The Eurasian roundabout:
Trade flows into Russia through the Caucasus and Central Asia*

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October 2023

Abstract

This paper documents a substantial change in regional trade patterns precipitated by the war on Ukraine and the subsequent introduction of trade sanctions on Russia. It provides evidence suggestive of intermediated trade via neighbouring economies being used to circumvent the sanctions. The analysis, based on HS6 product-level data on bilateral monthly exports, shows a sharp drop in direct exports from the EU to Russia following the introduction of sanctions in March 2022. At the same time, an increase in the EU exports to Armenia, Kazakhstan and the Kyrgyz Republic (CCA3, all members of Eurasian Customs Union alongside Belarus and Russia) is observed. Both patterns are particularly pronounced for product groups partially or fully subject to the EU sanctions as well as goods that are similar to the sanctioned ones. The drop in EU exports to Russia was around 80 percent steeper for sanctioned goods than for other products, while exports of sanctioned goods to CCA3 rose by extra 30 percent relative to those of other goods. The increase in exports of sanctioned goods to CCA3 represents a small fraction of the reduction in their direct exports to Russia but can be large for specific product groups.

Keywords: sanctions, trade diversion, re-exports, intermediated trade, Russia

JEL Classification Number: F14, F15, F51

1 Introduction

Wars significantly disrupt international trade (Glick and Taylor (2010); Berger et al. (2013); Fisman et al. (2014)), in part because economic sanctions more or more frequently accompany conflict (Hufbauer and Oegg (2009); Kaempfer and Lowenberg (1988)). Although sanctions are typically found to have a negative impact on bilateral trade and the performance of targeted firms (Crozet and Hinz (2020); Ahn and Ludema (2020); Draca et al. (2022)), the evidence on their overall effectiveness is mixed. This is due to partial compliance and various ways in which sanctioned entities and firms can circumvent sanctions by redirecting trade flows or finding alternative suppliers (Bergeijk (1995); Haidar (2017)).

This study sheds light on the channels of sanction evasion by providing evidence consistent with trade intermediated via third countries being used to circumvent sanctions. It also shows that product misclassification and misspecification of the destination country may be used to go around sanctions. Our analysis focuses on the European Union (EU) sanctions imposed on Russia in the aftermath of its full-scale invasion of Ukraine on the 24th of February 2022. It exploits product-level data on bilateral monthly exports where products partially or fully subject to the EU sanctions can be identified.

Comprehensive economic sanctioned imposed on Russia by the EU and other large economies in response to the war on Ukraine present a unique case for studying the changes in trade patterns resulting from the conflict and imposition of wide-scale economic sanctions. This episode stands out in terms of its size, comprehensive nature and the size of the targeted economy.[1] Export sanctions covered an extensive yet diverse set of goods, from dual-use technology to luxury consumer goods, and were accompanied by voluntary boycott of the Russian market by a large number of mostly "Western" firms (Sonnenfeld et al. (2022)). In addition, sanctions were simultaneously upheld by the vast majority of advanced economies, ruling out diversion of trade from sanctioning parties towards other advanced economies or close allies of the countries imposing sanctions (as found by Yang et al. (2009) in another context). A swift imposition of sanctions with little or no advance notice also ruled out building up of stocks of imported goods (as documented in other cases by Afesorgbor (2019)).

Our analysis focuses on trade patterns in the aftermath of the sanctions being introduced. It is based on bilateral monthly data on exports at the 6-digit Harmonised System (HS) level of disaggregation, covering the period from January 2017 to December 2022. The disaggregated data allow us to identify products partially or fully subject to the EU sanctions. We focus on exports to Russia as well as to a number of Russia's neighbours. Of particular interest are trade flows to Armenia, Kazakhstan and the Kyrgyz Republic (CCA3). These three countries are part of a customs-free trade bloc with Russia, the

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[1]Russia's GDP at market exchange rates in 2021 amounted to US$1.8 trillion making Russia 11th largest economy in the world.

Eurasian Economic Union.[2] Goods exported to these economies could potentially be shipped to Russia with minimum checks (akin to shipments, say, within the EU). We also consider exports to Georgia (providing the only land bridge between Armenia and Russia as the border between Armenia and Azerbaijan remains closed), selected other economies sharing a land border with Russia, and the rest of the world.

We follow a triple-differencing approach comparing (i) exports to Russia (or CCA3) to exports to the rest of the world; (ii) the pre- to the post-sanction period; (iii) sanctioned goods to non-sanctioned goods. We control for importer-month fixed effects to account for fluctuations in the aggregate demand in the importing country, product-month fixed effects to account for seasonality and fluctuations in the product-specific supply and its prices, and importer-product fixed effects to take into account differential demand patterns across importers. Standard errors are clustered on products. Our outcome variables are either the value of exports (logged or in the form of hyperbolic sine) or an indicator variable capturing non-zero flows of a given product between the two partners in a given month. An event-study analysis shows no differential trends in the EU/UK exports of sanctioned vs non-sanctioned products before March 2022.[3]

Both summary statistics and our regression analysis reveal several striking regularities. After the imposition of economic sanctions on Russia starting in March 2022, the EU/UK (which we consider jointly) exports to Russia more than halved. At the same time, the EU/UK exports to Armenia, Kazakhstan and the Kyrgyz Republic (all members of Eurasian Customs Union alongside Belarus and Russia) increased by between 50 and 252 percent. The EU/UK exports to these economies relative to exports to the rest of the world exhibit a clear structural break in March 2022, the month when sanctions were introduced, with the divergence increasing further over time. Furthermore, the data show a clear increase in exports from CCA3 countries to Russia.

The drop in the EU/UK exports to Russia in the post-sanction period was around 80 percent steeper for sanctioned goods than for other goods, while exports of sanctioned goods to CCA3 rose by an extra 30 percent relative to other goods. Similarly, the increase in exports from CCA3 countries to Russia was particularly pronounced for goods under EU sanctions. There is no indication of differential trends for sanctioned versus other goods prior to the war.

In terms of magnitudes, the increase in the EU/UK exports of sanctioned goods to CCA3 represents a small fraction of the reduction in direct exports of sanctioned goods to Russia in general, on the order of 10 percent, though rising over time. However, the resulting "substitution ratio" is high for more than 200 specific HS6 product lines.

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[2]Belarus, the remaining member, was also subject to economic sanctions.
[3]Our analysis treats exports from the EU and the UK as a single aggregate.

Shipment of goods via third countries is only one of the methods that may be employed to circumvent sanctions. Another possible channel is misspecification of the destination country, i.e., a large proportion of sanctioned goods exported to CCA3 may have never reached the destination countries stated in the export documents, having been "lost" in transit through Russia. And indeed, the patterns found in the data are in line with this hypothesis. Finally, there is some (albeit not very strong) indication that product missclassification may be used to get around sanctions.

Intermediated trade and trade "lost in transit" are observed in parallel with other forms of trade diversion. In particular, exports from China and Turkiye to Russia increased relative to the pre-sanctions trend from around the middle of summer of 2022. Additional exports tended to be more pronounced for sanctioned goods in the case of China, while in the case of Turkiye patterns in the composition of trade are less clear cut. For China, the data also reveal a significant increase in exports of new product groups to Russia. Overall, it took about two to four months for these new supply routes to emerge.

Our paper contributes to several strands of the economic literature. First, we contribute to the literature on intermediated (or "entrepot") trade by showing that trade routed via third countries can be used to evade economic sanctions. Such trade has been earlier shown to facilitate evasion of tariffs and taxes (Fisman et al. (2008)). We further demonstrate that transit through the sanctioned country to its neighbours may be used for indirect shipments, with goods failing to reach their intended destination.

We contribute to the literature on the effectiveness of economic sanctions by providing for the first time evidence, in a triple-differenced setting, consistent with rerouting of trade via neighbouring economies being used to increase access to sanctioned imports. The existing evidence has been mixed. Baronchelli et al. (2022) study the history of small arms embargoes and do not find evidence of sanction-busting through abnormal trade patterns among sanctioned countries' neighbours. Gutmann and Neumeier (2022) and Frank (2017) find no evidence of sanction busting through diverted trade. Crozet and Hinz (2020) find that the earlier round of sanctions on Russia resulted in a broad-based decline in sanctioning countries' exports to Russia, which can be mostly attributed to increased country risk affecting all transactions with Russia. Tyazhelnikov et al. (2023) show that intermediated trade via Belarus was used to circumvent restrictions on import of food from the EU imposed by Russia in the aftermath of the annexation of Crimea in 2014 while Crozet et al. (2021) show that firms exporting to neighbouring countries reduced their direct sales to Russia by more than other firms in the aftermath of the 2014 round of sanctions.[4]

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[4]There is also a literature focusing on exports of sanctioned countries. Haidar (2017) shows a decline in Iranian non-oil exports to countries that introduced sanctions relative to other countries in the post-sanction period, while Babina et al. (2023) show that Russian oil shipments were largely redirected to alternative markets in response to the EU embargo and G7 price cap on Russian seaborne crude oil, both of which took effect in December 2022.

The rest of the paper is structured as follows. The next section describes the economic sanctions imposed on Russia in 2022 and presents the data sources. Section 3 sets the stage by presenting the broad patterns found in the data. Section 4 lays out our empirical approach. Section 5 presents the results on intermediated trade and trade "lost in transit". Section 6 focuses on exports from China and Turkiye, thus documenting further diversion in trade patterns. Section 7 discusses some broader implications of the analysis. The last section concludes.

2 Setting and Data

2.1 Sanctions on the Russian economy: An overview

Prior to Russia's full-scale invasion of Ukraine in 2022, a narrower set of sanction was already in place. These earlier sanctions were introduced in response to the annexation of Crimea in 2014 and the armed conflict in Eastern Ukraine that started in the same year. Those sanctions predominantly targeted specific companies and individuals. They were accompanied by counter-measures imposed by Russia, notably a ban on import of various food products from the EU, the US and the UK (see Peeva (2019) for an overview). Those sanctions and counter-sanctions were found to result in a broad-based reduction in Russia's trade with the sanctioning countries (Crozet and Hinz (2020)), an increase in prices of the affected goods (Hinz and Monastyrenko (2022)), weaker performance of sanctioned companies (Ahn and Ludema (2020)) and possibly an increased popular support for the government (Peeva (2019)).

On 23 February 2022, the EU expanded its sanctions in response to the recognition of the non-government controlled areas of the Donetsk and Luhansk oblasts of Ukraine and the ordering of Russian armed forces into those areas. The sanctions were further expanded in ten waves, with most in place by the mid-March of 2022. Luxury goods, for instance, were added as part of the fourth package on 15 March 2022, while technology-related goods were added as part of earlier packages. Overall, export prohibitions have covered arms, advanced and dual-use technology, quantum computing, advanced semiconductors, sensitive machinery, transportation and chemicals, goods for use in the oil industry and maritime navigation and goods seen to enhance Russia's industrial production capacity as well as luxury products.

In addition to exports, sanctions have also applied to investments in a number of sectors; use of public funds; imports from Russia of certain goods such as coal, iron and steel, and wood; aviation, Russian freight operators; restrictions on financial services including transactions with Russia's Central Bank; as well as travel bans and financial measures targeting more than 1,200 individuals and 100 companies.

The UK, US, Canada, Japan, Switzerland and a number of other economies adopted their own sanction packages, while China and Turkiye are among Russia's main trading partners that did not impose economic sanctions on Russia (see Free Russia Foundation (2023)).

2.2 Bilateral trade data

Following the imposition of sanctions, Russia suspended publication of trade statistics and a number of other key economic indicators, such as the breakdown of government expenditure. Thus our econometric analysis is based on the data reported by the exporting countries, including the EU and the UK (treated as a single aggregate), the US, Turkiye and China.

We will be primarily interested in export flows to Russia and the CCA3 members of the Eurasian Customs Union (Armenia, Kazakhstan and the Kyrgyz Republic). However, we will also allow for a differential post-sanction pattern of exports to Georgia (because of its location between Armenia and Russia and thus being an obvious transit route). The remaining importer is the rest of the world (as an aggregate).

The values of exports in nominal US dollars are available from the UN COMTRADE database at the 6-digit Harmonised System (HS) level in a monthly frequency for the period January 2017 - December 2022 (October 2022 in the case of Turkiye's exports). The data for China come from the China Customs Administration. They are also reported at the HS6 level and disaggregated by the destination country and month.

The HS6 level of disaggregation distinguishes, for example, between cotton men's shirts (code 610510) and men's shirts of man-made materials (code 610520), both falling within the same HS4 code 6105. Table 1 summarizes descriptive statistics for trade flows.

2.3 Sanctioned goods

To identify products or product groups, on which the EU introduced sanctions to export to Russia in the aftermath of the invasion, we use information from the EU Council Regulation 833/2014 and its subsequent amendments[5] as well as from the EU list of dual-technology product codes.[6] Product codes are also marked as subject to sanctions in cases when sanctions cover HS6 codes only partially. For example, exports of "luxury" sports equipment or clothing with prices in excess of a certain threshold (typically €300) are subject to sanctions, while cheaper items in the same product group may not be

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[5]https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:02014R0833-20221007from=ENtocId108, for instance, Annex II and Annex VII-B

[6]https://trade.ec.europa.eu/doclib/docs/2016/february/tradoc$_1$54240.pdf

subject to restrictions. In other cases, only a subset of HS8 product codes within an HS6 code may be covered (for example, champagne but not prosecco among sparking wines). Numerous other exemptions may apply, for instance, on health and environmental grounds or in relation to goods required by Russia to fulfil its contractual obligations with respect to deliveries of gas and oil to Europe. Most packages also include provisions for trade covered by pre-existing contracts to be carried out by a certain date, sometimes into the following year. Thus some of the trade in HS6 product groups coded as sanctioned may in fact be covered by such contract wind-down clauses.

For each product line we record the date when sanctions enter into force (see Annex Figure A1). We code the respective HS6 product line as subject to sanctions starting from the next month (for instance, April 2022 for sanctions adopted in mid-March 2022). The list of product groups partially covered by the sanctions is an eclectic mix of 2,182 HS6 codes (as of December 2022) combining: weapons (HS 9301), semi-conductor media (852352), engines and pumps (8412, 8413), containers (860900), aircraft and parts (88), ammonia (281420), steel pipes for oil pipelines (730411), navigation instruments (9014), ski suits (611220), and others.

We also identify product lines that are not necessarily covered by sanctions but are similar to goods that are partially under sanctions (i.e., those nested in the same HS4 code). Those products are of interest since goods covered by sanctions may be intentionally misclassified in customs declarations to avoid detection.[7] By way of example, x-ray apparatus for dentistry and similar medical uses (HS 902213) is not covered by the EU sanctions on Russia, while x-ray apparatus for non-medical uses (HS 902219) is among the sanctioned products. We identify a total of 1,379 "similar" products (as of December 2022).

We use a categorical variable distinguishing between sanctioned, similar and other goods (a base category comprising the remaining 1,808 HS6 codes, as of December 2022). Over time, the number of sanctioned and similar product groups increased slightly (see Annex Figure A1). Annex Table A1 summarizes application of sanctions by HS section.

3 First look at the data: Broad patterns

Russia's invasion of Ukraine in February 2022 and the subsequent introduction of economic sanctions against Russia has led to profound changes in the regional trade patterns. This is clearly visible in Figure 1, which depicts export values denominated in US dollars adjusted for US inflation. It traces trade in goods that subsequently were subject to sanctions (as of December 2022), goods similar to

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[7]For instance, Bevan (2008), discusses how arms can be declared as sports arms for customs purposes. The literature has documented product misclassification being frequently used to evade import duties. See for instance, Fisman and Wei (2004), Javorcik and Narciso (2008) and Javorcik and Narciso (2017).

sanctioned goods and other products.

Starting with the top panel, the graphs depict a dramatic drop in the exports from the EU/UK to Russia, accompanied by a substantial increase in exports to CCA3 (Armenia, Kazakhstan and the Kyrgyz Republic). These changes are particularly pronounced for sanctioned goods, which accounted for majority of exports prior to the war. A very similar pattern is visible for US exports, with the exports of sanctioned goods to Russia becoming negligible in terms of value after the Russian invasion of Ukraine and the exports to CCA3 being on the rise.

Bilateral trade flows should not be considered in isolation. The trajectory of aggregate exports originating from a particular exporter should be considered before drawing conclusions about export reorientation. This is done in Figure 2, which depicts the EU/UK exports to Russia relative to the aggregate EU/UK exports, as well as the EU/UK exports to CCA3 relative to aggregate flows. As clearly visible in the figure, the EU/UK exports to Russia dropped dramatically relative to the exports to the rest of the world, while the EU/UK exports to CCA3 went up in relative terms.

These striking trends suggest that a substantial part of additional exports to Central Asia and the Caucasus may have been re-routed to buyers in Russia. Indeed, the Kyrgyz Republic and Armenia have recorded significant increases in exports to Russia (see Figure 3), though the records of trade within the EEU customs union are likely to be incomplete.

In terms of magnitudes, the rise in the (recorded) trade between the EU and CCA3 corresponds to a small fraction of the drop in direct EU exports to Russia (around 10 per cent based on calculations presented in Table 3). Nonetheless, the rerouted trade may be important in case of specific product groups.[8]

The picture is markedly different for exports from Turkiye and China, depicted in the bottom part of Figure 1. After a temporary drop in Turkiye's exports to Russia in March-April 2022, the trade flows resumed, reaching the record value during the period depicted in the graph (January 2017 - October 2022). Trade in all product categories went up. At the same time, Turkish exports to CCA3 saw a stratospheric increase, albeit from a small baseline in absolute terms. This increase was most pronounced for sanctioned goods but is also visible in other goods. China's exports exhibited yet a different pattern - after a temporary drop in the aftermath of Russian invasion of Ukraine, they recovered to the previously reached levels. Unlike flows from other countries, Chinese exports registered a steady and sizeable increase in the 12 month prior to the war.

The bottom part of Figure 2 normalizing exports to particular destination by total exports, which may

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[8]We will come back to this issue in Section 4.8.

be particularly relevant in the Chinese context, given the disruptions caused in the country by the zero-Covid policy. However, even with this normalization, the broad patterns discussed earlier are confirmed. After a temporary dip in Chinese exports to Russia immediately following the invasion of Ukraine, trade flows recover and grow in importance as a share of total Chinese exports. Similarly, the importance of CCA3 as an export destination increases over time.

Yet another cut of the data is presented in Table 2, which lists export values adjusted for US inflation and normalizes the flows that took place during March-December 2022 by their value value during the corresponding months in 2017-21. The pattern is broadly similar to those discussed earlier: a drop in Western exports to Russia accompanied by an increase in exports to Central Asia and the Caucasus. More specifically, exports from the EU, UK and US to Armenia and the Kyrgyz Republic increased by 120-252 percent relative to the 2017-21 average.

4 Empirical specifications

4.1 Intensive margin of trade

Our triple-differenced specification for a single exporting country takes the following form:

$$Log(Exp_{pit}) = \beta_1 Sanction_{pt} * Rus_i + \beta_2 * Sanction_{pt} * CCA3_i + \beta_3 Sanction_{pt} * Geo_i +$$
$$+ \alpha_{pi} + \alpha_{pt} + \alpha_{it} + \epsilon_{pit}$$
(1)

where the dependent variable is defined as the logarithm of the value of exports of HS6 product p exported in month t to the importing country i. The coefficients of interest are those on interaction terms between an indicator for the product being subject to sanctions (which takes value of one from the month following the imposition of sanctions with respect to a particular HS6 product group) and an indicator for a particular importer. Three types of importers are of interest to us: (i) Russia (Rus), as the country that is under sanctions; (ii) CCA3 (Armenia, Kazakhstan and the Kyrgyz Republic), which all are members of the Eurasian Customs Union along with Russia and Belarus and thus could serve as a conduit for intermediated trade;[9] and (iii) Georgia (Geo), which in addition to being Russia's neighbour, provides the only usable land bridge between Armenia and Russia. Like CCA3 countries, Georgia shares substantial common history with Russia as a former part of the Russian Empire and the

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[9]Belarus has been subject to its own set of EU sanctions over its role in the invasion of Ukraine. For more information on the Eurasian Customs Union see Isakova et al. (2016).

Soviet Union and is home to significant Russian-speaking groups.[10]

The specification includes several sets of fixed effects. Product-importer (α_{pi}) fixed effects capture differences in demand for a specific product across various importers related, for instance, to differences in tastes or domestic production capacity. In our single-exporter specification, they will also capture factors affecting the trading relationship between a given exporter and a given importer, such as distance, linguistic proximity, historical links or common border and allow for a differential impact of these factors across products. Product-time (α_{pt}) fixed effects pick up general trends in trade in particular goods, including price fluctuations or shocks to the product supply. Importer-time (α_{it}) fixed effects account for fluctuations in the business cycle in the importing country, its exchange rate, or anything else that may affect the aggregate demand for imports. These fixed effects would subsume broad trends in trade in the aftermath of the imposition of sanctions – a drop in exports to Russia and an increase in exports to Armenia or the Kyrgyz Republic, or an overall decline in exports of a particular product in a particular year – but not differences in bilateral trade in specific products within a given month.

4.2 Extensive margin: Probability of trade taking place

Half or more of observations on bilateral monthly trade at this high level of disaggregation are zeros. With this in mind, it is also useful to look at the extensive margin of trade – the probability that exports in a given month are positive for a given pair of trade partners and a given HS6 product code. Specifications similar to those for the intensive margin of trade are estimated as a linear probability model:

$$P(Exp_{pit} > 0) = \beta_1 * Sanction_{pt} * Rus_i + \beta_2 * Sanction_{pt} * CCA3_i + \beta_3 Sanction_{pt} * Geo_i +$$
$$+ \alpha_{pi} + \alpha_{pt} + \alpha_{it} + \epsilon_{pit}$$

(2)

where the dependent variable takes a value of one for positive trade values and zero otherwise.

4.3 Extensive and intensive margin

To combine the estimates on the extensive and the intensive margins of trade, we use the inverse hyperbolic sine transformation of the values of trade, $log(Exp + \sqrt{Exp^2 + 1})$ (see MacKinnon and

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[10]Such ethno-linguistic ties have been previously shown to play an important role in international trade networks, likely even more so in the case of a major disruption to established patterns of trade (see Greif (1993); Rauch (1999); Rauch and Trindade (2002)).

Magee (1990)). This transformation approximates the logarithmic transformation for large trade volumes while assigning the value of zero to zero trade rather than discarding zero observations.

5   Results: Intermediated trade and trade "lost in transit"

5.1   EU exports of sanctioned products

We begin our econometric analysis by considering the EU/UK exports (EU-27 plus UK) to Russia, CCA3, Georgia and the rest of the world. We focus on the differential patterns of trade between products that were fully or partially subject to sanctions versus all other products (including similar goods that are not subject to sanctions). And in particular, we are interested in whether exports of these products to Russia and CCA3 exhibited a differential pattern.

The results, presented in Column 1 of Table 4, suggest that once sanctions have been imposed, the EU/UK exports to Russia of fully or partially sanctioned goods were 80 percent lower compared to exports of other goods and to what could have been expected based on patterns observed prior to the imposition of sanctions. This difference is statistically significant at the 1 percent level and comes on top of the overall drop in EU exports to Russia (subsumed in the respective fixed effect).

At the same time, from March 2022 onwards the EU/UK exports of fully or partially sanctioned goods to CCA3 were around 30 percent higher than exports of other goods. Again the estimated coefficient is statistically significant at the 1 percent level. The corresponding coefficient on the interaction term for exports to Georgia is small, negative and not statistically significant.

Similar patterns are observed on the extensive margin. For instance, for sanctioned goods the probability of observing EU/UK exports to Russia declined by an additional 14 percentage points while the probability of EU/UK exports to CCA3 increased by an additional 2.5 percentage points (see Column 2). This is a sizeable effect, considering the unconditional probability of observing a non-zero trade between EU/UK and a CCA3 economy in a given month being equal to 42 per cent (see Table 1). Hyperbolic sine specifications yield estimates qualitatively similar to those obtained for the logarithm of trade (see Column 3). Coefficients tend to be larger reflecting the combined effects on the extensive and intensive margins. In the case of Georgia, only one coefficient reaches conventional significance levels.

These very striking pattern is consistent with a scenario under which Western firms cut direct trading relationships with Russia but scale up trade with entities located in the CCA3 countries. It is possible that these CCA3 intermediaries then re-export products to Russia, not necessarily with the knowledge

of the Western exporter. Some media reports further suggested that goods shipped to CCA3 countries through Russia and may not physically enter the destination economies. Indeed, the gap between exports reported by the EU/UK and the respective imports reported by the economies in the Caucasus and Central Asia widened in the later months of 2022 (. Various transshipment schemes have been previously shown to be used to evade tariffs (for instance, Rotunno et al. (2013)). A distinct advantage of our analysis focused on trade reported by exporters (as opposed by importers) is that it picks up trades that may get "lost in transit".

5.2 EU exports of goods similar to sanctioned goods

As mentioned earlier, the existing literature has documented frequent and extensive misclassification of imported products and found evidence consistent with such misclassification being used to evade import taxes (Fisman et al. (2008); Javorcik and Narciso (2008); Javorcik and Narciso (2017)). Thus in this section, we additionally distinguish between goods that are similar to sanctioned products. These are products that belong to the same HS4 digit product group as thus could plausibly be used to hide sensitive imports.[11]

The results are presented in the bottom panel of Table 4. They are qualitatively similar to those for sanctioned products, though the estimates tend to be somewhat smaller in magnitude. For instance, the EU exports of similar-to-sanctioned goods to Russia declined more substantially than those of other goods, although the observed differential, of around 10 percent, is significantly smaller than that for the fully or partially sanctioned goods (around 80 percent in these specifications). Moreover, the results reveal additional increase in the probability of exports of similar goods from EU to CCA3, statistically significant at the 1 percent level.

The pattern observed with respect to exports to Russia may have to do with the ambiguity of sanctions and compliance complexity (the burden of proof that shipment is distinct from a similar shipment that would be subject to sanctions). The results may also reflect voluntary withdrawal by firms supplying such "similar" goods, which may have, for instance, higher technological content (see Sonnenfeld et al. (2022) on voluntary withdrawals versus decisions to continue supplying the Russian market).

When it comes to the increase in (new) exports to CCA3, although this pattern may reflect inaccurate declaration of goods shipped to those economies, it may also pickup a genuine increase in trade in "similar" goods on account of the corresponding decline in direct exports of those goods to Russia. We return to this point later when discussing the cumulative magnitudes of the detected trade patterns and

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[11]Recall the example of x-ray apparatus for dentistry and similar medical uses (HS 902213) not being covered by the EU sanctions on Russia, while x-ray apparatus for non-medical uses (HS 902219) being subject to sanctions.

their implications.

5.3 Exports from the US

Exports from the US exhibit an equally large drop for fully or partially sanctioned goods relative to other goods as the EU exports, both on the intensive and the extensive margins (see Table 4 Columns 4-6). However, there is less evidence suggesting a disproportionate growth in shipments of sanctioned goods to CCA3. The coefficients are smaller, around 0.1, and statistically significance varies (see Columns 4 and 10). The differences between increases in exports of goods to CCA3 for sanctioned and other goods consistently reach conventional statistical significance levels only when movements on the extensive and intensive margins are combined in hyperbolic specifications (Columns 6 and 12).

It should be noted than the EU/UK is a much more important trading partner for the CCA3 economies than the US and other advanced economies located farther away. In 2021, US exports to the region represented less than 16 percent of the combined exports of the EU member states and the UK to the same economies.

5.4 Event study analysis

The mostly-unanticipated nature of the war and the clear-cut timing of sanctions means that our setting lends itself well to an event-study analysis. The underlying econometric specifications are similar to those considered earlier, except for an additional battery of interaction terms between the sanctions dummy and the dummy variables for each month before and after the introduction of sanctions. January 2022 serves as the base (omitted) period. In this exercise we maintain consistent treatment and control samples over time, that is, samples of sanctioned and other goods using regulations in place as of December 2022.

$$Log(Exports_{pit}) = \sum_t \beta_t Month_t * Sanction_p * Russia_i + \sum_t \gamma_t Month_t * Sanction_p * CCA3_i \tag{3}$$
$$+\alpha_{pi} + \alpha_{pt} + \alpha_{it} + \epsilon_{tgi}$$

While monthly trade is volatile and standard errors are larger, a number of distinctive patterns emerge from this analysis (see Figure 4). Up until February 2022, the differences between the EU/UK exports of subsequently sanctioned goods to Russia and those of other goods were broadly stable, with no differential trends. In March 2022, the EU/UK exports of sanctioned goods to Russia dropped

dramatically relative to exports of other goods. This differential kept increasing between March and mid-summer 2022, stabilizing in the later months of the year.

In contrast, a statistically significant increase in the EU/UK exports of sanctioned goods to CCA3 (above an increase in exports of other goods) is observed from March 2022 onwards, increasing steadily through the end of the summer and then stabilizing. Again, there is no strong evidence of differential pre-trends. This pattern is suggestive of new supply chains via Armenia, Kazakhstan and the Kyrgyz Republic being set up within days of the imposition of sanctions and taking several months to scale up.

5.5   Patterns by type of sanctioned products

We subdivide all products into four broad, mutually exclusive types of goods subject to trade sanctions: Dual-use and military technology; goods that enhance industrial and transport capacity; and luxury goods. We assign goods to types in the order listed. For example, dual-use technology goods that may enhance industrial capacity is classified as dual-use technology.[12] The results are presented in Table 5.

A drop in direct trade between the EU/UK/US and Russia is observed for all types of sanctions, with larger effects for goods used in the industry. Differential increases in exports to CCA3 are also observed for most goods, including EU exports of dual-use technology and products vital for the industry.

5.6   Exports from CCA3 to Russia

Next, we look at the exports from CCA3 to Russia and other trading partners. We estimate an equation similar to Equation 1 with all fixed effects additionally interacted with each exporter (for instance, creating exporter-by-importer-by-HS6 fixed effects). The data for Armenia and the Kyrgyz Republic are taken from UN Comtrade; the data for Kazakhstan come from the national customs statistics.

The results, presented in Table 6, are consistent with trade in sanctioned goods being intermediated by CCA3 countries. CCA3's exports of sanctioned goods to Russia increased by an additional 55-75 percent relative to other goods, while exports of similar goods increased by an additional 50 percent. Large differential effects are also observed on the extensive margin of trade: the probability of observing exports increased by an additional 6 percentage points for goods that were put on the sanctions list. It is particularly striking that exports of dual-use technology goods and goods essential for industrial capacity from CCA3 economies to Russia rose by an extra 90 percent compared with exports of other goods. Overall, these results are also consistent with the emergence of intermediated trade in sanctioned goods.

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[12]We also separately identify goods goods for use in the oil and gas industry as part of robustness checks.

5.7 Trade lost in transit

Next, we investigate whether some goods shipped to CCA3 may have been "lost in transit", possibly while travelling overland through the territory of Russia.[13]. To do so, we look at imports from individual EU economies and the UK as reported by Armenia, Georgia and the Kyrgyz Republic, and the corresponding exports reported by the EU economies and the UK. As detailed data on bilateral imports of Kazakhstan were not available at the time of writing, we are unable to include Kazakhstan in this analysis.[14] Rather than focusing on monthly figures, we aggregate flows taking place in March-December in each year considered (2017-2022) to limit discrepancies arising from normal transit times.[15]

Discrepancies between export and import records are common. Besides the transit time, they also stem from the fact that exports are recorded on f.o.b. (free on board) basis, while the import figures include the cost of insurance and freight (so-called c.i.f. basis). Moreover, import flows tend to be monitored more carefully than import flows due to import taxes being collected. Thus typically importing county i would report a higher value of flows from exporting country e, relative to what e would report as trade directed to i.

Hence what we are looking for in the data is a change in the ratio of imports reported by the recipient country to exports reported by the sending country coinciding with the timing of the war. We calculate the ratio for Armenia's imports from the EU/UK and Kyrgyz imports from the EU/UK. We do so separately for sanctioned goods, goods similar to sanctioned good and the remaining products. We log the ratio, so if the figures reported for imports and exports are identical, the logged ratio would be equal to zero. If our hypothesis about trade being "lost in transit" is true, we should observe a drop in the ratio in 2022 and this drop should be more pronounced for sanctioned goods than for the other products.

This is indeed the case. As visible in Figure 5, the ratio has been stable fairly during the period 2017-21 and (as expected) close to zero. In 2022, however, the ratio dropped by around 50 percentage points for product groups which became subject to EU sanctions, amounting to US\$ 0.8 billion of trade going "missing". For other goods, including those similar to sanctioned ones, the drop was much smaller, of around 15 percentage points. This holds for aggregate values of exports (left panel) as well as for a representative (median) trade at the HS6-partner level (right panel).

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[13]Transit of goods from the EU through Russia to third countries was not restricted in 2022. Transit of dual-use goods became restricted in February 2023, as part of the 10th sanctions package

[14]On the exporter side, we exclude Austria, France and Malta due to substantial gaps in data reported in UN Comtrade).

[15]The exporting country and the importing country record flows as they cross their borders, hence the discrepancy in the timing.

To give a few examples, in 2017-21 the ratio of imports of vehicle parts (HS code 870830) as reported by Armenia and the Kyrgyz Republic relative to the exports to those countries reported by the EU/UK was between 89 and 110 percent. However, in 2022 it dropped to 30 percent suggesting that about 2/3 of exports have "gone missing" in transit. In the case of various engine parts (HS code 840999), the ratio dropped from 95 percent in 2021 to 17 percent in 2022. Detailed data for Kazakhstan are not available. However, the ratio for aggregate EU-Kazakhstan trade records declined from 92 percent in 2021 to 74 percent in 2022, corresponding to US$ 2 billion of EU/UK exports being "lost in transit".

To further investigate trade "lost in transit", we employ regression analysis. Each observation corresponds to bilateral trade between an EU member country or the UK and a CCA importer for a particular HS6 product group in March-December of a given year. The dependent variable is the logarithm of the ratio of bilateral imports to the corresponding bilateral exports. All specifications include EU exporter by CCA importer by HS6 fixed effects and EU exporter by CCA importer by year fixed effects. The latter subsume the overall decline in the ratio of reported imports to exports in EU-CCA trade in 2022 (see Equation 4).

$$Log(Imp_{piet}/Exp_{piet}) = \gamma_1 Post_t * Sanction_p + alpha_{pei} + \alpha_{iet} + \epsilon_{peit} \qquad (4)$$

The results presented in Table 7 indicate that reported imports of sanctioned goods declined by extra 30 percentage points in 2022 relative to the corresponding reported exports and relative to the ratios observed for other goods. These effects are statistically significant at the 1 percent level and observed for all types of sanctioned goods, with the larger coefficients for industrial-capacity goods and dual-use goods. The emergence of lost-in-transit trade is also observed for EU exports to Georgia (with a somewhat smaller estimated coefficient of around 0.2).

5.8 Discussion: The magnitude of intermediated trade

In total, the increase in exports of fully or partially sanctioned goods from the EU, the UK and the US to CCA3 amounted to US$ 4.3 billion over the period March-December 2022. This amounts to almost four fifth of the overall increase in exports from these countries to CCA3. However, it corresponds to less than 10 percent of the decline in the direct exports of fully or partially sanctioned goods from these economies to Russia over the same period (see Table 3).

The extent of rerouting appears to be high for particular product groups. In general, the "substitution

ratio" for consumption goods and durable goods exceeds 15 percent. More specifically, for internal-combustion vehicles (870324), the increase in exports to CCA3 represents more than 60 per cent of the corresponding reduction in exports to Russia. The EU/UK exports to CCA3 for this product line averaged US$ 286 million in May-December 2022, compared with an average of less than US$ 20 million in the same months of 2017-21. Increased volumes were observed, in particular, for exports to Kazakhstan and the Kyrgyz Republic. Meanwhile, the corresponding EU/UK exports to Russia dropped by US$ 424 million. For porcelain tableware (691110) the substitution ratio is around 55 percent, for printers (844331), around 60 percent; for water sports equipment (950629) it exceeds 80 percent.

For a number of specific lines, such as automatic data processing machines, or computers (847130), cellular phones (851712), electronic vehicles (870380) and combine harvesters (843351), the ratio exceeds 100 per cent. For example, the EU/UK exports of computers (HS 847130) to CCA3 increased from US$ 28 million to US$ 143 million (driven by increases in exports to Kazakhstan and Armenia) while the corresponding exports to Russia declined by US$ 49 million. Overall, product lines with the substitution ratio in excess of 50 percent are a diverse mix covering more than 230 HS6 product codes. This is consistent with evidence in Avdeenko et al. (2023) who show that Western brands were widely sold online in Russia via websites tracked by Google Analytics.

While the total additional trade from selected advanced economies via Armenia, Kazakhstan and the Kyrgyz Republic (in sanctioned and non-sanctioned goods) is a small percentage of the decline in direct exports to Russia, the amounts involved are large for the intermediary economies. In the Kyrgyz Republic and Armenia, they were equivalent to 8 to 11 per cent of their GDP (annualized), rising much further if additional imports from China and Turkiye are included (to up to 90 per cent of GDP, annualized, for the Kyrgyz Republic).

The logistics and intermediation services associated with increased exports would have made a sizeable contribution to these economies' GDP and capital inflows. As a result, the currencies of economies providing intermediary services performed better than most emerging market currencies in March-December 2022; in some cases, they have appreciated against the US dollar notwithstanding dollar's overall strength during that period. The cost of various intermediary services is effectively billed to end-consumers in Russia who face significantly higher prices for imported goods (see Hinz and Monastyrenko (2022) for evidence of price increases following the earlier round of sanctions and counter-sanctions in Russia).

5.9 Unit values

Next, we investigate if the average unit values of exports of sanctioned products changed relative to those of other products once sanctions have been imposed. Average unit values are calculated by dividing the nominal value of exports by the quantity of exports (the unit of measurement being specific to an HS6 product group). The data on shipments in physical terms is also obtained from UN Comtrade.

In general, additional compliance costs or other costs associated with trade in sanctioned goods are likely to be at least partially passed on to the consumer, leading to an increase in the average unit value of exports. In addition, cheaper, non-differentiated, generic products may be easier to substitute from other suppliers, for instance, those in China (see the next section). Such substitution can also drive up the average unit value of EU's exports.

However, for luxury goods where sanctions apply to items above a certain threshold value (for instance, €300 for most items of apparel, €750 for mobile phones or €1,500 for pianos), one could also observe a shift towards cheaper items within the same HS6 product group, i.e., towards those priced below the sanctions threshold. The reported price of some items may even be artificially lowered to a value just below the cut-off. This may result in a lower average unit value of exports in response to sanctions. In the light of these opposing effects, we distinguish between HS6 product lines containing luxury goods, where application of sanctions depends on the unit value, and all other goods subject to sanctions. The results are reported in Table 8.

In the triple-differencing analysis, the average unit value of EU exports to Russia increased by an additional 6 percent in the case of sanctioned goods other than luxury goods (primarily on account of goods used in the industry and transportation). For luxury goods, the average unit values declined by around 20 percent relative to what could otherwise be expected. The latter finding is in line with (at least some) compliance with sanction tresholds.

When we consider shipments from the EU/UK to CCA3 countries, luxury goods fetched a 7 percent average unit value premium (Columns 2 and 3). This could be due to higher costs associated with intermediated trade or with more expensive items (e.g., those priced above sanction thresholds) being shipped via CCA3 countries.

Patterns found for trade from CCA3 to Russia are not quite consistent with the above findings. In particular, they suggest a decline in unit values of luxury goods shipped to Russia. At the same time, the average unit value of exports of sanctioned goods essential for industrial capacity and dual-use technology from CCA3 to Russia increased by an additional 50 to 90 percent (Columns 4-6).

Overall, there is indication of average prices paid by the recipients of (at least some) sanctioned goods in Russia paying higher prices, which may reflect additional costs associated with indirect routing or an increased number of intermediaries (see also Hinz and Monastyrenko (2022) for evidence on the increase in consumer prices in response to the earlier rounds of sanctions and counter-sanctions in Russia).

5.10 Robustness checks

We run a number of robustness checks. First, we repeat the analysis performed for aggregate EU exports looking at exports of individual EU member states (with all fixed effects additionally interacted with each exporter). The results are qualitatively and quantitatively similar to those discussed earlier.

Next, we aggregate trade during March-December of each year. In 2022, this approach yields trade in the aftermath of Russia's invasion of Ukraine. Looking at the same period in each year alleviates concerns related to seasonality in trade patterns while aggregated flows tend to be less volatile. Again, the results are qualitatively similar to those reported earlier.

We further conduct placebo tests by looking at similar patterns for additional importers that share a land or sea border with Russia and are not directly involved in the conflict (Azerbaijan, Mongolia and Turkiye). We do not find significant patterns for these neighbours. The results for exports to Russia and CCA3 remain unchanged in these specifications. If anything, the positive coefficient on exports of similar goods from the EU/UK to CCA3 becomes statistically significant (see Annex Tables A2 and A3). The results hold if we include all economies separately instead of the rest-of-the-world aggregate.

Additional specifications use time-invariant sanctions variable (for instance, as of December 2022) interacted with a dummy variable for the period March-December 2022; other specifications include different sets of fixed effects. These produce similar results. In specifications without product-by-importer fixed effects, the interaction terms of interest are included and estimated separately for the pre-sanctions and post-sanctions periods, with the difference between the two being most comparable to the earlier estimates. The combination of the two interaction terms produce qualitatively and quantitatively similar results.

When we look at the types of sanctions, we specifically identify a subset of goods essential for the capacity of the oil and gas industry, given the importance of these sectors for Russia's fiscal revenues and export receipts. This is a fairly narrow set of around 30 HS6 product lines, mostly imported to Russia from the United States. We find that exports of these goods from the United States have virtually ceased, with no other statistically significant patterns given the small size of this sample. In the main analysis these HS6 lines are subsumed in the broader category of goods essential for the

industrial capacity.

Finally, Appendix A presents some additional analysis that disaggregates the results by various product types.

6 Results: Trade diversion

6.1 Exports from China

Next, our analysis focuses on China's exports, which display a markedly different pattern from those of the EU/UK and US exports. The results in the top panel of Table 9 indicate that Chinese shipments of fully or partially sanctioned goods to Russia, CCA3 and Georgia increased by additional 7 to 16 percent compared with trade in other goods, with these differences being statistically significant at the 1 percent level (except for one coefficient for Georgia). These magnitudes increase to 10 to 21 percent when we account for goods similar to sanctioned products in the bottom panel of the table. Looking at examples of specific products, exports of heavy-duty trucks from China to Russia increased markedly in 2022. Large and statistically significant effects are also observed on the extensive margin of trade, reflecting diverse nature of production and export capacity of China's economy.

There is no indication of China increasing exports of goods similar to sanctioned products to CCA3 or Georgia more than exports of other products. None of the relevant interaction terms in the bottom panel of the table is statistically significant at conventional levels (with the exception of the interaction terms of Georgia in the extensive margin analysis).

6.2 Exports from Turkiye

The patterns for Turkiye are the least clear-cut. When we compare trade in the fully or partially sanctioned products to other products in the top panel of Table 9, we see no differential trajectory for these two types of products when destined to Russia. However, we see an increase in exports of fully or partially sanctioned goods to CCA3 at the intensive margin.

The picture changes when we additionally consider products similar to sanctioned products (see the bottom panel). According to those specifications, exports from Turkiye to Russia increased significantly more rapidly for fully or partially sanctioned products and products similar to the sanctioned ones, with the largest differential (of 24 percent) observed for similar products. Compared with non-similar goods, trade in sanctioned goods increased by an additional 20 percent. As in the previous specification,

exports of fully or partially sanctioned goods to CCA3 also increased by an additional 20 percent. Unlike in the case of China's exports, these effects are only observed at the intensive margin, where Turkiye-Russia (or Turkiye-CCA3) export relationships already existed, with no effect or the opposite effect on the extensive margin.

7   Discussion: Drivers of intermediated trade

The drop in exports to Russia to a large extent reflects direct application of trade sanctions. The direct role of trade sanctions is also consistent with stronger evidence of intermediated trade found for economies within the Eurasian Economic Union, where customs-free arrangements may be supportive of trade in sanctioned goods.

At the same time, only part of trade intermediated through neighbouring economies appears to be related to sanctions, in particular when trade from China and Turkiye, not technically subject to sanctions, is taken into account. This suggests that factors unrelated to trade sanctions may also play an important role.

Some companies made individual decisions to stop selling goods and services directly to Russia and Belarus (see Sonnenfeld et al. (2022), who show that announcements of withdrawal from the Russian market were associated with improved stock market performance).

Increased complexity of clearing payments from and to Russia for compliance reasons may have also played a role in reshaping trade flows following the introduction of financial sanctions, alongside availability of trade finance, in line with a large literature documenting such effects (see, for instance, Demir and Javorcik (2018)). Increased due diligence would apply to payments required to settle import-export transactions. In particular, it may be easier to clear separate payments between, say, a Russian entity and an intermediary in CCA3 and between that intermediary and an entity in the EU or the UK. Indeed, capital flows from Russia to CCA3 economies and Georgia increased markedly in the later months of 2022 (although those increases mix trade payments, capital flight, transfers accompanying emigration and other payments).

Part of the observed increases in import demand from CCA3 economies may be related to other factors, including the arrival of a substantial number of migrants from Russia who crossed the border in 2022. Some of them set up local businesses (unrelated to wholesale trade) and would have needed to make purchases of equipment; others would make increased purchases of personal effects. At the same time, estimates of such migration in the first half of 2022, as a percentage of local populations, are in single

digits, and it is hard to see how those factors could explain away most of the observed increase in import demand in CCA economies. Moreover, the patterns of immigration to Armenia, Georgia and the Kyrgyz Republic were similar. At the same time, increased exports to countries inside the Eurasian Customs Union were much more likely to be observed for sanctioned or similar goods, while for Georgia no such patterns emerged. It is also hard to see why demand from new arrivals would follow the documented patterns with respect to specific types of products, for instance specific goods and products that typically rely on letters of credit.

Since trade between China or Turkiye and Russia is not technically subject to sanctions, its increased routing via CCA3 and Georgia, with an emphasis on sanctioned and / or similar goods, may reflect convenience considerations such as ease of making international payments or exporters' preference not to be seen as supplying goods sanctioned by the EU.

In addition, as Russian-owned trading companies that based themselves in neighbouring economies and local intermediaries developed shipment channels to route trade from the sanctioning economies to Russia via CCA3 and Georgia, they may increasingly find opportunities to use these channels for shipment of goods sourced from elsewhere. This would be consistent with an important role played by ethno-linguistic frameworks in international trade documented, for instance, by (Rauch (1999); Rauch and Trindade (2002)).

8 Conclusion

Using bilateral monthly exports at the HS6 level of disaggregation, we document a number of striking patterns in trade of Russia and its neighbours in the aftermath of Russia's invasion of Ukraine. The EU, UK and US exports to Russia dropped sharply following the introduction of economic sanctions in March 2022. At the same time, the EU/UK exports to Armenia, Kazakhstan and the Kyrgyz Republic (CCA3, all members of Eurasian Customs Union alongside Belarus and Russia) increased markedly. These patterns consistent with rerouting of trade to Russia were more pronounced for product groups where goods are at least partially subject to sanctions and for goods that are similar to sanctioned ones. This intermediated trade includes shipments from the EU to CCA3, presumably lost in transit through Russia, as they have never been recorded as imports at CCA3 customs. The increase in exports of sanctioned goods to CCA3 represents a small fraction of the reduction in direct exports of sanctioned goods to Russia (around 10 percent) but can be large for specific product groups. New supply chains (routes) took around 2-4 months to set up.

The evidence suggests that intermediated trade via neighbouring economies may be used to circumvent

economic sanctions, on a limited scale. Such trade has been earlier shown to be a tool of evading tariffs or taxes. This intermediated trade complements patterns of trade diversion in Russia's direct trade with other partners and, in particular, an increase in exports from China and Turkiye.

The patterns of trade summarized in this paper rely on official exporter data. They do not pick up any illicit activities (smuggling of sanctioned or non-sanctioned goods). We are also limited by the nature of the data (aggregated at the HS6 product group level), which does not cover actual goods, their unit costs, traders or trademark owners. This often creates ambiguity as to the extent to which such trade, were it to take place between the EU and Russia directly, would be covered by trade sanctions. At the same time, by revealing some of the complex shifts in trade following the imposition of comprehensive packages of trade restrictions, the paper invites further research into ways in which supply chains respond to sanctions.

References

Afesorgbor, Sylvanus Kwaku (2019) 'The impact of economic sanctions on international trade: How do threatened sanctions compare with imposed sanctions?' *European Journal of Political Economy* 56, 11–26

Ahn, Daniel P., and Rodney D. Ludema (2020) 'The sword and the shield: The economics of targeted sanctions.' *European Economic Review* 130, 103587

Avdeenko, Alexandra, Maximilian Kaiser, Krisztina Kis-Katos, and Leonie Reher (2023) 'Sanctions, sales, and stigma: A tale on the performance of international brands in Russia.' Working Paper, University of Goettingen

Babina, Tania, Benjamin Hilgenstock, Oleg Itskhoki, Maxim Mironov, and Elina Ribakova (2023) 'Assessing the impact of international sanctions on Russian oil exports.' CEPR discussion paper 58455, Centre for Economic Policy Research

Baronchelli, Adelaide, Raul Caruso, and Roberto Ricciuti (2022) 'Trade in small arms and light weapons: Are embargoes effective?' *The World Economy* 45(5), 1336–1361

Bergeijk, Peter A. G. van (1995) 'The impact of economic sanctions in the 1990s.' *The World Economy* 18(3), 443–455

Berger, Daniel, William Easterly, Nathan Nunn, and Shanker Satyanath (2013) 'Commercial imperialism? Political influence and trade during the cold war.' *American Economic Review* 103(2), 863–96

Bevan, J (2008) 'Arsenals adrift: Arms and ammunition diversion.' In 'Small arms survey 2008: Risk and resilience' (Cambridge University Press)

Crozet, Matthieu, and Julian Hinz (2020) 'Friendly fire: The trade impact of the Russia sanctions and counter-sanctions.' *Economic Policy* 35(101), 97–146

Crozet, Matthieu, Banu Demir, and Beata Javorcik (2022) 'International trade and letters of credit: A double-edged sword in times of crises.' *IMF Economic Review* 70(2), 185–211

Crozet, Matthieu, Julian Hinz, Amrei Stammann, and Joschka Wanner (2021) 'Worth the pain? Firms' exporting behaviour to countries under sanctions.' *European Economic Review* 134, 103683

Demir, Banu, and Beata Javorcik (2018) 'Don't throw in the towel, throw in trade credit!' *Journal of International Economics* 111, 177–189

Draca, Mirko, Jason Garred, Leanne Stickland, and Nele Warrinnier (2022) 'On target? Sanctions and the economic interests of elite policymakers in Iran.' *The Economic Journal* 133(649), 159–200

Fisman, Raymond, and Shang-Jin Wei (2004) 'Tax rates and tax evasion: Evidence from "missing imports" in China.' *Journal of Political Economy* 112(2), 471–500

Fisman, Raymond, Peter Moustakerski, and Shang-Jin Wei (2008) 'Outsourcing tariff evasion: A new explanation for entrepôt trade.' *The Review of Economics and Statistics* 90(3), 587–592

Fisman, Raymond, Yasushi Hamao, and Yongxiang Wang (2014) 'Nationalism and economic exchange: Evidence from shocks to Sino-Japanese relations.' *The Review of Financial Studies* 27(9), 2626–2660

Frank, Jonas (2017) 'The empirical consequences of trade sanctions for directly and indirectly affected countries.' FIW Working paper 174

Free Russia Foundation (2023) 'Effectiveness of U.S. sanctions targeting Russian companies and individuals.' Technical Report

Glick, Reuven, and Alan M. Taylor (2010) 'Collateral damage: Trade disruption and the economic impact of war.' *The Review of Economics and Statistics* 92(1), 102–127

Greif, Avner (1993) 'Contract enforceability and economic institutions in early trade: The Maghribi traders' coalition.' *The American Economic Review* 83(3), 525–548

Gutmann, Jerg, Matthias Neuenkirch, and Florian Neumeier (2022) 'Do China and Russia undermine US sanctions? evidence from DiD and event study estimation.' CESifo Working Paper, CESifo

Haidar, Jamal Ibrahim (2017) 'Sanctions and export deflection: Evidence from Iran.' *Economic Policy* 32(90), 319–355

Hinz, Julian, and Evgenii Monastyrenko (2022) 'Bearing the cost of politics: Consumer prices and welfare in Russia.' *Journal of International Economics* 137, 103581

Hufbauer, G., J. Schott K. Elliott, and B. Oegg (2009) *Economic sanctions reconsidered, 3rd ed.* (Peterson Institute for International Economics)

Isakova, Asel, Zsoka Koczan, and Alexander Plekhanov (2016) 'How much do tariffs matter? Evidence from the customs union of Belarus, Kazakhstan and Russia.' *Journal of Economic Policy Reform* 19(2), 166–184

Javorcik, Beata S., and Gaia Narciso (2008) 'Differentiated products and evasion of import tariffs.' *Journal of International Economics* 76(2), 208–222

_ (2017) 'WTO accession and tariff evasion.' *Journal of Development Economics* 125, 59–71

Kaempfer, William H., and Anton D. Lowenberg (1988) 'The theory of international economic sanctions: A public choice approach.' *The American Economic Review* 78(4), 786–793

MacKinnon, James G., and Lonnie Magee (1990) 'Transforming the dependent variable in regression models.' *International Economic Review* 31(2), 315–339

Peeva, Aleksandra (2019) 'Did sanctions help Putin?' Discussion Papers 2019/7, Free University Berlin, School of Business Economics

Rauch, James E. (1999) 'Networks versus markets in international trade.' *Journal of International Economics* 48(1), 7–35

Rauch, James E., and Vitor Trindade (2002) 'Ethnic Chinese networks in international trade.' *The Review of Economics and Statistics* 84(1), 116–130

Rotunno, Lorenzo, Pierre-Louis Vézina, and Zheng Wang (2013) 'The rise and fall of (Chinese) African apparel exports.' *Journal of Development Economics* 105, 152–163

Sonnenfeld, Jeffrey, Steven Tian, Steven Zaslavsky, Yash Bhansali, and Ryan Vakil (2022) 'It pays for companies to leave Russia.' SSRN Working Paper, Social Sciences Research Network

Tyazhelnikov, Vladimir, John Romalis, and Yongli Long (2023) 'Russian counter-sanctions and smuggling: Forensics with structural gravity estimation.' Working Paper, University of Sydney

Yang, Jiawen, Hossein Askari, John Forrer, and Lili Zhu (2009) 'How do us economic sanctions affect EU's trade with target countries?' *The World Economy* 32(8), 1223–1244

Figure 1: Exports to Russia and CCA, by exporter and type of goods
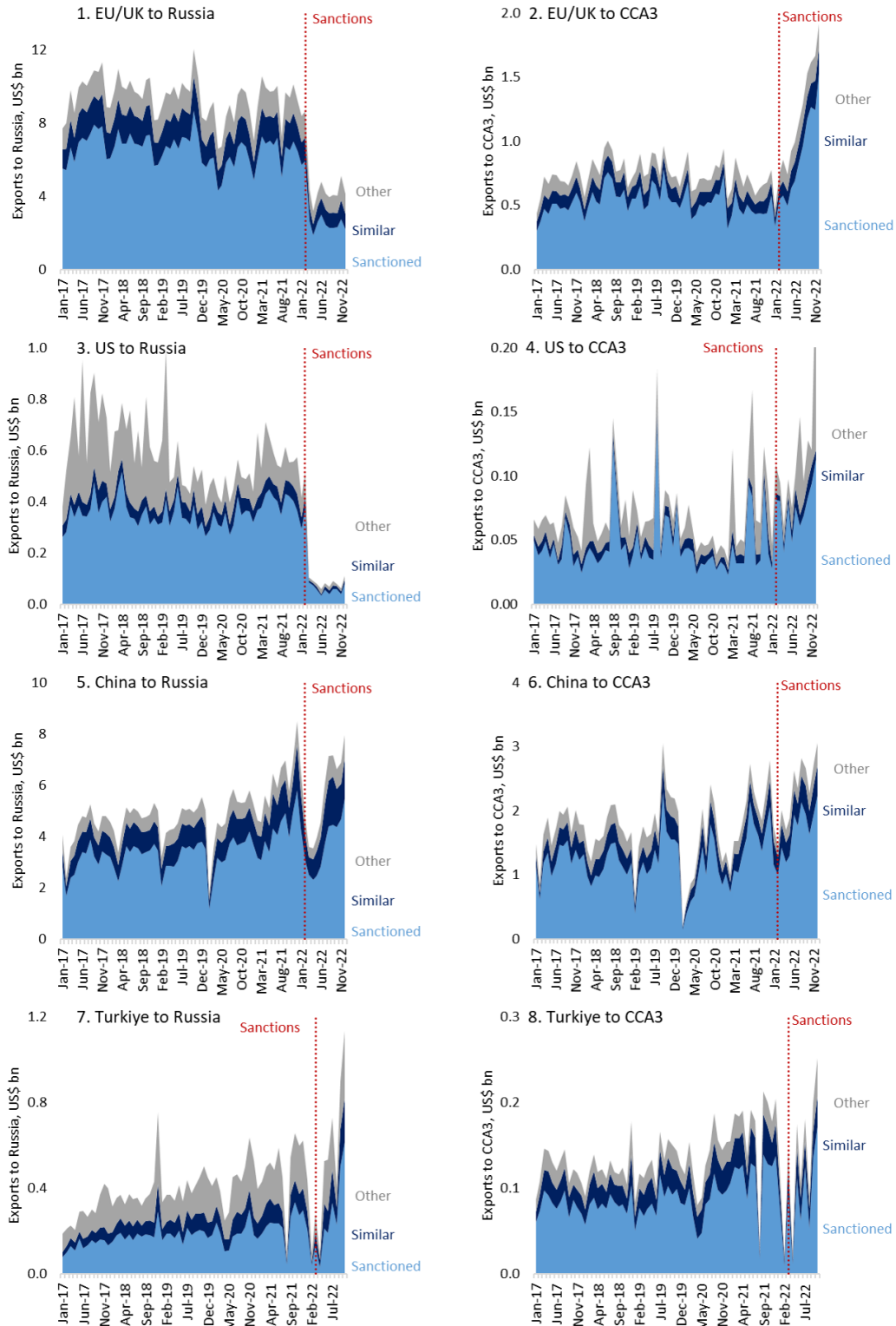
Source: Authors' calculations based on UN Comtrade and China Customs Administration.
Note: Based on trade reported by exporters. Trade in nominal US dollars is adjusted for US inflation.
EU total is inclusive of the UK. Sanctioned refers to HS6 product lines where EU sanctions apply at least
partially as of December 2022. Similar goods are those not sanctioned by the EU but within the same
HS4 as sanctioned products. CCA3 is Armenia, Kazakhstan and the Kyrgyz R.

Figure 2: Share of exports to Russia and CCA3 in total exports
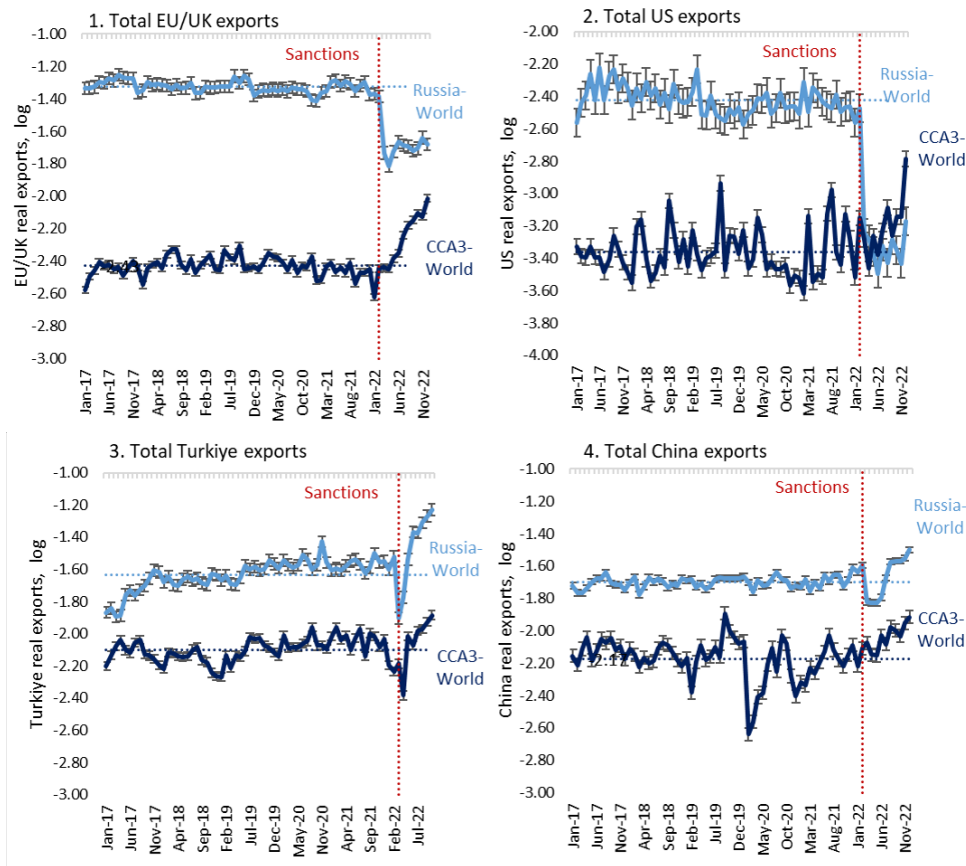
Source: Authors' calculations.
Note: The figure shows the log-difference between exports to Russia (or CCA3) and exports to the rest of the world in a given month. The 99% confidence intervals shown as shaded areas are based on standard errors calculated for the entire period. CCA3 is Armenia, Kazakhstan and the Kyrgyz R.

Figure 3: Exports to Russia from CCA3 have increased substantially
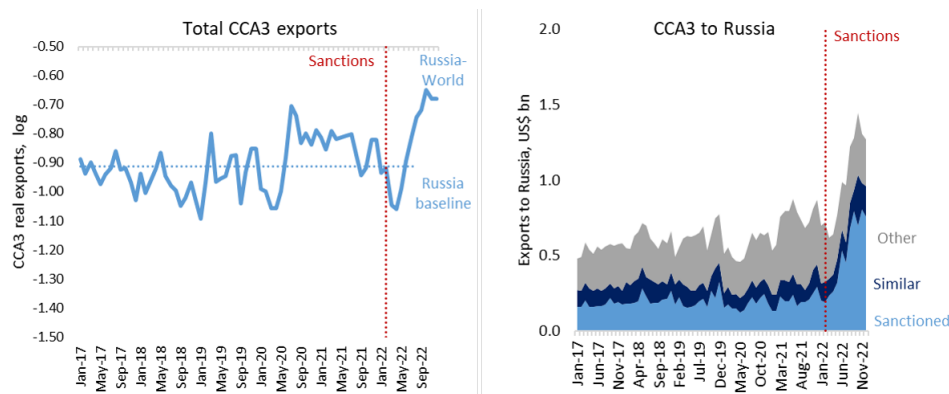
Source: Authors' calculations based on UN Comtrade, Refinitiv Eikon and Kazakhstan customs statistics.
Note: Based on trade reported by exporters. Trade in nominal US dollars is adjusted for US inflation.

Figure 4: Exports of sanctioned vs non-sanctioned goods
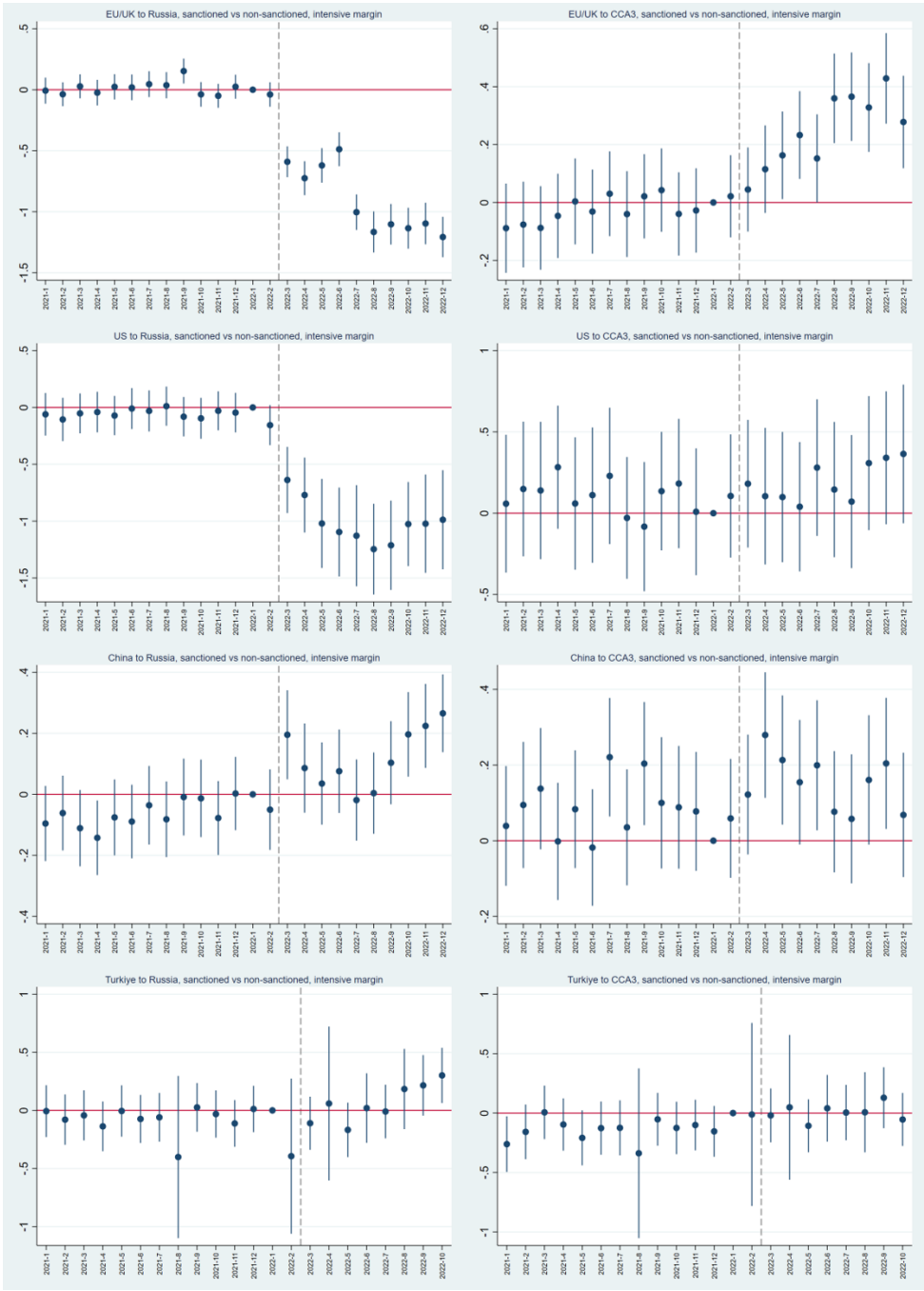
Source: Authors' calculations.

Note: The figure shows coefficients on the interaction terms between month dummy variables, Sanctions dummy and Russia (CCA3) as importer; EU, US, China and Turkiye are exporters. The dependent variable is the logarithm of monthly bilateral trade in a given product group at the HS6 level. Standard errors are clustered at the HS6 level; 95% confidence intervals are shown. Sanctioned products are based on EU legislation and include HS6 groups where sanctions apply in a subset of cases as of December 2022. CCA3 is Armenia, Kazakhstan and the Kyrgyz R.

Figure 5: Lost in transit: Ratio of imports recorded by Armenia and the Kyrgyz Republic to exports recorded by EU/UK, March-December of each year

Source: Authors' calculations based on UN Comtrade.
Note: Based on bilateral trade at the HS6 level in March-December of each year. The ratio of imports as reported by Armenia and the Kyrgyz Republic to the corresponding exports as reported by EU member states and the UK.

Table 1: Descriptive statistics

		EU/UK exports to Russia					China exports to Russia			
*V*ariables	Mean	Median	St. dev.	Min	Max	Mean	Median	St. dev.	Min	Max
Trade, log	11.83	12.11	2.84	-0.02	20.79	11.91	12.21	2.59	0.00	20.15
Trade, hyperbolic	9.99	11.92	5.63	0.00	21.48	8.75	11.43	6.19	0.00	20.85
Trade, non-zero	0.80	1.00	0.40	0.00	1.00	0.69	1.00	0.46	0.00	1.00

		EU/UK exports to CCA3					China exports to CCA3			
*V*ariables	Mean	Median	St. dev.	Min	Max	Mean	Median	St. dev.	Min	Max
Trade, log	8.91	9.03	2.71	-0.02	19.30	10.21	10.44	2.72	0.00	19.14
Trade, hyperbolic	4.03	0.00	5.05	0.00	19.99	4.13	0.00	5.55	0.00	19.84
Trade, non-zero	0.42	0.00	0.49	0.00	1.00	0.38	0.00	0.49	0.00	1.00

		EU/UK exports to rest of the world					China exports to rest of the world			
*V*ariables	Mean	Median	St. dev.	Min	Max	Mean	Median	St. dev.	Min	Max
Trade, log	14.96	15.25	2.62	-6.93	23.17	15.20	15.58	2.72	0.00	23.72
Trade, hyperbolic	15.33	15.89	3.41	0.00	23.86	14.47	15.96	5.23	0.00	24.42
Trade, non-zero	0.98	1.00	0.14	0.00	1.00	0.91	1.00	0.29	0.00	1.00

		US exports to Russia					Turkiye exports to Russia			
*V*ariables	Mean	Median	St. dev.	Min	Max	Mean	Median	St. dev.	Min	Max
Trade, log	10.89	10.76	1.88	7.82	19.86	9.68	10.00	2.74	0.00	18.37
Trade, hyperbolic	3.66	0.00	5.49	0.00	20.55	4.13	0.00	5.36	0.00	19.06
Trade, non-zero	0.32	0.00	0.46	0.00	1.00	0.40	0.00	0.49	0.00	1.00

		US exports to CCA3					Turkiye exports to CCA3			
*V*ariables	Mean	Median	St. dev.	Min	Max	Mean	Median	St. dev.	Min	Max
Trade, log	10.06	9.79	1.61	4.22	18.73	8.54	8.61	2.43	0.00	17.07
Trade, hyperbolic	1.41	0.00	3.68	0.00	19.42	2.76	0.00	4.43	0.00	17.77
Trade, non-zero	0.13	0.00	0.34	0.00	1.00	0.30	0.00	0.46	0.00	1.00

		US exports to rest of the world					Turkiye exports to rest of the world			
*V*ariables	Mean	Median	St. dev.	Min	Max	Mean	Median	St. dev.	Min	Max
Trade, log	14.49	14.65	2.47	7.82	23.56	12.18	12.50	2.94	0.00	20.84
Trade, hyperbolic	14.32	15.16	4.26	0.00	24.25	9.98	12.07	5.97	0.00	21.54
Trade, non-zero	0.94	1.00	0.23	0.00	1.00	0.78	1.00	0.42	0.00	1.00

Source: Authors' calculations based on UN Comtrade and China Customs Administration.

Note: Unit of observation is bilateral exports at HS6 level in a given month from January 2017 to December 2022 (for Turkiye, to October 2022). Observations with zero trade in all month for a given country pair and HS6 product group are not included. CCA3 is Armenia, Kazakhstan and the Kyrgyz R.

Table 2: Average monthly cross-border trade flows in March-December 2022, in percent of the March-December average in 2017-21

From	CCA3	World	ARM	KAZ	KGZ	GEO	BLR	RUS	AZE	MNG	TJK	UZB
Turkiye	152	117	49	147	162	137	159	159	105	195	160	124
EU + UK + US	166	108	220	150	352	146	77	42	72	107	148	129
of which:												
EU	169	104	209	154	359	132	81	45	89	108	110	138
Germany	186	97	223	168	520	130	77	37	98	94	112	154
UK	101	104	242	85	576	127	8	23	46	80	84	129
US	164	113	421	144	221	206	10	14	59	109	745	62
China (to Dec)	132	102	158	100	206	86		114	144	137		

Source: Authors calculations based on UN Comtrade and China Customs Administration.

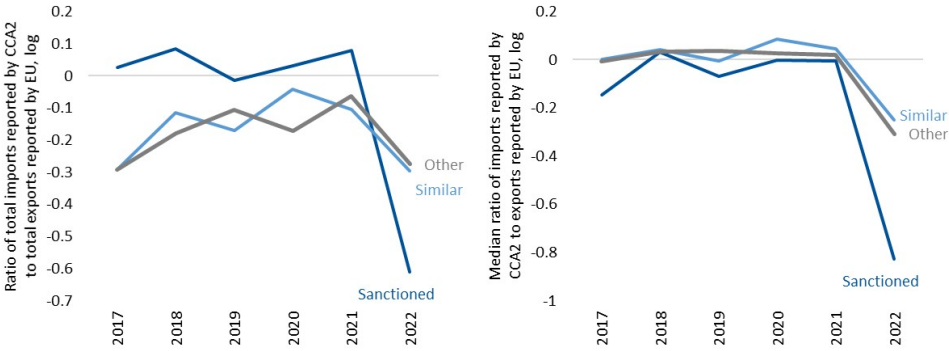*Note*: Based on trade reported by exporters. Trade in nominal US dollars is adjusted for US inflation. Data on Turkiye's exports cover the period March-October. CCA3 refers to Armenia, Kazakhstan and the Kyrgyz R.

Table 3: Change in export volumes, Mar-Dec 2022 relative to the average of Mar-Dec 2017-21, in US$ billion

	Total trade		Sanctioned		Similar		Other	
	Russia	CCA3	Russia	CCA3	Russia	CCA3	Russia	CCA3
EU/UK	-53.9	5.1	-42.9	4.0	-6.6	0.5	-4.4	0.6
US	-5.2	0.5	-3.1	0.3	-0.4	0.0	-1.7	0.2
China	6.9	6.0	2.1	4.6	4.0	1.1	0.8	0.3
Turkiye	1.7	0.1	0.8	0.1	0.4	0.0	0.4	0.0
CCA3	4.1		3.6		0.5		0.1	

Source: Authors calculations based on UN Comtrade and China Customs Administration.

Note: Based on trade reported by exporters. Trade in nominal US dollars adjusted for US inflation. EU total is inclusive of the UK. Sanctioned refers to HS6 product lines where EU sanctions apply at least partially. Similar goods are those not sanctioned but within the same HS4 as sanctioned. CCA3 is Armenia, Kazakhstan and the Kyrgyz R.

Table 4: Exports of sanctioned vs other goods: EU/UK, US

	1	2	3	4	5	6
Exporter		EU/UK			US	
Dep. var.: Exports	Log	0-1	Hyperbolic	Log	0-1	Hyperbolic
Sanctioned x Russia	-0.785***	-0.136***	-2.212***	-0.603***	-0.0694***	-1.046***
	(0.0406)	(0.00719)	(0.0889)	(0.0889)	(0.00886)	(0.110)
Sanctioned x CCA3	0.286***	0.0246***	0.541**	0.142**	0.0166***	0.241***
	(0.0339)	(0.00408)	(0.0452)	(0.0618)	(0.00611)	(0.0718)
Sanctioned x Georgia	0.0139	0.00580	0.134***	-0.00981	-0.00111	0.0302
	(0.0305)	(0.00467)	(0.0461)	(0.0988)	(0.00692)	(0.0815)
Observations	1,098,452	1,892,664	1,892,664	200,971	852,264	852,264
R^2	0.928	0.757	0.888	0.968	0.827	0.910

	7	8	9	10	11	12
Exporter		EU/UK			US	
Dep. var.: Exports	Log	0-1	Hyperbolic	Log	0-1	Hyperbolic
Sanctioned x Russia	-0.828***	-0.145***	-2.323***	-0.530***	-0.0815***	-1.176***
	(0.0441)	(0.00761)	(0.0886)	(0.102)	(0.00973)	(0.120)
Similar x Russia	-0.0991**	-0.0197***	-0.262***	0.180*	-0.0255**	-0.277**
	(0.0439)	(0.00739)	(0.0825)	(0.106)	(0.0108)	(0.131)
Sanctioned x CCA3	0.314***	0.0309***	0.628***	0.0607	0.0256***	0.308***
	(0.0375)	(0.00455)	(0.0501)	(0.0884)	(0.00688)	(0.0817)
Similar x CCA3	0.0623	0.0142***	0.199***	-0.163*	0.0191**	0.141
	(0.0434)	(0.00508)	(0.0537)	(0.0927)	(0.00799)	(0.0921)
Sanctioned x Georgia	-0.0277	0.000355	0.0890*	-0.158	-0.00131	-0.00226
	(0.0342)	(0.00522)	(0.0509)	(0.107)	(0.00795)	(0.0936)
Similar x Georgia	-0.104**	-0.0136**	-0.112*	-0.382***	-0.000564	-0.0722
	(0.0420)	(0.00600)	(0.0582)	(0.143)	(0.00888)	(0.101)
Observations	1,098,452	1,892,664	1,892,664	200,971	852,264	852,264
R^2	0.928	0.757	0.888	0.968	0.827	0.910

Source: Authors' calculations.

Note: Standard errors are clustered at the HS6 level. All regressions include month x importer, month x HS6 and HS6 x importer fixed effects. *, **, *** denote statistical significance at the 10%, 5% and 1% levels, respectively. The dependent variable is the logarithm of bilateral trade in a given month in a given product group at the HS6 level; 0-1 variable for trade taking place or the inverse hyperbolic sine transformation of trade. Importer economies comprise Armenia, Georgia, Kazakhstan, Kyrgyz R., Russia and the rest of the world (aggregated). Sanctioned refers to HS6 product lines where EU sanctions apply at least partially. Similar goods are those not sanctioned but within the same HS4 as sanctioned. In columns 1-6 similar goods are part of "other" group. CCA3 is Armenia, Kazakhstan and the Kyrgyz R.

Table 5: Exports of sanctioned vs other goods, by type of sanctions

Exporter Dep. var.: Exports	1 Log	2 EU/UK 0-1	3 Hyperbolic	4 Log	5 US 0-1	6 Hyperbolic
Luxury goods x Russia	-0.552***	0.0262***	-0.316***	-0.209	-0.0290**	-0.439**
	(0.0595)	(0.00997)	(0.112)	(0.206)	(0.0145)	(0.184)
Industrial/transport capacity x Russia	-1.486***	-0.394***	-5.328***	-0.515**	-0.0591***	-0.802***
	(0.0935)	(0.0112)	(0.130)	(0.223)	(0.0166)	(0.204)
Dual-use and military technology x Russia	-0.764***	-0.105***	-1.793***	-0.713***	-0.0940***	-1.448***
	(0.0521)	(0.00912)	(0.107)	(0.0948)	(0.0109)	(0.136)
Luxury goods x CCA3	0.168***	0.0336***	0.611***	0.288**	-0.00633	-0.0340
	(0.0486)	(0.00681)	(0.0762)	(0.129)	(0.00977)	(0.119)
Industrial/transport capacity x CCA3	0.452***	0.0259***	0.558***	0.0961	0.0225*	0.285**
	(0.0662)	(0.00729)	(0.0822)	(0.0838)	(0.0119)	(0.138)
Dual-use and military technology x CCA3	0.333***	0.0236***	0.548***	0.0966	0.0232***	0.318***
	(0.0432)	(0.00508)	(0.0571)	(0.0651)	(0.00727)	(0.0856)
Observations	1,098,452	1,892,664	1,892,664	200,971	852,264	852,264
R-squared	0.928	0.758	0.889	0.968	0.827	0.911

Source: Authors' calculations.

Note: Standard errors are clustered at the HS6 level. All regressions include month x importer, month x HS6 and HS6 x importer fixed effects. *, **, *** denote statistical significance at the 10%, 5% and 1% levels, respectively. The dependent variable is the logarithm of bilateral trade in a given month in a given product group at the HS6 level. Importer economies comprise Armenia, Georgia, Kazakhstan, Kyrgyz R., Russia and the rest of the world (aggregated). Sanctioned refers to HS6 product lines where EU sanctions apply at least partially, all sanctioned product lines are classified into the presented mutually exclusive categories. CCA3 is Armenia, Kazakhstan and the Kyrgyz R.

Table 6: Exports of sanctioned vs other goods from CCA3

Exporter Dep. var.: Exports	1 Log	2 0-1	3 Hyperbolic	4 Log	5 CCA3 0-1	6 Hyperbolic	7 Log	8 0-1	9 Hyperbolic
Sanctioned x Russia	0.560***	0.0482***	0.620***	0.777***	0.0725***	0.877***			
	(0.0805)	(0.00623)	(0.0655)	(0.0866)	(0.00685)	(0.0722)			
Similar x Russia				0.556***	0.0611***	0.644***			
				(0.109)	(0.00825)	(0.0837)			
Luxury goods x Russia							-0.0053	0.00704	0.136
							(0.0973)	(0.00852)	(0.0892)
Industrial capacity x Russia							0.805***	0.0729***	0.882***
							(0.167)	(0.0117)	(0.124)
Dual-use tech x Russia							0.896***	0.0675***	0.858***
							(0.104)	(0.00798)	(0.0847)
Observations	169,958	1,206,948	1,206,948	169,958	1,206,948	1,206,948	169,958	1,206,948	1,206,948
R^2	0.863	0.766	0.813	0.863	0.766	0.813	0.863	0.766	0.813

Source: Authors' calculations.

Note: Standard errors are clustered at the HS6 level. All regressions include month x importer X exporter, month x HS6 X exporter and HS6 x importer X exporter fixed effects. *, **, *** denote statistical significance at the 10%, 5% and 1% levels, respectively. The dependent variable is the logarithm of bilateral trade in a given month in a given product group at the HS6 level. Importer economies comprise Russia and the rest of the world (aggregated). Exporters are Armenia, Kazakhstan and the Kyrgyz R. Sanctioned refers to HS6 product lines where EU sanctions apply at least partially. Data through December 2022.

Table 7: Lost in transit: The ratio of reported CCA imports to EU/UK exports

Dependent variable: Importer	1 Armenia	2 Kyrgyz R.	3 Georgia	4 Arm, Kyr	5 Arm, Kyr	6 Arm, Kyr, Geo
Post-war x Sanctioned	-0.312***	-0.353***	-0.203***	-0.324***		-0.252***
	(0.0513)	(0.0966)	(0.0298)	(0.0477)		(0.0279)
Post-war x Luxury goods					-0.222***	
					(0.0676)	
Post-war x Industrial capacity					-0.343***	
					(0.0744)	
Post-war x Dual-use tech					-0.385***	
					(0.0617)	
Observations	32,290	13,993	69,972	46,283	46,283	116,255
R^2	0.620	0.562	0.534	0.605	0.605	0.578

Source: Authors' calculations.

Note: Standard errors are clustered at the HS6 level. *, **, *** denote statistical significance at the 10%, 5% and 1% levels, respectively. The dependent variable is the logarithm of the ratio of bilateral imports as reported by CCA (Armenia, the Kyrgyz Republic and / or Georgia) to the corresponding bilateral exports, as reported by EU/UK, in March-December of a given year in a given product group at the HS6 level. specifications include EU exporter by CCA importer (if applicable) by HS6 fixed effects and EU exporter by CCA importer (if applicable) by year fixed effects. Sanctioned refers to HS6 product lines where EU sanctions apply at least partially.

Table 8: Unit value of exports, sanctioned goods versus other goods

	1	2	3	4	5	6
Exporter		EU/UK			CCA3	
Dep. var.: Log exports	Baseline	Luxury vs non-luxury	Sanction type	Baseline	Luxury vs non-luxury	Sanction type
Sanctioned x Russia	-0.0433**	0.0507**		0.185**	0.545***	
	(0.0208)	(0.0257)		(0.0808)	(0.0994)	
Luxury goods x Russia		-0.198***	-0.198***		-0.243**	-0.241**
		(0.0293)	(0.0293)		(0.0943)	(0.0943)
Industrial/transport capacity x Russia			0.138***			0.868***
			(0.0401)			(0.162)
Dual-use and military technology x Russia			0.0266			0.478***
			(0.0304)			(0.111)
Sanctioned x CCA3	0.0106	-0.0355*				
	(0.0175)	(0.0204)				
Luxury goods x CCA3		0.0704***	0.0703***			
		(0.0251)	(0.0251)			
Industrial/transport capacity x CCA3			-0.0551*			
			(0.0299)			
Dual-use and military technology x CCA3			-0.0275			
			(0.0245)			
Observations	1,019,317	1,019,317	1,019,317	145,698	145,698	145,698
R^2	0.938	0.938	0.938	0.791	0.791	0.791

Source: Authors' calculations.

Note: Standard errors are clustered at the HS6 level. All regressions include month x importer, month x HS6 and HS6 x importer fixed effects. *, **, *** denote statistical significance at the 10%, 5% and 1% levels, respectively. The dependent variable is the logarithm of the average unit value of bilateral trade in a given month in a given product group at the HS6 level (nominal value divided by quantity). Where exporter is EU/UK, the importer economies comprise Armenia, Georgia, Kazakhstan, Kyrgyz R., Russia and the rest of the world (aggregated). Where exporter economies are CCA3 (Armenia, Kazakhstan and the Kyrgyz R.), importer economies are Russia and the rest of the world (aggregated). Sanctioned refers to HS6 product lines where EU sanctions apply at least partially.

Table 9: Exports from China and Turkiye

	1	2	3	4	5	6
Exporter		China			Turkiye	
Dep. var.: Exports	Log	0-1	Hyperbolic	Log	0-1	Hyperbolic
Sanctioned x Russia	0.201***	0.0383***	0.602***	0.145**	0.00357	0.192**
	(0.0330)	(0.00596)	(0.0735)	(0.0584)	(0.00843)	(0.0927)
Sanctioned x CCA3	0.173***	0.0276***	0.406***	0.270***	-0.0110*	0.00693
	(0.0369)	(0.00515)	(0.0768)	(0.0501)	(0.00632)	(0.0736)
Sanctioned x Georgia	0.105**	0.0274***	0.377***	0.0517	-0.00136	0.0591
	(0.0430)	(0.00637)	(0.0877)	(0.0437)	(0.00724)	(0.0799)
Observations	768,759	1,510,992	1,510,992	528,154	1,314,073	1,314,073
R^2	0.918	0.742	0.865	0.900	0.715	0.820

	7	8	9	10	11	12
Exporter		China			Turkiye	
Dep. var.: Exports	Log	0-1	Hyperbolic	Log	0-1	Hyperbolic
Sanctioned x Russia	0.256***	0.0454***	0.732***	0.264***	0.00799	0.290***
	(0.0383)	(0.00700)	(0.0876)	(0.0693)	(0.00945)	(0.103)
Similar x Russia	0.110***	0.0154**	0.279***	0.268***	0.0105	0.231**
	(0.0397)	(0.00703)	(0.0852)	(0.0732)	(0.0104)	(0.113)
Sanctioned x CCA3	0.179***	0.0322***	0.495***	0.279***	-0.0122*	-0.0107
	(0.0446)	(0.00612)	(0.0884)	(0.0582)	(0.00725)	(0.0832)
Similar x CCA3	0.0130	0.00994	0.192**	0.0209	-0.00281	-0.0393
	(0.0459)	(0.00621)	(0.0888)	(0.0688)	(0.00776)	(0.0906)
Sanctioned x Georgia	0.133***	0.0375***	0.487***	0.0292	-0.00757	-0.00164
	(0.0506)	(0.00738)	(0.0987)	(0.0500)	(0.00820)	(0.0895)
Similar x Georgia	0.0553	0.0210***	0.235**	-0.0512	-0.0147	-0.143
	(0.0529)	(0.00745)	(0.0946)	(0.0558)	(0.00908)	(0.101)
Observations	768,759	1,510,992	1,510,992	528,154	1,314,073	1,314,073
R^2	0.918	0.742	0.865	0.900	0.715	0.820

Source: Authors' calculations.

Note: Standard errors are clustered at the HS6 level. All regressions include month x importer, month x HS6 and HS6 x importer fixed effects. *, **, *** denote statistical significance at the 10%, 5% and 1% levels, respectively. The dependent variable is the logarithm of bilateral trade in a given month in a given product group at the HS6 level; 0-1 variable for trade taking place or the inverse hyperbolic sine transformation of trade. Importer economies comprise Armenia, Georgia, Kazakhstan, Kyrgyz R., Russia and the rest of the world (aggregated). Sanctioned refers to HS6 product lines where EU sanctions apply at least partially. Similar goods are those not sanctioned but within the same HS4 as sanctioned. In columns 1-6 similar goods are part of "other" group. CCA3 is Armenia, Kazakhstan and the Kyrgyz R.

9 Annex: Additional Figures and Tables

Figure A1: Number of sanctioned product groups
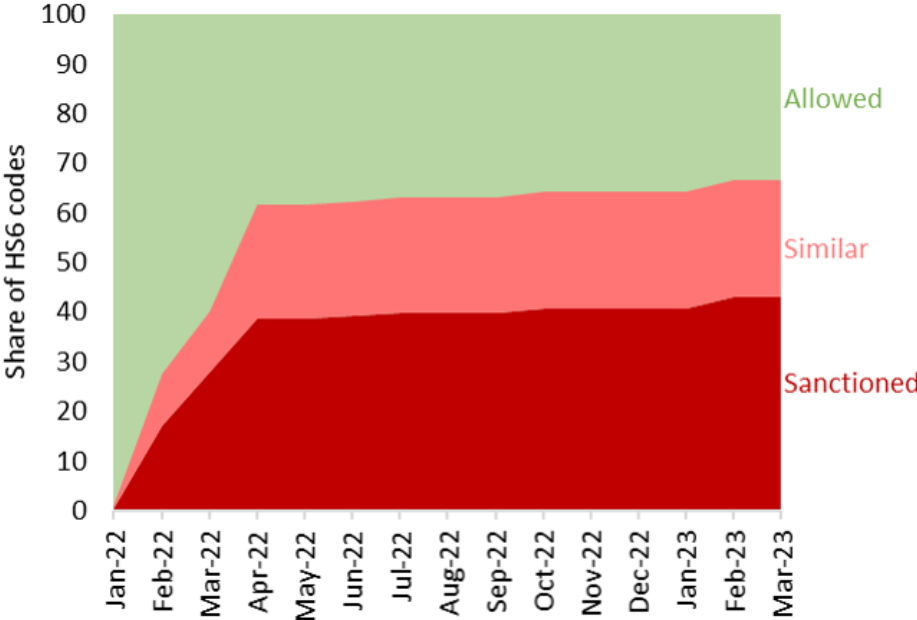
Source: EU and authors' calculations.
Note: HS6 product group is marked as sanctioned from the month following the adoption of the corresponding package. Similar goods are those not sanctioned but within the same HS4 as sanctioned.

Table A1: Sanctioned products, by HS section, product type, and sanction type

N	HS section	Number of HS6 product lines Part-sanctioned	Similar	Other
		By HS section		
I	Animal products	2	2	367
II	Vegetable products	10	29	269
III	Animal and vegetable oils	0	0	48
IV	Prepared food, beverages and tobacco	29	23	165
V	Mineral products	48	28	73
VI	Chemicals	379	363	124
VII	Plastics and rubber	105	83	21
VIII	Leather and fur skins	21	0	48
IX	Wood and articles of wood	16	35	70
X	Wood pulp and paper	62	43	35
XI	Textiles and textile articles	308	234	252
XII	Footwear, headgear, umbrellas, etc.	33	2	12
XIII	Articles of stone and glass	71	45	23
XIV	Precious or semi-precious stones, jewellery	45	1	7
XV	Base metals and articles of base metal	232	159	170
XVI	Machinery and electrical equipment	494	204	79
XVII	Vehicles, aircraft, vessels	120	17	6
XVIII	Optical, precision, medical and other instruments	136	40	31
XIX	Arms and ammunition	20	0	0
XX	Miscellaneous manufacturing	44	36	42
XXI	Works of art	7	0	0
	Total	2182	1344	1842
		By product type		
	Capital	409	185	103
	Intermediate	1230	1039	964
	Consumption	534	120	775
	Generic	732	445	465
	Specific	875	740	318
	Non-durable	66	57	626
	Durable	468	63	149
	Non-differentiated	591	592	939
	Differentiated	1582	752	904
		By sanction type		
	Luxury goods	570		
	Industrial/transport capacity	536		
	Oil and gas	13		
	Dual-use and military technology	1063		

Source: Authors' calculations.

Note: Number of HS6 product lines where EU sanctions apply at least partially as of December 2022. Similar goods are those not sanctioned but within the same HS4 as sanctioned. Differentiated products as defined in Rauch (1999), other classifications are based on Broad Economic Categories classification version 5.

Table A2: Exports of sanctioned vs similar vs other goods: EU/UK, US, alternative control group

Exporter	1	2 EU/UK	3	4	5 US	6
Dep. var.: Exports	Log	Non-zero	Hyperbolic	Log	Non-zero	Hyperbolic
Sanctioned x Russia	-0.779***	-0.137***	-2.210***	-0.620***	-0.0724***	-1.077***
	(0.0408)	(0.00720)	(0.0835)	(0.0885)	(0.00890)	(0.110)
Sanctioned x CCA3	0.286***	0.0244***	0.540***	0.103*	0.0176***	0.230***
	(0.0338)	(0.00408)	(0.0452)	(0.0599)	(0.00583)	(0.0676)
Sanctioned x Georgia	0.0115	0.00554	0.132***	-0.0229	-0.000925	0.0162
	(0.0303)	(0.00464)	(0.0457)	(0.0952)	(0.00646)	(0.0748)
Observations	1,640,415	2,798,784	2,798,784	346,039	1,355,256	1,355,256
R^2	0.908	0.730	0.864	0.955	0.774	0.872

Exporter	7	8 EU/UK	9	10	11 US	12
Dep. var.: Exports	Log	Non-zero	Hyperbolic	Log	Non-zero	Hyperbolic
Sanctioned x Russia	-0.816***	-0.145***	-2.319***	-0.569***	-0.0833***	-1.192***
	(0.0444)	(0.00763)	(0.0887)	(0.101)	(0.00976)	(0.121)
Similar x Russia	-0.0862*	-0.0188**	-0.256***	0.132	-0.0227**	-0.242*
	(0.0442)	(0.00742)	(0.0829)	(0.106)	(0.0109)	(0.132)
Sanctioned x CCA3	0.324***	0.0315***	0.635***	0.0168	0.0240***	0.275***
	(0.0374)	(0.00456)	(0.0502)	(0.0847)	(0.00665)	(0.0775)
Similar x CCA3	0.0819*	0.0163***	0.219***	-0.174*	0.0139*	0.0974
	(0.0430)	(0.00512)	(0.0543)	(0.0889)	(0.00760)	(0.0860)
Sanctioned x Georgia	-0.0217	0.00113	0.0954*	-0.161	-0.00257	-0.0250
	(0.0341)	(0.00519)	(0.0507)	(0.107)	(0.00741)	(0.0858)
Similar x Georgia	-0.0851**	-0.0112*	-0.0926	-0.341**	-0.00346	-0.0890
	(0.0414)	(0.00597)	(0.0581)	(0.142)	(0.00830)	(0.0935)
Observations	1,640,415	2,798,784	2,798,784	346,039	1,355,256	1,355,256
R^2	0.908	0.730	0.864	0.955	0.774	0.872

Source: Authors' calculations.

Note: Standard errors are clustered at the HS6 level. All regressions include month x importer, month x HS6 and HS6 x importer fixed effects. *, **, *** denote statistical significance at the 10%, 5% and 1% levels, respectively. The dependent variable is the logarithm of bilateral trade in a given month in a given product group at the HS6 level; 0-1 variable for trade taking place or the inverse hyperbolic sine transformation of trade. Importer economies comprise Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyz R., Mongolia, Russia, Turkiye (all interacted with the Sanctions dummy) and the rest of the world (aggregated). Sanctioned refers to HS6 product lines where EU sanctions apply at least partially. Similar goods are those not sanctioned but within the same HS4 as sanctioned. In columns 1-6 similar goods are part of "other" group. CCA3 is Armenia, Kazakhstan and the Kyrgyz R.

Table A3: Exports of sanctioned vs similar vs other goods: China and Turkiye, alternative control group

	1	2	3	4	5	6
Exporter		China			Turkiye	
Dep. var.: Exports	Log	0-1	Hyperbolic	Log	0-1	Hyperbolic
Sanctioned x Russia	0.202***	0.0393***	0.616***	0.132**	0.00312	0.182**
	(0.0334)	(0.00599)	(0.0738)	(0.0582)	(0.00841)	(0.0924)
Sanctioned x CCA3	0.174***	0.0310***	0.449***	0.257***	-0.0112*	-0.00491
	(0.0369)	(0.00518)	(0.0766)	(0.0498)	(0.00634)	(0.0736)
Sanctioned x Georgia	0.108**	0.0292***	0.407***	0.0388	-0.00153	0.0545
	(0.0430)	(0.00636)	(0.0868)	(0.0435)	(0.00723)	(0.0797)
Observations	1,121,393	2,239,704	2,239,704	698,425	1,733,869	1,733,869
R^2	0.894	0.704	0.834	0.881	0.687	0.795

	7	8	9	10	11	12
Exporter		China			Turkiye	
Dep. var.: Exports	Log	0-1	Hyperbolic	Log	0-1	Hyperbolic
Sanctioned x Russia	0.255***	0.0471***	0.753***	0.248***	0.00699	0.275***
	(0.0388)	(0.00718)	(0.0878)	(0.0693)	(0.00942)	(0.102)
Similar x Russia	0.103**	0.0169**	0.297***	0.261***	0.00918	0.220**
	(0.0403)	(0.00706)	(0.0856)	(0.0739)	(0.0104)	(0.112)
Sanctioned x CCA3	0.178***	0.0364***	0.541***	0.258***	-0.0135*	-0.0317
	(0.0448)	(0.00615)	(0.0881)	(0.0575)	(0.00726)	(0.0831)
Similar x CCA3	0.00518	0.0116*	0.199**	0.00460	-0.00517	-0.0595
	(0.0462)	(0.00622)	(0.0880)	(0.0685)	(0.00775)	(0.0900)
Sanctioned x Georgia	0.135***	0.0398***	0.518***	0.0216	-0.00846	-0.0107
	(0.0509)	(0.00736)	(0.0976)	(0.0499)	(0.00818)	(0.0892)
Similar x Georgia	0.0499	0.0221***	0.237**	-0.0387	-0.0163*	-0.153
	(0.0530)	(0.00742)	(0.0934)	(0.0559)	(0.00909)	(0.101)
Observations	1,121,393	2,239,704	2,239,704	698,425	1,733,869	1,733,869
R^2	0.894	0.704	0.834	0.881	0.687	0.795

Source: Authors' calculations.

Note: Standard errors are clustered at the HS6 level. All regressions include month x importer, month x HS6 and HS6 x importer fixed effects. *, **, *** denote statistical significance at the 10%, 5% and 1% levels, respectively. The dependent variable is the logarithm of bilateral trade in a given month in a given product group at the HS6 level; 0-1 variable for trade taking place or the inverse hyperbolic sine transformation of trade. Importer economies comprise Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyz R., Mongolia, Russia, Turkiye (all interacted with the Sanctions dummy) and the rest of the world (aggregated). Sanctioned refers to HS6 product lines where EU sanctions apply at least partially. Similar goods are those not sanctioned but within the same HS4 as sanctioned. In columns 1-6 similar goods are part of "other" group. CCA3 is Armenia, Kazakhstan and the Kyrgyz R.

A   Appendix: Additional analysis of product types

This Appendix examines the patterns of exports to Russia, CCA3 economies and Georgia by type of products, for instance, distinguishing between final consumption goods and intermediate or capital goods typically used as production inputs by domestic firms. The results are reported in Table A4. A number of regularities emerge. While not surprising per se, they are reassuringly consistent with the nature of trade rerouting and trade diversion in the aftermath of the imposition of economic sanctions on Russia.

First, increased trade routed via CCA3 economies is disproportionately concentrated in final (consumer) durable goods. This pattern may be explained by the willingness of well-off consumers in Russia to accept a high premium for these types of goods, a premium that can pay for the work of intermediaries involved. For domestic firms using intermediate EU products as inputs, it may be harder to pass on additional costs to consumers. Likewise, non-durable goods (those that expire more quickly) may not lend themselves easily to complex indirect routings.

In contrast, increased direct exports from China to Russia disproportionately concern intermediate goods as firms in Russia looked for alternative supply chains. Increases in China-Russia trade in sanctioned goods relative to non-sanctioned goods were also larger for non-differentiated products (those with a lower degree of brand recognition where customers may be more price-sensitive and more inclined to switch to alternative suppliers) and generic goods (those less likely to be produced for a particular customer).

We also focus on products that are more likely to require letters of credit – a type of trade finance instrument provided by a bank in importer country and confirmed by a bank in exporter country. Crozet et al. (2022) show that reliance on letters of credit is beneficial for cross-border trade at times of increased uncertainty but harmful at times of financial turmoil. Since both the issuing bank and the confirming bank are required to run know-your-customer compliance checks, dependence on letters of credit may also affect trade in goods covered by sanctions differentially from trade in other goods. An index of letter-of-credit intensity is available at the HS4 level from Crozet et al. (2022) and is applied to all HS6 product groups within HS4.

We look at the subsample of product groups with above-median letter-of-credit intensity and those with below-median intensity. The results are reported in Table A5. The additional increase in EU exports of sanctioned goods to CCA3 economies is substantially higher for goods that typically do not require trade finance, although for trade-finance-intensive goods the coefficient on the sanctions variable is also positive and statistically significant. The difference in the extent of intermediated trade between the two groups of products is likely explained by stricter compliance checks accompanying trade backed by letters of credit. In the case of China's exports, the increase in trade in sanctioned goods with Russia is somewhat greater for non-letter-of-credit intensive goods (those with fewer compliance checks). In contrast, the increase in China's exports of sanctioned goods to CCA3 economies is significantly larger for letter-of-credit-intensive products, which may not be surprising, given that China does not participate in the EU sanctions.

Table A4: Exports of sanctioned vs other goods, by type of product

Dep. var.: Log exports	1	2	3	4	5	6	7	8	9
Type of good	Final-intermediate			Differentiation		Durability		Specificity	
	Final	Interm	Capital	Diff	Non-d	Durable	Non-d	Specific	Generic

Exporter — EU/UK

Sanctioned x Russia	-0.477***	-2.985***	-2.153***	-2.011***	-2.881***	-0.218	-0.0593	-2.614***	-2.892***
	(0.131)	(0.113)	(0.205)	(0.0949)	(0.165)	(0.159)	(0.271)	(0.132)	(0.150)
Sanctioned x CCA3	0.926***	0.475***	0.279**	0.426***	0.463***	0.392***	0.236*	0.322***	0.430***
	(0.0861)	(0.0611)	(0.108)	(0.0524)	(0.0846)	(0.106)	(0.134)	(0.0731)	(0.0795)
Sanctioned x Georgia	0.244***	0.139**	0.0706	0.0601	0.174*	0.00773	-0.0673	0.116	0.0919
	(0.0827)	(0.0643)	(0.114)	(0.0526)	(0.102)	(0.103)	(0.147)	(0.0777)	(0.0828)
Observations	506,736	1,108,296	277,200	1,257,624	635,040	290,808	215,928	701,064	593,064
R^2	0.891	0.896	0.852	0.882	0.895	0.877	0.904	0.893	0.880

	10	11	12	13	14	15	16	17	18
Exporter	China								

Sanctioned x Russia	0.388***	0.858***	0.184	0.401***	1.245***	0.207	0.478	0.525***	0.921***
	(0.148)	(0.103)	(0.141)	(0.0789)	(0.172)	(0.165)	(0.410)	(0.113)	(0.132)
Sanctioned x CCA3	0.627***	0.393***	-0.262	0.250***	0.200	-0.0327	0.190	0.211*	0.328**
	(0.165)	(0.107)	(0.163)	(0.0891)	(0.162)	(0.211)	(0.345)	(0.114)	(0.139)
Sanctioned x Georgia	0.395**	0.406***	0.0302	0.280***	0.333*	0.292	-0.169	0.121	0.618***
	(0.182)	(0.118)	(0.206)	(0.103)	(0.184)	(0.229)	(0.380)	(0.124)	(0.165)
Observations	377,640	864,504	268,848	1,108,872	402,120	265,392	112,248	590,040	506,664
R^2	0.871	0.871	0.835	0.861	0.875	0.872	0.870	0.866	0.858

Source: Authors' calculations.

Note: Standard errors are clustered at the HS6 level. All regressions include month x importer, month x HS6 and HS6 x importer fixed effects. *, **, *** denote statistical significance at the 10%, 5% and 1% levels, respectively. The dependent variable is the logarithm of bilateral trade in a given month in a given product group at the HS6 level. Importer economies comprise Armenia, Georgia, Kazakhstan, Kyrgyz R., Russia and the rest of the world (aggregated). Sanctioned refers to HS6 product lines where EU sanctions apply at least partially. Differentiated products as defined in Rauch (1999), other classifications are based on Broad Economic Categories classification version 5. CCA3 is Armenia, Kazakhstan and the Kyrgyz R.

Table A5: Exports of sanctioned vs other goods, by letter-of-credit intensity

Dep. var.: Log exports	1	2	3	4	5	6
Type of good	Log trade		0-1		Hyperbolic	
	Intensive	Not intensive	Intensive	Not intensive	Intensive	Not intensive

Exporter — EU/UK

Sanctioned x Russia	-0.650***	-0.989***	-0.130***	-0.151***	-2.122***	-2.458***
	(0.0500)	(0.0691)	(0.00955)	(0.0117)	(0.110)	(0.132)
Sanctioned x CCA3	0.151***	0.449***	0.00358	0.0446***	0.249***	0.770***
	(0.0422)	(0.0479)	(0.00545)	(0.00642)	(0.0570)	(0.0676)
Observations	594,413	497,356	1,049,472	828,648	1,049,472	828,648
R^2	0.925	0.932	0.761	0.751	0.885	0.892

	7	8	9	10	11	12
Exporter	China					

Sanctioned x Russia	0.161***	0.211***	0.0249***	0.0295***	0.425***	0.480***
	(0.0423)	(0.0499)	(0.00745)	(0.00987)	(0.0895)	(0.111)
Sanctioned x CCA3	0.206***	0.0635	0.00918	0.0268***	0.195***	0.336***
	(0.0462)	(0.0555)	(0.00578)	(0.00773)	(0.0735)	(0.0972)
Observations	441,295	323,650	887,976	615,816	887,976	615,816
R^2	0.913	0.924	0.740	0.744	0.860	0.873

Source: Authors' calculations.

Note: Standard errors are clustered at the HS6 level. All regressions include month x importer, month x HS6 and HS6 x importer fixed effects. *, **, *** denote statistical significance at the 10%, 5% and 1% levels, respectively. The dependent variable is the logarithm of bilateral trade in a given month in a given product group at the HS6 level. Importer economies comprise Armenia, Georgia, Kazakhstan, Kyrgyz R., Russia and the rest of the world (aggregated). Sanctioned refers to HS6 product lines where EU sanctions apply at least partially. Letter-of-credit-intensive products are those with the median or above intensity index based on Crozet et al. (2022), non-intensive products are the rest. CCA3 is Armenia, Kazakhstan and the Kyrgyz R.