Shooting down trade: Firm-level effects of embargoes*

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

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Abstract

In November 2015, Turkey's unexpected downing of a Russian military jet in Syria prompted Russia to impose a swift and comprehensive embargo on specific Turkish exports. This study leverages this quasi-natural experiment to estimate both the immediate and longer-term effects of the imposition and subsequent lifting of these sanctions. Utilizing administrative data encompassing all Turkish exporters, we first examine the impact on trade at the firm level, assessing the direct effects of the embargo, the redirection of trade to alternative markets, and the circumvention through other products. Second, we investigate broader repercussions on domestic operations, including firms' sales, procurement, and employment. Our findings show that while the embargo caused immediate and substantial declines in exports of affected products to Russia, firms partially mitigated these losses through trade diversion. Although relative trade patterns normalized post-sanctions, absolute trade values remained subdued. The analysis reveals that affected firms experienced declines in domestic sales and supplier relationships, with temporary disruptions in employment. However, most negative effects dissipated following the embargo's removal, except for some persistent reductions in procurement and supplier links, likely linked to persistent lower trade volumes after the lifting of the embargo.

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†Middle East Technical University & Dumlupınar University. E-Mail: uaytun@metu.edu.tr.

‡Corresponding author: Bielefeld University & Kiel Institute for the World Economy. E-Mail: julian.hinz@uni-bielefeld.de.

§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 kilometers 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 Erdoğan apologized to Russian President Putin.

Countries have long used economic sanctions to punish their adversaries in 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, it is crucial to assess the magnitude of economic costs and the channels through which sanctions can operate.

In this paper, we assess the consequences of trade sanctions on the targeted 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 imposition of the embargo. These declines constitute the *embargo effect*. Second, when faced with sanctions, some 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 to Russia of non-embargoed goods and close substitutes to embargoed items may also be affected. Some exporters may attempt to circumvent the sanctions by declaring embargoed products under different labels or by processing sanctioned raw materials into other forms. These declines (or increases) are unintended effects of sanctions and constitute the *circumvention effect*. We also estimate the lifting effects of the sanctions.

This analysis of firm-level trade effects relies on Turkish Customs data provided by the Turkish Statistical Institute (TURKSTAT). The dataset encompasses all Turkish exporters and offers detailed monthly information on export transactions at the firm level. 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.

[1] Use 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.

To address this issue, we apply a novel methodological 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 flexible fixed effects for Turkish firms, other origin countries, and destinations at the time and product-level.

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 relative trade cost effects effectively return to pre-sanction levels after the lifting of sanctions.

In the second part of our analysis, we broaden our investigation to explore how sanctions impacted firms beyond just their trade activities. We do this by merging several administrative datasets using unique firm identifiers, allowing us to track affected firms along other relevant dimensions. We examine how sanctions influence various aspects of firms' operations, such as domestic sales, purchases, relationships with other firms, and employment levels. To capture the uneven exposure of firms to Russian sanctions, we measure the share of embargoed exports to Russia in firms' total exports the year before the sanctions. Our findings reveal immediate adverse 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. However, most negative effects dissipated following the embargo's removal, except for some persistent reductions in procurement and supplier links, likely linked to persistent lower trade volumes after the lifting of the embargo. These results are robust to different robustness tests using alternative measures for embargo exposure or estimators.

This paper contributes to the growing body of literature that examines the economic effects of geopolitical tensions and international trade sanctions, with a particular focus on their impact on exporters. While our paper focuses on an empirical investigation of the impact of sanctions, there have also been significant advances on the theoretical side aiming to understand the mechanisms at play. Theoretical research has investigated the rationale behind imposing sanctions, often positioning them as coercive tools in foreign policy (Eaton and Engers, 1999; Thoenig, 2023; Becko, 2024; Clayton et al., 2024). Becko (2024) discusses how sanctions serve to maintain a nation's credibility in issuing future threats, while Liu and Yang (2024) emphasize power through trade linkages in bilateral relations. Most closely related to our work is the work of Lastauskas et al. (2023), who also offer a novel explanation for their findings — mirroring ours — of firms reducing employment and finding alternative export markets, where forward-looking firms face non-convexities in the labor market along with heterogeneous variable trade costs.

Empirically, trade sanctions and their effects have been studied extensively, with mixed

conclusions on their political effectiveness and economic impact.[2] Analyzing the economic impact of sanctions, the literature primarily differentiates between the effects of trade sanctions, which broadly restrict imports or exports for entire economies (Haidar, 2017; Hinz and Monastyrenko, 2022; Chowdhry et al., 2024), and targeted sanctions, which are focused on specific firms or industries (Ahn and Ludema, 2020; Nigmatulina, 2021; Draca et al., 2023). While targeted sanctions tend to show limited effectiveness, trade sanctions often reveal a wider range of outcomes. For example, Crozet and Hinz (2020) and Haidar (2017) both note that while sanctioned trade volumes generally decrease, significant trade diversion can occur, undermining the intended impact of these measures.

A recent line of research highlights the use of intermediated or "roundabout" trade as a means to circumvent sanctions. Chupilkin et al. (2024a) and Chupilkin et al. (2024b) show how post-2022 sanctions on Russia led to increased trade through neighboring countries, emphasizing the role of regional partners and non-Western markets in mitigating direct trade restrictions. These findings resonate with work by Tyazhelnikov and Romalis (2024), who document the use of Belarus as an intermediary to bypass EU food import restrictions imposed by Russia post-2014. Similarly, Babina et al. (2023) show that Russian oil exports were successfully redirected after the EU embargo and G7 price cap on crude oil, illustrating how energy markets adapt to sanctions.

A subset of the literature focuses on firm-level outcomes, examining how sanctions disrupt business operations. Görg et al. (2024), Kohl et al. (2024) and Jäkel et al. (2024) analyze the impact of the 2014 sanctions on Russia along various firm dimensions in trade and foreign direct investment with German, Dutch, and Danish firm-level data, respectively. All document firms' adaptability to the sudden shocks along export market, labor and investment margins. Crozet et al. (2021) show that firms are more likely to exit sanctioned markets if they already have operations in neighboring countries. Nigmatulina (2021) reports that Russian companies targeted by 2014 sanctions faced various impacts, some benefiting from state support that offset the adverse effects of restrictions. Egorov et al. (2024) investigate the sanctions imposed on the Russian Federation in 2022 using various firm-level data, showing that the measures had a significant impact and could not make up for trade diversion through alternative suppliers.

Our paper is also related to a recent literature that emphasizes the importance of interdependencies across export markets in shaping firm behavior and outcomes. Albornoz et al. (2023) explore how firms introduce products sequentially across countries, providing insights into the strategic expansion decisions in foreign markets.[3] Morales et al.

[2] Gold et al. (2024) and Peeva (2018) provide recent analyses of the political impact of sanctions in the context of the 2014 sanctions on Russia. Both find evidence for "rallying around the flag", suggesting politically undesired (side-)effects of the episode.

[3] In an earlier paper, Albornoz et al. (2016) highlight how firms' survival in export markets is influenced by sunk and fixed costs in relation to distance, suggesting that in the case of sanctions entry (and exit) dynamics of alternative markets of affected firms are likely also a function of the destination market's characteristics.

(2019) complement these findings, showing that firms' export decisions are influenced by gravity-like forces beyond traditional trade costs, including interactions between market conditions in different countries. These works are relevant in the context of the Russian embargo on Turkish firms, where the interplay between market interdependencies and trade restrictions plays a crucial role in firm outcomes.

Moreover, research on export decisions and domestic conditions further informs our analysis. Berman et al. (2015) explore the link between firms' export behavior and domestic sales, while Almunia et al. (2021) document how firms resort to exports during domestic downturns to "vent out" excess capacity. Defever et al. (2015) show that geographic proximity influences firms' market entry strategies, with firms typically entering nearby markets first. More recently, Alfaro-Urena et al. (2023) provide evidence on firm export dynamics in interdependent markets, emphasizing how a firm's performance in one market can significantly affect its outcomes in others. Closely related to our paper is Albornoz et al. (2021), who study the effects of the sudden removal of preferences for a large share of Argentinian firms for exports to the United States. They find that not only product exports directed to the US are affected by the tariff hikes, but firms change their product basket as well as switch to alternative destinations.[4]

By leveraging a natural experiment — the Russian embargo on exports of specific Turkish agricultural products — this study contributes to the sanctions literature by offering an empirical analysis of both the immediate and long-term effects on exporters. It integrates comprehensive administrative data to assess firm-level outcomes beyond trade, encompassing domestic sales, supply chain interactions, and employment. 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 consequences 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. The datasets used in the exercise are described in section 3. We then estimate the impact on trade flows in section 4, before studying other outcomes at the firm level for entities exposed to the embargo in section 5. In section 6 we run several robustness checks and discuss potential mechanisms at play in section 7. Section 8 concludes.

[4]We review our empirical results in terms of their theoretical framework in section 7, alongside a discussion of the mechanisms proposed in Lastauskas et al. (2023).

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 kilometres 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, [...] Russia [would] not tolerate such attacks",[5] hinting at potential repercussions for Russia-Turkey relations. 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 583,[6] 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,

[5] See e.g. https://www.bbc.com/news/world-middle-east-34913173.

[6] The Decree 583 focused solely on the incident and was titled "On measures to ensure state security and protection of Russian citizens from criminal and other unlawful actions and on the application of special economic measures in relation to the Republic of Turkey."

chicken, turkey, and salt, effective from January 1, 2016.[7] Appendix A presents the full list of the sanctioned products.

The duration of the sanctions was not specified when they were announced, leaving exporters uncertain about how long they would remain in place. In fact, interviews conducted for this study with Turkish exporters affected by the sanctions suggest that many exporters expected the sanctions to last a long time and were thus equally surprised by the sudden lifting of the measures.

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 How important was the Turkish-Russian trade?

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, Iran, the United States, and the United Arab Emirates.

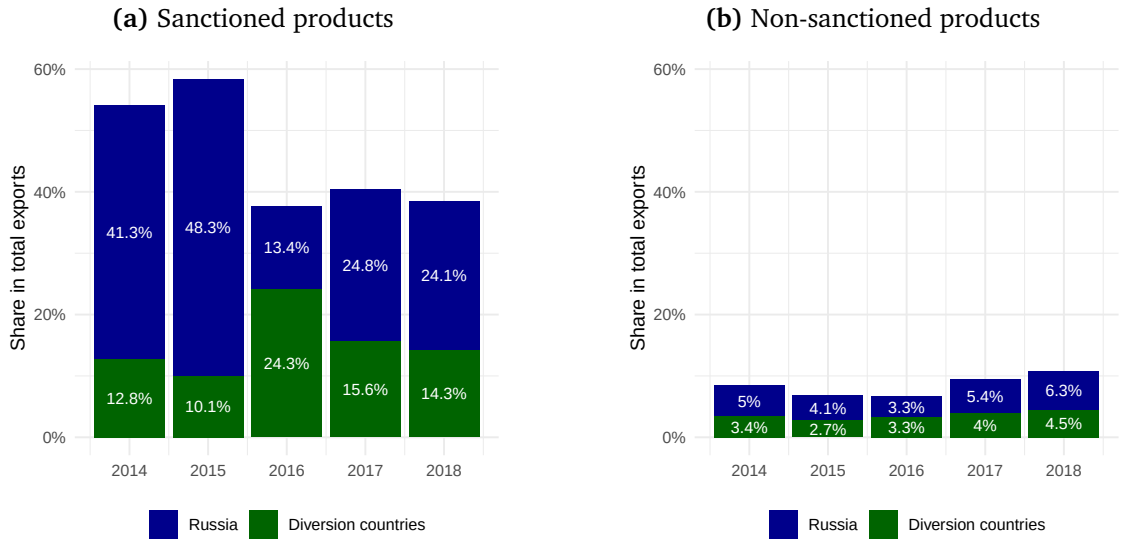
The sanctions targeted a substantial share of Turkish exports of affected products to Russia, amounting to nearly half (48%) of their total exports in 2015. Notably, likely trade diversion destinations in the proximity of Russia received 10% of Turkish exports of sanctioned products during that period (Figure 1a).[8] Combined, Russia and these diversion countries accounted for 60% of the total exports of sanctioned goods. By comparison, non-sanctioned products constituted only 4% and 2% of Turkey's total export volume to Russia and the diversion countries in 2015, respectively (Figure 1b).

The imposition of sanctions had a discernible impact on overall Turkish exports to Russia.

[7] We reviewed Turkish and Russian media and official documents to understand better how products were chosen. Unfortunately, beyond the initial decree, little official information was available. This highlights Russia's consistent lack of transparency in trade policy decisions. Other research, like Demir (2015), notes that "Russian authorities stressed that they cautiously determined the scope of sanctions and aimed to contain the damage to Russian firms operating in Turkey," while Korhonen et al. (2018) also see a (possibly populist) motive of "supporting domestic production." This mirrors the 2014 food embargo against Western countries after Russia annexed Crimea, where the government also provided no clear criteria for product selection. Interestingly, the public debate in Russia in the immediate aftermath of imposing the embargo addressed some of the issues faced by Russian consumers, like apparent price coordination between remaining suppliers (https://www.interfax.ru/business/487209), increased demand for local fish production (https://ura.news/news/1052231842), as well as difficulties with finding new foreign suppliers for embargoed products, higher prices, and potential sanctions busting through third countries (https://www.svoboda.org/a/27394074.html). As we show in Section 2.3, we believe Russia deliberately chose products that Turkey exports heavily to Russia but are less crucial for the Russian market, making it easier for Russia to find other suppliers.

[8] We define these countries of the former Soviet Union, i.e., 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 (cumulative) 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 products (Panel B). Source: TURKSTAT.

Within the first year of sanctions, Turkish exports to Russia plummeted by 52%. Concurrently, exports to countries neighboring Russia — the so-called diversion countries — experienced a 10% decrease. However, exports of sanctioned products to these neighboring countries surged by an impressive 105%, indicative of their role in circumventing the sanctions.[9]

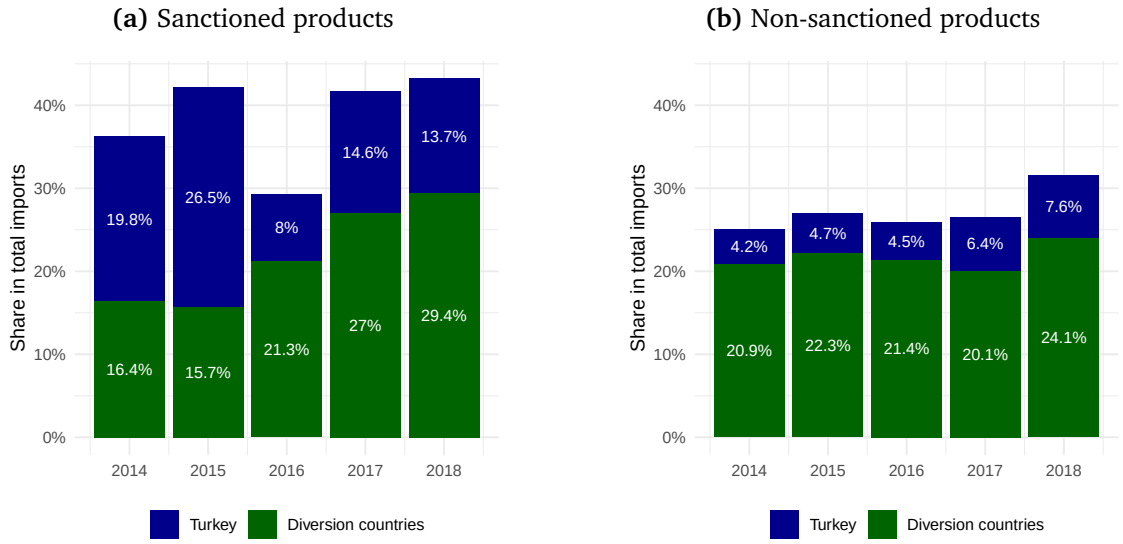
Before the sanctions, imports from Turkey constituted a significant share of Russia's total imports of embargoed products. In 2015, Turkey accounted for 26.5% of Russia's imports of sanctioned products, while imports from diversion countries made up around 15.7% (Figure 2a). The implementation of sanctions in 2016 reduced Turkey's share to 8%. Although this share slightly recovered in 2017, it remained at 14.6% in 2018, still below pre-sanctions levels. Conversely, non-sanctioned products, which comprised around 4.7% of Russia's total imports in 2015, saw very little change in the following years (Figure 2b).

3 Data and summary statistics

To analyze the impact of the embargo on firms' exports and other firm-level outcomes, we bring together several firm-level administrative datasets. 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

[9]Own calculations based on data from UN Comtrade.

Figure 2: Importance of imports from Turkey and diversion countries for Russia



Notes: The figures show the (cumulative) value of imports from 14 diversion countries (see main text for the list) and Turkey relative to all Russian imports for sanctioned products (Panel A) and non-sanctioned products (Panel B). Source: UN Comtrade.

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 and suppliers, to track their sales and purchases. 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.[10]

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

[10]To identify embargo-related suppliers and purchases, we first utilize the correspondence table between HS and NACE codes. If the NACE code of a firm matches the NACE equivalent of the embargoed products, we classify this firm as an embargo-related producer providing inputs to other firms. Similarly, by applying this method to the customer side of the network data and aggregating by each firm, we obtain the embargo-related purchases.

Table 1: Summary statistics of firms in 2015

Panel A: Exporters of sanctioned products			
	Russia	Diversion	Any
Number of firms	407	619	1,589
Median number of products exported	7	5	4
Median number of destinations served	4	3	2
Median total firm exports	957,108	462,527	172,509
Panel B: Exporters of any products			
	Russia	Diversion	Any
Number of firms	629	1,553	5,613
Median number of products exported	4	2	1
Median number of destinations served	4	2	1
Median total firm exports	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, or any country worldwide.

employment, wages, and workdays.

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.

3.1 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, 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, 1,589 firms exported these products. Among them, 407 firms exported to Russia, while 619 firms exported to diversion countries. The remaining 563 firms exported to other nations. The median firm trading with Russia exported 7 different products (to Russia), those trading with diversion

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
Domestic purchases (in TL)	4,992,482	3,662,604
Domestic agri. purchases (in TL)	358,037	123,140
Domestic sales of agri. producers (in TL)	616,480	878,510
Number of domestic customers	2	2
Number of domestic suppliers	8	5
Number of domestic agri. suppliers	8	5
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).

countries 5, both being slightly higher than the global median of 4. Similarly, the median firm exporting to Russia was exporting to 4 countries in total, twice as many as those exporting to all countries, with those exporting to diversion countries being active on 3 markets.

Panel B provides comparable statistics for exporters of all products, including those in Panel A. It shows that, in contrast to firms exporting sanctioned products, the median Turkish exporter shipped fewer products (4) but to a similar number of destinations (4). These findings imply that firms dealing in sanctioned products exporting to Russia did not differ much from exporters of other products to Russia in terms of trading partners and traded products, while there were, on average, larger than firms exporting to other markets.

Table 2 presents summary statistics for the second phase of the analysis, focusing on firm-level outcomes beyond trade. The analysis categorizes 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 numbers of 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 more domestic sales and purchases and engage with a higher number of domestic suppliers.

4 Estimation of the impact on firm exports

Using this data, we now turn to the immediate effect of the embargo — the impact on exports of exposed firms. We do so by relating exports at the firm level to the shock, while

controlling for a range of fixed effects at the firm, time, destination, and product levels.

The related literature in international trade usually estimates the impact of firm $\times$ destination $\times$ time-specific shocks in a difference-in-differences-type estimation with firm-level data from one country, controlling for combinations of firm-, time-, and destination-specific factors using fixed effects. However, a destination $\times$ time-specific fixed effect that controls for demand effects in the destination economy is almost always omitted due to its collinearity with the variable of interest. Following the novel estimation strategy proposed by Aytun et al. (2024), we combine firm-level data from Turkey with country-level data from UN Comtrade. This combination enables us to include the most flexible sets of fixed effects, even for firm-level estimations, i.e., firm $\times$ time, firm $\times$ destination, and destination $\times$ time. Without incorporating country-level data, the destination $\times$ time fixed effect would be collinear with the variable of interest, as the origin would remain the same. Adding multiple origin countries with country-level data resolves this issue.

Adding a product dimension, we estimate the following equation:

$$X_{\{i,o\}dkt} = \exp\left(\Gamma_{\{i,o\}kt} + \Gamma_{dkt} + \Gamma_{\{i,o\}dk} + S'_{odkt}\delta_k\right) \cdot \epsilon_{\{i,o\}dkt} \tag{1}$$

where $X_{\{i,o\}dkt}$ represents 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} is a destination $\times$ product $\times$ time fixed effect, and $\Gamma_{\{i,o\}dk}$ is a firm- or country-level bilateral origin $\times$ destination $\times$ product $\times$ month fixed effect.[11] Combining firm-level and country-level trade data allows us to estimate the firm-level effects of sanctions while including all three sets of fixed effects. The vector δ_k measures the average effect of the sanctions, as indicated by the dummy variable matrix S_{odkt}. The first measure is the imposition of the embargo, capturing the impact of the Russian embargo on the exports of sanctioned products from Turkey during the imposition period. The second measure, diversion, assesses the extent to which Turkish exports of sanctioned products were diverted to neighboring countries. Lastly, circumvention reflects how non-embargoed flows from Turkey to Russia were affected. We also test whether these effects persist after the embargoes were gradually lifted. We estimate equation (1) using a Pseudo-Poisson Maximum Likelihood estimator, as is standard now in the trade literature following Silva and Tenreyro (2006) and Head and Mayer (2014).

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 indirectly affected products, particularly those that intensively use

[11] See Appendix B for a stylized sketch of a model that yields the estimating gravity-like equation.

Table 3: Embargo, diversion, and circumvention effect

Model:	(1) Three-way with global data	(2) Two-way	(3) Two-way with est. FE	(4) Three-way
Variables				
Embargo × imposition period	-13.2126***	-14.3005***	-12.8438***	-13.4946***
	(0.7723)	(0.6709)	(0.7206)	(1.0803)
Embargo × lifting period	0.1297	-0.3988**	-0.1179	0.1169
	(0.2094)	(0.1859)	(0.1487)	(0.2267)
Diversion × imposition period	0.7716***	0.1072	0.1218	0.0879
	(0.1954)	(0.1282)	(0.1160)	(0.1635)
Diversion × lifting period	0.2919*	-0.2021*	-0.2126**	-0.0483
	(0.1724)	(0.1228)	(0.1056)	(0.1726)
Circumvention × imposition period	-0.4720**	-0.4569***	-0.4154***	0.1260
	(0.2402)	(0.1450)	(0.1418)	(0.2115)
Circumvention × lifting period	-0.1531	-0.1932	-0.0981	0.4061**
	(0.2373)	(0.1437)	(0.1346)	(0.2094)
Est. destination × product × time FE			0.8457***	
			(0.0461)	
Russia embargo × imposition period	-5.1439***			
	(0.2642)			
Fixed-effects				
Origin × product × time	Yes	Yes	Yes	Yes
Origin × destination × product × month	Yes	Yes	Yes	Yes
Destination × time	No	No	No	Yes
Destination × product × time	Yes	No	No	No
Observations	8,994,657	1,191,522	1,111,195	1,186,163

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), while "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 four-digit substitute products for embargoed goods exported by Turkey to Russia. The first column combines firm-level and product-level UN Comtrade data, including destination × product × time fixed effects. The Russia embargo × imposition period controls for Russia's embargo on related products from EU countries introduced in 2014. In columns 2–4, only firm-level data is used. The second column incorporates origin × product × time fixed effects and origin × destination × product × month fixed effects. The third column adds estimated destination × product × time fixed effects using UN Comtrade data, following Crozet et al. (2021), while the fourth column replaces them with destination × time fixed effects (omitting the product dimension). All columns include a sample covering corresponding two-digit HS classification chapters (2, 6, 7, 8, 25) for embargoed products. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at the origin (or firm) × product level.

trade finance measures. Görg et al. (2024) 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 Russian sanctions on Dutch and Danish firm-level exports, respectively. However, none of these empirical setups adequately control for unobservable time-varying characteristics at the destination country level. This issue is particularly relevant for analyzing the effects of sanctions, as sanctioned or sanctioning countries tend to be peculiar and warrant controlling for shocks observed in the destination country. In principle, this issue is present in all single-country firm-level estimations of trade policy changes.

The results of estimating equation (1) are displayed in Table 3, contrasting these findings with less flexible (but more common) variations of included sets of fixed effects. The results for our preferred specification are shown in column (1). The embargo effectively reduces trade to zero for affected products ($(\exp(-13.2126)-1)\cdot 100) \approx -99.99979\%$). Importantly, after the embargo was lifted, the effect did not persist, and exports of previously sanctioned products were not significantly different compared to the control group.[12]

Interestingly, but not unexpectedly, affected firms diverted trade to third markets, almost doubling their export flows ($(\exp(0.7716)-1)*100 \approx +116.75\%$). Notably, these changes *do* persist, as flows after lifting the sanctions remain 34% higher compared to the control group. Another common finding in related literature is that related products — defined here as being in the same HS4 chapter as embargoed ones — are also affected, either positively, as firms circumvent measures by exporting (or labeling as) similar products, or negatively, as firms suspend exports of unaffected products due to legal ambiguities. We find a negative circumvention effect — non-embargoed products were also affected, with exports decreasing by almost 38% — but this effect again vanishes after the measures are lifted. In our preferred specification using country-level data, we also control for Russia's 2014 embargo on EU food and agricultural products to account for diverted demand shocks impacting Turkish exports.[13]

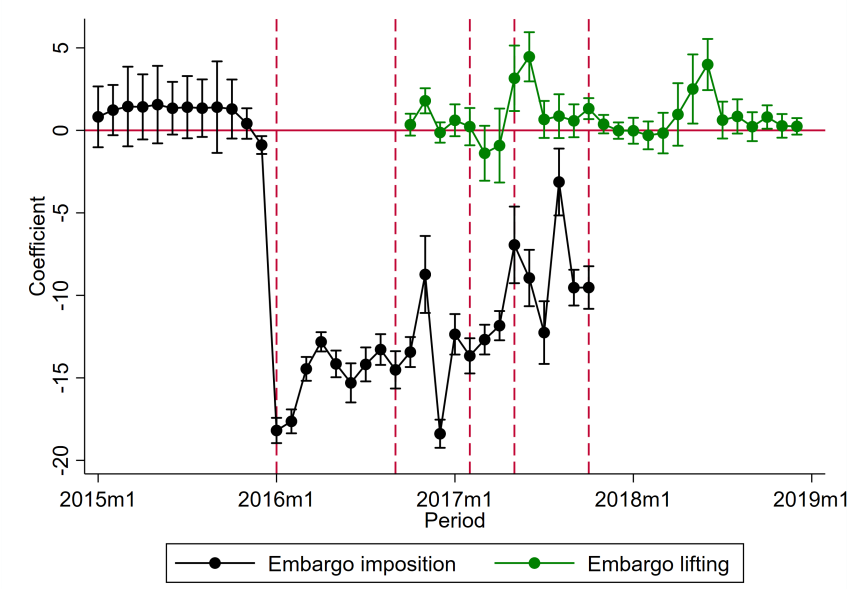
We compare our preferred specification to standard approaches for estimating the effects of trade cost changes — in this case, sanctions — on firm exports. Table 3, column (2), reports results for a two-way fixed effects setup that controls for origin $\times$ product $\times$ time and bilateral origin $\times$ destination $\times$ product $\times$ month characteristics but excludes destination market controls. Column (3) maintains the same fixed effects but incorporates *estimated* fixed effects based on global data to control for destination market shocks.[14] Column (4) 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 capture the direct embargo imposition effect, the lifting effect varies from an economically and statistically significant negative -50% to insignificance. The same inconsistency is observed for diversion effects, which are estimated as significantly positive, negative, or insignificant. Circumvention effects also show considerable variation. For the reasons outlined above — including the most flexible three sets of fixed effects by combining firm-level and country-level data — our preferred specification in column (1) provides the most sensible results.

[12] Note that the coefficient does not allow for interpretation at the level due to the inclusion of destination $\times$ time-specific fixed effects.

[13] As expected and consistent with other studies, this embargo was also highly effective, reducing trade to effectively zero.

[14] See Crozet et al. (2021) for a similar approach.

Figure 3: Imposition and lifting effect of embargo: monthly plot estimates



Notes: This figure illustrates the regression coefficients broken down into monthly effects of the imposition (black line) and lifting (green line) of the embargo from January 2015 to December 2018. Identification is otherwise equivalent to the estimation of equation (1) using firm-level and global data. The first dashed line marks the common period of sanction imposition, with subsequent dashed lines indicating lifting dates for product groups. Appendix A details these sanctioned groups and their imposition dates.

We present the results of a simple event study exercise, following equation (1), in Figure 3. The black line shows the evolution of the embargo effect coefficients when interacted with time dummies, highlighting the significant drop during the embargo period. The green line illustrates the coefficients for the lifting effect over time, showing that nearly all values remain close to and insignificantly different from zero. These findings align with the average coefficients shown in column (1) of Table 3.

These results demonstrate that the embargo had a significant and lasting impact on affected firms, resulting in lower sales to Russia and relatively higher sales to third markets. The next section delves deeper into this finding, examining how firm and product heterogeneity influence the severity or mitigation of the impact of these measures.

4.1 Heterogeneity by firm characteristics

In this section, we explore how different firms respond to sanctions. We analyze the interaction between firm characteristics and key variables in our baseline equation to do this. We focus on two distinguishing characteristics: the size of firms as measured by their total value of exports and a measure of firm diversification as measured by the number of products exported during the first year a firm entered the export market before 2016. Specifically, we interact the variables of interest in equation (1) with dummy variables denoting a firm's size or measure of diversification being above the median.

Table 4: Effects by Firm Size and Diversification

Model:	Baseline (1)	Large Firm (2)	Diversified Firm (3)
Variables			
Embargo × imposition period	-13.2126***	-16.5765***	-9.1355***
	(0.7723)	(0.5089)	(1.1965)
× large/diversified firm		3.1108***	-5.3333***
		(0.8911)	(1.4953)
Embargo × lifting period	0.1297	0.3508	0.5183
	(0.2094)	(0.7239)	(1.1288)
× large/diversified firm		-0.1684	-0.3441
		(0.7325)	(1.1293)
Diversion × imposition period	0.7716***	2.9536***	2.2227***
	(0.1954)	(0.5519)	(0.6848)
× large/diversified firm		-2.2589***	-1.5358**
		(0.5590)	(0.6777)
Diversion × lifting period	0.2919*	1.6995***	1.3437*
	(0.1724)	(0.5917)	(0.6975)
× large/diversified firm		-1.3973**	-1.0475
		(0.5952)	(0.6981)
Circumvention × imposition period	-0.4720**	-3.2216**	-4.3751***
	(0.2402)	(1.3558)	(1.1024)
× large/diversified firm		2.8243**	3.9931***
		(1.3540)	(1.1054)
Circumvention × lifting period	-0.1531	0.8270	-0.5468
	(0.2373)	(2.1771)	(2.8378)
× large/diversified firm		-0.9620	0.4169
		(2.1793)	(2.8397)
Russia embargo × imposition period	-5.1439***	-5.2037***	-5.2037***
	(0.2642)	(0.2659)	(0.2659)
Fixed-effects			
Origin × product × time	Yes	Yes	Yes
Origin × destination × product × month	Yes	Yes	Yes
Destination × product × time	Yes	Yes	Yes
Observations	8,994,657	8,994,657	8,994,657

Notes: This table presents results for regressions where the impact of embargo, diversion, and circumvention is interacted with firm size and diversification characteristics. The large firm column uses interactions for firms with total exports above the median in the first year they exported, while the diversified firm column interacts with firms exporting a number of products above the median in their first export year. All regressions employ a triple-difference methodology with PPML. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at the origin (or firm) × product level.

Table 4 reports the results. The first column provides the baseline results for all firms, while the second and third columns display the interaction effects for firms with specific characteristics. The second column presents the interaction effects for firms with total exports above the median in their first export year, referred to as large firms. The third column shows the interaction effects for firms exporting a number of products above the median in their first export year, referred to as diversified firms. All columns use our preferred specification for estimating equation (1), which incorporates all three sets of flexible fixed effects.

The table investigates how large firms or those exporting multiple products responded to sanctions during the imposition period, revealing interesting patterns. Larger firms, based on total exports, were more likely to continue exporting compared to smaller firms, as indicated by the positive interaction coefficient. In contrast, multi-product (diversified) firms were less likely to export to Russia during the imposition period, as shown by the negative interaction coefficient. Despite these contrasting results, the overall reduction in trade was effectively close to 100% for both groups, suggesting that while the differences are statistically significant, they are not economically substantial. Additionally, larger and more diversified firms did not react differently when the embargo was lifted, as indicated by the interaction terms during the lifting period.

In contrast, firm characteristics played a significant role in the diversion effect during the imposition period. The interaction terms for diversion reveal that larger firms were less likely to redirect their exports to other countries, suggesting that smaller firms were more proactive in seeking alternative markets to offset their export losses. Similarly, more diversified firms, in terms of their number of exported products, engaged less in trade diversion compared to more specialized ones. However, larger and more diversified firms were able to mitigate their export losses by exporting close substitutes to Russia, highlighting a strategic response to the restrictions.

4.2 Heterogeneity by product types

We now investigate heterogeneous effects by product types and classify food items by perishability and processing status following the Broad Economic Categories (BEC) classification. Among the embargoed items, only two non-food, non-beverage products — salt and clove — fall into the non-perishable category. Chicken and turkey are classified as processed products. We create dummy variables to indicate these product groups and interact them with our variables of interest in our preferred specification with the full set of fixed effects of estimating equation (1). Therefore, we documented how perishable and non-processed goods were affected by the embargo during both the imposition and lifting periods compared to other embargoed goods.

Table 5 presents the results with column (1) reproducing the baseline results. The second column, showing the interaction with perishable goods, reveals that perishable products subject to Russia's embargo during the imposition period were somewhat less likely to be significantly affected. However, again economically the coefficients still indicate a total collapse in the trade of sanctioned products. In the third column, we interact with the non-processed status and find a similar outcome.

The coefficients of other variables reveal important findings. The sixth row examines the diversion interaction with product characteristics during the imposition period, revealing that Turkish firms diverted more perishable goods compared to non-perishable ones.

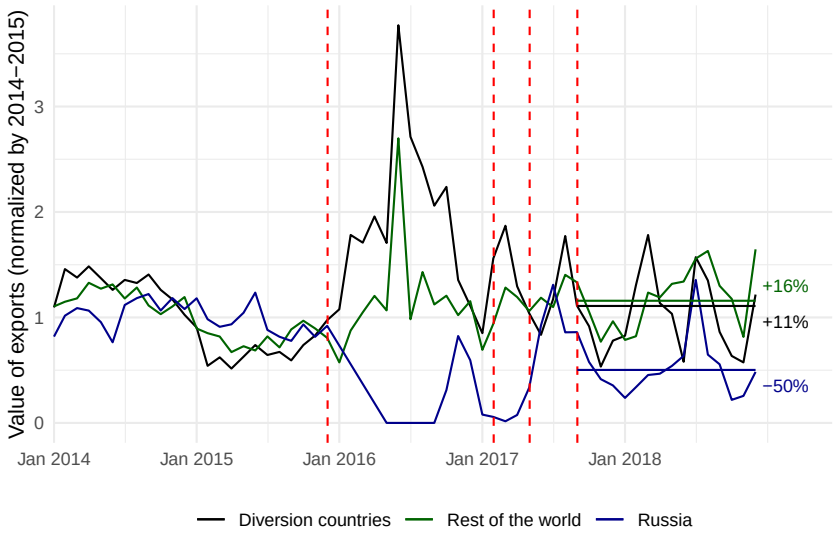
Table 5: Effects by Product Heterogeneity

Model:	(1) Baseline	(2) Perishable good	(3) Non-processed good
Variables			
Embargo × imposition period	-13.2126***	-15.9940***	-5.4184***
	(0.7723)	(1.0083)	(0.8221)
× perishable/non-processed product		2.8159**	-12.6480***
		(1.2714)	(0.8445)
Embargo × lifting period	0.1297	-1.4910**	-2.3585***
	(0.2094)	(0.5875)	(0.5433)
× perishable/non-processed product		1.6918***	2.6801***
		(0.6261)	(0.5880)
Diversion × imposition period	0.7716***	-0.7891	0.3616
	(0.1954)	(0.4889)	(0.3359)
× perishable/non-processed product		1.5864***	0.6538
		(0.5275)	(0.4110)
Diversion × lifting period	0.2919*	-0.4041	0.3333
	(0.1724)	(0.4713)	(0.3940)
× perishable/non-processed product		0.7243	0.0378
		(0.5027)	(0.4382)
Circumvention × imposition period	-0.4720**	-15.0111***	7.7088***
	(0.2402)	(1.2458)	(1.3623)
× perishable/non-processed product		14.5446***	-8.1822***
		(1.2689)	(1.3833)
Circumvention × lifting period	-0.1531	-1.4614	5.7077***
	(0.2373)	(1.3980)	(1.6133)
× perishable/non-processed product		1.3108	-5.8615***
		(0.2402)	(1.6307)
Russia embargo × imposition period	-5.1439***	-5.1434***	-5.1432***
	(0.2642)	(0.3012)	(0.3012)
Fixed-effects			
Origin × product × time	Yes	Yes	Yes
Origin × destination × product × month	Yes	Yes	Yes
Destination × product × time	Yes	Yes	Yes
Observations	8,994,657	8,994,657	8,994,657

Notes: This table presents the impact of Russian sanctions on export values using a triple-difference methodology with a PPML estimator. The baseline results are shown in the first column. The second column examines product heterogeneity by classifying sanctioned items as perishable (e.g., fruits) or non-perishable (e.g., cloves, salt). The third column separates products by processed and non-processed status. "Embargo" refers to Russian sanctions, and "diversion" indicates trade redirected to related countries. The "imposition period" covers the duration of the sanctions, and "lifting" spans from the end of sanctions to December 2018. "Circumvention" pertains to four-digit substitute products for embargoed goods exported by Turkey to Russia. All models include destination × product × time fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at the origin (or firm) × product level.

However, there is no significant effect for non-processed goods, as shown in the third column. Furthermore, exports of these products did not significantly change persistently by type of good, as the effect turns insignificant after the embargo was lifted, as indicated in the eighth row. The tenth row demonstrates that perishable goods were more likely to be exported to Russia by being relabeled or slightly altered during the imposition period,

Figure 4: Exports of embargoed products to Russia, diversion countries, and the rest of the world



Notes: This figure illustrates levels of exports of embargoed products from Turkey to Russia (dark blue), diversion countries (black), and the rest of the world (dark green), normalized by their average monthly values in 2014 and 2015. The first dashed line marks the common period of sanction imposition, with subsequent dashed lines indicating lifting dates for product groups. Appendix A details these sanctioned groups and their imposition dates.

while this was less likely for non-processed goods. Non-processed goods are not easily disguised are altered in their appearance, making circumvention near impossible.

4.3 Relative versus absolute effects of the lifting of sanctions

As established above, the embargo effect is not persistent, i.e. exports of embargoed products is not significantly different to thew non-embargoed flows and those to other destinations after the sanctions where lifted in 2017. Figure 3 shows this neatly, as the dark green line is for almost all of the periods not statistically significantly different from zero. This could lead to the conclusion that firms should also not see a persistent effect of the embargo after it was lifted.

However, looking at the absolute trade levels in Figure 4 this is only part of the story. In fact, while exports of the affected products to Russia were no different from those in the control group, the absolute level of the value of exports was nevertheless 50 % lower on average in the time after sanctions were lifted, compared to the average of 2014 to 2015. However, exports to diversion countries and the rest of the world were higher post-sanction than they were before the sanctions were imposed.

Hence, in relative terms, exports of embargoed products recovered after sanctions were lifted, but in absolute terms, trade levels still remained subdued. This matters for the

analysis below, where we investigate the impact of the embargo beyond firm-level exports.

5 Impact on other firm outcomes

Having established the effect of the embargo on firms' export, we now turn to the exploration of other firm outcomes to investigate whether the measures had a wider economic impact.

The analysis focuses on firms with export activities towards Russia before the 2016 sanctions. The firms' exposure to the embargo is determined by whether it traded sanctioned products with Russia before the sanctions.

For other firm-level outcomes we lose information about specific products, and hence consider a firm as exposed if it traded any sanctioned products to Russia in 2015. More specifically, if a firm exported goods before the imposition of the measures where restrictions were lifted again in October 2016, we consider the firm treated only for the period from January 2016 to September 2016. If a firm exported all embargoed products to Russia in 2015, we consider the treatment to last for the entire sanctions period (January 2016 to October 2017) as relevant for this firm.

We identify the effects on firm-level outcomes using a simple difference-in-differences model with a continuous treatment variable. The estimation follows this specification:

$$\begin{aligned} y_{it} = \exp\big(&\beta \cdot \text{exposure}_i \times \text{imposition period}_t + \\ &\eta \cdot \text{exposure}_i \times \text{lifting period}_t + \\ &\psi_{im} + \phi_t\big) \cdot \epsilon_{it} \end{aligned} \tag{2}$$

where the subscripts i, m, and t represent the firm, month, and time, respectively.[15] The exposure variable is computed for each firm as its share of Russian exports in total firm exports in 2015:

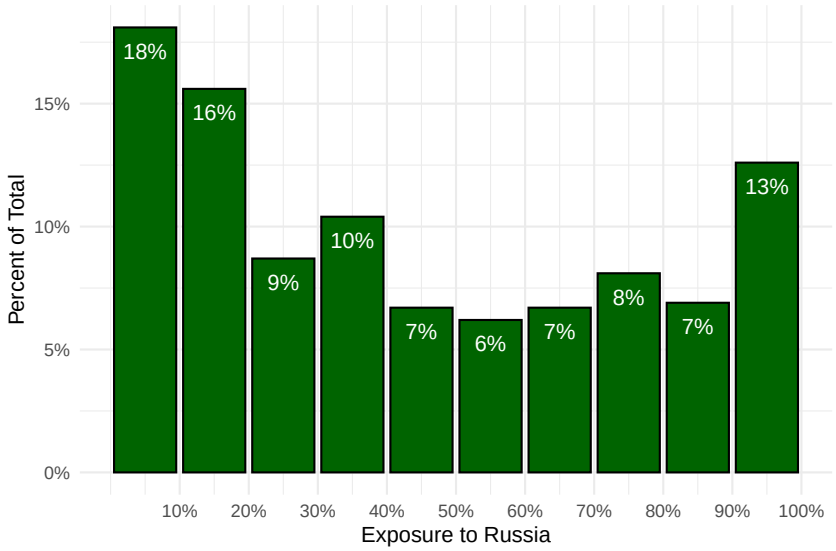
$$\text{exposure}_i = \frac{\text{embargoed exports to Russia}_i^{2015}}{\text{total exports}_i^{2015}} \tag{3}$$

where the numerator is the total exports of embargoed goods of firm i to Russia in 2015. The denominator is the firm's total export value to any destination and of any product for the same period.

Figure 5 illustrates the distribution of firms in terms of their exposure to the sanctions as measured by equation (3). The data shows that among 404 treated firms, the intensity of exposure varied significantly across firms. For example, more than 18% of firms had

[15] Month denotes the calendar month, e.g. June, to control for seasonal patterns, whereas time denotes the actual point in time, e.g. June 2016.

Figure 5: Distribution of $exposure_i$



Notes: Each bar denotes the share of firms with an exposure measure in the decile denoted on the x-axis.

exposure intensities below 10%, while the top 13% exported embargoed products only to Russia. This underlines the importance of measuring the exposure to Russian sanctions with a continuous measure.

As in section 4 we estimate equation (3) with a PPML estimator to identify the effect of the Russian embargo on various firm-level measures related to domestic trade and employment. Specifically, the dependent variable, y_{it}, is taken as: 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) domestic sales of producers related to embargoed products; viii) number of customers of producers related to embargoed products; ix) the number of employees; and x) the average daily wage of the employees in the firm. The variables ψ_{im} and ϕ_t represent firm $\times$ month and time fixed effects[16] respectively.

Recent advances in difference-in-differences (DiD) methodologies have introduced sophisticated techniques designed to address challenges in complex settings, such as staggered treatment timing and treatment switching across multiple periods. Key contributions include Callaway and Sant'Anna (2021), who developed methods for DiD with multiple time periods, and De Chaisemartin and D'haultfœuille (2023), who provided tools to handle intertemporal treatment effects. Wooldridge (2021, 2023) also extended DiD approaches to non-linear models, focusing on binary treatments. These methods enhance the robustness of causal inference in settings where units may switch between treatment and control groups or where treatment effects vary over time.

[16]When examining the producer effects of embargo, we use firm,$\times$ quarter fixed effects because employment data that can be linked to network data is available in this frequency.

Table 6: Domestic sales and purchases effects of embargo

Model:	(1) Domestic sales (Value)	(2) Number of customers	(3) Purchases (Value)	(4) Number of suppliers
Variables				
Exposure	-0.3138**	-0.2608**	-0.5838***	-0.4183***
× period imposition	(0.1442)	(0.1241)	(0.1531)	(0.1109)
Exposure	-0.2106	-0.2679	-0.5083***	-0.3690***
× period lifting	(0.1685)	(0.1662)	(0.1807)	(0.1308)
Fixed-effects				
Firm × month	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes
Observations	412,616	412,616	413,433	413,433

Notes: This table shows the impact of Russian 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 "Exposure" is a share of embargoed good exports of the firm in its total exports 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. The header of each column shows the outcome variable. Columns 1 to 4 show the effect of the embargo on domestic sales and purchases in terms of value and number of links (customers and suppliers). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at firm and time.

However, these advanced DiD methods do not fully apply to our study due to the nature of our empirical context. In our analysis, all products (and hence firms) are treated simultaneously when sanctions are imposed, and there is no switching between treatment and control groups over time. The stability of these groups, or the use of "clean" comparisons (Roth et al., 2023), simplifies the estimation process. Finally, while these modern DiD techniques are not directly compatible with our non-linear estimator and continuous exposure measures, we test the robustness of our results — with some adjustments to our original approach to implement these techniques (e.g., by using linear methods instead of non-linear, or binary exposure measures instead of continuous). Qualitatively, our results remain robust to these alternative approaches.[17]

5.1 Impact on domestic sales, supply chains and purchases

Tables 6 and 7 present the estimation results for various outcome variables related to domestic trade, following equation (2). The first two columns of Table 6 show the embargo's impact on total domestic sales (by value) and the number of domestic customers for exporters. The first column indicates that firms with higher exposure to sanctions experienced a greater decrease in domestic sales than exporters with lower exposure. Quantitatively, a 10% increase in exposure intensity, defined as the share of embargoed goods in total firm exports to Russia, leads to a $(\exp(-0.3138) - 1) \times 100 = 26.9\%$ decline

[17]The results are available in the online appendix at:
https://julianhinz.com/research/shooting_down_trade/shooting_down_trade_online_appendix.pdf.

Table 7: Impact on producers of embargoed goods

Model:	(1) Agri/Salt Purchases (Value)	(2) Number of agri/salt suppliers	(3) Domestic sales of producers (Value)	(4) Number of customers of producers
Variables				
Exposure	-0.9662***	-0.6506***	-0.5206**	-0.2927***
× period imposition	(0.3495)	(0.1545)	(0.2201)	(0.0981)
Exposure	-0.4049	-0.7386***	-0.4559*	-0.2805**
× period lifting	(0.2472)	(0.1855)	(0.2664)	(0.1275)
Fixed-effects				
Firm × month	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes
Observations	84,272	84,272	163,085	163,085

Notes: This table displays the effects of the Russian sanctions on domestic trade concerning agricultural and salt producers and their customer relationships, using a difference-in-differences methodology with a PPML estimator. Columns 1 and 2 present the estimates of purchase value and the number of suppliers in the industries providing embargo-related products to exporters, respectively. These industries correspond to the NACE classification of sanctioned HS products (100-500, 893, and 1011). 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. The exposure variable in these columns is the mean total embargoed Russian exports of their customers in 2015. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at firm and time.

in total domestic sales. Furthermore, the second column suggests that more heavily sanctioned firms interact with fewer domestic customers, indicating reduced transactions with domestic firms during the imposition and lifting of sanctions. In other words, the firms most strongly affected reduced their total sales and concentrated these sales among fewer firms. However, this decline in trade and the collapse of trade links did not persist after the sanctions were lifted, as the lifting interaction of exposure does not yield any significant results in either column. These results are interesting as they hint that affected firms did not divert products destined for the Russian market to domestic customers. This suggests no such mechanism as in Almunia et al. (2021), where domestic slumps are shown to be compensated by increased export sales, ceteris paribus.

Columns 3 and 4 analyze the impact on total domestic purchases and the number of suppliers as the outcome variables. Both columns reveal that exporters with a relatively high share of embargoed exports reduced their purchases and the number of suppliers when faced with sanctions. This indicates that heavily affected firms scaled back their transactions with downstream firms. The reduction trend persists even beyond the embargo period, suggesting long-term impacts on firms' whole supply chain activities. The results from all four columns taken together suggest that starting with the embargo, affected firms scaled down.

Not all exporters of embargoed goods also produce these products themselves. In Table 7 we therefore focus on those firms that either source embargoed products domestically,

or produce them themselves. In column 1 and 2, we look at embargoed firms' purchases and number of suppliers in embargo-related industries. The coefficient shows a negative and significant effect during the embargo's imposition period, with a 10% increase in direct exposure being related to a 6.2% decrease in purchases of embargoed products. This indicates that firms intensively exporting sanctioned products to Russia reduce also some essential purchases and number of suppliers related to embargoed products, at least during the sanction period. Once the sanctions were lifted, these firms' purchases did not significantly differ from other firms but the number of supplier links remained subdued. 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.

In columns 3 and 4 of Table 7, we report the effect of the embargo on downstream producers in embargo-related industries. Specifically, we investigate the domestic sales and number of customers of producers supplying embargo-related inputs to Russian exporters. Here, we compute the exposure measure as the mean of downstream connected exporters of embargoed goods to Russia. In the first row, we observe that producers with customers who have a high share of exposure experience declines in sales and losses of business links during the imposition period. Quantitatively, a ten-point increase in mean exposure results in a 4% reduction in sales and a 2.5% reduction in the number of customers, respectively. As seen in the second row, these domestic trade losses persist after the sanctions were lifted.

5.2 Impact on firm employment and wages

Table 8 explores the embargo's impact on employment and average daily wages. The first two columns focus on exporters of embargoed products, while the last two examine their suppliers, primarily agricultural producers selling their products to Russian exporters. The first column reveals that firms with a high share of export intensity in sanctioned products to Russia reduced their workforce during the imposition period of the embargo, compared to firms with lower exposure. Notably, the magnitude of this effect does not persist after the lifting of the embargo, suggesting that the negative impact on the labor market dissipated over time. The sanctions have no significant impact on the average wages of these firms during both the imposition and lifting periods, as shown in the second column. The results again underline the impression that directly affected firms downsized, also in terms of their employed labor.

Columns 3 and 4 apply the same analysis to suppliers of the exporters. Again, no significant effect on labor market outcomes can be detected for these firms aside from a very small yet significant — but likely spurious — negative effect on daily wages. Overall these findings suggest that the sanctions had a rather small effect on the labor market with little to no

Table 8: 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
Variables				
Exposure	-0.2517***	0.0473	-0.1928	-0.0990*
× period imposition	(0.0953)	(0.0387)	(0.1280)	(0.0514)
Exposure	-0.2581	0.0060	-0.1669	-0.0596
× period lifting	(0.1669)	(0.0446)	(0.1309)	(0.0539)
Fixed-effects				
Firm × month	Yes	Yes	No	No
Firm × quarter	No	No	Yes	Yes
Time	Yes	Yes	Yes	Yes
Observations	318,011	318,011	61,073	61,073

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. The variable "Exposure" is a share of embargoed good exports of firm in its total exports 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. Exposure variable in these columns is the mean total embargoed Russian export of their customers 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.

ripple effect to upstream firms.

5.3 Heterogeneity by firm characteristics

As in section 4 where we looked at the embargo's impact on export, we suspect that outcomes beyond trade may also be heterogeneous along firm characteristics. We therefore augment our specification in equation (2) and interact the treatment variables with firm characteristics. Specifically, this augmented estimating equation is:

$$\begin{aligned} y_{it} = \exp\big(&\beta \cdot \text{exposure}_i \times \text{imposition period}_t + \\ &\gamma \cdot \text{exposure}_i \times \text{imposition period}_t \times \text{firm characteristic}_i + \\ &\eta \cdot \text{exposure}_i \times \text{lifting period}_t + \\ &\theta \cdot \text{exposure}_i \times \text{lifting period}_t \times \text{firm characteristic}_i + \\ &\psi_{im} + \phi_t\big) \cdot \epsilon_{it} \end{aligned} \tag{4}$$

where γ and θ capture the uneven effects of imposition and lifting periods for firms with different characteristics before the sanctions in 2015. Specifically, we ask whether the effects differ across firms by size as measured as total export value, the number of products

and destinations. We report these results in Appendix E. Some specifications point towards an advantage for multi-destination and multi-product firms in dealing with the embargo, though. In the last column of Table A15, we observe that multi-destination can firms significantly mitigate the negative effect of the embargo on domestic sales. Additionally, multi-product firms, as well as these multi-destination firms, are less likely to lose their number of suppliers during the imposition period (last two columns of Table A18). This is consistent with findings for the employment and wage of these types of firms, as in Tables A21 and A22, we find that multi-product and large exporters are less likely to lay off workers during the imposition period.

6 Robustness

To test the robustness of the results, we redo the above analyses by using alternative measures for the embargo exposure, by checking for their consistency over time with event studies, as well as by making use of alternative estimators.

6.1 Alternative measure for embargo exposure

In our baseline specification, we use a continuous exposure measure calculated based on the share of sanctioned products exported to Russia relative to firms' overall exports in the previous year. In Appendix C, we use an alternative binary measure that categorizes firms as either exposed or not. Firms that exported sanctioned products to Russia in 2015 are considered exposed, while those that did not are considered unaffected. This alternative measure does not capture the intensity of exposure and assigns equal weight to all firms, regardless of the importance of their trade with Russia. Naturally, this introduces more noise. However, the results remain similar for most outcomes, with a few exceptions, indicating that the estimated effects are not highly sensitive to the method of measuring exposure to sanctions. When examining domestic sales and employment outcomes in Tables A9 and A10, both variables of interest (imposition and lifting) are insignificant, constituting exceptions to the general trend. In contrast, coefficients from PPML estimations (Tables 6, 7, and 8) and OLS estimations (Tables A11 and A12) using the continuous treatment yield significant and consistent coefficients, suggesting that the unequal distribution of exposure across firms is crucial in explaining these differences.

6.2 Alternative estimator

Following the related literature, we use Poisson Pseudo Maximum Likelihood (PPML) in all our baseline estimates, which is particularly useful for trade data that includes many zeros. However, to ensure that our results are not driven by the estimation method, we re-estimate all specifications with an Ordinary Least Squares (OLS) estimator as a

robustness check. Appendix Section D presents these results. Reassuringly, the results remain mostly unchanged, confirming our findings. One exception to this are the finding related to domestic sales and the number of customers for producers. While the PPML estimation results in in Tables A9 and A10 show a negative and significant effect for both outcomes during the imposition period, the OLS results report insignificant coefficients. The main reason for this difference may be attributed to the presence of zeros in the former estimator. Some treated producers might have entirely cut their sales, and accounting for these firms by including zeros may be highlighting the difference.

6.3 Event studies

We also perform event study estimations for all exercises conducted above. Figure 6 reports these results, displaying the monthly event coefficients for each outcome listed in Tables 6, 7, and 8 during the imposition period. Each panel shows the evolution of firm-level outcomes before the sanctions (to the left of Period 0) and across the four sanction periods (i.e., Periods 1, 2, 3, and 4). The dotted lines mark the end of each sanction period. The event studies confirm the absence of pre-trends and provide a clear visualization of how the effects evolve over time.

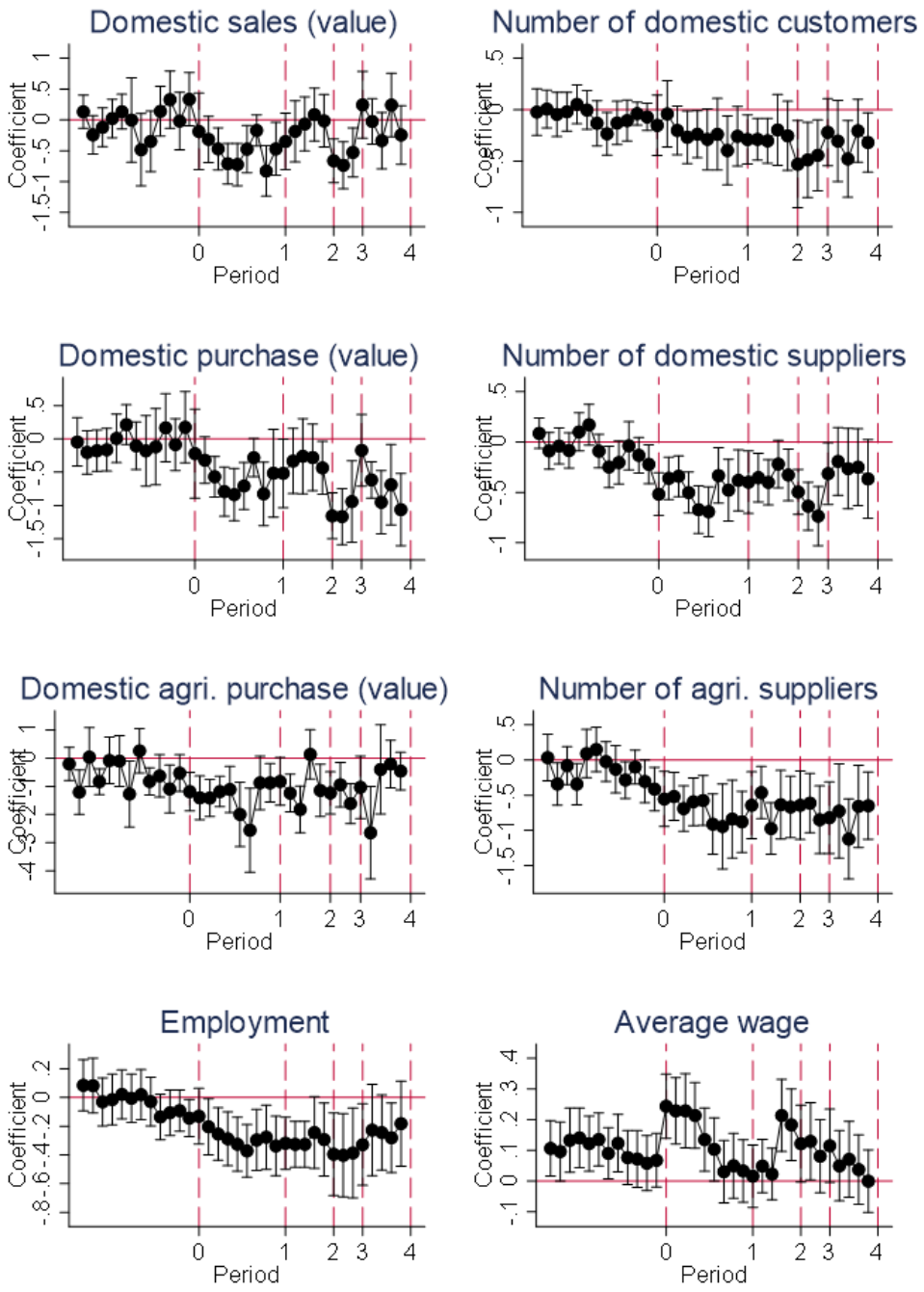
7 Discussion of results and potential mechanisms

Our analysis demonstrates that the Russian embargo on Turkish exports had immediate, profound impacts on affected firms. Exports of embargoed products to Russia plummeted, and although trade with alternative markets surged, it did not fully offset the initial losses. This suggests that while Turkish firms demonstrated adaptability, significant barriers hindered a seamless redirection of exports. Post-sanction recovery was mixed: while relative trade patterns normalized after the embargo was lifted, absolute trade values did not fully recover to pre-embargo levels.

The broader repercussions on domestic activities are equally interesting. Firms exposed to the sanctions curtailed domestic sales and reduced procurement from suppliers, indicating that the embargo's disruption extended well beyond trade itself. While employment impacts were temporary for many exporters, these were not passed on to upstream suppliers. Other effects did spread through the supplier network, however: Firms producing embargoed goods reacted negatively, as their downstream customers selling to Russia stopped or reduced sourcing.

Importantly, most of the negative results remained transitory and vanished once the embargo was finally lifted towards the end of 2017. Those effects that did remain — like reduced number of suppliers and purchases of exposed firms — can at least in part be attributed to lower absolute levels of exports of embargoed goods towards Russia.

Figure 6: Imposition effect of embargo on other firm outcomes: monthly plot estimates



Notes: This figure shows the monthly estimated effects of the Russian embargo on firm-level outcomes during the imposition period. The title above each panel indicates the dependent variable. The estimation equation corresponds to Equation (2). The point labeled 0" on the horizontal axis marks the start of the sanctions in January 2016. The points labeled "1", "2", "3", and "4" correspond to the lifting dates of the sanctions for the different product groups, which occurred in October 2016, March 2017, June 2017, and November 2017, respectively. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at firm and time.

These findings align with established theoretical mechanisms and resonate with recent works by Albornoz et al. (2021) and Lastauskas et al. (2023), which provide relevant frameworks for understanding these responses.

Connection to *Firm Export Responses to Tariff Hikes* by Albornoz et al. (2021)

Albornoz et al. (2021) study how firms adjust their export behavior in response to sudden import tariff increases, using the suspension of US Generalized System of Preferences (GSP) for Argentinian imports as a natural experiment. This policy shock led to higher tariffs on one-third of affected Argentine exports, causing significant shifts in firm-level export strategies. Their main finding highlights how firms responded not just by reducing exports of tariffed products but also by reshuffling their product mix, either ceasing to export some products or increasing exports of other goods. Importantly, the study documents third-market effects: firms withdrawing from the US market were more likely to reduce exports to other markets as well, suggesting firm-level interdependencies shaped by economies of scale and diseconomies of scope in production and export decisions.

The core theoretical mechanism described in their paper relies on the interplay between fixed and variable export costs. Firms face market-specific fixed costs and product-specific fixed costs, which interact with diseconomies of scope in production. When a tariff increase raises the variable cost of exporting a product, firms with lower profitability are forced to adjust their product mix, potentially leading to a reduction in the marginal cost of exporting other goods. This dynamic results in interdependencies across products within the same market and across different export markets.

Applying this framework to our analysis of the Russian sanctions on Turkish exports, we observe similar mechanisms at play. The embargo effectively increased the variable cost of exporting certain products to Russia, mirroring the tariff hike scenario. Our results show that Turkish firms responded by reducing their exports of sanctioned products, aligning with the extensive and sub-extensive margin adjustments identified by Albornoz et al. (2021). Additionally, we find that these adjustments had spillover effects: firms redirected their exports to alternative markets and adapted their product strategies, illustrating the existence of interdependencies across products and markets. The results emphasize how sanctions, akin to tariff hikes, trigger shifts in firm export behavior due to the structural costs and strategic reallocations firms face when encountering trade barriers.

Connection to *How do Firms Adjust when Trade Stops?* by Lastauskas et al. (2023)

Lastauskas et al. (2023) investigate firm-level responses to sudden and long-lasting economic sanctions, using the case of Lithuania's food sector after Russia imposed sanctions on EU imports in 2014. This abrupt demand shock led to various firm adjustments, including employment and investment changes and shifts to new export markets. The authors find

that firms initially adjust by reducing part-time employment, followed by cuts in full-time positions if the shock persists. Additionally, investment drops immediately, and firms increase their exports to non-sanctioned markets as a revenue recovery strategy.

The authors propose a theoretical framework where firms optimize under non-convex labor adjustment costs and heterogeneous variable trade costs. Part-time labor, being the most flexible adjustment margin, acts as a proxy for shock severity. Larger adjustments in part-time employment signal future reductions in capital investment and full-time employment. The empirical analysis supports these theoretical implications, revealing that firms experiencing greater initial part-time labor reductions were more likely to adjust capital and full-time labor subsequently. The shift to new markets, while helpful, was insufficient to fully offset the loss of profits.

The mechanisms outlined in Lastauskas et al. (2023) resonate with the findings in this paper on the embargo's impact on Turkish firms. The sanctions imposed by Russia on Turkish exports similarly acted as an exogenous shock to variable trade costs, leading to shifts in firm behavior. Turkish firms not only redirected their exports to alternative markets but also showed significant employment effects. Firms, when faced with such shocks, adjust their behavior by altering input use and reducing operational costs, depending on the expected severity and persistence of the shock. Next to the observed employment effects in the analysis above, an additional margin in this current analysis are domestic purchases and the number of domestic suppliers, which both also take a significant hit, mirroring the Lithuanian firms' strategy of leveraging several margins of adjustment.

8 Conclusion

The recent literature and anecdotal evidence have highlighted the unforeseen consequences of trade sanctions. This paper analyzes sanctions imposed by Russia on Turkey as a response to an unanticipated military conflict. This scenario serves as 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 done for other countries. By leveraging linked datasets for Turkey, we provide new insights into the broader economic impact beyond trade on affected firms — including their domestic sales and purchases, employment, and wages.

Our findings reveal that the embargo had an immediate and profound impact on Turkish exports of sanctioned products to Russia, effectively reducing them to near zero. While Turkish firms demonstrated adaptability by redirecting exports to alternative markets, these efforts only partially offset the initial losses. Post-sanction recovery was mixed: while relative trade patterns normalized following the lifting of the embargo, absolute trade levels did not fully recover to their pre-embargo values, indicating persistent scars on trade

volumes.

Beyond the direct trade effects, our analysis shows that the embargo had significant repercussions on domestic operations for affected firms. Firms with high exposure to the sanctions experienced declines in domestic sales and procurement, and many reduced the number of their suppliers. These disruptions suggest that the embargo's impact extended into firms' broader operational activities. However, most of these negative effects were temporary and diminished once the sanctions were lifted, with the exception of some lasting reductions in domestic purchases and supplier relationships.

In terms of employment, the results indicate that affected firms reduced their workforce during the sanction period, though these effects were short-lived and did not persist after the sanctions were lifted. Notably, there were no significant impacts on average wages, and the employment effects did not extend to upstream suppliers. This suggests that while direct exporters faced short-term labor adjustments, the broader labor market experienced limited spillovers.

Firm characteristics played an important role in determining the severity of the embargo's impact. Larger firms and those exporting a more diversified range of products were better positioned to mitigate the negative effects, reflecting their greater strategic flexibility. In contrast, smaller and less diversified firms were more vulnerable, highlighting the importance of firm size and product diversification in resilience to trade shocks.

These findings align with established theoretical mechanisms and resonate with works such as Albornoz et al. (2021) and Lastauskas et al. (2023), which explore firm-level responses to trade shocks and sanctions. The observed firm behavior in response to the Russian embargo could reflect similar cost structures and interdependencies between products and markets, aligning with theoretical predictions about firm adaptability and export strategy.

From a policy perspective, the study underscores that while trade sanctions can effectively disrupt trade, their broader economic impact on the targeted country may be limited if firms can shift exports to other markets. However, this depends on firm characteristics, suggesting that policymakers need to consider firm heterogeneity when assessing the efficacy and collateral impacts of sanctions. Future research could focus on the specific conditions that facilitate or impede firms' ability to adapt to trade disruptions, especially for smaller or less diversified firms.

In conclusion, this study contributes to the literature by offering a comprehensive analysis of both immediate and long-term effects of trade sanctions — both in terms of their imposition and their lifting, and not only on export performance but also on domestic economic activities and employment.

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A 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 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 estimating the embargo's trade effects. 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,[18] such that

$$U_{dkt} = \left(\int_{i \in \Theta_d} (a_{idkt}\ q_{idkt})^{\frac{\sigma-1}{\sigma}}\ di \right)^{\frac{\sigma}{\sigma-1}}. \tag{5}$$

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.[19] The demand in market d for a firm i at time t is then given by

$$x_{idkt} = \left(\frac{p_{ipt}}{a_{idkt}} \right)^{1-\sigma} A_{dkt} \tau_{odkt}^{1-\sigma}. \tag{6}$$

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 (6), we obtain firm exports as

$$x_{idkt} = (p_{ikt} \psi_{idk} e^{\epsilon_{idkt}})^{1-\sigma} A_{dkt} \tau_{odkt}^{1-\sigma}. \tag{7}$$

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

$$x_{odkt} = \sum_{i \in o} x_{idkt} = N_{okt} A_{dkt} \left(\bar{\psi}_{odk} \tau_{odkt} \right)^{1-\sigma} e^{\epsilon_{odkt}}. \tag{8}$$

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.

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

[19] 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.

Table A9: Domestic trade effects of embargo, binary treatment

Model:	(1) Domestic Sales (Value)	(2) Number of customers	(3) Purchases (Value)	(4) Number of suppliers	(5) Agri/Salt Purchases (Value)	(6) Number of agri/salt suppliers	(7) Domestic sales of producers (Value)	(8) Number of customers of producers
Variables								
Embargo	-0.0622	-0.1412**	-0.2291***	-0.1338***	-0.3446***	-0.1759**	0.1229	0.0039
× period imposition	(0.0442)	(0.0592)	(0.0398)	(0.0370)	(0.1225)	(0.0778)	(0.1105)	(0.0560)
Embargo	-0.0235	-0.2092**	-0.2026***	-0.1328***	-0.2700**	-0.1983**	0.3048*	0.0400
× period lifting	(0.0595)	(0.0879)	(0.0630)	(0.0477)	(0.1166)	(0.0942)	(0.1650)	(0.0788)
Fixed-effects								
Firm × month	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	412,616	412,616	413,433	413,433	84,272	84,272	163,085	163,085

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. In columns 7 and 8 the sample covers agricultural firms selling products to exporters within the two-digit HS chapters (2, 6, 7, 8, 25) of embargoed goods. Exposure variable in these columns is the mean total embargoed Russian export of their customers in 2015. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at firm and time.

C Alternative measure of exposure

As robustness check, we adopt the binary treatment instead of the exposure variable above. Following equation is also estimated:

$$\begin{aligned} y_{it} = \exp\big(&\beta \cdot embargo_i \times imposition\ period_t + \\ &\eta \cdot embargo_i \times lifting\ period_t + \\ &\psi_{im} + \phi_t\big) \cdot \epsilon_{it} \end{aligned} \tag{9}$$

Where $embargo_i$ 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. 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.

Table A10: Employment and average wages effects of embargo, binary treatment

Model:	(1)	(2)	(3)	(4)
	Exporters		Suppliers	
	Number of employees	Ave. daily wage	Number of employees	Ave. daily wage
Variables				
Embargo	-0.0711	0.0102	-0.0146	-0.0402**
× period imposition	(0.0494)	(0.0221)	(0.0838)	(0.0167)
Embargo	-0.1196*	-0.0141	0.0592	-0.0377**
× period lifting	(0.0712)	(0.0239)	(0.0784)	(0.0191)
Fixed-effects				
Firm × month	Yes	Yes	Yes	Yes
Firm × quarter	No	No	No	No
Time	Yes	Yes	Yes	Yes
Observations	318,011	99,492	61,073	61,073

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. "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.

D Alternative estimator

As robustness check, we apply Ordinary Least Squares (OLS).

Table A11: Domestic sales, number of customers, purchases and number of suppliers effects of embargo, OLS estimator

Outcome	Log(Domestic sales)	Log(Domestic sales)	Log(Number of customers)	Log(Number of customers)	Log(Domestic purchases)	Log(Domestic purchases)	Log(Number of suppliers)	Log(Number of suppliers)	Log(Agri/salt purchases)	Log(Agri/salt purchases)	Log(Number of agri/salt suppliers)	Log(Number of agri/salt suppliers)
Treatment	Continuous	Binary	Continuous	Binary	Continuous	Binary	Continuous	Binary	Continuous	Binary	Continuous	Binary
Embargo x period imposition	-0.4163***	-0.1112**	-0.1226**	-0.0598*	-0.5632***	-0.2523***	-0.2839***	-0.0876**	-0.7431***	-0.3132***	-0.1755**	-0.0440
	(0.1079)	(0.0505)	(0.0549)	(0.0308)	(0.1105)	(0.0530)	(0.0761)	(0.0366)	(0.2286)	(0.0900)	(0.0688)	(0.0416)
Embargo x period lifting	-0.2184*	-0.0046	-0.0791	-0.0506	-0.3893***	-0.1454**	-0.1860**	-0.0143	-0.3914*	-0.1632	-0.2148***	-0.0649
	(0.1276)	(0.0662)	(0.0643)	(0.0403)	(0.1360)	(0.0653)	(0.0862)	(0.0407)	(0.2256)	(0.0997)	(0.0727)	(0.0499)
Observations	330,304	330,304	330,304	330,304	333,838	333,838	338,838	333,838	33,581	33,581	33,581	33,581

Notes: This table shows the impact of Russia sanctions on the domestic sales (column 1 and 2), number of customers (column 3 and 4), domestic purchases (column 5 and 6), number of suppliers (column 7 and 8), domestic agriculture/salt purchases (column 9 and 10) and number of agriculture/salt suppliers (column 11 and 12) of Turkish firms, using a difference-in-differences methodology with a OLS 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 either a share of embargoed good exports of firm in its total exports or a dummy that takes one if a firm exports embargoed products in 2015 in 2015. While "Continuous" refers to former treatment, "Binary" is the latter. "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. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at firm and time.

Table A12: Employment effects of embargo, OLS estimator

Outcome	Log(Employment)	Log(Employment)	Log(Average wage)	Log(Average wage)
Treatment	Continuous	Binary	Continuous	Binary
Embargo x period imposition	-0.1857**	-0.0881**	0.0062	-0.0017
	(0.0727)	(0.0392)	(0.0129)	(0.0071)
Embargo x period lifting	-0.1797**	-0.0859*	-0.0073	-0.0080
	(0.0888)	(0.0466)	(0.0164)	(0.0084)
Observations	282,769	282,769	282,769	282,769

Notes: This table shows the impact of Russia sanctions on the employment (column 1 and 2) and average daily wage (column 3 and 4) of Turkish firms, using a difference-in-differences methodology with a OLS 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 either a share of embargoed good exports of firm in its total exports or a dummy that takes one if a firm exports embargoed products in 2015 in 2015. While "Continuous" refers to former treatment, "Binary" is the latter. "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. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at firm and time.

Table A13: Producer domestic sales and number of customers effects of embargo, OLS estimator

Outcome	Log(Domestic sales)	Log(Domestic sales)	Log(Number of customers)	Log(Number of customers)
Treatment	Continuous	Binary	Continuous	Binary
Embargo x period imposition	0.0721	0.0048	-0.0439	-0.0057
	(0.0823)	(0.0319)	(0.0770)	(0.0239)
Embargo x period lifting	0.0636	0.0236	-0.0358	-0.0099
	(0.1102)	(0.0389)	(0.0954)	(0.0281)
Observations	111,301	111,301	111,301	111,301

Notes: This table shows the impact of Russia sanctions on the domestic sales (column 1 and 2) and number of customers (column 3 and 4) of Turkish firms providing agriculture and salt inputs to firms, using a difference-in-differences methodology with a OLS 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 either a share of embargoed good exports of firm in its total exports or a dummy that takes one if a firm exports embargoed products in 2015 in 2015. While "Continuous" refers to former treatment, "Binary" is the latter. "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. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at firm and time.

E Heterogeneity by firm characteristics

Table A14: Producer employment of embargo, OLS estimator

Outcome	Log(Employment)	Log(Employment)	Log(Average wage)	Log(Average wage)
Treatment	Continuous	Binary	Continuous	Binary
Embargo x period imposition	0.0309	-0.0331	-0.0126	-0.0094*
	(0.0819)	(0.0278)	(0.0194)	(0.0055)
Embargo x period lifting	0.0294	-0.0789**	-0.0122	-0.0098
	(0.0897)	(0.0319)	(0.0185)	(0.0065)
Observations	51,775	51,775	51,770	51,770

Notes: This table shows the impact of Russia sanctions on the employment (column 1 and 2) and average daily wage (column 3 and 4) of Turkish firms providing agriculture and salt inputs to firms, using a difference-in-differences methodology with a OLS 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 either a share of embargoed good exports of firm in its total exports or a dummy that takes one if a firm exports embargoed products in 2015 in 2015. While "Continuous" refers to former treatment, "Binary" is the latter. "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. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are clustered at firm and time.

Table A15: Domestic sales effects of embargo

Model:	(1) Baseline	(2) Median total export	(3) Median num. of products	(4) Median num. of destinations	(5) Log(total) export)	(6) Log(num. of products)	(7) Log(num. of destinations)
Variables							
Exposure × period imposition	-0.3138**	-0.2604	-0.5746***	-0.5972***	-1.921**	-0.6993***	-0.7469***
	(0.1442)	(0.1732)	(0.1832)	(0.2037)	(0.7805)	(0.1939)	(0.1968)
Exposure × period lifitng	-0.2106	0.1389	-0.2050	-0.5610***	-1.4700*	-0.4723**	-0.7733***
	(0.1685)	(0.1842)	(0.2203)	(0.2161)	(0.8668)	(0.1355)	(0.2381)
Exposure × period imposition		-0.0563	0.3233	0.4285*	0.1014*	-0.0152	0.2730***
× firm chr.		(0.2271)	(0.2440)	(0.2584)	(0.0525)	(0.0311)	(0.0906)
Exposure × period lifting		-0.3719	-0.0062	0.5209*	0.0799	-0.0058	0.3450***
× firm chr.		(0.2546)	(0.2948)	(0.2721)	(0.0577)	(0.0746)	(0.1054)
Fixed-effects							
Firm × month	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	412,616	412,616	412,616	412,616	302,409	412,616	412,616

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 "Exposure" is a share of embargoed good exports of firm in its total exports 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 A16: Domestic customers effects of embargo

Model:	(1) Baseline	(2) Median total export	(3) Median num. of products	(4) Median num. of destinations	(5) Log(total) export)	(6) Log(num. of products)	(7) Log(num. of destinations)
Variables							
Exposure × period imposition	-0.2608**	-0.2580***	-0.3761**	-0.3146**	-1.216*	-0.3955***	-0.3083**
	(0.1241)	(0.0962)	(0.1643)	(0.1322)	(0.7278)	(0.7278)	(0.1289)
Exposure × period lifting	-0.2679	-0.3161	-0.3001	-0.1474	-0.6757	-0.6757	-0.2031
	(0.1662)	(0.2509)	(0.2249)	(0.1046)	(0.9249)	(0.9249)	(0.1408)
Exposure × period imposition		-0.0032	0.2420	0.1028	0.0679	0.0679	0.0414
× firm chr.		(0.1590)	(0.2398)	(0.2404)	(0.0539)	(0.0539)	(0.0861)
Exposure × period lifting		0.0513	0.0817	-0.2807	0.0295	0.0295	-0.0648
× firm chr.		(0.2946)	(0.3057)	(0.3415)	(0.0678)	(0.0678)	(0.1238)
Fixed-effects							
Firm × month	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	412,616	412,616	412,616	412,616	412,616	412,616	412,616

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 "Exposure" is a share of embargoed good exports of firm in its total exports 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 A17: Domestic purchases effects of embargo

Model:	(1) Baseline	(2) Median total export	(3) Median num. of products	(4) Median num. of destinations	(5) Log(total) export)	(6) Log(num. of products)	(7) Log(num. of destinations)
Variables							
Exposure × period imposition	-0.5838***	-0.6138***	-0.7024***	-0.6536***	-1.8080*	-0.8570***	-0.8195***
	(0.1531)	(0.1932)	(0.2339)	(0.2133)	(0.9407)	(0.2608)	(0.2248)
Exposure × period lifting	-0.5083***	-0.1970	-0.3401*	-0.5944***	-1.2690	-0.7281**	-0.7708***
	(0.1807)	(0.1732)	(0.1992)	(0.2192)	(1.0720)	(0.3068)	(0.2541)
Exposure × period imposition		0.0318	0.1453	0.1119	0.0777	0.1078	0.1553
× firm chr.		(0.2533)	(0.2912)	(0.2796)	(0.0619)	(0.0810)	(0.1014)
Exposure × period lifting		-0.3292	-0.2288	0.1388	0.0488	0.0899	0.1736
× firm chr.		(0.2695)	(0.3135)	(0.3084)	(0.0719)	(0.1081)	(0.1184)
Fixed-effects							
Firm × month	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	413,433	413,433	413,433	413,433	413,433	413,433	413,433

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 A18: Domestic number of suppliers effects of embargo

Model:	(1) Baseline	(2) Median total export	(3) Median num. of products	(4) Median num. of destinations	(5) Log(total) export)	(6) Log(num. of products)	(7) Log(num. of destinations)
Variables							
Exposure × period imposition	-0.4183***	-0.1774	-0.6055***	-0.5919***	-1.5670**	-0.7609***	-0.6896***
	(0.1109)	(0.1296)	(0.1616)	(0.1344)	(0.6608)	(0.1805)	(0.1465)
Exposure × period lifting	-0.3690***	-0.0009	-0.4418**	-0.5358***	-0.9920	-0.5934***	-0.6096***
	(0.1308)	(0.2571)	(0.1800)	(0.1684)	(0.8415)	(0.2027)	(0.1907)
Exposure × period imposition		-0.2715	0.2595	0.2873	0.0762*	0.1533**	0.1980**
× firm chr.		(0.1803)	(0.2089)	(0.1917)	(0.0450)	(0.0704)	(0.0901)
Exposure × period lifting		-0.4141	0.1067	0.2749	0.0417	0.1043	0.1751
× firm chr.		(0.2914)	(0.2366)	(0.2330)	(0.0584)	(0.0800)	(0.1237)
Fixed-effects							
Firm × month	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	413,433	413,433	413,433	413,433	413,433	413,433	413,433

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 A19: Domestic agricultural/salt purchases effects of embargo

Model:	(1) Baseline	(2) Median total export	(3) Median num. of products	(4) Median num. of destinations	(5) Log(total) export)	(6) Log(num. of products)	(7) Log(num. of destinations)
Variables							
Exposure × period imposition	-0.9662***	-0.7807	-1.541***	-1.2800**	-4.4480**	-1.5500***	-1.3750***
	(0.3495)	(0.5334)	(0.5561)	(0.5565)	(1.8100)	(0.5877)	(0.5258)
Exposure × period lifting	-0.4049	0.1571	-0.4299	-0.5115*	-0.6305	-0.5333	-0.4580
	(0.2472)	(0.6901)	(0.2777)	(0.3093)	(1.1760)	(0.3265)	(0.2872)
Exposure × period imposition		-0.1909	1.0360*	0.6010	0.2354**	0.3050	0.3359
× firm chr.		(0.6138)	(0.6037)	(0.6132)	(0.1148)	(0.1857)	(0.2594)
Exposure × period lifting		-0.5838	0.1005	0.2317	0.0175	0.0853	0.0626
× firm chr.		(0.7204)	(0.4041)	(0.4256)	(0.0825)	(0.1307)	(0.1924)
Fixed-effects							
Firm × month	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	84,272	84,272	84,272	84,272	84,272	84,272	84,272

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 A20: Domestic agricultural/salt suppliers effects of embargo

Model:	(1) Baseline	(2) Median total export	(3) Median num. of products	(4) Median num. of destinations	(5) Log(total) export)	(6) Log(num. of products)	(7) Log(num. of destinations)
Variables							
Exposure × period imposition	-0.6506***	-0.9201***	-0.9447***	-0.8099***	-2.4020***	-1.0290***	-0.8912***
	(0.1545)	(0.3360)	(0.2350)	(0.2563)	(0.8356)	(0.2509)	(0.2555)
Exposure × period lifting	-0.7386***	-0.5934	-0.7319***	-0.7566***	-1.3750	-1.121***	-0.7606***
	(0.0820)	(0.4019)	(0.1697)	(0.1939)	(0.9615)	(0.2709)	(0.2175)
Exposure × period imposition		0.2910	0.4995*	0.2702	0.1194**	0.1936**	0.1856
× firm chr.		(0.3677)	(0.2878)	(0.2985)	(0.0543)	(0.0828)	(0.1454)
Exposure × period lifting		-0.1593	0.0020	0.0365	0.0438	0.1899**	0.0220
× firm chr.		(0.4523)	(0.3281)	(0.3203)	(0.0695)	(0.0950)	(0.1821)
Fixed-effects							
Firm × month	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	84,272	84,272	84,272	84,272	84,272	84,272	84,272

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 A21: Employment effects of embargo

Model:	(1) Baseline	(2) Median total export	(3) Median num. of products	(4) Median num. of destinations	(5) Log(total) export)	(6) Log(num. of products)	(7) Log(num. of destinations)
Variables							
Exposure × period imposition	-0.2517***	-0.2673*	-0.4322***	-0.3518***	-1.3420***	-0.5342***	-0.4004***
	(0.0953)	(0.1398)	(0.1302)	(0.0884)	(0.4318)	(0.1238)	(0.0907)
Exposure × period lifting	-0.2581	-0.1573	-0.3686**	-0.3816***	-1.5560**	-0.5379***	-0.4780***
	(0.1669)	(0.3696)	(0.1611)	(0.1250)	(0.7841)	(0.1728)	(0.1538)
Exposure × period impositio		0.0169	0.2551	0.1624	0.0715**	0.1287***	0.1056
× firm chr.		(0.1693)	(0.2551)	(0.1485)	(0.0286)	(0.0432)	(0.0683)
Exposure × period lifting		-0.1078	0.1683	0.2044	0.0859	0.1349*	0.1562
× firm chr.		(0.4052)	(0.2680)	(0.2624)	(0.0563)	(0.0718)	(0.1523)
Fixed-effects							
Firm × quarter	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	318,011	318,011	318,011	318,011	318,011	318,011	318,011

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. The variable "Exposure" is a share of embargoed good exports of firm in its total exports 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 A22: Average daily wage effects of embargo

Model:	(1) Baseline	(2) Median total export	(3) Median num. of products	(4) Median num. of destinations	(5) Log(total) export)	(6) Log(num. of products)	(7) Log(num. of destinations)
Variables							
Exposure × period imposition	0.0473	0.0030	-0.0117	0.0437	0.0913	0.0243	-0.3953***
	(0.0387)	(0.0874)	(0.0614)	(0.0531)	(0.2520)	(0.0604)	(0.0917)
Exposure × period lifting	0.0060	-0.0225	-0.0384	0.0349	-0.1302	-0.0101	-0.4827***
	(0.0446)	(0.1366)	(0.0712)	(0.0578)	(0.3226)	(0.0728)	(0.1550)
Exposure × period imposition		0.0538	0.1073	0.0113	-0.0032	0.0146	0.1002
× firm chr.		(0.0953)	(0.0741)	(0.0698)	(0.0175)	(0.0244)	(0.0708)
Exposure × period lifting		0.0349	0.0836	-0.0787	0.0100	0.0105	0.1619
× firm chr.		(0.1432)	(0.0866)	(0.0873)	(0.0224)	(0.0308)	(0.1527)
Fixed-effects							
Firm × month	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	318,011	318,011	318,011	318,011	318,001	318,011	318,011

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 "Exposure" is a share of embargoed good exports of firm in its total exports 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.