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Not-so-innocent bystanders:
Trade with neighbors of sanctioned countries

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Not-so-innocent bystanders: Trade with neighbors of sanctioned countries[*]

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Abstract

Geographic neighbors of sanctioned countries (targets) may suffer from indirect effects of sanctions or benefit by helping targets circumvent restrictions. I study the effects of sanctions on trade among neighbors and targets using data from BACI for 2002–2022 and separately accounting for export of sensitive goods: arms, dual use goods and machinery. I find that export of dual use goods (in value) and machinery (in value and weight) from benevolent neighbors to targets increases when sanctions are in place. Additionally, I show that the weight of arms exported by neighbors to Iran, as well as value of dual use goods and weight of machinery exported to Russia were significantly higher with sanctions in place suggesting that their neighbors were not innocent bystanders.

JEL Classification Codes: F13, F51.

Keywords: Trade sanctions, extraterritorial effects, trade.

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1   Introduction

According to the Global Sanctions Data Base (GSDB) compiled by Felbermayr, Kirilakha, Syropoulos, Yalcin, and Yotov (2020), sanctions have been recently employed with an increasing frequency. But, as is evident from the GSDB records, their imposition in many cases does not achieve the stated goals. One of the reasons may be sanctions busting activities of third states who increase their trade with countries targeted by sanctions (targets) compensating for the lost trade between targets and countries imposing sanctions on them (senders). Although sanctions busting may occur via geographically distant third states,[1] neighbors (i.e. countries sharing a common border with targets) can be expected to play a particular role: First, redirection of targets' trade to their neighbors is the most efficient in terms of additional transport costs. Second, customs checks on the common border between targets and neighbors are organized on a bilateral basis and require no involvement of third parties making it easier to export or even smuggle restricted goods. Finally, compared to the rest of the world, neighbors usually have closer economic and cultural ties with targets, which facilitate their business connections and possible busting or evasion of sanctions.

In this paper, I contribute to research on the effects of sanctions by studying trade among targets and their neighbors using bilateral trade data for 2002–2022 from BACI. There exists literature on effects of sanctions on neighbors' total trade: export or import (Bove, Di Salvatore, and Nisticò, 2023; Slavov, 2007). I add to it by, first, focusing on bilateral trade between neighbors and targets and differentiating among cases when neighbors act as senders of sanctions (i.e. join the coalition) versus do not impose sanctions on targets (benevolent neighbors). Second, I separately consider the effects on product groups that are likely to be targeted by sanctions. In order to make an informed judgment on the role of neighbors in sanction busting, it is important to take into account not only their total trade with targets, but also specifically analyze trade in sensitive goods such as arms, dual

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[1] For example, Soviet Union provided extensive support to Cuba in the wake of the US sanctions (Early, 2009).

use goods and technological products (machinery), since their export to targets is likely to be restricted when sanctions are in place.[2] The data set covers the years 2002–2022, when the transition from complete bans on trade with targets to smart (i.e. targeted) sanctions took place in the US (Drezner, 2011), one of the main users of sanctions as a foreign policy tool, followed by the rest of the world. It is thus reasonable to expect for this time period stronger effects of sanctions on goods that are likely to be targeted. For completeness, I report the results for these product groups not only for export to targets, but also for import from them. Additionally, I separately report the results for weight of traded goods to differentiate between price and quantity effects. Finally, I analyze two prominent cases that received broad media coverage and interest in the research community: Trade sanctions imposed on Iran in 2006–2016 and on Russian Federation since 2014. Sanctions were found to have negative effects on bilateral trade with senders for both Iran (Felbermayr, Syropoulos, Yalcin, and Yotov, 2020; Ghodsi and Karamelikli, 2022) and Russia (Bělín and Hanousek, 2021; Flach, Heiland, Larch, Steininger, and Teti, 2024). Trade with Iran and Russia was restricted in response to their actions challenging the existing international order. Therefore, it is particularly important to understand whether sanction busting via neighbors took place in their case.

I find that, first, on average sanctions have positive and significant effects on value of export from benevolent neighbors to targets (this effect is driven by neighbors for whom target is among top 5 export destinations), as well as their import from targets (also driven by top 5 partners). This result supports the hypothesis that benevolent neighbors are not innocent bystanders. On the other hand, targets' trade with neighbors that join sanctions coalitions decreases (one exception: export from such neighbors to targets in terms of weight, the effect is insignificant). The assessment of the role of neighbors remains unchanged once product dimension is taken into account: Benevolent neighbors export to targets significantly more of dual use goods (in value) and machinery (in value and weight). Importantly, I cannot

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[2]See Appendix A for a review of trade restrictions for selected sanction cases.

find any evidence that export of other (non-sensitive) goods from benevolent neighbors to targets changes significantly. Simultaneously, the effect on export of sensitive goods from neighbors that join sanction coalitions is insignificant, for machinery even lower in weight. Finally, separate analysis of sanctions imposed on Russia and Iran shows that, first, Iran's neighbors were not innocent bystanders as their export of arms increased in terms of weight once the sanctions were in place; also the reduction in value of arms exported to Iran was lower for neighbors than for the rest of the world. Second, Russia's benevolent neighbors exported more dual use goods (in value) and machinery (in weight) with sanctions in place. Sensitivity checks demonstrate that Russia's benevolent neighbors provided their support already in 2014–2021, i.e. before the full scale invasion of Ukraine. The findings in Chupilkin, Javorcik, and Plekhanov (2023) suggest that the role of Russia's neighbors in evasion of sanctions increased since 2022.

Regressions by product group deliver an important secondary result: Coefficient for export of arms from senders to Russia is insignificant, while export of dual use goods is significantly lower in terms of value, but not weight. These two categories of goods were specifically targeted by sanctions already since 2014. Similarly, the effects of Iran sanctions on export of sensitive goods from senders are mixed, while for other targets the corresponding coefficients for export from senders are mostly insignificant and robust reduction of trade is observed only for goods which do not belong to the group of selected sensitive goods. Although violation of sanctions is a possible explanation for this result, as Hausmann, Schetter, and Yildirim (2024, p. 122, Figure 5) demonstrate for the case of Russia, coordination among senders is insufficient: The same product may be banned for export by the US and only restricted by the EU and vice versa. This finding highlights the importance of clear specification of policy instruments and coordination among allies to achieve stated goals.

The remainder of this paper is organized as follows: Section 2 provides a review of the literature. In Section 3, I describe the data. Sections 4–6 discuss the empirical results, Section 7 concludes.

2 Literature

There exists a broad literature on trade-related effects of sanctions quantifying their impact on both sender and target countries. The standard data source for sanctions is the Global Sanctions Data Base (GSDB) by Felbermayr et al. (2020), it differentiates among trade, financial, arms, military, travel and other sanctions. Sanction cases are reported on a bilateral basis, but GSDB provides no information on specific products or industries targeted by sanctions. So far strong findings for negative effects on trade flows are confirmed only for trade sanctions: Combining country-level trade data and GSDB, Felbermayr et al. (2020) find that both trade and financial sanctions negatively impact bilateral trade in a gravity setting, but the negative effects of trade sanctions are more robust. In the same setting, arms, military, travel and other sanctions do not have a significant impact on trade. Besedeš, Goldbach, and Nitsch (2024) find similar results for Germany's trade in goods and services: Financial sanctions have significant impact on trade when they are combined with export restrictions, while Felbermayr et al. (2020) show that non-trade sanctions affect trade only indirectly through general equilibrium forces.

Beyond direct or primary effects on trade among senders and targets, trade sanctions have extraterritorial effects on third countries, as Kwon, Syropoulos, and Yotov (2022) demonstrate. The authors show that welfare losses for targets are larger when extraterritorial effects are taken into account, while senders may experience welfare gains due to increased trade with third countries. At the same time, the effects on third countries are ambigouos and depend on the strength of their economic connections to senders and targets.

Neighbors of target countries may suffer from indirect effects of sanctions (innocent bystanders) or benefit by engaging in their evasion. Using gravity model, Slavov (2007) shows that exports and imports of targets' neighbors decrease when sanctions are imposed and concludes that neighbors are innocent bystanders. Early (2009) also finds that neighbors are less likely to engage in sanctions busting activities, instead, allies of senders are more likely to help targets evade sanctions. Bove et al. (2023) review this result using panel data analysis

and synthetic control method and confirm that on average neighbors' exports and imports decrease, but trade of some neighbors actually increases suggesting opportunistic behavior and/or increased costs. This finding casts a doubt on the idea that neighbors are innocent bystanders and is confirmed in micro-based studies by Besedeš, Goldbach, and Nitsch (2021) and Crozet, Hinz, Stammann, and Wanner (2021), who find suggestive evidence of firms from sender countries engaging in evasion of sanctions: After the imposition of sanctions, their export to targets' neighbors increases. Recent paper by Chupilkin et al. (2023) confirms this result for sanctions imposed on the Russian Federation in the wake of its 2022 full scale invasion of Ukraine and goes one step further by connecting it to products targeted by sanctions. The authors use product-level data on sanctions to show that the drop in export from the EU to the Russian Federation and an increase in the EU export to Russia's neighbors were particularly strong for sanctioned goods suggesting evasion activities.

Further, the literature on effects of sanctions on selected industries and product groups is growing too. For example, Larch, Shikher, Syropoulos, and Yotov (2022) study energy and mining sectors, while Larch, Luckstead, and Yotov (2024) analyze trade in agricultural goods with the focus on sanctions imposed by Russia in 2014. For sensitive goods, Bove and Böhmelt (2021) demonstrate that neighbors of countries subjected to arms embargo import more arms and interpret this result as shifting trade to neighbors. In contrast to that, Baronchelli, Caruso, and Ricciuti (2022) do not find any significant effects on neighbors' trade in small arms and light weapons. For dual use goods, Peterson (2021) shows that their export from third parties to targets of embargoes imposed by the United States decreases, so third parties thus comply with the US policy preferences.

These findings highlight the importance of international coordination in design of sanctions and lead to the issue of sanctions coalitions. Historically both adversaries and allies of senders provided support to targets: For example, not only the Soviet Union, at the time the main adversary of the United States, provided extensive support to Cuba in the wake of the US sanctions (Early, 2009), but also its allies Japan and the United Kingdom (Early,

2012). Recent papers on sanctions coalitions include Chowdhry, Hinz, Kamin, and Wanner (2024); Flach et al. (2024) and Mahlstein, McDaniel, Schropp, and Tsigas (2022). All of them find that negative effects of sanctions on target are stronger when more countries join the coalition. The value of coalitions is particularly high when important trade partners of targets join them; for Russia, China is such important partner (Chowdhry et al., 2024) and simultaneously its geographic neighbor. Finally, in connection to optimal design of sanctions, the paper by Hausmann et al. (2024) deserves particular attention: The authors suggest a procedure to identify products that should be sanctioned in order to maximize the costs of sanctions for targets at minimal losses for senders.

3 Data

I use data from three main sources: Trade data from BACI by CEPII (Gaulier and Zignago, 2010), sanctions data from GSDB (Felbermayr et al., 2020)[3] and indicators for regional trade agreements and contiguity from Gravity database (Conte, Cotterlaz, and Mayer, 2022) also provided by CEPII.[4]

The underlying data source for BACI is the UN Comtrade database. The sample of BACI used in this paper includes 151 exporters and importers in 2002–2022.[5] An important advantage of these data is detailed product information available at 6 digits in Harmonized System classification. One disadvantage of BACI is that it does not include domestic trade, thus I cannot follow the best practice of gravity estimation suggested by Yotov (2022).[6] Other existing data sets that report domestic trade flows cannot provide the product-level details necessary to identify export of arms and dual use goods. I aggregate 6-digit bilateral

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[3]I use the 3rd edition of the GSDB database (Kirilakha, Felbermayr, Syropoulos, Yalcin, and Yotov, 2021; Syropoulos, Felbermayr, Kirilakha, Yalcin, and Yotov, 2024).

[4]I use the 202211 version of Gravity, it ends in 2021. I copy the 2021 values for regional trade agreements and common border for 2022 trade data.

[5]Among them are the 37 countries targeted by multilateral trade sanctions during the observation period and all of their neighbors; the rest are the largest exporters in 2022.

[6]Despite inclusion of domestic trade flows being best practice, data sets without domestic trade flows are commonly used as well: For example, Chowdhry et al. (2024) also use data from BACI, while French and Zylkin (2024) employ UN Comtrade.

trade flows to separate categories of arms, dual use goods, machinery and other products and estimate gravity model using *ppmlhdfe* by Correia, Guimarães, and Zylkin (2020) with the aggregated data.[7]

Table 1: Summary statistics

	Mean	St.dev.	Min	Max
RTA	0.171	0.376	0	1
Sender-Target	0.025	0.157	0	1
Target-Sender	0.027	0.161	0	1
Neighbor-Target	0.004	0.063	0	1
Target-Neighbor	0.004	0.063	0	1
Arms	0.172	0.377	0	1
Dual use	0.281	0.450	0	1
Machinery	0.258	0.437	0	1
Observations	1594530			

RTA and contiguity data from Conte et al. (2022), sanctions from GSDB, classification of arms and dual use goods from Kohl, van den Berg, and Franssen (2024), own presentation.

Table 1 provides summary statistics for the aggregated data. For 17.1% of observations exporter and importer are members of a regional trade agreement. Since the literature so far confirms negative effect on trade flows only for trade sanctions (GSDB contains records of financial, arms, military, travel and other sanctions as well), I consider only trade sanctions in my analysis. 2.5% of observations are trade flows from sender to target and 2.7% from target to sender.[8] Trade flows between targets and their neighbors in both directions account for less than 1% of total observations. Since Syropoulos et al. (2024) find that multilateral sanctions are more damaging to targets than unilateral, I expect the changes in trade with neighbors to be stronger for countries targeted with multilateral sanctions. Indicators of neighbor-target relationship thus take value of one if target is subjected to multilateral sanctions, while dummies for target-sender account for both unilateral and multilateral trade sanctions. I make one addition to the GSDB records: In August 2014, Ukraine imposed

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[7]To the best of my knowledge, due to high computational requirements product-level estimations so far have been implemented only in French and Zylkin (2024).

[8]I assign the indicators of export and import sanctions reported in GSDB to the corresponding trade flows.

restrictions on export of arms and dual use goods to the Russian Federation and thus joined the coalition of countries imposing trade sanctions on Russia.[9] Similarly, Russia was not Ukraine's benevolent neighbor due to extending to Ukraine on January 1, 2016 the embargo imposed on the EU, US and their partners. Figure 1 maps the 37 countries in the sample that were targets of multilateral trade sanctions in 2002–2022.

Figure 1: Targets of multilateral trade sanctions
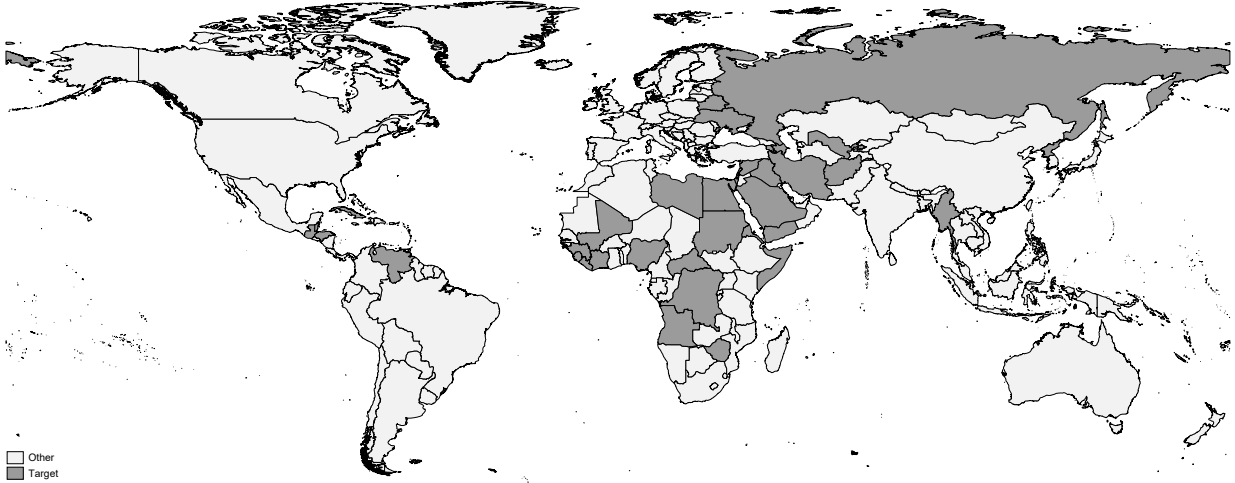
Data sources: Sanctions data from GSDB, shapefiles from World Bank (2024), own presentation.
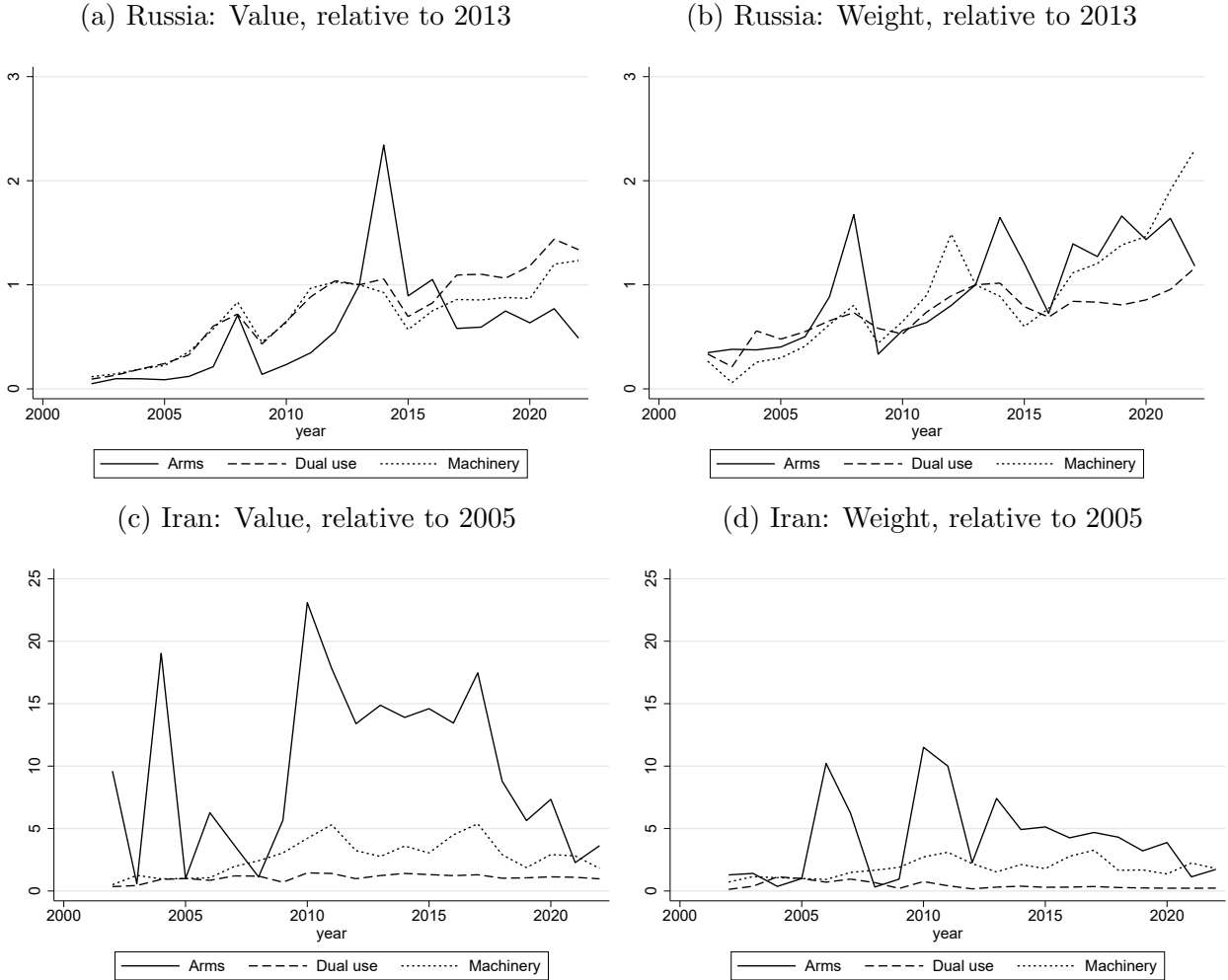
The list of codes that identify arms and dual-use goods is provided by Kohl et al. (2024) and is based on the EU regulations. Kohl et al. (2024) compile the list of arms and military products themselves using a keyword search through the EU Combined Nomenclature and use the EU list of dual-use goods from TARIC.[10] Identification of arms and dual use goods follows the EU regulations for all countries in the sample in line with the literature: Peterson (2021, p. 1842, note 21) uses the EU list to study the effects of restrictions imposed by the US citing difficulties in translating the US Export Control Classification Numbers to 6-digit

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[9]These restrictions were introduced by presidential decree No 691/2014, link `https://www.president.gov.ua/documents/6912014-17592` (in Ukrainian, accessed on August 14, 2024).

[10]Kohl et al. (2024) provide a time-varying assignment of product codes to dual use goods for 2007–2020. I assign to the dual use group all of these products regardless of the specific timing of their inclusion in the list since my sample covers a slightly different time period. Their classification follows the Combined Nomenclature and is at 8 or 10 digits, I assign 6-digit codes to arms or dual use goods if any corresponding 8-digit code belongs to it. If any resulting 6-digit code is simultaneously attributed to both arms and dual use goods, it is assigned to arms.

HS codes. Category "Arms" additionally includes products with 2-digit HS code 93, while technological goods are summarized in category "Machinery", which includes all observations with HS code 84.[11]

Figure 2: Export of sensitive goods from neighbors to Russia and Iran

(a) Russia: Value, relative to 2013

(b) Russia: Weight, relative to 2013

(c) Iran: Value, relative to 2005

(d) Iran: Weight, relative to 2005

Data sources: Trade data from BACI, own presentation. Value (in constant 2010 USD) and weight relative to the last year before sanctions. For Russia, neighbors = benevolent neighbors, for Iran – all neighbors.

Figure 2 presents the descriptive statistics to motivate the idea that neighbors may not be innocent bystanders. I report the value and weight of export of sensitive goods from benevolent neighbors to Russia and all neighbors to Iran (since all neighbors joined sanctions

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[11]Since GSDB separately records sanctions on arms, one of the sensitive product groups, I check whether all of the countries targeted by multilateral trade sanctions were subjected to restrictions in arms trade. Only 5 of them were not targeted by arms bans: Belize, Guatemala, Honduras, Saudi Arabia and Ukraine.

imposed on Iran) relative to the last value before sanctions were imposed (for Russia, it is the year 2013 and for Iran – 2005). I separately provide the results for trade value and weight in metric tons to differentiate between changes in total value of trade resulting from price movements versus changes in physical flows of goods. This helps mitigate the concerns voiced in Bove et al. (2023) that increased values of trade among neighbors and targets after the imposition of sanctions may be observed due to changes in trade costs.[12] The statistics for arms stand out particularly: The value of neighbors' export to Russia more than doubled in 2014 and remained above the 2013 value till 2016, while weight fell below the 2013 value only in the year 2016. For Iran, both value and weight of arms export from neighbors were above the 2005 levels for almost every successive year.

4 Country-level trade

First, I run a gravity estimation with the data aggregated by country pair and time:

$$X_{eit} = exp[\text{RTA}_{eit} + \text{Sen-Tar}_{eit} + \text{Neigh-Tar}_{eit} + \text{Neigh=Sen-Tar}_{eit}$$

$$+\text{Tar-Sen}_{eit} + \text{Tar-Neigh}_{eit} + \text{Tar-Neigh=Sen}_{eit} + \beta_{et} + \gamma_{it} + \mu_{ei}],$$

where RTA takes value of 1 for trade partners that are members of a regional trade agreement, Sen-Tar denotes export from sender to target that do not have a common border, Neigh-Tar – export from benevolent neighbor to target and Neigh=Sen-Tar identifies cases of export from neighbors that join sanctions to targets, analogously for export from target to sender. As is usual in gravity estimation (Yotov, Piermartini, Monteiro, and Larch, 2016), I control for exporter-time, importer-time and country pair fixed effects which explain most of the variation in the data, e stands for exporter, i – importer and t – year. Errors are clustered at country pair level, results are reported in Table 2.[13]

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[12]Weight is an imperfect measure of trade quantity, but it is the only one included in BACI.
[13]Regression tables are prepared using Jann (2007).

Table 2: Trade flows under sanctions

	Sender		Neighbor		Top 5	
	Value (1)	Weight (2)	Value (3)	Weight (4)	Value (5)	Weight (6)
RTA	0.146***	0.114**	0.143***	0.113**	0.143***	0.111*
	(0.0214)	(0.0433)	(0.0212)	(0.0432)	(0.0212)	(0.0433)
Sen-Tar	-0.135***	-0.289***	-0.107***	-0.254**	-0.110***	-0.254**
	(0.0303)	(0.0730)	(0.0323)	(0.0828)	(0.0316)	(0.0827)
Neigh-Tar			0.213*	0.179		
			(0.104)	(0.121)		
Neigh-Tar: Top5					0.459*	0.224
					(0.178)	(0.170)
Neigh-Tar: Other					0.0877	0.197*
					(0.0575)	(0.0987)
Neigh=Sen-Tar			-0.204**	-0.230		
			(0.0735)	(0.151)		
Neigh=Sen-Tar: Top5					-0.209	-0.408*
					(0.179)	(0.200)
Neigh=Sen-Tar: Other					-0.260***	-0.285
					(0.0614)	(0.185)
Tar-Sen	-0.193***	-0.216**	-0.171***	-0.203**	-0.169***	-0.200**
	(0.0303)	(0.0671)	(0.0304)	(0.0696)	(0.0307)	(0.0699)
Tar-Neigh			0.148*	-0.102		
			(0.0673)	(0.0772)		
Tar-Neigh: Top5					0.294***	-0.0839
					(0.0854)	(0.100)
Tar-Neigh: Other					-0.0348	-0.168+
					(0.0970)	(0.100)
Tar-Neigh=Sen			-0.508***	-0.518***		
			(0.0850)	(0.0950)		
Tar-Neigh=Sen: Top5					-0.176	0.00573
					(0.219)	(0.209)
Tar-Neigh=Sen: Other					-0.556***	-0.600***
					(0.0877)	(0.101)
Pseudo R-sq.	0.991	0.978	0.991	0.978	0.991	0.978
Obs.	460451	460261	460451	460261	460451	460261

The table presents *ppmlhdfe* estimates of sanctions' effects on trade flows. All regressions controlling for country pair and country-time fixed effects. Errors clustered at country pair level. Standard errors in parentheses. $+ p < 0.10$ * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The first set of results replicates the findings in the existing literature and demonstrates that the value of trade flows between sender and target is indeed lower than the baseline in both directions: Value of export from sender to target (targeted by export sanctions) drops by ca. 12.6%,[14] while export from target to sender (i.e. import sanctions in place) decreases by 17.6%. Not only the value of trade, but also physical flows of goods among senders and targets are lower too, as results in column (2) demonstrate. Next, results in columns (3) and (4) show that trade with benevolent neighbors increases in value, but not in weight. Instead, trade among targets and neighbors that join sanctions decreases: coefficients are negative and significant except for weight of export from such neighbors to targets.

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[14]The coefficient should be interpreted as follows: $(e^{-0.135} - 1) * 100 \approx 12.6\%$

Finally, I check whether the finding that benevolent neighbors trade more with targets is driven by cases with particularly close trade connections. I define close connection as target being among top 5 importers for neighbor (analogously for export from target to neighbor: neighbor is among top 5 importers of target's output). The last set of the results presented in Table 2 under "Top 5" shows that this is indeed the case for value of trade with benevolent neighbors. In contrast to that, decrease in value of trade with neighbors that join sanctions is driven by countries outside top 5 group. In terms of weight, export from non-top 5 benevolent neighbors increases, while it decreases for top 5 neighbors joining sanction coalition. Export from targets decreases to all non-top 5 neighbors joining the coalition, but doesn't change significantly to top 5.

5 Trade by product group

In the next step, I repeat the same estimation for trade flows by product group: arms, dual use goods, machinery and other products. Complete regression results are reported in Table 3 in Appendix B, I illustrate the main findings here with Figure 3.[15]

Figure 3: Effects of sanctions on trade flows by product group
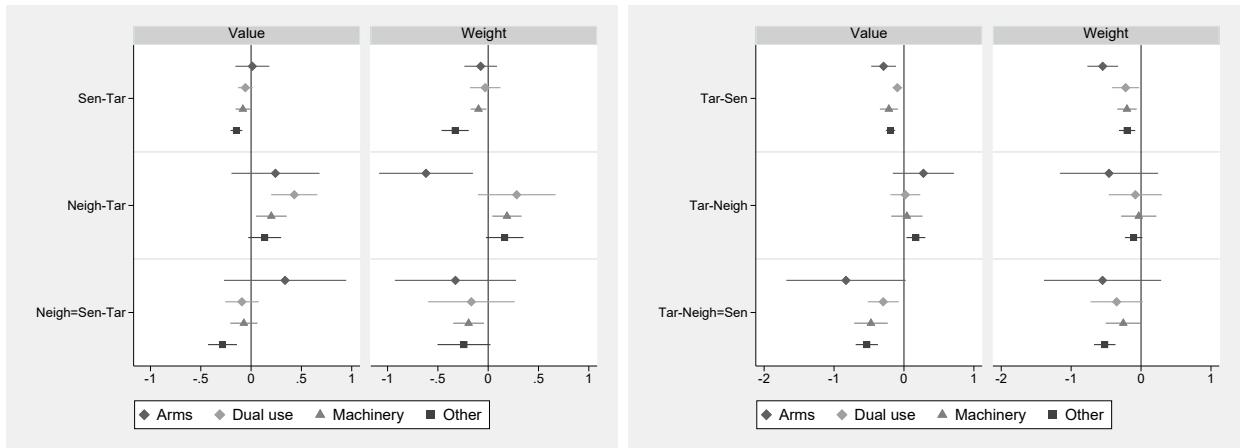
(a) Export from sender to target (b) Export from neighbor to target

Estimations include country-time and country pair fixed effects, results reported at 90% confidence level.

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[15]Coefficients are plotted using Jann (2014).

For some categories of sensitive goods, export from benevolent neighbors to targets increases: Export of dual use goods (only in value) and machinery (both value and weight) from benevolent neighbors to targets increases, while no increase is observed for neighbors that join coalition. Simultaneously, sanctions do not have a significant effect on export of other goods from neighbors, so positive effect on the bilateral trade appears to be larger for sensitive goods. The effect on export of arms from benevolent neighbor is insignificant for value and negative for weight. Export from targets to neighbors that join sanctions declines for dual use goods (in value), machinery and other products as reported in panel (b) of Figure 3, while the effect on export to benevolent neighbors is mostly insignificant.

The surprising finding is that the coefficient for export of arms and dual use goods from senders to targets is insignificant, so I can find no evidence for a decline. Still, there is a significant decline in export of machinery and other goods from senders to targets, both in value and weight. The paper by Thurner, Schmid, Cranmer, and Kauermann (2019) suggests a potential explanation for an insignificant effect of sanctions on arms trade: Security considerations played a major role during the Cold War and regained importance since 2001, the time period covered by my sample. Only few countries in the world are able to produce modern military goods and they tend to trade them with their partners. Thus, trade in arms among senders and targets could be low even before sanctions are imposed, this is why no significant decline is observed. Another reason is the observation that trade sanctions are not always combined with arms sanctions: Trade in arms was not restricted with 5 out of 37 countries targeted by multilateral trade sanctions covered by my data and trade in arms between senders and Ukraine, one of the targeted countries, actually increased, see Table 6. Still, there is at least one exception not supported by these arguments, it is trade in arms with Russia: As Figure 4 demonstrates, even though since 2014 trade in dual use goods and machinery decreased in absolute terms for both value and weight, trade in arms in 2015 and 2017 was above the 2013 levels in value and for weight it was below the 2013 levels only in 2018. Bělín and Hanousek (2021) provide a potential reason for that: Retroactivity of

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sanctions imposed on Russia meant that export of sanctioned goods was still possible for contracts signed before sanctions came into force. Finally, panel (b) of Figure 3 shows that in contrast to targets' import from senders, their export to them declines in value and weight for all product groups.

Figure 4: Export of sensitive goods from senders to Russia

(a) Value, relative to 2013   (b) Weight, relative to 2013
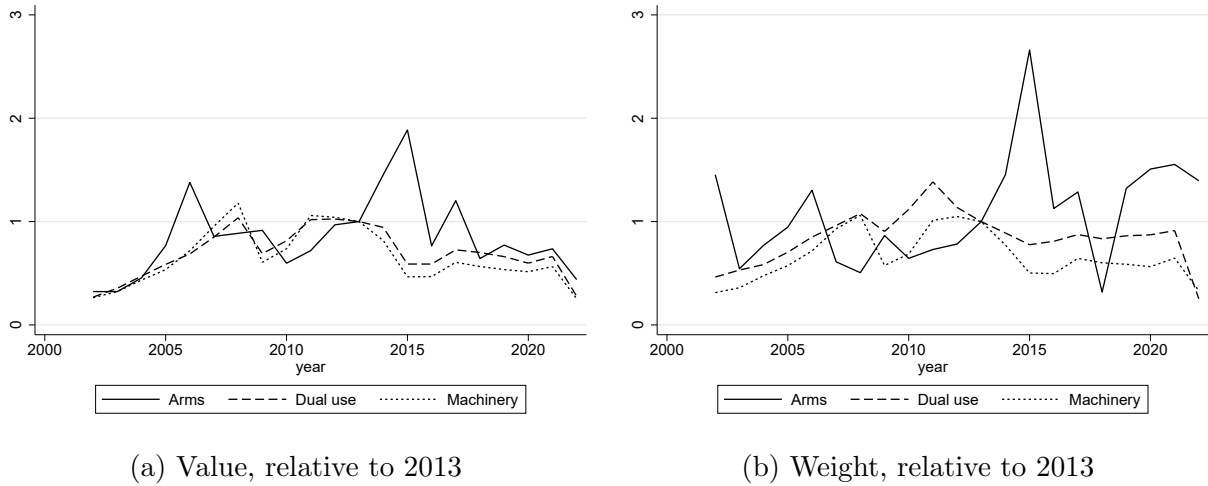
Data sources: Trade data from BACI, own presentation.

Summing up, benevolent neighbors increase export of dual use goods (in value) and machinery to targets after sanctions are imposed. Similar effect is not observed for other product groups or for neighbors that impose sanctions, thus I interpret this evidence as supporting the hypothesis of neighbors helping targets.

6   Iran and Russia

In this section, I separately analyze two cases: sanctions imposed on Iran in 2006–2016 and on Russia since 2014 to highlight the heterogeneity across sanctions cases. There is an important difference between Iran and Russia in terms of sanctions design: Iran sanctions were imposed by the UN, so formally all UN members joined them and thus Iran didn't have benevolent neighbors. Russian sanctions were imposed by a coalition of countries, so some

of Russia's geographic neighbors did not join them. Further, export of a number of sensitive goods to Russia was restricted by the US, the EU or their partners without any formal restrictions for other goods, while sanctions on Iran were more general, see Appendix A. Full regression results are reported in Table 4 in Appendix B, I illustrate them here with Figures 5 and 6.

Figure 5: Effects of sanctions on trade flows from senders and neighbors to Russia and Iran
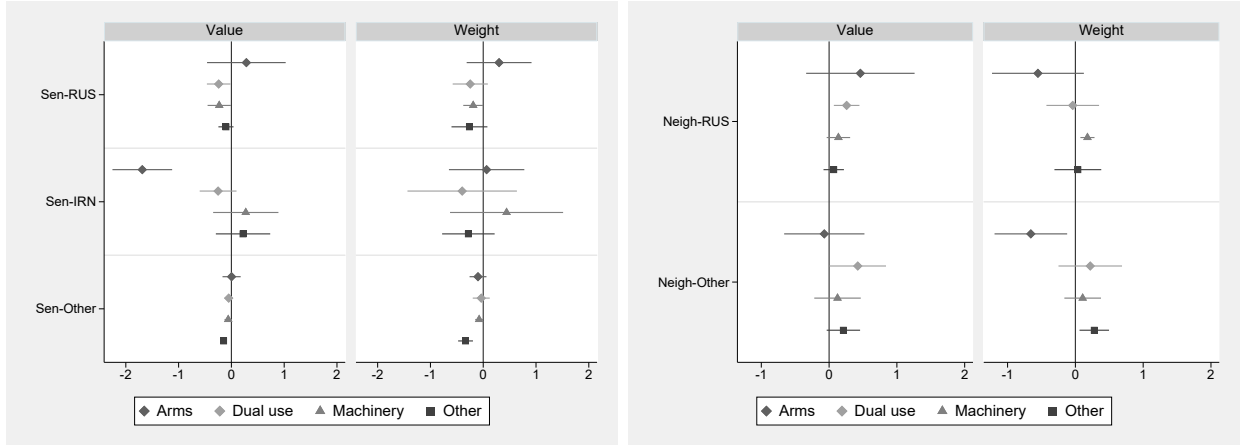
(a) Sender-Target and Neighbor-Target
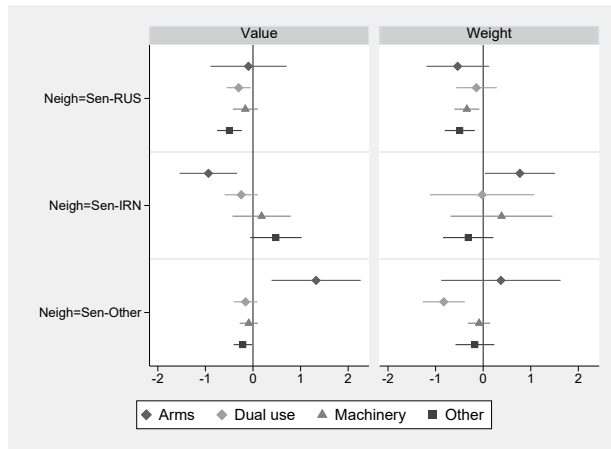
(b) Target-Sender and Target-Neighbor

(c) Target-Sender and Target-Neighbor

Estimations include country-time and country pair fixed effects, results reported at 90% confidence level.

Figure 5 reports the results for exports from senders and neighbors to targets. In case of Russia, sanctions had a negative and significant effect on value of exported dual use goods and on export of machinery from senders (both value and weight). For Iran, only value of

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exported arms declined, while the remaining targets imported lower weight of machinery and less other goods from senders (both in value and weight).

Main results are reported in Panels (b) and (c) of Figure 5: Russia's benevolent neighbors exported higher value of dual use goods and more machinery in terms of weight, while both value of exported dual use goods and weight of machinery, as well as export of other goods (both value and weight) to Russia declined for trade flows from neighbors that joined the coalition. Iran's import of arms from neighbors declined by less compared to other senders (-61% versus -82%) and even increased in weight; no significant effects are observed for other product groups. For other targets, we observe the expected effects as well: A positive coefficient on import of dual use goods from benevolent neighbors (in value) and a negative for import of dual use goods from neighbors that joined sanctions (in weight).

Figure 6 reports the results for export from targets to senders and neighbors. It demonstrates that Russian export of machinery to senders increased both for trade value and weight after the imposition of sanctions, while export of other goods decreased. In case of Iran, export of arms to senders decreased in value, export of machinery decreased in weight, while export of dual use goods and other goods dropped in both value and weight. Russia exported significantly more machinery to its benevolent neighbors, but less arms and dual use goods (both in weight). This is not unexpected, as since 2014 Russia openly participated in two wars: in Ukraine and in Syria. Russian exports of sensitive goods to its neighbors that joined sanctions coalition didn't change significantly, while export of other goods declined in both value and weight. For Iran, export to neighbors dropped in almost every category with the only exception being weight of exported arms, while the effect of sanctions on export of other targets to their neighbors is mixed.

In the last step, I perform two sensitivity checks. The first one differentiates among sanctions imposed on Russia in 2014–2021 and in 2022, when the full scale invasion of Ukraine started and additional sanctions were imposed on Russia. The results are reported in Table 5 and demonstrate that Russia's benevolent neighbors increased their export of

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Figure 6: Effects of sanctions on trade flows from Russia and Iran to senders and neighbors
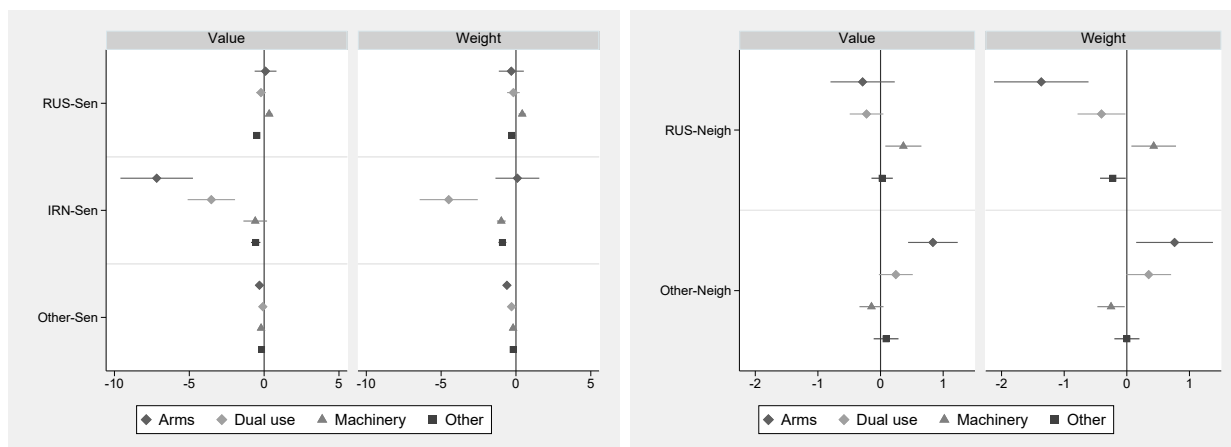
(a) Sender-Target and Neighbor-Target
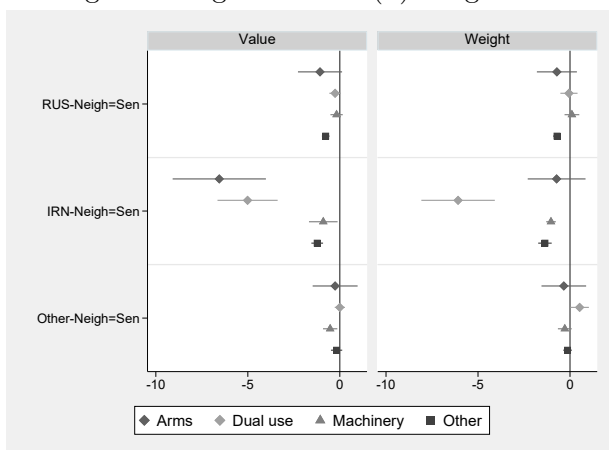
(b) Target-Sender and Target-Neighbor

(c) Target-Sender and Target-Neighbor

Estimations include country-time and country pair fixed effects, results reported at 90% confidence level.

dual use goods (in value) and machinery (in weight) already in 2014–2021. For 2022, also a strong negative effect on export from senders to Russia can be observed for most product categories. One exception are arms (in weight): the coefficient is positive and significant suggesting higher export.

Table 6 differentiates among the effects of sanctions on trade with Ukraine versus other countries. As Kohl et al. (2024) report, sanctions imposed by the European Union, the US and their partners on the Russian Federation in the wake of its occupation of Crimea and military intervention in eastern Ukraine included bans on export of arms and equipment

used for oil exploration and extraction, as well as restrictions on export of dual use goods. Simultaneously, sanctions were imposed by the same group of senders on trade with firms active in the occupied Crimea.[16] Since Crimea is recognized internationally as Ukrainian territory, the corresponding sanctions are recorded in GSDB as targeting Ukraine, while no limits on export of sensitive goods to Ukraine were officially set. Thus, the nature of restrictions imposed on Russia and Ukraine in the wake of the same event is very different and so their effects should differ too: While export of sensitive goods to Russia is expected to go down, the same won't necessarily happen for Ukraine. According to the results in Table 6, export of arms to Ukraine from its neighbors that joined sanctions increased, in line with the idea of trade in arms occurring among allies from Thurner et al. (2019). Also, Ukraine's only benevolent neighbor (Belarus) significantly increased export of dual use goods, machinery and other products since 2014, in line with the expectations on the role of neighbors not joining sanctions. On the other hand, neighbors that joined sanctions reduced their export of dual use goods.

7   Conclusion

There is a longstanding debate in the literature on the role of neighbors of sanctioned countries: are they supporting targets by providing sanctioned goods or do they suffer from indirect effects of sanctions? In this paper, I contribute to the resolution of this question by studying the effects of trade sanctions on trade flows among senders, targets and their neighbors. For that, I focus on trade flows in sensitive goods: arms, dual use goods and machinery. Further, I differentiate among neighbors that join the sanctions coalitions and the

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[16]Restrictions on trade with occupied territories of Donetsk and Luhansk regions were introduced by the US on February 21, 2022 by the Executive order 14065 (link to the text: `https://www.whitehouse.gov/briefing-room/presidential-actions/2022/02/21/executive-order-on-blocking-property-of-certain-persons-and-prohibiting-certain-transactions-with-respect-to-continued-russian-efforts-to-undermine-the-sovereignty-and-territorial-integrity-of-ukraine/`, accessed on September 2, 2024) and on February 23, 2022 by Council regulation (EU) 2022/263 (link to the text `https://eur-lex.europa.eu/eli/reg/2022/263/oj`, accessed on August 25, 2024).

benevolent ones who do not impose sanctions on targets. I additionally separately analyze the effects of sanctions imposed on Russia and Iran.

My results suggest that benevolent neighbors are not innocent bystanders, since their trade with targets increases in value once sanctions are in place. Moreover, they sell to targets more sensitive products: dual use goods (in value) and machinery (in weight). Finally, the neighbors of Iran and Russia specifically appear to facilitate trade in sensitive goods: Export of arms from Iran's neighbors increases in weight and experiences a smaller decline in value compared to the rest of the world, while Russia's neighbors sell more dual use goods (in value) and machinery (in weight).

A   Goods targeted by sanctions

The practice of sanctions implementation changed over time and since early 2000s they became more targeted: According to the GSDB records, prior to the year 2000, ca. 43% of trade sanctions were complete bans on trade flows, whereas in 2000–2022 only 6%. Sanctions may be imposed on different product groups depending on the targeted country and their purpose. In the following, I summarize the information on a few selected prominent cases: Russian Federation, Belarus, Iran, Myanmar and North Korea to identify the product groups typically targeted by sanctions.

Sanctions imposed on the Russian Federation in the wake of the annexation of Crimea, deployment of its armed forces in eastern Ukraine and involvement in downing of the MH17 flight in 2014 included bans on export of arms and equipment used for oil exploration and extraction, as well as restrictions on export of dual use goods (Kohl et al., 2024). After the start of the full scale invasion of Ukraine in 2022, advanced semiconductors, sensitive machinery, transportation, chemical products, maritime navigation and luxury goods were sanctioned as well (Chupilkin et al., 2023). Due to the involvement of Belarus in Russian full scale invasion of Ukraine, in March 2022 the Council of the EU restricted exports of inputs crucial for Belarusian production.[17] Also restrictions on export of dual use goods, machinery and technology were strengthened,[18] along with the prohibition of export of arms and surveillance equipment. Similar restrictions on export of dual use goods and technology to Belarus were announced by the United States in April 2022.[19]

As Haidar (2017) reports, sanctions previously imposed on Iran were strengthened in 2006 in order to halt its nuclear program and included restrictions on Iranian imports of

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[17]These are potash and goods used in production of tobacco, mineral products or products of wood, cement, iron and steel and rubber. Information on the EU sanctions imposed on Belarus is available via the EU sanctions map: `https://www.sanctionsmap.eu/#/main?search=%7B%22value%22:%22%22,%22searchType%22:%7B%7D%7D` (accessed on April 3, 2024).

[18]Some of these measures were introduced already in May 2021 after Belarus diverted Ryanair flight 4978 to arrest an opposition journalist.

[19]Press release of the U.S. Department of Commerce from April 9, 2022, available here: `https://www.commerce.gov/news/press-releases/2022/04/commerce-department-expands-restrictions-exports-russia-and-belarus` (accessed on April 3, 2024).

nuclear-related materials and technology. Non-oil export sanctions were imposed in 2008 with the goal to exert pressure on Iranian economy. Haidar (2017) does not identify specific products targeted by sanctions beyond already mentioned nuclear-related materials and technology. Instead, the United States, the European Union, Canada and Australia adopted different measures from authorization of imports to prohibitions on provision of services to Iranian vessels in order to put Iranian exporters under pressure (Haidar, 2017, p. 329). EU strengthened the sanctions in 2012 by imposing an oil embargo and freezing assets of Iran's central bank (Felbermayr et al., 2020).

Meyer and Thein (2014) study the impact of sanctions on international businesses in Myanmar. The authors note that the U.S. prohibited all imports from Myanmar in 2003 except for teak and gems processed outside the country (restrictions on gems were strengthened in 2008), while according to GSDB, Myanmar was under US arms sanctions in 1989–2016. The EU imposed an arms embargo in 1996 and added bans on exports of timber, metals and precious stones from Myanmar in 2007 (Meyer and Thein, 2014).

In the case of North Korea, UN sanctions have been imposed in 2006 in connection to nuclear tests. According to Kim, Kim, Park, and Sun (2023), sanctions were targeting North Korean import of arms, military and luxury goods, fuel, vehicles and helicopter parts and export of natural resources such as coal, iron, copper and nickel, as well as export of seafood, textiles and food and agricultural machinery.

Summing up, country-specific trade restrictions cover diverse product groups and their composition differs on a case-by-case basis. Among targeted groups often are arms and technological products. I account for arms specifically using product-level codes provided by Kohl et al. (2024), while technological goods are summarized in category "Machinery", which includes all observations with HS code 84.[20] Luxury goods, a category targeted by the

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[20]HS code 84 includes among others Computer Numerical Control (CNC) machinery for working metals, which is particularly important for production of missiles. Corresponding positions are included in the List of Common High Priority Items prepared by the EU, Japan, UK and the US aiming at limiting the ability of the Russian Federation to wage war. The list is available here `https://finance.ec.europa.eu/publications/list-common-high-priority-items_en` (accessed on March 22, 2024).

sanctions imposed on Russian Federation and North Korea, are hard to identify, as Chupilkin et al. (2023) note, thus I do not control for them specifically. I additionally analyze trade in dual-use goods separately: Their exports are often restricted, but not always prohibited, for example, in the case of sanctions on Russian Federation.

B   Regression results

Table 3 reports the results for impact of sanctions on trade in sensitive goods discussed in section 5 and illustrated with Figure 3.

Table 3: Effects of sanctions on trade flows by product group

	Arms		Dual use		Machinery		Other	
	Value	Weight	Value	Weight	Value	Weight	Value	Weight
RTA	0.152	0.0967	0.101**	0.104^{+}	0.0618*	0.0776*	0.164***	0.120**
	(0.0979)	(0.0969)	(0.0352)	(0.0584)	(0.0242)	(0.0369)	(0.0281)	(0.0447)
Sen-Tar	0.0125	-0.0745	-0.0570	-0.0296	-0.0815^{+}	-0.0962*	-0.146***	-0.328***
	(0.103)	(0.0987)	(0.0443)	(0.0923)	(0.0448)	(0.0475)	(0.0354)	(0.0821)
Neigh-Tar	0.242	-0.618*	0.429**	0.283	0.201*	0.187*	0.135	0.164
	(0.266)	(0.284)	(0.140)	(0.235)	(0.0931)	(0.0882)	(0.0993)	(0.114)
Neigh=Sen-Tar	0.338	-0.325	-0.0912	-0.167	-0.0718	-0.194*	-0.285**	-0.241
	(0.369)	(0.366)	(0.101)	(0.261)	(0.0821)	(0.0929)	(0.0876)	(0.160)
Tar-Sen	-0.292**	-0.548***	-0.0941*	-0.221^{+}	-0.216**	-0.202*	-0.192***	-0.199**
	(0.108)	(0.134)	(0.0431)	(0.117)	(0.0786)	(0.0847)	(0.0399)	(0.0709)
Tar-Neigh	0.278	-0.458	0.0197	-0.0811	0.0417	-0.0326	0.171*	-0.106
	(0.265)	(0.427)	(0.130)	(0.231)	(0.136)	(0.153)	(0.0822)	(0.0762)
Tar-Neigh=Sen	-0.829	-0.550	-0.297*	-0.349	-0.472**	-0.254^{+}	-0.531***	-0.519***
	(0.519)	(0.510)	(0.135)	(0.228)	(0.146)	(0.153)	(0.0968)	(0.0935)
Pseudo R-sq.	0.941	0.938	0.988	0.963	0.992	0.984	0.989	0.978
Obs.	271525	269201	446086	444909	408896	407815	458169	457853

The table presents *ppmlhdfe* estimates of sanctions' effects on trade flows. All regressions controlling for country pair and country-time fixed effects. Errors clustered at country pair level. Standard errors in parentheses.
$+ p < 0.10$ * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4 reports the results for impact of sanctions on trade in sensitive goods, trade with Russia and Iran is identified separately. These findings are discussed in section 6.

Table 4: Trade flows under sanctions with Russia and Iran

	Arms		Dual use		Machinery		Other	
	Value	Weight	Value	Weight	Value	Weight	Value	Weight
RTA	0.145	0.0977	0.102**	0.105$^+$	0.0617*	0.0762*	0.162***	0.114*
	(0.0977)	(0.0968)	(0.0352)	(0.0586)	(0.0243)	(0.0371)	(0.0282)	(0.0447)
Sen-RUS	0.284	0.301	-0.240$^+$	-0.246	-0.231$^+$	-0.190$^+$	-0.103	-0.261
	(0.453)	(0.374)	(0.136)	(0.202)	(0.134)	(0.114)	(0.0870)	(0.207)
Sen-IRN	-1.688***	0.0644	-0.251	-0.399	0.273	0.442	0.221	-0.281
	(0.344)	(0.434)	(0.212)	(0.630)	(0.376)	(0.651)	(0.313)	(0.302)
Sen-Other	0.00401	-0.0987	-0.0506	-0.0375	-0.0602	-0.0774$^+$	-0.147***	-0.335***
	(0.105)	(0.0974)	(0.0466)	(0.0979)	(0.0421)	(0.0447)	(0.0380)	(0.0853)
Neigh-RUS	0.461	-0.552	0.259*	-0.0389	0.137	0.178**	0.0683	0.0365
	(0.486)	(0.412)	(0.115)	(0.236)	(0.105)	(0.0633)	(0.0914)	(0.210)
Neigh=Sen-RUS	-0.0950	-0.536	-0.301$^+$	-0.143	-0.162	-0.343*	-0.497**	-0.492*
	(0.487)	(0.400)	(0.155)	(0.261)	(0.160)	(0.160)	(0.159)	(0.192)
Neigh=Sen-IRN	-0.936*	0.772$^+$	-0.247	-0.0214	0.181	0.387	0.483	-0.315
	(0.367)	(0.447)	(0.213)	(0.668)	(0.372)	(0.650)	(0.328)	(0.322)
Neigh-Other	-0.0707	-0.657*	0.423$^+$	0.219	0.124	0.108	0.211	0.279*
	(0.360)	(0.326)	(0.253)	(0.285)	(0.208)	(0.164)	(0.150)	(0.132)
Neigh=Sen-Other	1.327*	0.372	-0.156	-0.827**	-0.0882	-0.0857	-0.213$^+$	-0.174
	(0.570)	(0.763)	(0.150)	(0.269)	(0.117)	(0.142)	(0.118)	(0.248)
RUS-Sen	0.0954	-0.310	-0.209	-0.169	0.339**	0.418**	-0.484***	-0.281*
	(0.443)	(0.508)	(0.192)	(0.258)	(0.130)	(0.142)	(0.0986)	(0.140)
IRN-Sen	-7.177***	0.0949	-3.527***	-4.493***	-0.594	-0.979***	-0.562**	-0.905***
	(1.473)	(0.891)	(0.962)	(1.180)	(0.480)	(0.178)	(0.192)	(0.162)
Other-Sen	-0.312**	-0.604***	-0.0878$^+$	-0.294*	-0.204*	-0.191*	-0.170***	-0.186*
	(0.108)	(0.138)	(0.0467)	(0.132)	(0.0859)	(0.0951)	(0.0450)	(0.0845)
RUS-Neigh	-0.286	-1.366**	-0.223	-0.405$^+$	0.365*	0.429*	0.0258	-0.223$^+$
	(0.312)	(0.459)	(0.163)	(0.232)	(0.175)	(0.217)	(0.104)	(0.125)
RUS-Neigh=Sen	-1.075	-0.713	-0.255	-0.0563	-0.175	0.103	-0.768***	-0.705***
	(0.729)	(0.661)	(0.191)	(0.283)	(0.204)	(0.244)	(0.125)	(0.131)
IRN-Neigh=Sen	-6.551***	-0.727	-5.014***	-6.083***	-0.898$^+$	-1.033***	-1.228***	-1.362***
	(1.541)	(0.955)	(0.993)	(1.214)	(0.473)	(0.159)	(0.194)	(0.223)
Other-Neigh	0.836***	0.762*	0.244	0.350	-0.145	-0.252$^+$	0.0886	0.00148
	(0.241)	(0.373)	(0.164)	(0.217)	(0.117)	(0.133)	(0.120)	(0.122)
Other-Neigh=Sen	-0.254	-0.336	0.00123	0.525$^+$	-0.524*	-0.282	-0.175	-0.133
	(0.743)	(0.737)	(0.169)	(0.305)	(0.237)	(0.229)	(0.186)	(0.142)
Pseudo R-sq.	0.941	0.938	0.988	0.963	0.992	0.984	0.989	0.978
Obs.	271525	269201	446086	444909	408896	407815	458169	457853

The table presents *ppmlhdfe* estimates of sanctions' effects on trade flows. All regressions controlling for country pair and country-time fixed effects. Errors clustered at country pair level. Standard errors in parentheses. $+\ p < 0.10$
$*\ p < 0.05$, $**\ p < 0.01$, $***\ p < 0.001$

Table 5 differentiates across effects of sanctions imposed on Russia in 2014–2021 and 2022.

Table 5: Russia sanctions before the full scale invasion of Ukraine vs 2022

	Arms		Dual use		Machinery		Other	
	Value	Weight	Value	Weight	Value	Weight	Value	Weight
RTA	0.144	0.0988	0.102^{**}	0.104^{+}	0.0629^{**}	0.0760^{*}	0.162^{***}	0.115^{**}
	(0.0977)	(0.0959)	(0.0352)	(0.0583)	(0.0239)	(0.0367)	(0.0281)	(0.0447)
Sen-RUS	0.148	-0.370	-0.177	-0.105	-0.205	-0.120	-0.0862	-0.221
	(0.524)	(0.504)	(0.131)	(0.211)	(0.135)	(0.113)	(0.0911)	(0.211)
Sen-RUS $\times$ 2022	1.016	2.302^{**}	-0.774^{+}	-1.284^{**}	-0.544^{+}	-0.666^{**}	-0.233	-0.455^{*}
	(0.895)	(0.848)	(0.430)	(0.392)	(0.308)	(0.206)	(0.157)	(0.181)
Sen-Other	0.132	-0.0420	-0.0395	0.0120	-0.0492	-0.0400	-0.115^{**}	-0.254^{*}
	(0.106)	(0.110)	(0.0455)	(0.102)	(0.0368)	(0.0414)	(0.0389)	(0.104)
Sen-Other $\times$ 2022	-0.484^{***}	-0.182	-0.0347	0.0979	-0.0476	-0.116^{***}	-0.0370	-0.0466
	(0.140)	(0.147)	(0.0372)	(0.129)	(0.0363)	(0.0346)	(0.0301)	(0.0815)
Neigh-RUS	0.432	-0.764	0.239^{*}	-0.0843	0.0849	0.134^{+}	0.0412	0.0535
	(0.516)	(0.525)	(0.107)	(0.254)	(0.116)	(0.0754)	(0.0994)	(0.216)
Neigh-RUS $\times$ 2022	0.204	0.347	0.0883	0.590^{*}	0.134	0.0690	0.242	-0.205
	(0.452)	(0.452)	(0.400)	(0.295)	(0.286)	(0.166)	(0.165)	(0.198)
Neigh=Sen-RUS	-0.0954	-0.718	-0.0969	0.641	-0.122	-0.261^{+}	-0.395^{**}	-0.275
	(0.511)	(0.516)	(0.175)	(0.489)	(0.158)	(0.151)	(0.127)	(0.191)
Neigh=Sen-RUS $\times$ 2022	-0.388	-1.860^{*}	-1.107^{*}	-1.695^{***}	-0.656^{*}	-0.965^{***}	-0.463^{+}	-1.865^{**}
	(0.607)	(0.926)	(0.452)	(0.472)	(0.307)	(0.234)	(0.271)	(0.710)
Neigh-Other	-0.0385	-0.654^{+}	0.460^{+}	0.339	0.0767	0.0797	0.234	0.299^{*}
	(0.363)	(0.345)	(0.245)	(0.278)	(0.192)	(0.144)	(0.146)	(0.140)
Neigh-Other $\times$ 2022	-0.230	0.0279	-0.0631	-0.478^{*}	0.277^{**}	0.192	0.0168	0.0234
	(0.240)	(0.362)	(0.119)	(0.230)	(0.101)	(0.127)	(0.0715)	(0.115)
Neigh=Sen-Other	0.366	-0.108	-0.151	-0.679^{**}	-0.0879	-0.0678	-0.109	-0.175
	(0.453)	(0.570)	(0.133)	(0.248)	(0.0879)	(0.104)	(0.112)	(0.223)
Neigh=Sen-Other $\times$ 2022	2.121^{**}	1.977^{*}	0.0954	0.522	-0.266	-0.247	-0.446	0.194
	(0.677)	(0.822)	(0.281)	(0.442)	(0.291)	(0.333)	(0.387)	(0.372)
RUS-Sen	0.0643	-0.122	-0.210	-0.130	0.353^{**}	0.429^{**}	-0.439^{***}	-0.262^{+}
	(0.453)	(0.525)	(0.202)	(0.262)	(0.129)	(0.145)	(0.100)	(0.141)
RUS-Sen $\times$ 2022	1.037^{+}	-1.887^{**}	0.0277	-0.563	-0.174	-0.102	-0.300	-0.303
	(0.567)	(0.627)	(0.290)	(0.358)	(0.227)	(0.206)	(0.325)	(0.326)
Other-Sen	-0.254^{**}	-0.485^{***}	-0.0674^{+}	-0.335^{*}	-0.170^{*}	-0.151^{+}	-0.153^{***}	-0.184^{*}
	(0.0969)	(0.132)	(0.0377)	(0.135)	(0.0756)	(0.0861)	(0.0452)	(0.0845)
Other-Sen $\times$ 2022	-0.612^{**}	-0.939^{***}	-0.142	0.297	-0.242^{**}	-0.333^{***}	-0.125^{*}	-0.0895
	(0.197)	(0.191)	(0.0931)	(0.208)	(0.0854)	(0.0750)	(0.0632)	(0.106)
RUS-Neigh	-0.291	-1.146^{*}	-0.251	-0.438^{+}	0.350^{*}	0.421^{*}	0.0200	-0.273^{*}
	(0.321)	(0.475)	(0.180)	(0.243)	(0.160)	(0.203)	(0.0918)	(0.124)
RUS-Neigh $\times$ 2022	0.369	-1.927^{**}	0.253	0.435	0.241	0.188	0.0617	0.435
	(1.271)	(0.690)	(0.184)	(0.290)	(0.255)	(0.240)	(0.311)	(0.292)
RUS-Neigh=Sen	-0.924	-0.456	-0.200	0.0165	-0.142	0.137	-0.679^{***}	-0.653^{***}
	(0.669)	(0.663)	(0.191)	(0.287)	(0.190)	(0.228)	(0.127)	(0.135)
RUS-Neigh=Sen $\times$ 2022	-1.605	-2.489^{**}	-0.544	-1.288^{**}	-0.486	-0.519	-0.847^{**}	-0.874^{*}
	(1.130)	(0.865)	(0.415)	(0.467)	(0.336)	(0.327)	(0.309)	(0.392)
Other-Neigh	1.074^{***}	0.918^{*}	0.267	0.260	-0.118	-0.220^{+}	0.148	-0.00956
	(0.237)	(0.388)	(0.172)	(0.214)	(0.107)	(0.130)	(0.128)	(0.123)
Other-Neigh $\times$ 2022	-3.692^{***}	-2.632^{***}	-0.267	0.635^{**}	-0.409	-0.619	-0.433^{***}	-0.00666
	(0.790)	(0.616)	(0.267)	(0.204)	(0.433)	(0.555)	(0.131)	(0.130)
Other-Neigh=Sen	-0.368	-0.609	-0.671^{**}	-1.074^{**}	-0.498^{**}	-0.249	-0.475^{***}	-0.376^{**}
	(0.741)	(0.623)	(0.223)	(0.346)	(0.181)	(0.178)	(0.134)	(0.131)
Other-Neigh=Sen $\times$ 2022	-0.0250	1.094	0.902^{+}	2.213^{*}	-0.123	-0.298	0.700^{***}	0.744^{***}
	(0.755)	(0.808)	(0.529)	(0.939)	(0.395)	(0.413)	(0.198)	(0.220)
Pseudo R-sq.	0.941	0.939	0.988	0.963	0.992	0.984	0.989	0.978
Obs.	271525	269201	446086	444909	408896	407815	458169	457853

The table presents *ppmlhdfe* estimates of sanctions' effects on trade flows. All regressions controlling for country pair and country-time fixed effects. Errors clustered at country pair level. Standard errors in parentheses. $+\ p < 0.10$
$*\ p < 0.05$, $**\ p < 0.01$, $***\ p < 0.001$

Table 6 reports the sensitivity check for effects of sanctions imposed on Ukraine.

Table 6: Trade flows under sanctions with Ukraine

	Arms		Dual use		Machinery		Other	
	Value	Weight	Value	Weight	Value	Weight	Value	Weight
RTA	0.140	0.0789	0.103**	0.105$^+$	0.0593*	0.0686$^+$	0.156***	0.101*
	(0.0984)	(0.0984)	(0.0353)	(0.0587)	(0.0243)	(0.0373)	(0.0286)	(0.0452)
Sen-UKR	1.129$^+$	1.162**	-0.335**	0.0848	0.0385	0.245*	0.216$^+$	0.580*
	(0.585)	(0.402)	(0.121)	(0.175)	(0.119)	(0.103)	(0.119)	(0.265)
Sen-Other	-0.00708	-0.114	-0.0522	-0.0316	-0.0855$^+$	-0.113*	-0.160***	-0.395***
	(0.103)	(0.101)	(0.0455)	(0.0955)	(0.0465)	(0.0494)	(0.0356)	(0.0741)
Neigh-UKR	-0.150	-0.115	0.983**	1.119*	0.281$^+$	0.405***	0.741***	1.317***
	(0.658)	(0.360)	(0.334)	(0.506)	(0.168)	(0.115)	(0.130)	(0.289)
Neigh=Sen-UKR	2.405***	0.964	-0.274*	-0.256	-0.0647	0.118	-0.0483	0.198
	(0.679)	(0.997)	(0.138)	(0.275)	(0.194)	(0.182)	(0.158)	(0.321)
Neigh-Other	0.154	-0.690*	0.392**	0.113	0.199*	0.169$^+$	0.120	0.116
	(0.267)	(0.285)	(0.143)	(0.212)	(0.0939)	(0.0885)	(0.102)	(0.113)
Neigh=Sen-Other	-0.262	-0.611*	-0.104	-0.0727	-0.0527	-0.238*	-0.322**	-0.370**
	(0.288)	(0.298)	(0.122)	(0.190)	(0.0910)	(0.0993)	(0.116)	(0.117)
UKR-Sen	-0.710	-0.988	0.202	0.496	0.382**	0.526**	0.298**	0.312*
	(0.681)	(0.818)	(0.155)	(0.331)	(0.133)	(0.181)	(0.113)	(0.159)
Other-Sen	-0.287**	-0.540***	-0.0962*	-0.230$^+$	-0.218**	-0.207*	-0.199***	-0.224**
	(0.109)	(0.137)	(0.0431)	(0.118)	(0.0788)	(0.0854)	(0.0406)	(0.0740)
UKR-Neigh	-0.0768	-2.440***	0.334$^+$	1.951***	-0.0106	0.293	0.147	0.455***
	(0.276)	(0.646)	(0.172)	(0.290)	(0.144)	(0.200)	(0.119)	(0.123)
UKR-Neigh=Sen	-0.340	-0.552	0.276	1.267***	-0.275	0.0666	-0.151	-0.0423
	(0.854)	(0.808)	(0.197)	(0.261)	(0.240)	(0.235)	(0.265)	(0.140)
Other-Neigh	0.282	-0.447	0.0149	-0.0937	0.0532	-0.0282	0.162*	-0.139$^+$
	(0.268)	(0.428)	(0.132)	(0.235)	(0.136)	(0.154)	(0.0817)	(0.0790)
Other-Neigh=Sen	-1.072$^+$	-0.603	-0.354*	-0.422$^+$	-0.404*	-0.236	-0.578***	-0.611***
	(0.618)	(0.560)	(0.159)	(0.246)	(0.173)	(0.192)	(0.0992)	(0.0993)
Pseudo R-sq.	0.941	0.938	0.988	0.963	0.992	0.984	0.989	0.978
Obs.	271525	269201	446086	444909	408896	407815	458169	457853

The table presents *ppmlhdfe* estimates of sanctions' effects on trade flows. All regressions controlling for country pair and country-time fixed effects. Errors clustered at country pair level. Standard errors in parentheses. $+ \ p < 0.10$ $* \ p < 0.05$, $** \ p < 0.01$, $*** \ p < 0.001$

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