are unintended effects of sanctions and constitute the *circumvention effect*. We also estimate the lifting effects of the sanctions.

We conduct this analysis into the firm-level trade effects using the Turkish Customs data made available by the Turkish Statistical Institute (TURKSTAT), which covers the universe of Turkish exporters and provides comprehensive information on export transactions at the firm level every month. However, since our triple difference estimation in the gravity model incorporates factors such as destination, product, and time, controlling for shocks at this level becomes challenging. To address this issue, we make use of a novel methodological

¹Use of economic sanctions to achieve foreign policy goals can be traced back in history. The Megarian decree in 432 BC offers one of the earliest examples of economic sanctions where the Athenian Empire banned trade with the city-state of Megara. In their review of 174 sanction episodes since World War I, Hufbauer et al. (2008) show the growing frequency of using sanctions.

approach proposed in Aytun et al. (2024), combining the Turkish Customs data with global product-level trade data from UN COMTRADE, which provides information on the origin, destination, product, and time for almost all countries. Using this data, we can introduce very flexible fixed effects for Turkish firms, other origin countries, and destinations.

We find that the embargo effectively — and as expected — wiped out Turkish exports of affected products to Russia while increasing flows to diversion destinations. Other related products also saw some negative impact, despite not being directly embargoed. Importantly — especially as a policy conclusion — these effects effectively return to pre-sanction levels after the lifting of sanctions.

Then, in the second part of our analysis, we broaden our investigation to explore how sanctions impacted firms in ways beyond just their trade activities. We accomplish this by merging several administrative datasets using unique firm identifiers. Through this approach, we examine how sanctions influenced various aspects of firms' operations, such as domestic sales, purchases, relationships with other firms, and employment levels. Our findings reveal immediate negative effects on employment, purchases, and domestic sales. This indicates that the impact of the sanctions extends beyond just exports, disrupting the regular operations of affected firms to a considerable extent. Furthermore, some of these effects do persist over time, as evidenced by the continued subdued activity of firms even after the embargo is lifted.

This paper contributes to the literature on sanctions and, more precisely, their impact on exporters (Haidar, 2017a; Crozet and Hinz, 2020; Crozet et al., 2021). It stands out as the first study to exploit a well-defined natural experiment to identify and estimate the causal effects of a product embargo on a sanctioned country's exports and exporters. The military conflict's unexpected nature, Russia's swift response, and the embargo's limited scope to specific products, without additional sanctions on financial institutions, the absence of reciprocal countermeasures by Turkey distinguish it from previous cases and allows for a more precise measurement of the effects of the Russian embargo.

A host of recent works studies the effect of sanctions at the firm-level for various sanctioning countries (Crozet and Hinz, 2020; Crozet et al., 2021; Görg et al., 2023; Kohl et al., 2024; Jäkel et al., 2024) or the target (Nigmatulina, 2021; Haidar, 2017b). While the overall results are consistent in their main message — the imposition of sanctions (unsurprisingly) hurts affected firms — few of these works investigate the aftermath of sanctions after they are lifted. The sanctions episode studied here allows us to do so and show that sanctions appear to have a long-run scarring effect on exposed firms.

The paper also stands out by leveraging a combination of administrative datasets, providing a comprehensive understanding beyond mere trade flows. By merging these datasets, the analysis extends beyond the impact on firms' exports to capture the broader conse-

quences on other economic activities and employment. This approach enables a more comprehensive assessment of the firm-level effects of the sanctions. Furthermore, the wealth of information on firm characteristics facilitates an examination of the diverse impacts of sanctions across different types of firms which is valuable for understanding the effectiveness of these sanctions.

The rest of the paper is structured as follows: In section 2 we provide a short summary of the political context. We provide a simple model for exports at the firm and aggregate country level in section 3 and describe its estimation in section 4. The datasets used in the exercise are described in section 5. We then estimate the impact on trade flows in section 6, before studying other outcomes at the firm level for entities exposed to the embargo in section 7. Section 8 concludes.

2 Context and political background

2.1 Russian Sukhoi Su-24 shootdown

On November 24, 2015, a Russian Sukhoi Su-24 aircraft, with the tail number 83, was returning to the Khmeimin airbase in Latakia, Northern Syria, approximately 35 kilometres south of the Turkish-Syrian border. As the aircraft approached Turkish airspace, Turkish ground-control officials issued repeated warnings, urging the Russian aircraft to alter its course. Despite ten warnings over five minutes, the Russian plane did not change its trajectory and breached Turkish airspace, penetrating about 2.19 kilometers for approximately 17 seconds.

In response, Turkish F-16 aircraft patrolling the Turkey-Syria border shot down the Russian aircraft with an air-to-air missile. The Russian plane, struck by the missile, returned to Syrian airspace before crashing into the mountainous Jabal Turkmen region in Latakia, an area contested by the Syrian government and rebel forces. Both pilots were ejected from the aircraft. One pilot was killed by ground fire from Turkmen rebels while still in the air, and the other was captured upon landing.

A few hours after the incident, Russian President Vladimir Putin condemned the shootdown, characterizing it as a "stab in the back by terrorist accomplices". He said Russia would not tolerate such attacks, hinting at potential repercussions for Russia-Turkey relations (BBC, 2015). In response, Foreign Minister Sergey Lavrov cancelled a planned visit to Turkey, and protests erupted outside the Turkish Embassy in Moscow. On 26 November, Prime Minister Dmitry Medvedev declared that Russia would retaliate with extensive economic sanctions against Turkey (Nissenbaum et al., 2015).

2.2 Timeline of the sanctions

On November 28, Russian President Vladimir Putin endorsed presidential decree number 583, establishing the legal basis for implementing economic embargoes on Turkish goods and services. Subsequently, the Russian Government issued Executive Order 1296 on November 30, 2015, outlining the sanctions on Turkey, which were set to take effect on January 1, 2016. These measures included restrictions on Turkish companies operating in Russia, hiring new Turkish workers, the suspension of visa-free travel between the two countries, and the prohibition of charter flights to Turkey. Additionally, Russia imposed an embargo on 17 Turkish products categorized by HS-6 codes, encompassing fruits, vegetables, flowers, chicken, turkey, and salt, effective from January 1, 2016.²

Over the subsequent two years, these prohibitions were progressively eased. The initial modification occurred in October 2016 when Russia removed five products from the list, reducing the number of banned items to 12. Subsequently, in March 2017 and June 2017, Russia excluded four and seven products, respectively. Ultimately, on November 1, 2017, Russia lifted the ban on the remaining product (tomato, HS-6 code 070200) from the list, concluding the embargo.

2.3 Turkish exports to Russia and the rest of the world

The Russian Federation stands as a significant trading partner for Turkey. In 2015, it ranked 11th among destinations for Turkish exports and fifth outside the European Union, trailing only Iraq, the United States, the United Arab Emirates, and Iran. Notably, it became the second-largest importer of Turkish goods following sanctions imposed on Belarus.

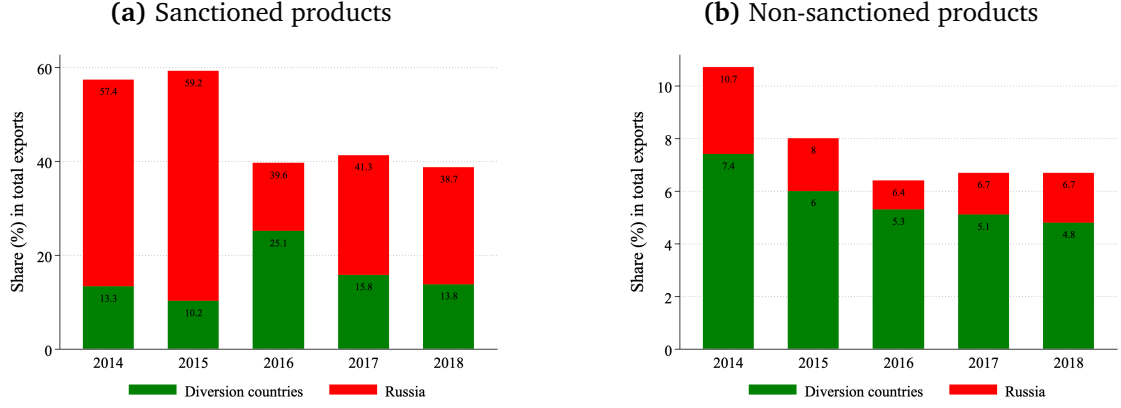
The imposed sanctions measures targeted a considerable portion of Turkish exports to Russia, comprising nearly half (49%) of total exports in 2015. Notably, likely trade diversion destination in the proximity of Russia³ received 10% of Turkish exports of sanctioned products during that period (Figure 1a). Together, Russia and possible diversion countries received 60% of the total exports of sanctioned goods. In contrast, products not subjected to sanctions constituted only 2% and 6% of Turkey's total export volume to Russia and these countries, respectively (Figure 1b).

The imposition of sanctions had a discernible impact on overall Turkish exports to Russia. Within the first year of sanctions, Turkish exports to Russia plummeted by 52%. Concurrently, exports to countries neighbouring Russia — the so-called diversion countries — experienced a 10% decrease. However, exports of sanctioned products to these neighbouring countries surged by an impressive 105 percent, indicative of their role in circumventing the sanctions.

²For a comprehensive list of the sanctioned products refer to the appendix A.

³These countries include Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Tajikistan, Turkmenistan, Ukraine, Uzbekistan.

Figure 1: Importance of Russian and diversion markets for Turkish exports



Notes: The figures show the value of exports to 14 diversion countries (see main text for the list) and to Russia relative to all Turkish exports for sanctioned products (Panel A) and non-sanctioned countries (Panel B). Source: TURKSTAT

3 Model for exports at the firm and country level

We will now outline a simplified model of international trade that forms the theoretical basis for the estimation of the trade effects of the embargo.

Demand in destination country d for a product k at time t is governed by a utility function that aggregates over the set Θ_d of all available varieties i ,⁴ such that

$$U_{dkt} = \left(\int_{i \in \Theta_d} (a_{idkt} q_{idkt})^{\frac{\sigma-1}{\sigma}} di \right)^{\frac{\sigma}{\sigma-1}}. \quad (1)$$

The elasticity of substitution is $\sigma > 1$, q_{idkt} is the quantity of variety i consumed in country d , and a_{idkt} is a demand shifter.⁵ The demand in market d for a firm i at time t is then given by

$$x_{idkt} = \left(\frac{p_{ipt}}{a_{idkt}} \right)^{1-\sigma} A_{dkt} \tau_{odkt}^{1-\sigma}. \quad (2)$$

A_{dkt} characterizes country d 's overall propensity to import product k from all countries, i.e., total expenditure on product k and multilateral resistance. The term p_{ikt} is the factory gate price charged by firm i irrespective of the buyer. Each firm i is located in a country o such that ad-valorem trade cost between origin country o and destination country d for product k are described by τ_{odkt} .

Let $a_{idkt} = (\psi_{idk} e^{\epsilon_{idkt}})^{-1}$, where ψ_{idk} summarizes firm i 's time-invariant non-price determinants of competitiveness on market d , and ϵ_{idkt} is a random shock. Rearranging equation

⁴A variety i is produced by a single firm, which hence can also be indexed i .

⁵ a_{idkt} captures firm-level characteristics, such as the quality of the offered variety i as perceived by consumers in country d , but also its network with purchasers in market d .

2, we obtain firm exports as

$$x_{idkt} = (p_{ikt}\psi_{idk}e^{\epsilon_{idkt}})^{1-\sigma} A_{dkt}\tau_{odkt}^{1-\sigma}. \quad (3)$$

Summing over all firms in a given origin country, country-level exports from country o to country d of product k at time t are expressed by

$$x_{odkt} = \sum_{i \in o} x_{idkt} = N_{okt} A_{dkt} (\bar{\psi}_{odk} \tau_{odkt})^{1-\sigma} e^{\epsilon_{odkt}}. \quad (4)$$

N_{okt} summarizes exporter \times product \times time-specific effects of firms from country o producing k at time t , e.g. the number of firms, their total sales, and the country's multilateral resistance. $\bar{\psi}_{odk}$ is an aggregate of determinants of the competitiveness of firms from country o in the country d , and ϵ_{odkt} is an error term.

Finally, assume that sanctions affect trade through changes in the trade costs so that $\tau_{odkt} = \tilde{\tau}_{odkt} e^{\delta_k S_{odkt}}$, where S_{odkt} is an indicator for a sanctions measure in place, δ_k the product-specific sanctions effect, and $\tilde{\tau}_{odkt}$ other standard trade costs.

4 Estimation with firm *and* country-level data

This model setup allows us to flexibly estimate a gravity equation at the firm or at the country level. Following the novel estimation strategy proposed by Aytun et al. (2024), we combine firm-level data from Turkey and and country-level data from UN Comtrade. Combining both datasets enables us to include the most flexible sets of fixed effects, even for firm-level estimations. Without including the country-level data, the destination \times product \times time fixed effect, Γ_{dkt} , would be collinear to the variable of interest, S_{odkt} , as the origin would always be the same. Adding multiple origin countries with country-level data solves this problem.

Therefore we can estimate equation (3) and (4) *jointly* as

$$X_{\{i,o\}dkt} = \exp(\Gamma_{\{i,o\}kt} + \Gamma_{dkt} + \Gamma_{\{i,o\}dkm} + \delta_k S_{odkt}) \quad (5)$$

where $X_{\{i,o\}dkt}$ are flows from either firm i or country o to country d of product k at time t , $\Gamma_{\{i,o\}kt}$ is a firm- or country-level origin \times product \times time fixed effect, Γ_{dkt} a destination \times product \times time fixed effect, and $\Gamma_{\{i,o\}dkm}$ a firm- or country-level bilateral origin \times destination \times product \times month fixed effect. δ_k measures the (average) effect of a sanctions measure, as indicated by the dummy variable S_{odkt} . Hence, combining firm-level and country-level trade data allows us to estimate the firm-level effects of sanctions while all three sets of fixed effects.

5 Data and summary statistics

We bring together several firm-level administrative datasets for the analysis. First, we use Turkish Customs data, referred to as “Dış Ticaret İstatistikleri” in Turkish, collected by the Ministry of Trade and provided by the Turkish Statistical Institute (TURKSTAT). This dataset allows us to explore the impact of sanctions on bilateral trade at the firm level. It covers all exporting firms, offering monthly trade data from 2002 onwards at the 6-digit HS level. The data provides details on the firm, product, and destination, facilitating the analysis of bilateral trade evolution and firm-level trade over time. Trade data includes the value and volume of trade measured in USD.

We extend the firm-level trade data by merging domestic firm-to-firm network data, known as “Beyan Alış-Beyan Satış Verileri” in Turkish, collected by the Ministry of Treasury and Finance and provided by Enterprise Information System (EIS) of the Ministry of Science, Industry, and Technology in Turkey. This dataset provides detailed information on domestic sales and purchases at the firm level, specifically for transactions exceeding 5,000 TL (equivalent to 3,200 USD in 2012). Using the data on firms’ networks, we match firms with their customers (suppliers) and the sales (purchases) they make. Furthermore, we use firm registry data, offering industry and location information for firms in Turkey. The four-digit NACE classification system helps identify embargo-related purchases by firms and the total domestic sales of embargo-related suppliers to exporters.

We merge the data with social security data, known as “Sosyal Güvenlik Verileri” collected by the Ministry of Labour and Social Security and provided within the Enterprise Information System (EIS). Using unique firm identifiers, we match firms with their data on total employment, wages, and workdays of employees.

Lastly, we supplement this dataset with UN COMTRADE, providing global trade data and enabling the inclusion of the preferred set of fixed effects. We focus on the two-digit chapters of embargoed products in both datasets, specifically chapters 2, 6, 7, 8, and 25. Notably, in trade statistics, observations only represent non-zero flows. Due to the nature of the Russian embargo, there were virtually no export flows of affected goods to Russia during the embargo period. We impute these cases with zero values along the included dimensions of the fixed effects, allowing us to capture the decline in exports to Russia and compare its effects with other countries.

5.1 Sample

Utilizing unique firm identifiers, we merge all the aforementioned information across datasets. As previously discussed, our sample is confined to firms involved in trading products classified under chapters 2, 6, 7, 8, and 25.

Table 1 presents summary statistics for firms involved in the first part of the analysis,

Table 1: Summary statistics of firms in 2015

Panel A: Sanctioned product exporters			
	Russia	Diversion	All
Number of firms	407	619	1,589
Number of products exported	7	5	4
Number of destinations served	4	3	2
Total export	957,108	462,527	172,509
Panel B: All exporters			
	Russia	Diversion	All
Number of firms	629	18,959	5,613
Number of products exported	4	2	1
Number of destinations served	4	2	1
Total export	858,195	77,704	43,140

Notes: This table displays summary statistics for the sample of Turkish exporters utilized in the analysis, drawn from customs data supplied by TURKSTAT. Panel A details exporters trading in sanctioned products, while Panel B encompasses all Turkish exporters, including those in Panel A. Column headers indicate whether the exporter trades with Russia, *Diversion countries*, and all countries worldwide.

focusing on product exports using customs data from TURKSTAT. Firms may export both sanctioned and non-sanctioned products to Russia and other countries.

Panel A outlines exporters dealing in sanctioned products. In 2015, approximately 1589 firms engaged in exporting such products. Among them, 407 firms exported to Russia, while 619 firms exported to diversion countries. The remaining 563 firms exported to other nations. On average, firms trading with Russia and diversion countries exported eight different products, slightly higher than the overall average of seven products for all exporters. Similarly, firms exporting to Russia and diversion countries typically engaged with four countries, twice as many as those exporting to all countries.

Panel B provides comparable statistics for all exporters, including those in Panel A. It shows that, in contrast to firms exporting sanctioned products, the median Turkish exporter shipped fewer products (four) but to a similar number of destinations (two). These findings imply that firms dealing in sanctioned products or exporting to Russia did not differ much from other exporters in terms of trading partners and traded products.

Table 2 presents summary statistics for the second phase of the analysis, focusing on firm-level outcomes beyond trade. The analysis categorises firms into two groups: those trading sanctioned products with Russia are labelled as exposed to the embargo (i.e., Treated group), while others are deemed unaffected (i.e., Control group).

The table indicates that firms in both groups have comparable employees, pay similar average wages, and collaborate with the same number of domestic customers. However, firms exposed to the embargo exhibit greater activity in the domestic market. They conduct

Table 2: Summary statistics of firms in 2015

	Treated	Control
Number of employees	13	15
Average wage (in TL)	43.30	46.13
Domestic sales (in TL)	6,441,105	4,385,632
Number of domestic customers	2	2
Domestic purchases (in TL)	4,992,482	3,662,604
Number of domestic suppliers	8	5
Domestic agri. purchases (in TL)	358,037	123,140
Number of domestic agri. suppliers	8	5
Domestic sales of agri. producers (in TL)	616,480	878,510
Number of domestic suppliers of agri. producers	1	2

Notes: This table displays summary statistics for the sample of Turkish exporters utilized in the analysis, drawn from firm-level data provided by Enterprise Information System (EIS).

more domestic sales and purchases and engage with a higher number of domestic suppliers.

6 Impact on firm exports

We first estimate the intensive margin of trade, measuring the immediate effects of the embargo on Turkish firms' export of affected products to Russia. In principle, similar exercises have been common in the recent related literature. Crozet and Hinz (2020) estimate the effect of the Western sanctions and Russian countermeasures imposed since 2014 on French firms' exports. They find — unsurprisingly — that trade in embargoed products effectively stops, while — more surprisingly — the bulk of the overall effect on trade is seen in very indirectly affected products, mostly those using intensively trade finance measures. Görg et al. (2023) run similar regressions on newly available German firm-level trade data. Finally, Kohl et al. (2024) and Jäkel et al. (2024) analyze the effect of the 2014 Russia sanctions on Dutch and Danish firm-level exports, respectively. However, all employed empirical setups have in common that they do not adequately control for unobservable time-varying characteristics at the destination country level. This appears to be particularly relevant for analyzing the effect of sanctions, as, arguably, sanctioned countries are peculiar and warrant controlling for shocks observed in the destination country. In principle, of course, this issue is present in all single-country firm-level estimations of trade policy changes.

By combining Turkish firm-level data and global product-level data following Aytun et al. (2024), we can overcome this issue, as outlined in section 4. Therefore, our preferred specification of equation (5) is using the full sets of fixed effects as suggested by the model structure.

Table 3: Intensive margin — embargo, diversion and circumvention effect

Model:	(1)	(2)	(3)	(4)
	Two-way	Two-way with est. FE	Three-way	Three-way with global data
<i>Variables</i>				
Embargo × imposition period	-14.3693*** (0.6742)	-12.9385*** (0.7310)	-13.6260*** (1.0807)	-13.3238*** (0.7000)
Embargo × lifting period	-0.7000*** (0.2061)	-0.1752 (0.1484)	-0.1518 (0.2411)	0.0207 (0.2240)
Diversion × imposition period	0.0831 (0.1308)	0.1730 (0.1191)	0.0607 (0.1672)	0.6730*** (0.1914)
Diversion × lifting period	-0.2351* (0.1346)	-0.0488 (0.1088)	-0.0977 (0.1786)	0.2460 (0.1663)
Circumvention × imposition period	-0.4436*** (0.1429)	-0.4077*** (0.1399)	0.0813 (0.2107)	-0.4136* (0.2217)
Circumvention × lifting period	-0.2090 (0.1413)	-0.1058 (0.1328)	0.5076** (0.2111)	-0.1635 (0.2356)
Est. destination × product × time FE		0.8567*** (0.0472)		
Russia embargo × imposition period				-4.6770*** (0.2642)
<i>Fixed-effects</i>				
Observations	1,185,212	1,114,179	1,179,861	13,001,185
Origin × product × time	Yes	Yes	Yes	Yes
Origin × destination × product × month	Yes	Yes	Yes	Yes
Destination × time	No	No	Yes	No
Destination × product × time	No	No	No	Yes

Notes: The table shows the impact of Russian sanctions on export values, utilizing the triple-difference methodology with a PPML estimator. The term "embargo" denotes the sanctioning country (Russia), and "diversion" refers to countries geographically and historically related to Russia. The "imposition period" represents the duration of the sanction on the relevant product. "Lifting" signifies the period from the lifting date of the sanction to December 2018. "Circumvention" pertains to a four-digit substitute for embargoed products exported by Turkey to Russia, treated as imposition from January 2016 to October 2017 and as lifting from November 2017 to December 2018. In the first three columns, only firm-level data is utilized. The first column incorporates origin × product × fixed effects and origin × destination × product × month fixed effects. The second column adds estimated destination × product × time fixed effects using COMTRADE data, while the third column replaces them with destination × time fixed effects. The final column combines firm-level and product-level COMTRADE data, introducing destination × product × time fixed effects. Russia embargo × imposition period controls Russia sanctions to EU in 2014. All columns include a sample covering corresponding two-digit chapters (2, 6, 7, 8, 25) of embargoed products in the HS classification. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at origin (or firm) × product.

The results are displayed in Table 3.⁶ The results for our preferred specification are displayed in column (4). The embargo effectively reduces trade to zero for affected products ($(\exp(13.052) - 1) \cdot 100 \approx -99.99979\%$). Importantly, after the embargo was lifted, the effect does not persist and exports of previously sanctioned products return to almost the same level as before the measures were imposed. Interestingly, but not unexpectedly, affected firms divert trade to third markets, almost doubling flows there ($(\exp(0.681) - 1) * 100 \approx +97.6\%$). Again, importantly, these changes do not persist, as

⁶We examine the impact of firm size on the response to the Russian embargo in the appendix, Table 6. There, we introduce interaction terms between the total export value and the number of products firms export, along with our variables of interest.

flows after lifting sanctions remain 28% higher compared to the pre-period. Another effect that is often found in the related literature is that related products — here defined as being in the same HS4 chapter as embargoed ones — are also affected, either positively as firms circumvent measures by exporting (or labelling as) slightly different products, or negatively as firms hold off exports of unaffected products because of legal ambiguities. We find a negative circumvention effect in our estimations — non-embargoed products were also affected — but the effect again vanishes after the measures are lifted. Note that in our preferred specification with country-level data we also control for Russia's embargo on food and agricultural products from EU countries starting in 2014 to capture the diverted demand shocks for Turkish exports.

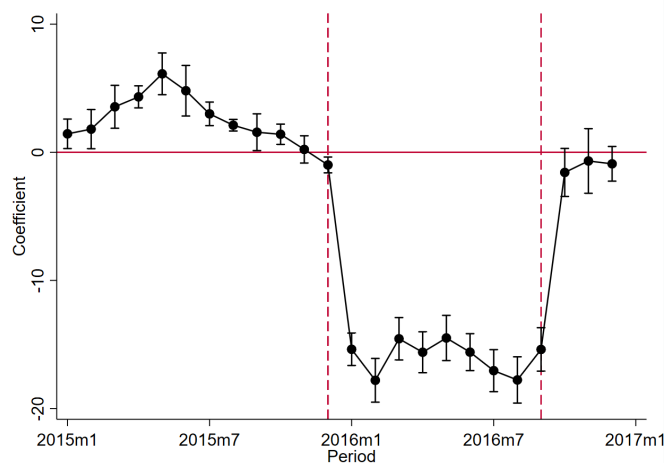
We contrast our preferred specification with customary approaches to estimating the effect of trade cost changes — here sanctions — on firm exports. Table 3 column (1) reports the results for a two-way fixed effects setup that controls for origin \times product \times time and bilateral origin \times destination \times product \times month characteristics, but omits any destination market controls. Column two is identical in the sets of fixed effects, but introduces *estimated* fixed effects on global data to control for destination market shocks.⁷ Column (3) adds a third set of fixed effects, however, at the destination \times time level, omitting the product dimension. This, therefore, identifies the effects of the sanctions in this remaining product-level variation. Remarkably, coefficients across these less preferred specifications vary widely. While all estimations pick up the direct embargo imposition effect, the lifting effect varies from an economically and statistically significant negative -50% to insignificance. The same picture holds true for diversion effect, which are estimated as either significantly positive, negative, or insignificant. Circumvention effects, again, vary widely. For the reason explained above — including the most flexible three sets of fixed effects by combining firm-level and country-level data — our preferred specification in column (4) also reports the most sensible results.

We report the outcomes of a simple event-study exercise analogous to specification 4 in Figure 2. The plot shows the evolution of the coefficient on the embargo effect when interacted with time dummies. The dramatic drop for the time of the imposition of the embargo is evident.

As these results clearly show, the embargo had a clear-cut and lasting effect on exposed firms in terms of lower sales to Russia and comparatively higher sales to third markets. The question now is: Did it matter for these firms?

⁷Compare e.g. Crozet and Hinz (2020) and Crozet et al. (2021), who follow this approach.

Figure 2: First twelve months of embargo: Monthly plot estimates



Notes: This figure illustrates the coefficient of the regression examining the monthly effects of the imposition and lifting of the embargo from January 2015 to December 2016. Identification is equivalent to an intensive margin equation using global data. The first dashed line denotes the period of sanction introduction, while the other represents the lifting period of the first group of products.

7 Impact on other firm outcomes

This section examines the embargo's impact on different firm-level outcomes beyond trade. As outlined in the previous section, the analysis concentrates on firms identified by their export activities before the 2016 sanctions. This approach mirrors earlier discussions, where a firm's exposure to the embargo depends on its trade in sanctioned products with Russia before the sanctions.

However, this analysis differs from the previous section by classifying firms as exposed if they traded any sanctioned product instead of assessing exposure at the product level. More concretely, if a firm in 2015 exported only goods whose sanctions were lifted in October 2016, we treated this firm until from January 2016 to September 2016. If it exported all embargoed products to Russia in 2015, then we choose the entire sanction period (from Jan 2016 to October 2017) as treated for this firm. Other variables and lifting periods have been generated in the same way.

We measure the effects on firm-level outcomes using a simple difference-in-differences model. We estimate the following specification:

$$\begin{aligned}
 y_{it} = & \exp(\beta \cdot \text{embargo}_{it} + \eta \cdot \text{embargo lifting}_{it} \\
 & + \theta \cdot \text{embargo}_{it} \times \text{firm characteristics}_i \\
 & + \mu \cdot \text{embargo lifting}_{it} \times \text{firm characteristics}_i \\
 & + \psi_{im} + \phi_t).
 \end{aligned} \tag{6}$$

The subscripts i , m , and t represent the firm, month, and time, respectively. We focus on the effects of Russian embargo on various firm-level measures related to the domestic trade and employment.

We focus on the following outcomes: i) the total sales value, ii) the total number of customers, iii) the total purchase value, iv) the total number of suppliers, v) the total purchase value related to sanctioned goods, vi) the total number of suppliers related to sanctioned goods, vii) the number of employees, and viii) the average daily wage of the employees in the firm. The variables ψ_{im} and ϕ_t represent firm \times month and period fixed effects, respectively.

embargo_{it} is a dummy variable that takes one for firms that exported sanctioned products to Russia in 2015 during the sanctioning period. As such, β captures the effect of embargoes on exposed firms' outcomes during the sanction period. η captures the evolution of firm outcomes during the months after the sanctions were lifted.

θ and μ capture the uneven effects of imposition and lifting periods for firms with different characteristics before the sanctions in 2015.

In the control group we have two sets of firms. First group includes firms exporting similar yet non-embargoed products (of HS chapters 2, 6, 7, 8, and 25) to Russia in 2015. Second, we include firms that export embargoed products to other countries in 2015. As such, the effects captured in the model measure the average treatment effect relative to these firms in the control group.

7.1 Impact on domestic sales, supply chains and purchases

Table 4 presents the estimation results for various outcome variables related to domestic trade, following equation (6). The first two columns show the embargo's impact on total domestic sales (by value) and the number of domestic customers for exporters. The first column shows that firms exposed to sanctions did not see any change in their domestic sales compared to exporters unaffected by the sanctions. However, the second column indicates that sanctioned firms interact with fewer domestic firms, suggesting they have reduced their transactions with domestic firms during the imposition and lifting of sanctions. Put differently, the affected firms have concentrated their sales among fewer firms.

Columns 3 and 4 focus on total domestic purchases and the number of suppliers. Both columns reveal that exporters of sanctioned products to Russia have reduced their purchases and supplier connections. This indicates that affected firms have reduced their transactions with downstream firms. The reduction trend persists even after the embargo period, suggesting long-term impacts on firms' supply chain activities.

Focusing on agriculture and salt purchases related to sanctioned products, columns 5 and 6 show a negative and significant effect during the embargo's imposition period.

Table 4: Domestic trade effects of embargo

Model:	(1)	(2)	(3)	(4)	(5)	(6)
	Domestic Sales (Value)	Customers	Purchases (Value)	Suppliers	Agri/Salt Purchases (Value)	Agri/Salt Suppliers
<i>Variables</i>						
Embargo	-0.0367	-0.1135**	-0.2176***	-0.1236***	-0.2267**	-0.1255**
× period imposition	(0.0499)	(0.0514)	(0.0481)	(0.0374)	(0.1128)	(0.0634)
Embargo	-0.0002	-0.1831**	-0.1845***	-0.1232***	-0.1615	-0.1428*
× period lifting	(0.0652)	(0.0851)	(0.0706)	(0.0470)	(0.1206)	(0.0820)
<i>Fixed-effects</i>						
Firm × month	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes	Yes
Observations	302,409	302,409	303,134	303,134	55,169	55,169

Notes: This table shows the impact of Russia sanctions on the domestic trade of Turkish firms, using a difference-in-differences methodology with a PPML estimator. The sample encompasses firms exporting products falling within the two-digit HS chapters (2, 6, 7, 8, 25) of embargoed goods. The variable "Embargo" is a dummy that takes one if a firm exports embargoed products in 2015. "Period Imposition" takes the value of one during the period whose duration is equal to the longest sanction duration among the products they exported. "Period Lifting" is a dummy variable taking the value of one from the lifting date of the sanction to December 2018. Header of each column shows the outcome variable. While columns 1 to 4 show the effect of embargo on the domestic sales and purchases in terms of value and number of links (customer and suppliers), 5 and 6 present the estimates of purchase value and the number of supplier in the industries providing embargo related products to exporters. These industries correspond (100-500, 893, and 1011) to the NACE classification of sanctioned HS products.

This indicates that firms exporting sanctioned products to Russia reduced some essential purchases and connections crucial for their exporting activities, at least during the sanction period. Once the sanctions were lifted, these firms' purchases did not significantly differ from other firms. These results are consistent with those related to the intensive margin of trade using global data in Table 3, suggesting that these firms resumed exporting sanctioned products to Russia once the sanctions were over. This observation explains the insignificant effect on purchases during the lifting period noted in the last two columns. Meanwhile, total purchases and the number of suppliers remained unchanged during the lifting period, as reported in columns 3 and 4.

7.2 Firm employment and wages

Table 5 explores the embargo's impact on employment and wages. The first two columns focus on exporters of embargoed products, while the last two examine their suppliers. The first column reveals that exporters to Russia of sanctioned products reduced their workforce during the imposition period of the embargo. Notably, this effect, in terms of its magnitude, persists even after the lifting of the embargo. This suggests that the negative impact on the labour market continues even as exports recover quickly. There is no significant impact of the sanctions on the average wage of these firms.

Columns 3 and 4 apply the same analysis to suppliers of the aforementioned exporters. No

Table 5: Effect of embargo on employment and average wages

Model:	(1)	(2)	(3)	(4)
	Exporters		Suppliers	
	Number of employees	Ave. daily wage	Number of employees	Ave. daily wage
<i>Variables</i>				
Embargo	-0.1108***	0.0102	0.0079	-0.0296*
× period imposition	(0.0411)	(0.0221)	(0.0457)	(0.0162)
Embargo	-0.1993***	-0.0141	0.0507	0.0283
× period lifting	(0.0760)	(0.0239)	(0.0534)	(0.0198)
<i>Fixed-effects</i>				
Firm × quarter	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes
Observations	99,492	99,492	40,386	40,386

Notes: This table shows the effect of Russia sanctions on the number of employees (columns 1 and 3) and average daily wages (columns 2 and 4) of Turkish firms using difference-in-differences methodology with PPML estimator. In columns 1 and 2 sample covers the firms exporting the products that two digit HS chapters (2, 6, 7, 8, 25) of embargoed products. Embargo variable in these columns is the dummy that takes one if a firm exports embargoed products in 2015. In columns 3 and 4 the sample covers agricultural firms selling products to exporters within the two-digit HS chapters (2, 6, 7, 8, 25) of embargoed goods. Embargo variable in these columns is the dummy that takes one if a firm exports embargoed products in 2015. Period imposition takes the value of one in the period whose duration is equal to the longest sanction duration among the products they exported. Period lifting is the dummy taking value of one from the lifting date of the sanction to Dec 2018. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at firm and time.

significant effect on labour market outcomes was detected for these firms. When these findings are combined with those related to domestic sales and the number of links for the same firms in Table 4, it can be concluded that the sanctions have no ripple effect on the labour market.

The further specifications reported in the appendix explore whether these effects are uneven across firms with different characteristics before the sanctions. Overall, while some effects seem to be uneven across firms, these differences do not seem to follow a clear pattern.

8 Conclusion

The recent literature and anecdotal evidence have highlighted the unforeseen consequences of trade sanctions. This paper analyses sanctions imposed by Russia on Turkey, a response to an unanticipated military conflict. This scenario is a quasi-natural experiment examining a significant economy's embargo on a key trading partner. The setting allows us to investigate the trade impact of the embargo — as others have do for other countries. Making use of linked datasets for Turkey, we can also do what so far has not been done in the literature

on sanction, that is to show the further economic impact beyond trade for affected firms — on their domestic sales and purchases, employment and wages. The analysis shows that while the trade effects are substantial, most of the second-order effects on affected firms are not.

Economic and trade sanctions have historically functioned as a tool for countries to exert pressure on adversaries. Our results indicate that embargoes targeting a specific range of products can profoundly affect bilateral trade and impact affected firms — but not much beyond.

References

- Aytun, Uğur, Julian Hinz, Cem Özgüzel, and Joschka Wanner**, “Firm-level Gravity with Fixed Effects,” Technical Report, Kiel Institute for the World Economy 2024. Available as a mimeo on the author’s website: https://julianhinz.com/research/firm_level_gravity/.
- Crozet, Matthieu and Julian Hinz**, “Friendly fire: the trade impact of the Russia sanctions and counter-sanctions,” *Economic Policy*, 05 2020, 35 (101), 97–146. eiaa006.
- , – , **Amrei Stammann, and Joschka Wanner**, “Worth the pain? Firms’ exporting behaviour to countries under sanctions,” *European Economic Review*, 2021, 134, 103683.
- Görg, Holger, Anna Jacobs, and Saskia Meuchelböck**, “Who Is to Suffer? Quantifying the Impact of Sanctions on German Firms,” IZA Discussion Papers 16146, Institute of Labor Economics (IZA) May 2023.
- Haidar, Jamal Ibrahim**, “Sanctions and export deflection: evidence from Iran,” *Economic Policy*, 04 2017, 32 (90), 319–355.
- , “Sanctions and export deflection: evidence from Iran,” *Economic Policy*, 2017, 32 (90), 319–355.
- Hufbauer, Gary Clyde, Jeffrey J. Schott, and Kimberly Ann Elliott**, *Economic Sanctions Reconsidered 3rd edition (hardcover + CD)* number 4082. In ‘Peterson Institute Press: All Books.’, Peterson Institute for International Economics, September 2008.
- Jäkel, Ina C., Søren Østervig, and Erdal Yalcin**, “The effects of heterogeneous sanctions on exporting firms: Evidence from Denmark,” *Review of International Economics*, 2024, 32, 161–19.
- Kohl, Tristan, Marcel van den Berg, and Loe Franssen**, “Going Dutch? Firm exports and FDI in the wake of the 2014 EU-Russia sanctions,” *Review of International Economics*, 2024, 32, 190–222.
- Nigmatulina, Dzhamilya**, “Sanctions and Misallocation. How Sanctioned Firms Won and Russia Lost.” Technical Report, Centre for Economic Performance, London School of Economics and Political Science 2021.
- Nissenbaum, Dien, Emre Peker, and James Marson**, “Turkey Shoots Down Russian Military Jet,” *Wall Street Journal*, 11 2015.

A Appendix: Timeline of the product embargo

1. In November 2015, Russia issued a presidential executive order (No 583) to ban the import of agricultural products, raw materials and food products, effective on **January 1, 2016**.
2. In **October 2016**, Russia makes some amendments to import ban by excluding following products:
 - **080510** fresh and dried oranges
 - **080520** fresh and dried mandarins
 - **080910** fresh apricots
 - **080930** fresh peaches including nectarines
 - **080940** fresh plums and blackthorn
3. In **March 2017**, the Russian government made amendments to list by eliminating products below:
 - **060312** Clove
 - **070310** Onion and shallots
 - **070410** Broccoli
 - **250100** Salt
4. In **June 2017**, the following products have been excluded from the prohibiting:
 - **020714** Chicken
 - **020727** Turkey
 - **070700** Cucumber and gherkin
 - **080810** Apples
 - **080830** Pears
 - **080610** Grapes
 - **081010** Strawberries
5. Effective on **November 1, 2017**, tomato (**070200**) ban lifted by the Russian Government

B Additional results

Table 6: Intensive margin and firm heterogeneity for above the median total exports

Model:	(1)	(3)	(5)
	Two-way with est. FE	Three-way	Three way with global data
Firm characteristic dummy	above the median total export	above the median total export	above the median total export
<i>Variables</i>			
Embargo × imposition period	-17.1652*** (0.4109)	-18.8965*** (0.5145)	-14.5624*** (0.4816)
Embargo × imposition period × firm chr.	4.2618*** (0.8449)	5.3021*** (1.1862)	1.2629 (0.8410)
Embargo × lifting period	0.2115 (0.4488)	0.6680 (0.6086)	0.2016 (0.7321)
Embargo × lifting period × firm chr.	-0.3894 (0.4733)	-0.8319 (0.6315)	-0.1803 (0.7429)
Diversion × imposition period	2.1151*** (0.4242)	2.1204*** (0.4078)	3.0237*** (0.5296)
Diversion × imposition period × firm chr.	-1.9590*** (0.4412)	-2.0779*** (0.4133)	-2.3710*** (0.5379)
Diversion × lifting period	1.1587*** (0.4183)	1.4066** (0.3999)	1.7590*** (0.5695)
Diversion × lifting period × firm chr.	-1.2121*** (0.4330)	-1.5113*** (0.4004)	1.5191*** (0.5710)
Circumvention × imposition period	-3.2735** (1.3667)	-2.6281* (1.3973)	-3.2173** (1.3339)
Circumvention × imposition period × firm chr.	2.8718** (1.3739)	2.7146* (1.3973)	2.8114** (1.3319)
Circumvention × lifting period	1.1467 (2.0013)	1.7845 (1.9729)	0.8012 (2.1770)
Circumvention × lifting period × firm chr.	-1.2546 (2.0057)	-1.2803 (1.9726)	-0.9670 (2.1791)
Est. destination × product × time FE	0.8566*** (0.0472)		
Observations	1,114,179	1,179,861	13,001,185
<i>Fixed-effects</i>			
Origin × product × time	Yes	Yes	Yes
Origin × destination × product × month	Yes	Yes	Yes
Destination × time	No	Yes	No
Destination × product × time	No	No	Yes

Notes: Standard errors are clustered at the origin (or firm) × product level. Columns (1), (3), and (5) interact each variable with a dummy for firms with total exports above the median in 2015. Russia embargo × imposition period in column (5) controls for Russia sanctions to EU in 2014. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at origin (or firm) × product.

Table 7: Intensive margin and firm heterogeneity for above the median number of products

Model:	(2)	(4)	(6)
	Two-way with est. FE	Three-way	Three way with global data
Firm characteristic dummy	above the median number of products	above the median number of products	above the median number of products
<i>Variables</i>			
Embargo × imposition period	-9.2610*** (1.4471)	-9.8140*** (1.8552)	-9.0844*** (1.1893)
Embargo × imposition period × firm chr.	-4.5651*** (1.6007)	-4.7854*** (1.8106)	-5.0460*** (1.4213)
Embargo × lifting period	0.3610 (0.9317)	0.3222 (0.7048)	0.4611 (1.1462)
Embargo × lifting period × firm chr.	-0.5500 (0.9434)	-0.4910 (0.7178)	-0.4549 (1.1473)
Diversion × imposition period	1.4578** (0.5681)	1.4094** (0.4959)	2.2399*** (0.6929)
Diversion × imposition period × firm chr.	-1.3076** (0.5810)	-1.3728*** (0.4945)	-1.5958** (0.6864)
Diversion × lifting period	0.9143 (0.5779)	1.0216** (0.4819)	1.3771* (0.7051)
Diversion × lifting period × firm chr.	-0.9760* (0.5885)	-1.1335** (0.4798)	-1.1462 (0.7045)
Circumvention × imposition period	-4.2804*** (0.9917)	-3.8528*** (0.9654)	-4.2929*** (1.1094)
Circumvention × imposition period × firm chr.	3.8884*** (1.0016)	3.9490*** (0.9667)	3.9021*** (1.1023)
Circumvention × lifting period	-0.3621 (2.4943)	0.1352 (2.3674)	-0.5976 (2.8662)
Circumvention × lifting period × firm chr.	0.2576 (2.4979)	0.3724 (2.3682)	0.4372 (2.8676)
Est. destination × product × time FE	0.8567*** (0.0472)		
Observations	1,114,179	1,179,861	13,001,185
<i>Fixed-effects</i>			
Origin × product × time	Yes	Yes	Yes
Origin × destination × product × month	Yes	Yes	Yes
Destination × time	No	Yes	No
Destination × product × time	No	No	Yes

Notes: Standard errors are clustered at the origin (or firm) × product level. Columns (2), (4), and (6) interact each variable with a dummy for firms with the number of products exported above the median in 2015. Russia embargo × imposition period in column (6) controls for Russia sanctions to EU in 2014. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at origin (or firm) × product.

Table 8: Effect of embargo on domestic sales

Dependent Variables: Model:	(1)	(2)	(3)	Domestic sales			(7)
		Median total export	Median num. of products	Median num. of destinations	Log(total export)	Log(num. of products)	Log(num. of destinations)
<i>Variables</i>							
Embargo × period imposition	-0.0367 (0.0499)	0.3355 (0.3656)	-0.0537 (0.1410)	-0.3696* (0.2210)	-0.4845 (0.3607)	0.0027 (0.1017)	-0.3284** (0.1366)
Embargo × period lifting	-0.0002 (0.0652)	0.6529 (0.4765)	0.0756 (0.1681)	-0.2059 (0.3002)	-0.2093 (0.5928)	0.0147 (0.1355)	-0.3370* (0.1776)
Embargo × period imposition × firm chr.		-0.3743 (0.3658)	0.0183 (0.1410)	0.3548 (0.2202)	0.0270 (0.0216)	-0.0152 (0.0311)	0.1098** (0.0459)
Embargo × period lifting × firm chr.		-0.6372 (0.4768)	-0.0855 (0.1684)	0.2197 (0.2985)	0.0216 (0.0354)	-0.0058 (0.0443)	0.1257** (0.0587)
<i>Fixed-effects</i>							
Firm × month	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	302,409	302,409	302,409	302,409	302,409	302,409	302,409

Notes: This table shows the impact of Russia sanctions on the domestic sales of Turkish firms, using a difference-in-difference methodology with a PPML estimator. The sample encompasses firms exporting products falling within the two-digit HS chapters (2, 6, 7, 8, 25) of embargoed goods. The variable "Embargo" is a dummy that takes one if a firm exports embargoed products in 2015. "Period Imposition" takes the value of one during the period whose duration is equal to the longest sanction duration among the products they exported. "Period Lifting" is a dummy variable taking the value of one from the lifting date of the sanction to December 2018. Columns 2 to 7 introduce firm characteristics. In columns 2 to 4, interactions occur between the variables and dummies set to one if a firm's total export, number of products, and destinations exported are above the median values of these characteristics. In columns 5 to 7, these values are interacted with the logarithmic form of these variables. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at firm and time.

Table 9: Effect of embargo on number of domestic customers

Dependent Variables: Model:	(1)	(2)	(3)	Number of customers			(7)
		Median total export	Median num. of products	Median num. of destinations	Log(total export)	Log(num. of products)	Log(num. of destinations)
<i>Variables</i>							
Embargo × period imposition	-0.1135** (0.0514)	-0.2245*** (0.0802)	-0.3337*** (0.1777)	-0.2292*** (0.0889)	-0.7970*** (0.2642)	-0.2262 (0.1376)	-0.2818** (0.1194)
Embargo × period lifting	-0.1831** (0.0851)	-0.2171 (0.2484)	-0.5235* (0.2852)	-0.1239 (0.1145)	-1.3220* (0.7763)	-0.3170 (0.2200)	-0.4633* (0.2714)
Embargo × period imposition × firm chr.		0.1122 (0.0911)	0.2685 (0.1806)	0.1249 (0.1004)	0.0422*** (0.0153)	0.0501 (0.0407)	0.0636** (0.0311)
Embargo × period lifting × firm chr.		0.0343 (0.2564)	0.4172 (0.2872)	-0.0633 (0.1351)	0.0702 (0.0451)	0.0602 (0.0650)	0.01050 (0.0795)
<i>Fixed-effects</i>							
Firm × month	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	302,409	302,409	302,409	302,409	302,409	302,409	302,409

Notes: This table shows the effect of Russia sanctions on the number of domestic customers for Turkish firms, using a difference-in-difference methodology with a PPML estimator. The sample includes firms exporting products falling within the two-digit HS chapters (2, 6, 7, 8, 25) of embargoed goods. The variable "Embargo" is a dummy that equals one if a firm exports embargoed products in 2015. "Period Imposition" takes the value of one during the period equivalent to the longest sanction duration among the products they exported. "Period Lifting" is a dummy variable taking the value of one from the lifting date of the sanction to December 2018. Columns 2 to 7 introduce firm characteristics. In columns 2 to 4, interactions occur between the variables and dummies set to one if a firm's total export, number of products, and destinations exported are above the median values of these characteristics. In columns 5 to 7, these values are interacted with the logarithmic form of these variables. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at firm and time.

Table 10: Effect of embargo on domestic purchases

Dependent Variables: Model:	Total domestic purchases						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Median total export	Median num. of products	Median num. of destinations	Log(total export)	Log(num. of products)	Log(num. of destinations)
<i>Variables</i>							
Embargo × period imposition	-0.2176*** (0.0481)	0.1865 (0.3142)	-0.2381 (0.1516)	-0.5569*** (0.1927)	-1.0700*** (0.3779)	-0.2283** (0.1105)	-0.5997*** (0.1419)
Embargo × period lifting	-0.1845*** (0.0706)	0.4957 (0.4566)	-0.1332 (0.1992)	-0.5193*** (0.1974)	-1.3490** (0.5812)	-0.1283 (0.1636)	-0.6554*** (0.1707)
Embargo × period imposition × firm chr.		-0.4062 (0.3177)	0.0227 (0.1567)	0.3637* (0.1925)	0.0514** (0.0224)	0.0042 (0.0374)	0.1435*** (0.0437)
Embargo × period lifting × firm chr.		-0.6839 (0.4600)	-0.0579 (0.2082)	0.3565* (0.1990)	0.0701** (0.0351)	0.0171 (0.0547)	0.1745*** (0.0544)
<i>Fixed-effects</i>							
Firm × month	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	303,134	303,134	303,134	303,134	303,134	303,134	303,134

Notes: The table shows the impact of Russian sanctions on the domestic total purchases of Turkish firms, utilizing the difference-in-difference methodology with a PPML estimator. The sample encompasses firms exporting products falling within the two-digit HS chapters (2, 6, 7, 8, 25) of embargoed goods. The variable "Embargo" is a dummy that equals one if a firm exports embargoed products in 2015. "Period Imposition" takes the value of one during the period equivalent to the longest sanction duration among the products exported by the firm. "Period Lifting" is a dummy variable taking the value of one from the lifting date of the sanction to December 2018. Columns 2 to 7 introduce firm characteristics. In columns 2 to 4, interactions occur between the variables and dummies set to one if a firm's total export, number of products, and destinations exported are above the median values of these characteristics. In columns 5 to 7, these values are interacted with the logarithmic form of these variables. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at firm and time.

Table 11: Effect of embargo on the total number of domestic suppliers

Dependent Variables: Model:	Number of total suppliers						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Median total export	Median num. of products	Median num. of destinations	Log(total export)	Log(num. of products)	Log(num. of destinations)
<i>Variables</i>							
Embargo × period imposition	-0.1236*** (0.0374)	0.0094 (0.2231)	-0.3075** (0.1474)	-0.5379*** (0.1547)	-1.0880*** (0.3619)	-0.3031** (0.1247)	-0.4614*** (0.1102)
Embargo × period lifting	-0.1232*** (0.0470)	0.1826 (0.3154)	-0.1842 (0.1476)	-0.4882*** (0.1769)	-0.5424 (0.3870)	-0.2077 (0.1318)	-0.3102** (0.1219)
Embargo × period imposition × firm chr.		-0.1162 (0.2254)	0.2164 (0.1500)	0.4554*** (0.1559)	0.0601*** (0.0221)	0.0753* (0.0453)	0.1397*** (0.0401)
Embargo × period lifting × firm chr.		-0.3113 (0.3170)	0.0727 (0.1510)	0.3751** (0.1795)	0.0262 (0.0239)	0.0361 (0.0465)	0.0770* (0.0447)
<i>Fixed-effects</i>							
Firm × month	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	303,134	303,134	303,134	303,134	303,134	303,134	303,134

Notes: The table presents the impact of Russian sanctions on the number of domestic suppliers for Turkish firms, employing the difference-in-difference methodology with a PPML estimator. The sample comprises firms exporting products falling within the two-digit HS chapters (2, 6, 7, 8, 25) of embargoed goods. The variable "Embargo" is a dummy that equals one if a firm exports embargoed products in 2015. "Period Imposition" takes the value of one during the period equivalent to the longest sanction duration among the products exported by the firm. "Period Lifting" is a dummy variable taking the value of one from the lifting date of the sanction to December 2018. Columns 2 to 7 include additional firm characteristics. In columns 2 to 4, interactions occur between the variables and dummies set to one if a firm's total export, number of products, and destinations exported are above the median values of these characteristics. In columns 5 to 7, these values are interacted with the logarithmic form of these variables. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at firm and time.

Table 12: Effect of embargo on domestic agricultural purchases

Dependent Variables: Model:	Purchases from suppliers in agriculture industry						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Median total export	Median num. of products	Median num. of destinations	Log(total export)	Log(num. of products)	Log(num. of destinations)
<i>Variables</i>							
Embargo × period imposition	-0.2267** (0.1128)	-0.1759 (0.7045)	-0.3387 (0.2165)	-0.6611* (0.4013)	-1.4520* (0.8605)	-0.3726** (0.1890)	-0.4945* (0.2475)
Embargo × period lifting	-0.1615 (0.1206)	0.6381 (0.8963)	-0.0686 (0.1409)	-0.3045 (0.3090)	-0.2458 (0.7447)	-0.2084** (0.1683)	-0.0778 (0.2316)
Embargo × period imposition × firm chr.		-0.0507 (0.7006)	0.1326 (0.2101)	0.4600 (0.4017)	0.0518 (0.0518)	0.0615 (0.0696)	0.0988 (0.1016)
Embargo × period lifting × firm chr.		-0.8023 (0.8951)	-0.1095 (0.1255)	0.1523 (0.3019)	0.0052 (0.0456)	0.0200 (0.0651)	-0.0305 (0.0849)
<i>Fixed-effects</i>							
Firm × month	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	55,169	55,169	55,169	55,169	55,169	55,169	55,169

Notes: This table shows the effect of Russia sanctions on the domestic agricultural purchases of Turkish firms using difference-in-difference methodology with PPML estimator. In all specifications our sample covers the firms exporting the products that two digit HS chapters (2, 6, 7, 8, 25) of embargoed products. Embargo is the dummy that takes one if a firm exports embargoed products in 2015. Period imposition takes the value of one in the period whose duration is equal to the longest sanction duration among the products they exported. Period lifting is the dummy taking value of one from the lifting date of the sanction to Dec 2018. In columns 2 to 7 we add firm characteristics. In columns 2 to 4 we interact the variables with the dummies that take value of one if total export, number of products and destinations exported of a firm are above the median values of these characteristics. In columns 5 to 7 we interacted these values with the logarithmic form of these variables. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at firm and time.

Table 13: Effect of embargo on the number of agricultural suppliers

Dependent Variables: Model:	Number of agricultural suppliers						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Median total export	Median num. of products	Median num. of destinations	Log(total export)	Log(num. of products)	Log(num. of destinations)
<i>Variables</i>							
Embargo × period imposition	-0.1255** (0.0634)	-0.4474 (0.3391)	-0.3357** (0.1668)	-0.4753** (0.2297)	-1.4980*** (0.4926)	-0.3888*** (0.1453)	-0.4639*** (0.1638)
Embargo × period lifting	-0.1428* (0.0820)	-0.0821 (0.4461)	-0.2270 (0.1662)	-0.5701*** (0.1558)	-1.7510*** (0.5133)	-0.4307** (0.1834)	-0.5157*** (0.1794)
Embargo × period imposition × firm chr.		0.3243 (0.3940)	0.2419 (0.1731)	0.3752 (0.2334)	0.0837*** (0.0296)	0.1142** (0.0520)	0.1304** (0.0608)
Embargo × period lifting × firm chr.		-0.0611 (0.4497)	0.0971 (0.1813)	0.4510*** (0.1679)	0.0977*** (0.0310)	0.1245* (0.0643)	0.1410** (0.0673)
<i>Fixed-effects</i>							
Firm × month	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	55,169	55,169	55,169	55,169	55,169	55,169	55,169

Notes: This table shows the effect of Russia sanctions on the domestic agricultural suppliers of Turkish firms using difference-in-difference methodology with PPML estimator. In all specifications our sample covers the firms exporting the products that two digit HS chapters (2, 6, 7, 8, 25) of embargoed products. Embargo is the dummy that takes one if a firm exports embargoed products in 2015. Period imposition takes the value of one in the period whose duration is equal to the longest sanction duration among the products they exported. Period lifting is the dummy taking value of one from the lifting date of the sanction to Dec 2018. In columns 2 to 7 we add firm characteristics. In columns 2 to 4 we interact the variables with the dummies that take value of one if total export, number of products and destinations exported of a firm are above the median values of these characteristics. In columns 5 to 7 we interacted these values with the logarithmic form of these variables. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at firm and time.

Table 14: Effect of embargo on employment

Dependent Variables: Model:	(1)	(2)	(3)	Number of employees			
		Median total export	Median num. of products	Median num. of destinations	Log(total export)	Log(num. of products)	Log(num. of destinations)
<i>Variables</i>							
Embargo × period imposition	-0.1108*** (0.0411)	-0.1362*** (0.0476)	-0.2392* (0.1310)	-0.3408*** (0.1135)	-0.9673*** (0.2851)	-0.2043* (0.1091)	-0.2868*** (0.0941)
Embargo × period lifting	-0.1993*** (0.0760)	0.0214 (0.3849)	-0.1661 (0.1464)	-0.3121** (0.1339)	-0.8500** (0.4091)	-0.2646 (0.1658)	-0.2925** (0.1275)
Embargo × period imposition × firm chr.		0.0257 (0.0587)	0.1521 (0.1330)	0.2435** (0.1159)	0.0521*** (0.0169)	0.0395 (0.0345)	0.0669** (0.0288)
Embargo × period lifting × firm chr.		-0.2220 (0.3908)	-0.0399 (0.1635)	0.1188 (0.1472)	0.0396* (0.0240)	0.0278 (0.0478)	0.0352 (0.0346)
<i>Fixed-effects</i>							
Firm × quarter	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	99.492	99.492	99.492	99.492	99.492	99.492	99.492

Notes: This table shows the effect of Russia sanctions on the number of employees of Turkish firms using difference-in-difference methodology with PPML estimator. In all specifications our sample covers the firms exporting the products that two digit HS chapters (2, 6, 7, 8, 25) of embargoed products. Embargo is the dummy that takes one if a firm exports embargoed products in 2015. Period imposition takes the value of one in the period whose duration is equal to the longest sanction duration among the products they exported. Period lifting is the dummy taking value of one from the lifting date of the sanction to Dec 2018. In columns 2 to 7 we add firm characteristics. In columns 2 to 4 we interact the variables with the dummies that take value of one if total export, number of products and destinations exported of a firm are above the median values of these characteristics. In columns 5 to 7 we interacted these values with the logarithmic form of these variables. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at firm and time.

Table 15: Effect of embargo on average daily wage

Dependent Variables: Model:	(1)	(2)	(3)	Ave. daily wage			
		Median total export	Median num. of products	Median num. of destinations	Log(total export)	Log(num. of products)	Log(num. of destinations)
<i>Variables</i>							
Embargo × period imposition	0.0102 (0.0221)	-0.0636 (0.0599)	-0.0166 (0.0320)	0.0092 (0.0479)	0.1979 (0.1700)	-0.0175 (0.0357)	0.0178 (0.0459)
Embargo × period lifting	-0.0141 (0.0239)	-0.0356 (0.0884)	-0.0242 (0.0358)	0.0406 (0.0519)	0.0301 (0.1904)	-0.0348 (0.0415)	0.0049 (0.0507)
Embargo × period imposition × firm chr.		0.0806 (0.0598)	0.0383 (0.0370)	0.0026 (0.0488)	-0.0132 (0.0120)	0.0140 (0.0126)	-0.0048 (0.0188)
Embargo × period lifting × firm chr.		0.0234 (0.0912)	0.0144 (0.0432)	-0.0732 (0.0565)	-0.0031 (0.0131)	0.0105 (0.0160)	-0.0120 (0.0217)
<i>Fixed-effects</i>							
Firm × month	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	99,482	99,482	99,482	99,482	99,482	99,482	99,482

Notes: This table shows the impact of Russia sanctions on the average wage of Turkish firms, utilizing a difference-in-difference methodology with a PPML estimator. The sample includes firms exporting products falling within the two-digit HS chapters (2, 6, 7, 8, 25) of embargoed goods. The variable "Embargo" is a dummy that takes one if a firm exports embargoed products in 2015. "Period Imposition" takes the value of one during the period whose duration is equal to the longest sanction duration among the products they exported. "Period Lifting" is a dummy variable taking the value of one from the lifting date of the sanction to December 2018. Columns 2 to 7 introduce firm characteristics. In columns 2 to 4, interactions occur between the variables and dummies set to one if a firm's total export, number of products, and destinations exported are above the median values of these characteristics. In columns 5 to 7, these values are interacted with the logarithmic form of these variables. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at firm and time.