Friendly fire: the trade impact of the Russia sanctions and counter-sanctions*

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Abstract

Economic sanctions are a frequently used instrument of foreign policy. In a diplomatic conflict they aim to elicit a change in the policies of a foreign government by damaging their economy. Sanctions, however, are also likely to affect the sanctioning country. This paper evaluates these costs, in terms of export losses, for the diplomatic crisis between the Russian Federation and 37 countries over the conflict in Ukraine that started in 2014. We first gauge the impact of the diplomatic conflict using a traditional trade framework and quantify the trade losses in a general equilibrium counterfactual analysis. Losses for the Russian Federation amount to US$53 billion or 7.4% of predicted total exports from 2014 until the end of 2015. Western sanctioning countries, however, have also been impacted with an estimated loss of US$42 billion, 0.3% of their total exports. Interestingly, we find that the bulk of the impact stems from products that are not directly targeted by Russian retaliation, an effect that we coin *friendly fire* — an unintended, largely self-inflicted cost for Western sanctioning countries. We investigate the underlying mechanism at the product- and firm level. Results indicate that the drop of Western exports has not been driven by a change in Russian consumers' preferences, but mainly by an increase in country risk affecting international transactions with Russia.

Keywords: Sanctions, trade, foreign policy, boycott, embargo, trade finance
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1 Introduction

Travel bans, asset freezes, as well as trade and financial sanctions, are some of the current favorites in the toolbox of foreign policy. Meant to hurt the target country's economy through restrictions or bans on the trade of certain goods and services, severance of financial ties, or an all-out embargo, sanctions are used when diplomacy fails, while military options appear too drastic. However, sanctions — or even the threat thereof — are not costless for the sanctioning economy, where domestic firms involved in business with the target countries might incur economic damages. It is therefore important for policymakers to have an assessment of the magnitude of economic costs and the channels through which a sanctions regime may inflict on their own country.

In this paper we assess the consequences of the sanctions regime against the Russian Federation, as well as their counter-sanctions, on the exports of goods of involved countries. The sanctions episode is particularly interesting to study, as it has remained a "hot topic" in political circles and has been eminent in the public debate in Western countries and Russia since its beginning in 2014. Public opinion is split into vocal pro and contra camps with prominent voices on either side, in particular in the European Union, and more so than in other sanctions episodes like those against Iran or North Korea. While political and security arguments dominate the political debate in Eastern European countries, in Western Europe the debate centers around economic aspects.

The sanctions regime has its origins in the escalating diplomatic conflict over the political and military crisis in Ukraine. Following the alleged involvement in separatist movements in eastern Ukraine and the annexation of Crimea after the "Maidan Revolution" in the winter of 2013–2014, 37 countries, including all EU countries, the United States and Japan, levied sanctions on the Russian Federation starting in March of 2014. The measures were intensified in successive "waves" during the early summer of 2014. Russia then retaliated in August of the same year by imposing an embargo on certain food and agricultural products.

We conduct the analysis into the economic costs of this sanctions episode from a macro and micro perspective. We first gauge the global effects in a standard trade model — a structural gravity framework. Using monthly data on trade in goods, we evaluate the impact on exports of the Russian Federation and all major economies — sanctioning or not — and find the overall costs to total US$96 billion, or about 0.7% of total predicted trade of the countries involved, from the beginning of the conflict until the end of 2015, with 56% being borne by the Russian Federation. The loss in exports in sanctioning Western countries[1] amounts to around US$42 billion, of which 92% is incurred by EU countries. Intriguingly, we find the strongest negative economic consequences for Western countries in absolute terms not to be caused by the Russian embargo, which accounts for only 13% of total lost trade. Instead, the bulk of the losses in sanctioning Western countries is an

[1] We use the term "Western" to refer to the countries that have raised sanctions against Russia, even if a number of them are Asian or Oceanian countries.

indirect and likely unintended result of own policies and measures — an effect we coin *friendly fire*.

This is a trade shock starting from the beginning of the diplomatic conflict, which is specific to bilateral trade relations between the countries involved and which affects goods whose trade is not subject to any restrictions under the sanctions. For the sake of simplicity, we sometimes refer to this fall in specific trade flows as the "impact of sanctions". However, since the sanctions are unintended to affect the activity of Western exporters of non-embargoed products to Russia, this trade loss is unexpected and akin to a friendly fire.[2] Therefore, we cannot and do not affirm that the *friendly fire* is directly and solely the consequence of sanctions. On the contrary, the purpose of the last section of the paper is to understand the causes of the decline of Western exports of non-embargoed products to Russia coinciding with the escalating diplomatic tension. This section exploits global monthly product-level data from UN COMTRADE, as well as a dataset of French firm-level exports. We rely on a number of indicators for characteristics associated with certain products, firms or sectors to study two mechanisms that could explain the emergence of *friendly fire*: A change in Russian consumers' attitude towards French products, and a sudden increase in *country risk* driven by political, legal and financial instability generated by the conflict itself and the sanctions.
The empirical analysis finds little evidence in favor of the consumers' preference channels. Instead, we find that products that use trade finance instruments extensively have been relatively more impacted. This finding suggests that the diplomatic turmoil and the escalation of sanctions, by increasing legal instability and weakening the Russian banking system, have increased the cost of financing and securing international trade relations with Russia.

Our paper stands in direct line with a number of very recent works, and contributes to a substantial literature on the use of sanctions as a foreign policy tool in both political science and economics. The bulk of the existent academic literature on sanctions has shed light on the determinants of the success or failure of such policies and the effect of sanctions on the *target* economy through which the intended outcome — change of certain policies — is supposed to work.[3] A smaller number of papers have looked at the economic impact of sanctions in *sending* countries. The case of the Embargo Act of 1807 is particularly well studied, as it provided the first use of sanctions and embargoes in the modern era. Frankel (1982), Irwin (2005), and O'Rourke (2007) find effects in the range of 4%–8% of U.S. GDP by looking at trade losses and commodity price changes. Hufbauer and Oegg (2003) look at macroeconomic effects of sanctions in place in the 1990s and find the total effect on U.S. GDP to hover around a much lower 0.4%. Caruso

[2]The word "unintended" should be stressed, as the measures are, by definition of the European Union's "Basic Principles on the Use of Restrictive Measures (Sanctions)" (10198/1/04 REV 1) supposed to be designed in a way that "has maximum impact on those whose behaviour we want to influence.", while at the same time "[t]argeting should reduce to the maximum extent possible any adverse humanitarian effects or unintended consequences for persons not targeted or neighbouring countries."

[3]See Drezner (1999) and Hufbauer et al. (2009) for instructive overviews over the state of research in this respect.

(2003) estimates the average effects of sanctions in the second half of the 20th century in a simple empirical setup on aggregate trade flows. This current paper is also related to Besedeš et al. (2017), who study the effect of sanctions on financial flows using highly detailed transaction data from German balance of payments statistics over a time period of 10 years, encompassing 20 different sanctions regimes. They find that sanctions have an *immediate* effect, where domestic investors sell assets held in the sanctioned countries, as well as investors from the targeted countries engaging less in the German financial market. Closer to our work in that he uses detailed data to investigate the trade impact of a specific sanction case, Haidar (2017) focuses on the Western-imposed sanctions on Iran. He finds the effect of export sanctions to be heterogeneous among Iranian firms. In this case of a strict embargo, firms tried to divert their exports to non-sanctioning countries, but this strategy proved to be more difficult for small exporters. We follow Haidar in using firm-level export data, but we study a very different case of sanction, where (except for some products) there are no explicit restrictions on trade. We therefore devote the second part of our paper to exploring the channels through which those products that were not directly targeted by any specific measure nevertheless experienced adverse effects.

Other recent papers have examined the economic impact of the Russia sanctions. While we focus on the impact on trade flows, Dreger et al. (2016) estimate the consequences of the sanctions on the Russian macroeconomic performance. They conclude that the sanctions have increased the volatility of the rouble exchange rate but that the 2015 sudden devaluation is mainly the consequence of the drop in oil prices. Ahn and Ludema (2017) take a diametrically opposed approach by studying the impact of sanctions at the microeconomic level. Their difference-in-differences analysis reveals that firms that were explicitly targeted by the "smart" sanctions experienced a sharp deterioration in their financial performance. Interestingly, they also find evidence of spillovers of sanctions: Firms that are not themselves sanctioned, but which belong to a sector in which certain companies are targeted and/or have a capital links with sanctioned companies, have also suffered losses. They explain these externalities by "de-risking" behaviours. In response to the legal and administrative uncertainty generated by the sanctions, foreign companies may have been excessively cautious and interrupted their business relations with all their Russian partners, even those not explicitly targeted by the sanctions. Although our investigation follows a completely different path, our results laid out in section 4 appear to corroborate this conclusion.

Furthermore, this current study is also linked to the literature studying the connection between conflict and trade. Glick and Taylor (2010) show the disruptive effects of war on international trade and economic activity in general. Their approach — comparable to ours in the first part of the paper — relies on a general equilibrium trade model.[4] Another strand of the literature analyzes changes in the consumer preferences following political shocks more generally. Fuchs and Klann (2013) show that high-level meetings with the

[4]Our approach differs from theirs in that we also take into account endogenous changes to production and expenditure following and extending approaches by Dekle et al. (2007, 2008) and Anderson et al. (2015).

Dalai Lama are costly for the hosting country, in the sense that bilateral trade with China is significantly reduced in the following year. Michaels and Zhi (2010) show that the diplomatic clash between France and the United States over the Iraq War in 2003 reduced significantly the trade between the two countries during a short period of time. Pandya and Venkatesan (2016) exploit scanner data to reveal that sales in the U.S. market of brands marketed to appear French, while not necessarily imported from France, were affected by this conflict. Heilmann (2016) studies the impact of various boycott campaigns, among others the boycott Danish products in some Muslim-majority countries in 2006 by using a synthetic control group methodology.[5]

Finally, our study is also part of the broad and recent literature on the influence of economic policy uncertainty on firms' decisions and trade (e.g. Bloom 2009, Baker and Davis 2016, Handley and Limao 2017).

The paper is structured as follows: section 2 provides a brief overview of the sanctions regime that affected trade flows between sanctioning countries and the Russian Federation. In section 3, we then quantify the country-level trade impact of the sanctions regime in a gravity framework for implicated sanctioning Western countries and the Russian Federation, as well as shedding light on possible trade diversion. In section 4, we investigate the channels through which non-embargoed products were affected exploiting product- and firm-level customs data. Section 5 provides the conclusion.

2 Western sanctions and Russian counter-sanctions

The Western sanctions against the Russian Federation and their counter-sanctions are rooted in the simmering conflict in the eastern Ukraine and the Crimea. In this section, we try to give an overview over the developments that led to the introduction of sanctions and discuss the measures. We provide this detailed description as our empirical analysis rests on monthly data on trade in goods — at the country and firm-level — to investigate the effect of the three periods the sanctions episode can be broken down into.

In the following discussion, we denote a "sanctioning country" as all countries that enacted sanctions against the Russian Federation and were thus the target of Russian counter-sanctions. As "embargoed products," we define all products that were targeted by *Russian* counter-sanctions — an import embargo on certain agricultural and food products. Western economic sanctions were predominantly aimed at the access to financial markets of a number of prominent Russian financial institutions, as well as defence and energy companies.[6] Western sanctions did not target any *commonly* traded goods in particular.

[5]Another closely related literature investigates how political representation promotes bilateral trade relations. For instance, Rose (2007) finds that the presence of embassies and consulates is positively correlated with exports, with each additional consulate being associated with around 6–10 % increase in trade, ceteris paribus.

[6]The companies in question are listed in Council Regulations No 833/2014 Annex III and No 960/2014 Annexes IV, V, and VI. Financial institutions listed are Sberbank (Russia's largest bank, then third largest bank

Those exports of highly specialized goods that were prohibited by Western countries were excluded from the analysis below, as trade in these goods is very granular.[7]

Aside from all EU member states and the United States, Norway, Albania, Montenegro, Georgia, Ukraine, Moldavia, Canada, Australia, New Zealand, and Japan enacted similar policies.[8] In terms economic size, countries sanctioning the Russian Federation totaled roughly 55% of the 2014 world GDP. Switzerland, historically politically neutral, enacted legislation that made it more difficult to circumvent sanctions, e.g., by transshipping European exports and imports through the country, yet did not introduce any measures of its own.

2.1 Winter 2013–2014: Origins of the conflict and growing tensions

In 2013, the eastern European country of Ukraine faced an apparent dilemma: either sign and conclude an Association Agreement with the European Union (EU) or accede to the Eurasian Customs Union.[9] The former would entail closer ties to "the West" and economic integration with the EU. The latter would lead to stronger economic integration with the Russian Federation and other former members of the Soviet Union, strengthening the historical bonds already in place. While on the surface both options appeared to be of economic consideration, the implications would run much deeper. Economic integration goes hand in hand with political and geopolitical ties (Martin et al., 2012; Hinz, 2017) and thus the domestic and international political debate turned more heated quickly.[10]

Ukraine is a multi-lingual and multi-ethnic country. In late 2013, the ruling government's decision against further economic and political integration with the EU led to an important wave of demonstrations in Kiev and the western part of the country. This protest movement known as the "Euromaidan" led to the overthrow of the sitting Ukrainian government on February 22, 2014.[11] The overthrown government headed by President Yanukovic was perceived as pro-Russian, drawing most of its support from the majority Russian-speaking

in Europe), VTB Bank (nationwide operating bank in Russia), Gazprom Bank (Russia's third largest bank, subsidiary of Gazprom), Vnesheconombank (VEB) (Russia's "Bank for Development and Foreign Economic Affairs"), and Rosselkhozbank (state-owned bank with agricultural focus). Defence companies listed are OPK Oboronprom, United Aircraft Corporation, and Uralvagonzavod. Energy companies listed are Rosneft (Russia's largest publicly traded energy company, majority stake owned by the Russian government), AK Transneft (Russian state-owned pipeline company), and Gazprom Neft (oil subsidiary of Gazprom). Next to these companies, any majority-owned subsidiary is equivalently considered listed.

[7] As detailed below, Western trade sanctions did apply for goods originating from or destined for Crimea. However, as flows to and from Crimea were previously recorded as Ukrainian, their exclusion does not affect the analysis below. For a discussion of the products affected by Western sanctions (e.g. military dual use, and certain manufacturing goods used in oil production and refinery), see section 3.

[8] The exact timing of the enacting of sanctions varies by country, but all did so until the end of August 2014.

[9] Ukraine already became observer to the Eurasian Customs Union in the summer of 2013 (Reuters, 2013). See Dragneva and Wolczuk (2012) for more on the Eurasian Customs Union.

[10] Already in August 2013, Russia voiced its opposition to Ukraine's ambition to form an Association Agreement with the European Union and blocked virtually all imports from Ukraine (Popescu, 2013; AP, 2013).

[11] See also (Dreyer et al., 2015, pp. 44-47) for a timeline of events surrounding the 2014 Ukrainian revolution and subsequent conflict in eastern Ukraine and Crimea.

regions of eastern and southern Ukraine. The "Euromaidan" was, in contrast, by and large pro-European or nationalist, drawing most of its support from the rest of the country (Dreyer et al., 2015). This political split turned increasingly violent, with the EU and United States siding with the "Euromaidan" and the Russian Federation supporting the rivaling factions.

2.2 Spring 2014: First two waves of sanctions – Travel bans and asset freezes

The situation deteriorated further in southeastern Ukraine, in particular on the peninsula of Crimea. On February 27, 2014 separatists and armed men seized key government buildings and the main airport, and on March 16, 2014 a much-criticized referendum was held that aimed at the absorption of the Crimea into the Russian Federation. European and allied Western countries, most prominently the United States, imposed the first sanctions on the Russian Federation in mid-March 2014. This initial first wave of sanctions from Western countries, largely consisting of "smart sanctions" in the form of individual travel bans and asset freezes, focused on implicated political and military personnel as well as first select Russian financial institutions (Ashford, 2016). A second wave in the weeks to follow expanded the list of sanctioned individuals and entities.[12] See appendix A.1 for a detailed presentation of the content and the timeline of diplomatic decisions.

2.3 Summer 2014: The third wave of sanctions – Trade and financial restrictions

In July 2014, after the crash of a civilian airplane (Malaysian airlines flight MH17), shot down over the separatist region of Donbass with the probable implication of pro-Russian insurgents, Western countries reinforced the sanctions. This third wave of sanctions went beyond previous measures in depth and scope. Not only were Russian individuals and entities targeted through "Individual Restrictive Measures", EU parlance for travel bans and asset freezes, but more severe "Economic Sanctions" were implemented by the European Union and allied countries.[13] European entities were restricted from exporting certain goods, military and dual-use goods, as well as very specific mining equipment. More consequential, however, were the financial sanctions targeting five major Russian financial institutions, as well as a number of defence and energy companies, from refinancing on the European and US markets (Ashford, 2016).

[12] The Russian Federation condemned the measures and on March 20, 2014, the Ministry of Foreign Affairs issued travel bans on nine high-ranking and influential U.S. politicians and officials. Three days later, 13 Canadian politicians and officials were targeted in a similar fashion and on May 27, 2015, a *blacklist* of 89 politicians and activists from European Union member states emerged. See http://archive.mid.ru//brp_4.nsf/newsline/1D963ACD52CC987944257CA100550142, http://archive.mid.ru//brp_4.nsf/newsline/177739554DA10C8B44257CA100551FFE, http://www.theglobeandmail.com/news/politics/russia-bans-entry-to-13-canadians-in-retaliation-for-ottawas-sanctions/article17635115/ and http://uk.reuters.com/article/russia-europe-travelban-idUKL5N0YL07K20150530 for reference.

[13] See http://www.consilium.europa.eu/en/policies/sanctions/ukraine-crisis/ on the EU's official wording of different sanctions measures.

The Russian side, unsurprisingly, retaliated and enacted sanctions on European and other sanctioning countries. On August 7, 2014, the Russian Federation imposed a ban on imports of certain raw and processed agricultural products as an "application of certain special economic measures to ensure the security of the Russian Federation."[14] The targeted products (henceforth the "embargoed products") were select agricultural products, raw materials and foodstuffs originating from the European Union, the United States, Canada, Australia and Norway. The list of banned products was modified on August 20, 2014 and other sanctioning countries were successively included. See appendix A.3 table 7 for the full list of 4 digit HS codes of embargoed products.

3 The big picture: Global impact of sanctions on Russia

We now proceed to quantify the effect of the sanctions episode on trade in a general equilibrium counterfactual framework. The approach relies exclusively on a fixed effects estimation and only requires data on trade flows. We focus our analysis to trade in goods and use monthly UN Comtrade data (United Nations Statistics Division, 2015) from January 2012 until December 2015 between all 37 sanctioning countries, Russia, and the 40 other largest exporters in the world. Data on aggregate monthly Chinese exports is taken from ITC TradeMap.

We exclude export flows of certain HS codes for which trade takes place only very infrequently and then in very large values. The respective HS codes are heading 8401 ("Nuclear reactors and part thereof") and chapter 88 ("Aircrafts, spacecrafts, and parts thereof"). Although the sales of these products are also very likely to be impacted by the political tensions, these transactions are usually one-off events resulting in enormous spikes of total export and import values in some months and zero flows in all other months. We also exclude those products that were marked by the European Union as "energy-related equipment" and are subject to prior export authorization: HS headings 7304, 7305, 7306, 8207, 8413, 8430, 8431, 8705 and 8905. Furthermore, as trade with military and dual-use goods is banned by the EU and other sanctioning countries, we exclude chapter 93 ("Arms & Ammunition, parts & accessories") and all HS codes that are masked the 4-digit level, i.e., those codes that are not shown for reasons of confidentiality. Finally, we aggregate (for this section only) to embargoed and non-embargoed product-level and are left with a total of 335451 non-zero observations.[15]

3.1 Quantification of lost trade

We quantify the cost of the diplomatic conflict in terms of "lost trade." We predict trade flows between Russia and sanctioning countries and calculate the difference to observed flows. This allows us to put a price tag on the escalating diplomatic tensions and the use

[14] See the *Russian President's Decree No. 560 of August 6, 2014* and the *Resolution of the Government Of the Russian Federation No. 830* of August 20, 2014.

[15] We provide the list of countries and descriptive statistics in table 8 in appendix B.

sanctions by both sides. The different sets of sanctions — imposed by the EU and other countries on the one hand, and by Russia on the other hand — are assumed to affect trade as a *bilateral* trade cost. As such, our approach is similar to Hufbauer et al. (2009), but improves upon the theoretical foundation of the model.[16] Aside from the direct, or partial equilibrium impact, the changes in trade impediments due to the conflict and sanctions also had feedback effects on both involved and uninvolved countries. Changes in bilateral trade resistances between Western sanctioning countries and Russia affect all countries through what is known as inward and outward multilateral resistance terms that reflect a country's position in the global trade matrix (Head and Mayer, 2014). Additionally, the sudden increase in bilateral trade costs between sanctioning countries and Russia likely had a sizable impact on production and expenditure in Russia and, to a probably lesser degree, in sanctioning Western countries.

The methodology we employ is comparable to Glick and Taylor (2010)'s, who examine the effect of the two world wars in a gravity setup and compute a counterfactual by modifying the multilateral resistance terms accordingly. Importantly, though, and in contrast to their work, we also explicitly take changes in production and expenditure figures into account, building on an approach initially pioneered by Dekle et al. (2007). We therefore conduct what Anderson et al. (2015) call a *full* GE exercise, as opposed to a *conditional* one that does not take into account these changes to production and expenditure.[17] We describe the approach in detail in appendix C and provide a short intuition in the following paragraphs.

Let trade between an origin country o and a destination country d at time t be described by an Armington-type gravity structure as in Head and Mayer (2014), so that

$$X_{odt} = \frac{Y_{ot}}{\Omega_{ot}} \cdot \frac{X_{dt}}{\Phi_{dt}} \cdot \phi_{odm}, \tag{1}$$

where $Y_{ot} = \sum_d X_{odt}$ is the value of production, i.e. all exports, in o at time t, and $X_{dt} = \sum_o X_{odt}$ is the value of expenditure, i.e. all imports, in d time t. Ω_{ot} and Φ_{dt} are the so-called outward and inward multilateral resistance terms that reflect the exports' and importers relative position in the world trade matrix. The structure of these terms is given by

$$\Omega_{ot} = \sum_{\ell \in d} \frac{X_{\ell t}}{\Phi_{\ell t}} \cdot \phi_{o\ell m} \quad \text{and} \quad \Phi_{dt} = \sum_{\ell \in o} \frac{Y_{\ell t}}{\Omega_{\ell t}} \cdot \phi_{\ell dm}.$$

The bilateral component ϕ_{odm} subsumes all seasonally-varying bilateral trade barriers and facilitators, which we assume to vary at the month-level denoted by subscript m (as opposed to t for year-month).

We estimate equation (1) with a Pseudo-Poisson Maximum Likelihood procedure by

[16] Hufbauer et al. (2009) employ what Head and Mayer (2014) coin a *naive* gravity setup.

[17] Note that, as in Dekle et al. (2007) and Anderson et al. (2015), the approach assumes the ratios of exports to imports to be the same in the predicted as in the observed scenarios.

regressing bilateral flows between country o and d at time t on origin $\times$ time, destination $\times$ time, and origin $\times$ destination $\times$ month fixed effects, such that:[18]

$$x_{odt} = \exp\left(\Psi_{ot} + \Theta_{dt} + \phi_{odm}\right) + \mu_{odt} \tag{2}$$

The respective fixed effects allow us to back out all components of equation (1). As discussed above, we assume the sanctions measures to affect bilateral trade costs. We allow the effect of these measures to vary by country-pair and time by estimating equation (1) on untreated observations *only*. While econometrically equivalent to including country-pair-time-varying sanctions dummies, this setup still allows us to estimate all required fixed effects, as involved countries continue to trade with untreated partners. The value added from this approach is that we rely exclusively on fixed effects and do not force any structural form on the effect of the policies.

Counterfactual bilateral resistances for treated country-pairs since the beginning of the crisis are thus simply the estimated ϕ_{odm} from the time before the crisis. Counterfactual multilateral resistance terms can simply be computed accordingly. In order to account for explicit changes to countries' production and expenditure, we follow Anderson et al. (2015) and account for changes to product and expenditure Y_{ot} and X_{dt} by what they coin the adjustment of *factory-gate prices* (see appendix C).

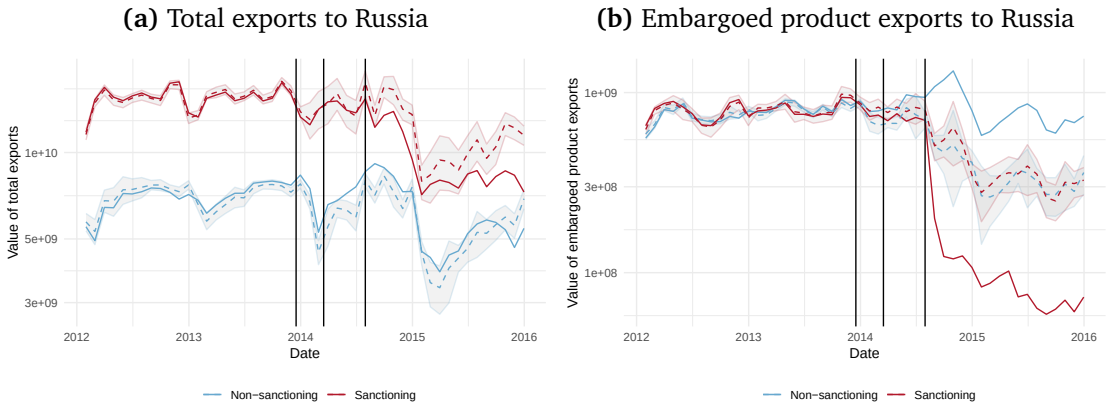
3.2 Estimated general equilibrium impact

Figures 1 and 2 show the results of performing the counterfactual analysis with total exports and those of embargoed products to Russia by all sanctioning and non-sanctioning countries. The solid line displays the observed value and the dashed one the predicted value using the procedure detailed above. The three vertical lines indicate the three dates at which the previously defined periods start: December 2013 for the beginning of the conflict, March 2014 for the first implementation of travel bans and asset freezes and August 2014 for the beginning of economic sanctions from both sides. The fit is remarkably good in the pre-conflict time between later "treated" country pairs and between "untreated" country pairs, suggesting precisely estimated fixed effects and general validity for the results. The importer $\times$ time fixed effects in particular appear to capture well the overall turmoil in the Russian economy, as the observed drastic drop of imports from *non-sanctioning* countries in early 2015 is almost perfectly mirrored by a predicted drop.

As seen in figures 1a and 1b, the predicted values match the observed values very closely for the time prior to the initial beginning of political tensions in December 2013. This changes afterwards. While the observed flows from non-sanctioning countries do not fall beneath their predicted values, those of the sanctioning countries do so strongly. Total trade of those countries moves away from its prediction starting in January 2014 and

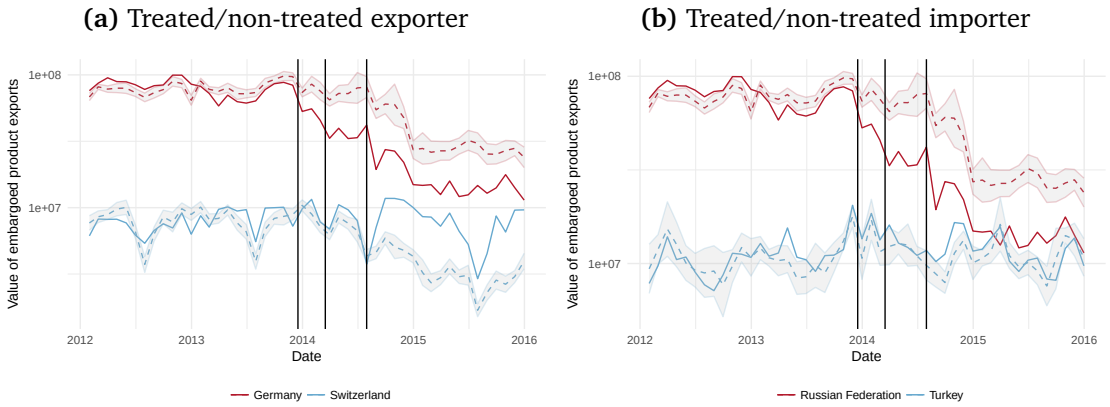
[18] We hence extend a usual gravity estimation by the month-dimension. As an example, for a flow between France and Russia in January 2014 we include France-Exporter-January-2014, Russia-Importer-January-2014, and France-Russia-January fixed effects.

Figure 1: Predicted vs. observed total value of exported goods to Russia from sanctioning and non-sanctioning countries by type of products.



Notes: Solid lines display observed trade flows, dashed lines predicted flows. Vertical lines indicate dates of interest. 95% confidence intervals based on standard errors multiway-clustered following Egger and Tarlea (2015) by origin, destination and time.

Figure 2: (Pseudo) placebo test with treated/non-treated exporter and importers.



Notes: Solid lines display observed trade flows, dashed lines predicted flows. Vertical lines indicate dates of interest. 95% confidence intervals based on standard errors multiway-clustered following Egger and Tarlea (2015) by origin, destination and time.

sharply so since the beginning of economic sanctions in August 2014. The pattern is dramatically visible for embargoed products, where the exports of sanctioning countries collapses starting in August 2014, while those from non-sanctioning countries remain stable and even appear to replace some of the exports from sanctioning Western countries.[19]

The picture is reinforced when zooming into two-country comparisons and performing (pseudo) placebo tests on non-treated importers and exporters. Figure 2a displays

[19]See appendix D, tables 9, 10 and 11 for the quantification of lost trade with total, embargoed and non-embargoed goods trade by period and country.

the total value of embargoed product exports to Russia from one sanctioning and one non-sanctioning country, namely Germany and Switzerland. The two countries are very comparable: both are located at similar distances to the Russian Federation, speak the same language and belong to the same free trade zone. However, only Germany is treated. Exports from Germany decreased significantly after the beginning of the conflict, as embargoed products were, as any other product, affected by an overall deterioration of political relations, sanction threats and anticipation effects, and the imposition of specific sanction measures over the course of the year 2014. Exports of embargoed products then collapsed almost entirely after the imposition of economic sanctions in August 2014, while those of neutral Switzerland remained virtually unchanged, being even above their predicted values. In figure 2b, we conduct another comparison exercise by looking at exports of embargoed products by Germany to Russia and Turkey — a non-treated importer. There is virtually no difference between observed and predicted trade flows to Turkey when artificially treating these as sanctioned. The results of these placebo tests clearly indicate the particularity of bilateral trade flows between sanctioning countries and Russia since the beginning of the conflict and further support the validity and quality of the predictions using the estimated fixed effects.

To get a better idea of the magnitude of the impact, we compute the difference between predicted and observed trade flows by country, i.e. the *lost trade*. We report the key findings in table 1 and refer to appendix D for the results in full detail. The total global lost trade for the period between December 2013 and December 2015 amounts to US$ 96 billion, or US$ 4 billion per month. US$ 53 billion are being borne by the Russian Federation, which amounts to 15 % of Russia's predicted exports in a scenario without sanctions. On the other side, Western countries also bear a significant share of the global lost trade. One finding of particular relevance for the political debate is that only US$ 5.4 billion, or 12.7% of Western lost trade, are accrued in embargoed products. The bulk of the lost trade from Western countries can therefore be considered *friendly fire*, a cost on private actors that were not directly targeted by the Russian embargo.[20]

Table 1: Export losses by type of goods and country group

	Total		Embargoed		Non embargoed	
	Loss		*Loss*		*Loss*	
	in $ bil.	*in %*	*in $ bil.*	*in %*	*in $ bil.*	*in %*
Russian Federation	-53.47	-10.10	0.01	1.02	-53.48	-10.13
Sanctioning countries	-42.37	-14.19	-5.41	-44.85	-36.96	-12.90
European Union	-38.79	-14.96	-3.74	-42.60	-35.05	-14.00

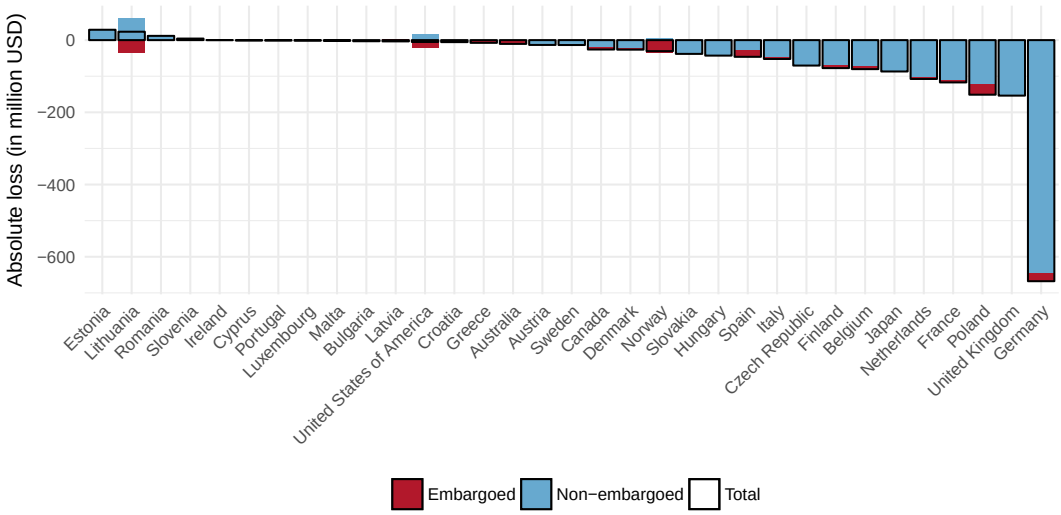
Note: Observed and predicted values, and absolute losses are exports between implicated countries in billions of USD. Relative losses are in percent of predicted exports.

The European Union bears 92% of all lost trade of sanctioning countries and 95% of lost

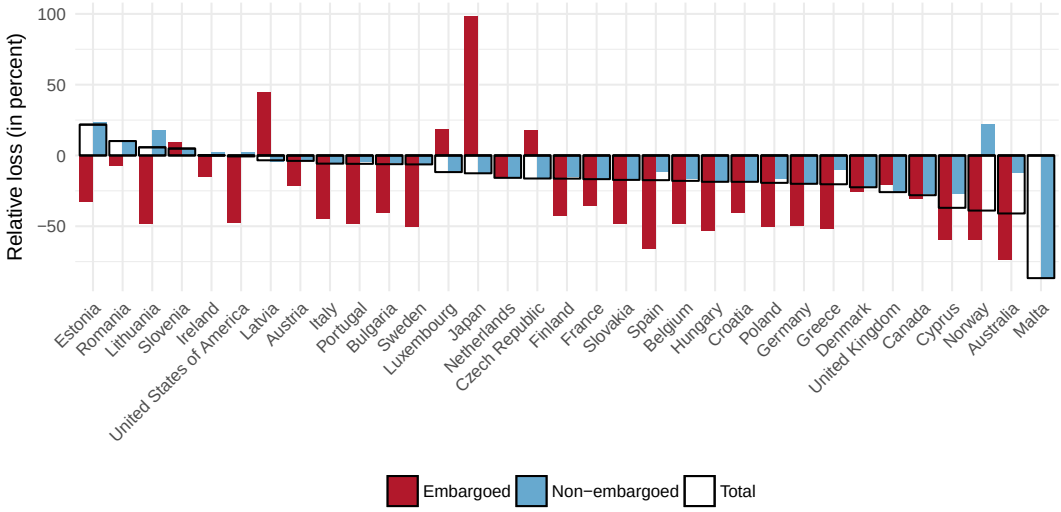
[20]Embargoed products are likely additionally exposed to the same factors that induced the decrease in exports of non-embargoed products, so that this estimate of friendly fire can be considered the lower-bound.

Figure 3: Composition lost exports to Russia of embargoed and non-embargoed products, by country

(a) Monthly absolute losses of exports to Russia (in million USD per month)



(b) Monthly relative losses of exports to Russia (in %)



trade in non-embargoed products. The impact, however, is not evenly distributed among sanctioning countries: Figures 3a and 3b display the average monthly difference between predicted and observed exports in relative and absolute terms by country, broken down into trade of embargoed and non-embargoed products. In relative terms, Malta, Norway and Australia are hit hardest, with lost trade amounting to up to 85% of predicted flows to Russia. When comparing to total exports, however, Finland (1.5 %), Poland (0.9 %) and Germany (0.6 %) are most affected.

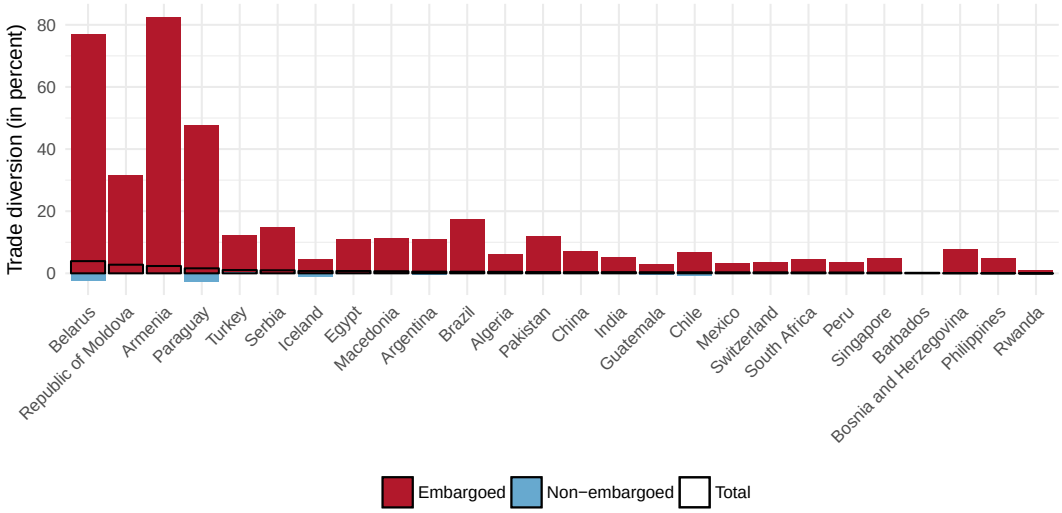
Germany's exports are, on average, about US$667 million lower per month compared to a counterfactual scenario without sanctions, most of it incurred by non-embargoed products. The United Kingdom (US$ 153 million) and Poland (US$ 151 million) follow,

Figure 4: Trade diversion of embargoed product and total exports.

(a) Exports of all products from China to Russia and France

(b) Exports of embargoed products from China to Russia and France

(c) Distribution of relative trade diversion



Notes: In (a) and (b) solid lines display observed trade flows, dashed lines predicted flows. Vertical lines indicate dates of interest. 95% confidence intervals based on standard errors multiway-clustered following Egger and Tarlea (2015) by origin, destination and time.

albeit in much smaller magnitudes. In percentage terms, Germany is bearing almost 38% of Western lost trade, while other major geopolitical players like the United Kingdom (8.7%), France (6.6%) and the United States (0.3%) are much less affected. Overall, the composition of the losses incurred varies widely by period and affected products.

As the counterfactual analysis predicts trade flows for all country pairs, we can also shed light on potential trade diversion at the macro level. Did some countries "pitch in" when others could not export embargoed products to Russia anymore? Figure 4, highlighting the role of China, suggests that this was indeed the case. While figure 4a shows only limited trade diversion in the grand scheme of things, zooming in to the smaller set of

embargoed products in figure 4b shows that China continued to export these products at about the same magnitude as before the sanctions, while predicted demand from Russia decreased significantly. Figure 4c strongly supports this narrative. Non-sanctioning countries increased their exports of embargoed products to Russia by up to 82 % relative to predicted flows, as in the case of Armenia. In total exports, however, this effect is near zero. This suggests that the Russian Federation, as a result of its own policy measures, shifted its demand for these products away from Western countries, towards those with which diplomatic relations remained unharmed. For other non-embargoed products, however, trade diversion by and large could not make up for lost trade with Western countries.

4 Drilling down: product- and firm-level impact

We now investigate the drivers of the decline in trade flows between the Russian Federation and sanctioning countries. Of course, the Russian embargo on agricultural and food products had an unambiguous consequence on exports of targeted countries. It is much more difficult to determine why diplomatic turmoil surrounding the conflict in Ukraine and the complex sanctions regime imposed by Western countries have affected exports of non-embargo products. Indeed, except for the specific products that we excluded from our analysis, they do not contain any provisions that explicitly aimed at reducing exports to Russia. Therefore, the trade impact of the diplomatic tensions estimated in the previous section must be the consequence of more indirect (and unexpected) mechanisms. We suspect two main mechanisms that may have been at work and contributed to the decline of exports. The first possible mechanism could be an abrupt change of Russian consumers' preferences resulting from a spontaneous boycott of Western products in reaction to the diplomatic gridlock. The second one is related to increasing country risk. The sudden rise of economic and political instability might have hindered firms in sanctioning Western countries to do business in Russia or with Russian firms. In this context, the sanctions themselves, which have may added legal ambiguity and weakened the Russian financial system, could have generated a disruption in the supply of trade finance services and lessened the ability to secure international payments.

In order to explore these channels, we exploit product- and firm-level variations in the exports trends of sanctioning countries to Russia. We implement two complementary empirical analyses based respectively on global bilateral trade data aggregated at the product level and French firm-level export data. The product-level analysis extends the previous gravity estimation by a product dimension. This allows us to see which products drove the aggregate results presented above. At the same time, the analysis with more detailed data also allows us to control for unobserved characteristics at origin-*product*-time, destination-*product*-time and origin-destination-*product*-month level. The firm-level analysis goes one step further and additionally adds a firm-level dimension. This allows us not only to distinguish between products in the impact of sanctions, but also by firm characteristics.

In order to isolate the impact of the diplomatic conflict and the sanctions affecting sanctioning countries' exports to Russia from possible confounding factors, we adopt a difference-in-differences approach which combines spatial and time differences. We focus on short-term effects and limit our treatment period to 2014.[21] We decompose the period of interest into three sub-periods defined with respect to the implementation of sanctions described in section 2:

- p_1, from December 2013 until February 2014, in which political tensions were increasing while no sanctions were put in place yet;
- p_2 starts in March 2014 with the implementation of the first wave of sanctions, later succeeded by the "second wave", and ends in July 2014. During this period Western governments targeted people and institutions implicated in the events in eastern Ukraine and Crimea with asset freezes and travel bans;
- p_3 starts in August 2014 with the implementation of harsher trade and financial sanctions, first by the EU and allied countries and then in retaliation by the Russian Federation.

Our specifications also include a treatment dummy, p_0, for the quarter preceding the start of the conflict (from September 2013 to November 2013). This variable allows to control for possible pre-treatment trends and see if exports to Russia had started to decrease some months before the treatment.

4.1 Product-level analysis: Empirical specification

We first describe our product-level analysis. We augment the gravity model from above, in particular equation (2), by adding a product-level dimension. We again exploit bilateral export data from UN COMTRADE by all sanctions countries, Russia and the 40 other largest exporters, but now disaggregated at the 4-digit product level of the HS classification.
Adding a product dimension increases the sample size dramatically. With 77 reporting countries, 233 partner countries and 1227 products,[22], and after eliminating all origin-destination-product triads for which we do not observe any trade over the sample period, we have more than 123 million observations.
While a general equilibrium counterfactual analysis is not feasible at this level of disaggregation, recent advances in the estimation of generalized linear models with high-dimensional fixed effects (Hinz et al., 2019) make the estimation of partial equilibrium effects possible.

[21] By focusing on short term effect we also alleviate the risk that our results are affected by confounding factors. Russia experienced violent macroeconomic shocks in 2015 and 2016. Even though our specifications control for the macroeconomic determinants of demand and competition on the destination markets, we have no guarantee that these macroeconomic shocks have a homogeneous impact on each exporter. Their impact may depend, for instance, on the quality or the price of the exported products.

[22] As before, we exclude from the analysis trade of oil and gas and all the products that are subjected to export restrictions within the framework of European sanctions (see table 6). We also exclude "Nuclear reactors and part thereof" (*HS 8401*) and "Aircrafts, spacecrafts, and parts thereof" (*HS 88*). The reason for this exclusion is that the trade of these products is very granular, which makes a robust identification of a trend in export flows very difficult.

Table 2: Benchmark regressions at product level (to all countries)

Sample	(1) All Products	(2) Embargoed	(3) Non-embargoed
$\Gamma \times$ Sep '13 - Nov '13	-0.015^b	-0.211^b	-0.014
	(0.006)	(0.089)	(0.012)
$\Gamma \times$ Dec '13 - Feb '14	-0.100^a	-0.513^a	-0.055^b
	(0.022)	(0.095)	(0.025)
$\Gamma \times$ Mar '14 - Jul '14	-0.094^a	-0.520^a	-0.046^a
	(0.023)	(0.104)	(0.014)
$\Gamma \times$ Aug '14 - Dec '14	-0.282^a	-3.260^a	-0.059^b
	(0.047)	(0.230)	(0.024)
Sample size	123274955	4192704	119082251

Notes: PPML estimates. Γ is a dummy indicating export flows from sanctioning countries to Russia. Regressions include all products in column (1), sample restricted to embargoed products in column (2) and non-embargoed products in column (3). Fixed effects: origin $\times$ product $\times$ time, destination $\times$ product $\times$ time and origin $\times$ destination $\times$ product $\times$ month. Robust standard errors in parentheses are clustered by origin, destination and time. Significance levels: ^{a}: p<0.01; ^{b}: p<0.05; ^{c}: p<0.1

Hinz et al. implement a Gauss-Seidel-type iteratively reweighted least squares estimation procedure for generalized linear models. More specifically, they make use of convenient properties of certain family-link combinations — the Poisson distribution with a log link function among them — to partial out the fixed effects from the estimation of the parameters of interest. This means that the model matrix does not include the fixed effects, which otherwise tends to make fixed effect Pseudo Poisson estimations with large numbers of observations infeasible. Making use of this new estimator, we can therefore estimate

$$x_{odkt} = \exp\left(\Psi_{okt} + \Theta_{dkt} + \phi_{odkm} + \boldsymbol{\gamma}\Gamma_{od} \times P_t\right) + \varepsilon_{odkt} \tag{3}$$

where Ψ_{okt} is an origin-product-time fixed effect, Θ_{dkt} a destination-product-time fixed effect, ϕ_{odkm} a origin-destination-product-month fixed effect. Γ_{od} is a dummy variable taking the value 1 when the exporter is a Western sanctioning country and the destination country is Russia. P_t is a vector of dummies indicating the periods of interest: p_0, p_1, p_2 and p_3. $\boldsymbol{\gamma}$ is the corresponding vector of parameters. As in the previous section, and as customary in the gravity literature following Egger and Tarlea (2015), errors are clustered by origin, destination and date.

Table 2 shows the results for estimating equation (3) for three groups of products. In column (1) we estimate coefficients on the interaction of the pre-period and three treatment periods and affected country pairs on all HS 4 product categories. In column (2) we subset the sample to only those product categories that are directly affected by the embargo, and in column (3) to those that are not. The results naturally confirm those shown in the previous section that exports to Russia of sanctioning countries dropped significantly with the diplomatic conflict, compared to the ones from non-sanctioning countries. Not surprisingly, the impact is particularly dramatic for embargoed products during period p_3, with a decrease of more than 96 %. Non-embargoed products again also see a decline in

exports by up to 5,7 %. Below we focus on these non-embargoed products and supplement our specification with an additional interaction of variables of interest to investigate the possible drivers of the export decline by estimating

$$x_{odkt} = \exp\left(\Psi_{okt} + \Theta_{dkt} + \phi_{odkm} + \boldsymbol{\gamma}\Gamma_{od} \times P_t + \boldsymbol{\kappa}\Gamma_{od} \times P_t \times K_k\right) + \vartheta_{odkt}, \qquad (4)$$

where K_k are certain product-level characteristics and κ is the respective vector of coefficients. We describe the characteristics in detail below.

4.2 Firm-level analysis: Empirical specification

We complement the product-level analysis with an analysis at the firm level. This allows us to investigate the impact further along firm characteristics. Here, we focus on the case of France, for which we have detailed customs data providing information on monthly exports at the *firm*-product-destination level. Each observation in our database records date (year and month), a unique firm code, 8-digit product code, the destination country and the exported value (in Euros).

The Russian Federation is a major trade partner for France. In 2013, it was the 12th most important destination for French exports, and the 5th one outside the European Union, after the United States, China, Switzerland and Japan. To estimate the effect of the conflict on the exports of French firms, we adopt the same difference-in-differences approach as above. However, since we only have one exporting countries, we cannot estimate the direct impact of the diplomatic tension on French firm-level exports as the shock is common to all exporters and the vector of treatment variables Γ_{od} in equation (4) is fully absorbed by the fixed effects. We therefore focus on interaction terms only with the following specification:

$$x_{idkt} = \exp\left(\Psi'_{ikt} + \Theta'_{dkt} + \phi'_{idk} + \boldsymbol{\kappa}'\Gamma'_d \times P_t \times K_k\right) + \vartheta'_{idkt}, \qquad (5)$$

where i denotes exporting firms and Γ'_d indicates export flows to Russia.[23] Our empirical specification hence compares the trend of exports of a given firm to Russia to its trend of exports to alternative destinations. In consequence, we restrict our sample to firms that export to Russia at least once between January 2013 and December 2014. We aggregate all individual trade flows at the 4-digit level of the HS product classification. Again, we exclude from the analysis the goods that are subjected to European export restrictions within the framework of European sanctions against Russia along with HS categories 8401 and 88.[24]

In order to control for unobserved determinants of time-varying individual supply capaci-

[23] This specification differs from equation 4 in that we have firm-destination-product fixed effects and not firm-destination-product-month ones. The reason is that firm-level trade flows are very sporadic. It is therefore extremely rare to observe firms exporting the same good, to the same country, the same month in at least two different years.

[24] All together, these two categories of products represented about 12% of French exports to Russia in 2012 but only 2% of French firms exporting to Russia which export very large amounts, in a very sporadic way.

ties (with the firm $\times$ product $\times$ date fixed effect Ψ'_{ikt}), we need a control group consisting of alternative destinations of French exports. The difficulty is that export flows to any other country are potentially affected by the treatment. The limitations on trade with Russia can influence the exports towards other destinations in two different ways. On the one hand, French firms that had to cut exports to Russia because of the sanctions may have tried to compensate for their losses by expanding their sales to other countries. In this case, the measures would have boosted the French export to non-Russian markets, which were to lead us to overestimate the impact of the treatment on French exports towards Russia. On the other hand, the diversion of trade toward non-Russian markets should increase the toughness of these destinations in terms of competition and make them less accessible to French exporters. This effect would bias downward the estimated impact of sanctions. It seems reasonable, however, that firms that are directly affected by the trade restrictions divert their exports intended to Russia first and foremost towards their own domestic market. As a consequence, the second bias is presumably stronger in countries involved in the sanctions regime. Therefore, our preferred control group is composed of sanctioning European countries in close proximity to Russia: Romania, Bulgaria, Greece, Finland, Norway, Sweden, Estonia, Latvia, Lithuania, Poland, Hungary, Czech Republic, Slovakia, Slovenia, and Croatia. Because all these countries actively sanctioned Russia, we expect French exports to this control group to be negatively affected by the sanctions, leading to a conservative lower bound estimate of the direct impact of sanctions on French exports towards Russia.[25] For the period 2012-2014, our main sample contains observations for 9,822 firms, 1,015 products and 30,211 firm-product pairs.

4.3 Change in consumers' attitude

One mechanism that could explain why the exports of non-embargoed products to Russia declined after the beginning of the conflict in Ukraine (and further when Western countries imposed sanctions) is an abrupt change of consumers' preferences. It is indeed possible that the Western sanctions have been perceived by Russian consumers as an unjustified interference in Russian affairs. If the diplomatic reaction of the Western governments had been perceived as a "Russia bashing," it could have deteriorated the brand image of Western products and led part of the Russian consumers to remove these products from their consumption basket.

Existing studies on the consequences of boycotts on international trade lead to diverging conclusions. However, several recent studies, including Michaels and Zhi (2010), Pandya and Venkatesan (2016), and Heilmann (2016),[26] confirm that boycott calls and, more gen-

[25] We have also conducted robustness tests with alternative control groups (including countries not participating in sanctions). These results, which corroborate the ones presented here, are available upon request.

[26] Heilmann (2016) studies the impact of various boycott campaigns. In particular, this paper confirms Michaels and Zhi (2010)'s conclusion showing that the diplomatic clash between France and the United States over the Iraq War in 2003 reduced significantly the trade between the two countries during a short period of time.

Table 3: Interaction with brand visibility - Non-embargoed products

Sample	(1) Products	(2) Firms	(3) Firms	(4) Firms
			Consumption products	Luxury products
$\Gamma \times$ Sep '13 - Nov '13	0.079^{b}	0.151		
$\times$ Consumption goods	(0.040)	(0.145)		
$\Gamma \times$ Dec '13 - Feb '14	0.167^{a}	0.102		
$\times$ Consumption goods	(0.028)	(0.097)		
$\Gamma \times$ Mar '14 - Jul '14	0.052^{c}	0.067		
$\times$ Consumption goods	(0.027)	(0.085)		
$\Gamma \times$ Aug '14 - Dec '14	0.197^{a}	0.097		
$\times$ Consumption goods	(0.052)	(0.143)		
$\Gamma \times$ Sep '13 - Nov '13			0.144	
$\times$ Luxury goods			(0.254)	
$\Gamma \times$ Dec '13 - Feb '14			0.190	
$\times$ Luxury goods			(0.117)	
$\Gamma \times$ Mar '14 - Jul '14			-0.020	
$\times$ Luxury goods			(0.127)	
$\Gamma \times$ Aug '14 - Dec '14			0.157	
$\times$ Luxury goods			(0.220)	
$\Gamma \times$ Sep '13 - Nov '13				-0.072
$\times$ Luxury firms				(0.080)
$\Gamma \times$ Dec '13 - Feb '14				0.180^{b}
$\times$ Luxury firms				(0.084)
$\Gamma \times$ Mar '14 - Jul '14				-0.011
$\times$ Luxury firms				(0.073)
$\Gamma \times$ Aug '14 - Dec '14				-0.066
$\times$ Luxury firms				(0.091)
Sample size	116540394	2043861	771494	636050

Notes: Non-embargoed products only. PPML estimates. Γ is a dummy indicating export flows from sanctioning countries to Russia (in column 1) or export flows to Russia (columns 2-4). Column (1): Coefficients on interaction of Γ and p_0 (Sep '13 - Nov '13), p_1 (Dec '13 - Feb '14), p_2 (Mar '14 - Jul '14) or p_3 (Aug '14 - Dec '14) not reported. Fixed effects are included for origin $\times$ destination $\times$ product $\times$ month, origin $\times$ product $\times$ time and destination $\times$ product $\times$ time. Columns (2-4): Fixed effects are included for firm $\times$ destination $\times$ product, firm $\times$ product $\times$ time and destination $\times$ product $\times$ time. Robust standard errors in parentheses are clustered by destination $\times$ product. Significance levels: ^{a}: p<0.01; ^{b}: p<0.05; ^{c}: p<0.1.

erally, worsening consumer attitudes towards a foreign country have a sizable impact on trade volumes. In the case of Russia, we are not aware of any large scale boycott campaign against Western products. However, during summer 2014, the Russian government set up a media campaign on its decision to ban Western food products in retaliation to the Western sanctions, organizing, for instance, the public destruction of illegally imported food. These official messages might have influenced consumers' decisions.

If a part of the impact estimated above is the consequence of a loss of popularity of Western products, we would expect a more severe trade disruption for consumer goods and varieties that are easily identified as Western products. Indeed, Heilmann (2016) shows clearly

that boycotts have larger effects on highly-branded products and consumer goods than on capital or intermediate ones. Building on these results, we base our identification strategy on the expected heterogeneous effect of the change in consumers' attitude across firms and products. In Table 3, we interact the treatment variables with various indicators that characterize products that are more likely to be subject to a change in Russian consumers' preferences. We propose three tests.

In columns (1) and (2) we add interactions with a dummy set to one for consumer goods.[27] In columns (3), we focus on French exports of consumer goods and break up the analysis the analysis according to whether it is relatively easy for consumers to identify the brand, and thus the geographical origin, of the products. This distinction is based on the presence of exporters of French luxury brands within a HS4 product category. The idea here is that luxury firms need to invest substantially in their brand image, which is possible only for products that are easily branded. The list of French exporters of luxury goods is provided by Martin and Mayneris (2015).[28] In order to identify the producers of luxury goods, they exploit the list of French firms that are member of the "Comité Colbert," a French organization gathering the main brands of the French luxury industry with the objective to promote these high-end products. We go further in column (4). Here, we retain the HS4 products goods that are exported by "Comité Colbert" members and we look at whether impact of the diplomatic conflict is different for these high-end producers, within their HS4. The underlying assumption here is that, within a given product category that may include luxury varieties (e.g. wines, perfumes, bags, etc), French luxury brands are more visible and easily identified as typically French. Therefore, they may be potential targets of boycott calls and/or more sensitive to worsening attitudes towards French products.[29] As column (1) shows, consumer products were on average *less* affected than the average product and hence cannot explain the drop of non-embargoed export to Russia. The picture is confirmed by looking at the firm-level effect. Except for a small and unexpected positive coefficient in column (4), none of the interaction terms are significantly different from zero. This discards the hypothesis that sudden changes in consumer preferences are the driver of the drop in Western exports to Russia after December 2014.

4.4 Country risk and trade finance

We now turn to the exploration of the role of country risk and "de-risking" behaviors (Ahn and Ludema, 2017). In times of political and legal instability, firms may be inclined to reduce their exports and stop or delay their search for new business opportunities, until

[27] We use the classification by broad economic categories (BEC) provided by the United Nations to identify consumer products. The BEC groups the sections of the Standard International Trade Classification (SITC) according their main end use. It distinguishes food, industrial supplies, capital equipment and consumer goods. After matching the SITC classification with the HS, we coded as consumer goods the HS4 containing majority of HS6 identified in the BEC as "consumer goods," "food," and " Passenger motor cars."

[28] We thank Julien Martin and Florian Mayneris for sharing their data.

[29] This hypothesis is in line with the evidence provided by Pandya and Venkatesan (2016). In their study of the consequence of the diplomatic conflict between France and the United States over the war in Iraq, they show that brands that are the most clearly *perceived* as French are the most impacted by the boycott campaign.

they are reassured on the legality of their transactions and the security of their shipments and payments. Similarly, financial intermediaries may be cautious to facilitate transactions, fearing repercussions in case of accidental breach of sanctions. This section therefore focuses on the specific role of trade finance during this diplomatic crisis. Growing political instability in Russia might have limited the issuance and/or increased the price of trade finance services aiming at mitigating the risk affecting international transaction. These restrictions logically raised the transaction costs and reduced the volume of trade.

In our case, this channel might be particularly important since the sanctions imposed by Western countries on major Russian businesses and financial institutions could have directly affected the provision of trade finance services by Russian banks.[30] Of course, the sanctions imposed by Western countries — since they were explicitly designed to spare Western exports as much as possible — did not directly target the provision of trade finance services. There is reason to believe that they impacted this business however. First, the financial sanctions imposed after August 2014, undoubtedly weakened the major Russian banks, reducing their capacity to offer competitive financial services. Second, even before these financial sanctions were put in place, it is possible that the initial diplomatic conflict and the first implemented sanction measures generated a climate of political and legal insecurity, leading both Western and Russian banks to stop or delay pending transactions until having guarantees on their legality. Existence of serious concerns about the scope of the sanctions and the resulting legal instability regarding trade finance is revealed, for instance, by the fact that the EU commission felt the need to publish a guidance note in December 2014 concerning the implementation of certain provisions of the financial sanctions.[31] The purpose of this note was to clarify some aspects of the regulation establishing the sanctions, including those relating to the provision of financial services by Russian banks. The note confirmed that "EU persons can process payments, provide insurance, issue letters of credit, extend loans, to sanctioned entities." At the same time the note remarks that the clarification followed questions that had been brought forward to the EU Commission, suggesting that some actors were facing legal uncertainty.

In order to assess the role of this possible link between the sanctions and trade, we look at whether the magnitude of the impact of the sanctions is related to the importance of the usage of trade finance instruments. Unfortunately, we face serious data limitations. We do not have any direct and comprehensive information about the usage of trade finance instruments. In fact, information of this kind is very rare. Most of the existing empirical literature on the importance of trade finance is based on partial and very limited data,[32] or on data reporting bank activities which contain very incomplete information about the

[30] The five Russian banks directly hit by the EU sanctions are Sberbank (the largest Russian bank and the third largest bank in Europe), VTB Bank, Gazprombank, Vnesheconombank and Rosselkhozbank.

[31] See also the "Commission Guidance note on the implementation of certain provisions of Regulation (EU) No 833/2014", `http://europa.eu/newsroom/files/pdf/c_2014_9950_en.pdf`.

[32] For instance, the empirical analysis provided by Antràs and Foley (2015) in support of their theoretical model is based on information for a single U.S.-based exporter.

international trade transactions.[33] Only few papers exploit very detailed data on the usage of trade finance instruments (e.g. Demir and Javorcik (2018) for Turkey and Ahn (2015) for Colombia and Chile). The latter show that the use of trade finance instruments varies greatly across firms, partner countries and products. Our empirical strategy is based on the variance across products. In the spirit of many empirical studies on the consequence of financial development, which exploit the variation in financial vulnerability across sectors computed from firm-level data for a reference country,[34] the identification of the role of trade finance is based on an interaction between our variables of interest and a product-level indicator of dependence on trade finance.

The indicator we use is calculated from the data exploited by Demir and Javorcik (2018).[35] Their data covers the universe of Turkish exports disaggregated by exporter, product, destination, and financing terms for 2003-2007. Three types of financing terms supporting international trade contracts are identified: "Cash-in-advance" (the importer pays before the arrival of the good and bears the risk), "open account" (the importer pays after the arrival and the exporter bears the risk) and "letters of credits" (a bank intermediary secures the payment on behalf of the importer confirming that the exporter meets the requirements specified in the contract). We aggregate this information to compute, for each HS4, the share of Turkish trade paid for by letters of credits. Needless to say, Turkey is not Russia. However the two countries share a lot of similarities and we can be confident that French firms that export towards these countries make very comparable decisions regarding their choice of payment contract. Russia and Turkey are both emerging countries, with comparable GDP per capita. More importantly for the choice of the financing terms that support international trade, they are equally distant to France and they have quite comparable levels of development of their financial systems.[36] According to the financial development indicator proposed by Svirydzenka (2016), Russia is ranked 32nd in the world and Turkey is 37th.[37] Furthermore, the use of Turkish data is not only motivated by the lack of data for Russia. It is also a way to obtain indicators that are exogenous to the economic and political situation in Russia.

After matching this source with our trade data, we have information on the use of letters of credit for 723 HS4-level products, all of which are not embargoed by the economic sanctions imposed by the EU or the Russian Federation. For most products, the share of trade using letters of credit is very small. The average is about 7.2% and the median value is only 4.1%. However, this share varies a lot across HS4. The coefficient of variation is 134%. The variance is also substantial within broader categories of products. In Figure 5, we report the average value across chapters of the HS classification (HS2), along with

[33] See e.g. Paravisini et al. (2014), Niepmann and Schmidt-Eisenlohr (2017a) and Niepmann and Schmidt-Eisenlohr (2017b).

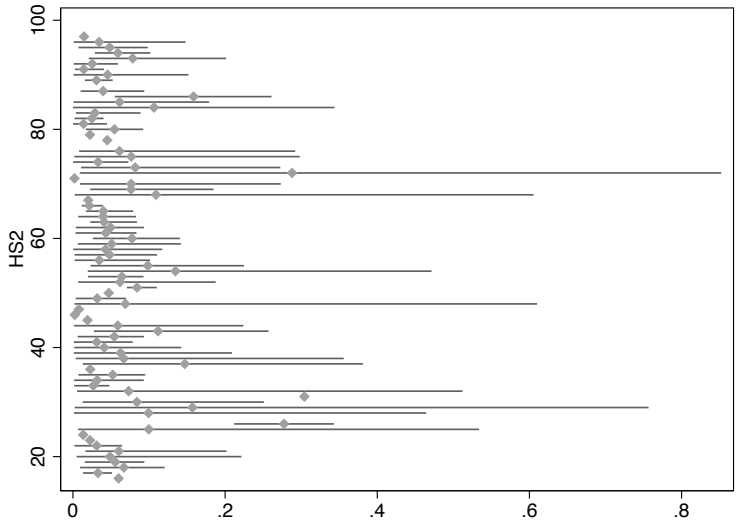
[34] See e.g. Rajan and Zingales (1998) and Manova (2013).

[35] We are deeply indebted to Banu Demir for providing us with these indicators.

[36] The recent literature on trade finance has revealed that these two variables influence greatly the usage of letters of credits

[37] In the ranking proposed by the World Economic Forum (World Economic Forum, 2012), Russia is ranked 39th and Turkey 42th.

Figure 5: Trade finance dependence: Share of trade using letters of credits by HS2 (mean, max and min)



the maximum and minimum levels. There are clearly some categories of products for which it is relatively common to rely on letters of credits. This is mainly the case for raw materials such as minerals, basic chemicals or metals. Within most chapters, however, and in particular in those showing high averages, the variance across HS4 is substantial.

If a part of the impact estimated above is the consequence of a higher perceived country risk and hence more costly trade finance instruments, we expect the drop in exports to be more pronounced for those products that use these intensively. We therefore interact the share of use of letter of credit financing by products with the respective treatment $\times$ period dummies. Results are shown in table 4. The estimates both on product- and firm-level, reported in columns (1) and (2), show that the reaction to the political shocks is higher for product categories where the usage of trade finance instruments is more widespread. Interestingly, in the firm-level regression the point estimate of the interaction term is largest (in absolute value) in period 3, when the Western financial sanctions were implemented.

Existing evidence on the usage of trade finance indicates that the provision of these services involves substantial fixed costs for the trading companies. Consequently, they are mainly used by large firms. Niepmann and Schmidt-Eisenlohr (2017a), for instance, show that the average value of "letter of credit"-financed transactions with the United States is about 18 times larger than those transactions that do not rely on bank intermediation. Therefore, we expect that the impact of dependence on trade finance is magnified for large firms. We test this prediction in columns (3) by interacting our variable of interest with dummies indicating whether the exporters have a size greater than the median value within their HS4. Results clearly confirm that the overreaction of products with higher trade finance

Table 4: Interaction with share of letter of credit financing — Non-embargoed products

Sample	(1) Products	(2) Firms	(3) Firms
$\Gamma \times$ Sep '13 - Nov '13	-0.005	-0.049	
$\times$ LC share	(0.018)	(0.035)	
$\Gamma \times$ Dec '13 - Feb '14	-0.059^{c}	-0.089^{b}	
$\times$ LC share	(0.035)	(0.041)	
$\Gamma \times$ Mar '14 - Jul '14	0.017	-0.092^{b}	
$\times$ LC share	(0.021)	(0.037)	
$\Gamma \times$ Aug '14 - Dec '14	-0.051^{a}	-0.147^{b}	
$\times$ LC share	(0.018)	(0.061)	
$\Gamma \times$ Sep '13 - Nov '13			-0.174
$\times$ LC share $\times$ Small			(0.112)
$\Gamma \times$ Dec '13 - Feb '14			-0.051
$\times$ LC share $\times$ Small			(0.114)
$\Gamma \times$ Mar '14 - Jul '14			-0.106
$\times$ LC share $\times$ Small			(0.130)
$\Gamma \times$ Aug '14 - Dec '14			-0.164
$\times$ LC share $\times$ Small			(0.130)
$\Gamma \times$ Sep '13 - Nov '13			-0.047
$\times$ LC share $\times$ Large			(0.035)
$\Gamma \times$ Dec '13 - Feb '14			-0.090^{b}
$\times$ LC share $\times$ Large			(0.042)
$\Gamma \times$ Mar '14 - Jul '14			-0.091^{b}
$\times$ LC share $\times$ Large			(0.038)
$\Gamma \times$ Aug '14 - Dec '14			-0.147^{b}
$\times$ LC share $\times$ Large			(0.061)
Sample size	101260881	1831356	1831356

Notes: Non-embargoed products only. PPML estimates. Γ is a dummy indicating export flows from sanctioning countries to Russia (in column 1) or export flows to Russia (columns 2-3). Column (1): Coefficients on interaction of Γ and p_0 (Sep '13 - Nov '13), p_1 (Dec '13 - Feb '14), p_2 (Mar '14 - Jul '14) or p_3 (Aug '14 - Dec '14) not reported. Fixed effects are included for origin $\times$ destination $\times$ product $\times$ month, origin $\times$ product $\times$ time and destination $\times$ product $\times$ time. Columns (2-3): Fixed effects are included for firm $\times$ destination $\times$ HS4, firm $\times$ time $\times$ HS4 and destination $\times$ time $\times$ HS4. Robust standard errors in parentheses are clustered by destination $\times$ product. Significance levels: ^{a}: p<0.01; ^{b}: p<0.05; ^{c}: p<0.1.

dependence is stronger for larger firms.

It could also be, however, that rather than securing financing for specific trade transactions, the production of certain products is generally more dependent on external financing (Manova (2012), e.g., finds that credit constraints impact both entry of firms and the volume of exports). In this case, the sanctions targeting Russian banks may have reduced the ability of financially constrained importers to maintain their trade relations. We therefore interact a widely used indicator of financial dependence proposed by Rajan and Zingales (1998) and expanded by Braun (2005) with the treatment $\times$ period dummies separately and in addition to our previous indicator of share of use of letter of credit by product. Columns (1) and (2) of table 5 show that products associated with higher

Table 5: Interaction with measure of financial dependence — Non-embargoed products

Sample	(1) Products	(2) Firms	(3) Products	(4) Firms
$\Gamma \times$ Sep '13 - Nov '13	0.002	0.203^a	0.004	0.213^a
$\times$ Financial dependence	(0.008)	(0.072)	(0.015)	(0.073)
$\Gamma \times$ Dec '13 - Feb '14	-0.021	0.065	-0.021	0.082^c
$\times$ Financial dependence	(0.022)	(0.044)	(0.023)	(0.045)
$\Gamma \times$ Mar '14 - Jul '14	0.048^a	0.107^b	0.045^a	0.128^a
$\times$ Financial dependence	(0.016)	(0.042)	(0.017)	(0.043)
$\Gamma \times$ Aug '14 - Dec '14	0.126^a	0.038	0.122^a	0.070
$\times$ Financial dependence	(0.019)	(0.065)	(0.020)	(0.067)
$\Gamma \times$ Sep '13 - Nov '13			-0.004	-0.060^c
$\times$ LC share			(0.019)	(0.032)
$\Gamma \times$ Dec '13 - Feb '14			-0.057	-0.092^b
$\times$ LC share			(0.036)	(0.041)
$\Gamma \times$ Mar '14 - Jul '14			0.012	-0.100^a
$\times$ LC share			(0.022)	(0.037)
$\Gamma \times$ Aug '14 - Dec '14			-0.043^b	-0.153^b
$\times$ LC share			(0.018)	(0.061)
Sample size	111714955	1895253	99094437	1821759

Notes: Non-embargoed products only. PPML estimates. Γ is a dummy indicating export flows from sanctioning countries to Russia (in column 1 and 3) or export flows to Russia (columns 2 and 4). Columns (1) and (3): Coefficients on interaction of Γ and p_0 (Sep '13 - Nov '13), p_1 (Dec '13 - Feb '14), p_2 (Mar '14 - Jul '14) or p_3 (Aug '14 - Dec '14) not reported. Fixed effects are included for origin $\times$ destination $\times$ product $\times$ month, origin $\times$ product $\times$ time and destination $\times$ product $\times$ time. Columns (2) and (4): Fixed effects are included for firm $\times$ destination $\times$ HS4, firm $\times$ time $\times$ HS4 and destination $\times$ time $\times$ HS4. Robust standard errors in parentheses are clustered by destination $\times$ product. Significance levels: ^{a}: p<0.01; ^{b}: p<0.05; ^{c}: p<0.1.

financial dependence do not exhibit a stronger decrease than other products, in fact they may, surprisingly, fare better than the average. This effect also has little to no impact on the estimated coefficients on the share of letter of credit use by product. Columns (3) and (4) show that the coefficients are virtually unchanged compared to those in table 4.

5 Conclusion

In this paper, we evaluate and quantify the effects of the diplomatic conflict involving sanctions between the European Union and other Western countries on the one side and the Russian Federation on the other side. The strength of pre-conflict trade ties between involved countries and the variety of policy measures employed make this case especially instructive. Aside from these economic characteristics, the episode is of particular political importance as it has remained a hotly debated topic in policy circles and the broader public since its beginning in early 2014.

We contribute to the literature along multiple lines by extending the analysis to the impact on the *sender* countries of the sanctions and providing detailed product and firm-level evidence.

The analysis is conducted from two perspectives: We first gauge the global effects in a traditional trade framework, highlighting the heterogeneous impact on the different countries involved. Using monthly trade data from UN Comtrade and ITC TradeMap, we perform a general equilibrium counterfactual analysis that allows us to put a price tag on the policies put in place. We find that the global *lost trade* — the difference between predicted and observed trade flows — amounts to US$ 4 billion per month, US$ 1.8 billion being borne by sanctioning Western countries. This cost on private actors is unevenly distributed among countries, with European Union member states bearing 92% of the sanctioning countries' impact. Interestingly, the bulk of the lost trade, 87%, is incurred through non-embargoed products, and can hence be considered *friendly fire*.

In order to gain a deeper understanding of the root causes of this observed friendly fire, we then drill deeper using a large dataset of global product-level export flows as well as a rich dataset of monthly French firm-level exports. We investigate the possible channels through which the exports of non-embargoed products are hurt. While a direct identification of a mechanism explaining friendly fire is difficult, we find evidence that country risk — through legal and political uncertainty, and financial sanctions — impeded the provision of trade finance services, causing firms and products relying on financial intermediation to cease or roll back sales in the Russian Federation, a business strategy referred to as "de-risking". The data rejects a plausible alternative mechanisms: a consumer boycott, i.e. a sudden change in preferences, cannot account for the decline in exports.

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A Details on EU and Russian sanctions

A.1 Detailed timeline

The initial EU measures were implemented through *Council Decision 2014/145/CFSP* and *Council Regulation (EU) No 269/2014* on March 17, 2014 and amounted to an "EU-wide asset freeze and travel ban on those undermining the territorial sovereignty or security of Ukraine and those supporting or doing business with them." The list of targeted individuals and entities was first amended with *Council Implementing Decision 2014/151/CFSP* and *Council Implementing Regulation (EU) No 284/2014* on March 21, 2014 to 33 persons and then extensively appended with what was called the second wave of sanctions with *Council Implementing Decision 2014/238/CFSP* and *Council Implementing Regulation (EU) No 433/2014* on April 28, 2014. Until the end of 2015, this list of persons was amended 12 times.[38]

The U.S. sanctions, implemented by *Executive Orders 13660*, *13661* and *13662*, targeted individuals or entities in a way such that "[...] property and interests in property that are in the United States, that hereafter come within the United States, or that are or hereafter come within the possession or control of any United States person (including any foreign branch) of the following persons are blocked and may not be transferred, paid, exported, withdrawn, or otherwise dealt in" while also "suspend[ing] entry into the United States, as immigrants or nonimmigrants, of such persons" (Kleinfeld and Landells, 2014, Executive Order 13662). Such asset freezes and travel bans were extended to a growing list of persons and entities, including major Russian financial institutions with close links to the Kremlin (Baker and McKenzie, 2014).[39]

Other countries allied with the European Union and the United States followed a similar path and introduced comparable measures at around the same time.[40] These lists of individuals and entities were successively appended over the spring and summer of 2014.[41]

The restrictions in the third wave of sanctions were enacted through *Council Decision 2014/512/CFSP* and *Council Regulation (EU) No 833/2014* on July 31, 2014.[42] European exporting firms were still mostly indirectly affected, as only a small number of industries'

[38] See `http://www.consilium.europa.eu/en/press/press-releases/2015/09/pdf/150915-sanctions-table---Persons--and-entities_pdf/` for a list of currently sanctioned people and entities.

[39] See the current *Sectoral Sanctions Identifications List* of the United States Office of Foreign Assets Control here `https://www.treasury.gov/ofac/downloads/ssi/ssi.pdf` and the list of *Specially Designated Nationals* here `https://www.treasury.gov/ofac/downloads/sdnlist.pdf`.

[40] See `https://en.wikipedia.org/wiki/List_of_individuals_sanctioned_during_the_Ukrainian_crisis` for a list of sanctioned individuals by the respective countries.

[41] Compare, e.g., Ashford (2016) and Dreger et al. (2016).

[42] The "third wave" had been in the making–publicly–for sometime then, presumably as a threat, see `http://www.euractiv.com/section/global-europe/news/eu-prepares-more-sanctions-against-russia/`. The US had implemented its measures on 17 July 2014 already and were pushing EU leaders to reciprocate, see `http://www.themoscowtimes.com/business/article/new-sanctions-wave-hits-russian-stocks/503604.html`.

exports were directly targeted: Those firms that export products and technology intended for military and dual use and some equipment for the oil industry.[43]

The U.S. State Department announced a "third wave" of sanctions on July 17, 2014, stating that the US Treasury Department had "imposed sanctions that prohibit U.S. persons from providing new financing to two major Russian financial institutions [...] and two Russian energy firms [...], limiting their access to U.S. capital markets", as well as "eight Russian arms firms, which are responsible for the production of a range of materiel that includes small arms, mortar shells, and tanks."[44] On July 29, 2014, these were broadly expanded, with the State Department announcing that new measures prohibited U.S. persons from "providing new financing to three major Russian financial institutions," while at the same time "suspend[ing] U.S. export credit and development finance to Russia."[45] Further amendments in the same vein were announced on September 9, 2014.[46]

Other Western countries reciprocated the measures taken by the United States and European Union and enacted similar trade sanctions and financial restrictions (Dreger et al., 2016; Dreyer et al., 2015). The Swiss government enacted further legislation that was meant to prevent circumvention of existing sanctions, while maintaining not to impose direct sanctions on the Russian Federation and as such was not affected by Russian counter-sanctions (Reuters, 2014).[47] All measures, from the Western and the Russian side, were extended multiple times and continue to be in place as of July 2017.

A.2 EU sanctions: List of embargoed products

Table 6: HS codes affected by export restrictions to Russia imposed by Westerns countries

Commodity Code	List of products
7304 11 00	Line pipe of a kind used for oil or gas pipelines, seamless, of stainless steel
7304 19 10	Line pipe of a kind used for oil or gas pipelines, seamless, of iron or steel, of an external diameter not exceeding 168,3 mm (excl. products of stainless steel or of cast iron)
7304 19 30	Line pipe of a kind used for oil or gas pipelines, seamless, of iron or steel, of an external diameter exceeding 168,3 mm but not exceeding 406,4 mm (excl. products of stainless steel or of cast iron)

Table 6 – *Continued on next page*

[43] Military use products are defined in the so-called *common military list* as adopted through *Council Common Position 2008/944/CFSP* and dual use goods through *Council Regulation (EC) No 428/2009*. See appendix table 6 for the affected HS 8 codes.

[44] See `https://www.treasury.gov/press-center/press-releases/Pages/jl2572.aspx`. Additionally previous "smart sanctions" in the form of travel bans and asset freezes were extended to more individuals and entities, including the two Ukrainian break-away regions "Luhansk People's Republic" and the "Donetsk People's Republic".

[45] See `https://www.treasury.gov/press-center/press-releases/Pages/jl2590.aspx`.

[46] See `https://www.treasury.gov/press-center/press-releases/Pages/jl2629.aspx`.

[47] See also the Swiss *Verordnung über Massnahmen zur Vermeidung der Umgehung internationaler Sanktionen im Zusammenhang mit der Situation in der Ukraine, AS 2014 877*. As a Schengen member state, all travel bans automatically included travel to Switzerland.

Table 6 – *Continued from previous page*

7304 19 90	Line pipe of a kind used for oil or gas pipelines, seamless, of iron or steel, of an external diameter exceeding 406,4 mm (excl. products of stainless steel or of cast iron)
7304 22 00	Drill pipe, seamless, of stainless steel, of a kind used in drilling for oil or gas
7304 23 00	Drill pipe, seamless, of a kind used in drilling for oil or gas, of iron or steel (excl. products of stain less steel or of cast iron)
7304 29 10	Casing and tubing of a kind used for drilling for oil or gas, seamless, of iron or steel, of an external diameter not exceeding 168,3 mm (excl. products of cast iron)
7304 29 30	Casing and tubing of a kind used for drilling for oil or gas, seamless, of iron or steel, of an external diameter exceeding 168,3 mm, but not exceeding 406,4 mm (excl. products of cast iron)
7304 29 90	Casing and tubing of a kind used for drilling for oil or gas, seamless, of iron or steel, of an external diameter exceeding 406,4 mm (excl. products of cast iron)
7305 11 00	Line pipe of a kind used for oil or gas pipelines, having circular cross-sections and an external diameter of exceeding 406,4 mm, of iron or steel, longitudinally submerged arc welded
7305 12 00	Line pipe of a kind used for oil or gas pipelines, having circular cross-sections and an external diameter of exceeding 406,4 mm, of iron or steel, longitudinally arc welded (excl. products longitudinally submerged arc welded)
7305 19 00	Line pipe of a kind used for oil or gas pipelines, having circular cross-sections and an external diameter of exceeding 406,4 mm, of flat-rolled products of iron or steel (excl. products longitudinally arc welded)
7305 20 00	Casing of a kind used in drilling for oil or gas, having circular cross-sections and an external diameter of exceeding 406,4 mm, of flat-rolled products of iron or steel
7306 11	Line pipe of a kind used for oil or gas pipelines, welded, of flat-rolled products of stainless steel, of an external diameter of not exceeding 406,4 mm
7306 19	Line pipe of a kind used for oil or gas pipelines, welded, of flat-rolled products of iron or steel, of an external diameter of not exceeding 406,4 mm (excl. products of stainless steel or of cast iron)
7306 21 00	Casing and tubing of a kind used in drilling for oil or gas, welded, of flat-rolled products of stain less steel, of an external diameter of not exceeding 406,4 mm
7306 29 00	Casing and tubing of a kind used in drilling for oil or gas, welded, of flat-rolled products of iron or steel, of an external diameter of not exceeding 406,4 mm (excl. products of stainless steel or of cast iron)
8207 13 00	Rock-drilling or earth-boring tools, interchangeable, with working parts of sintered metal carbides or cermets
8207 19 10	Rock-drilling or earth-boring tools, interchangeable, with working parts of diamond or agglomerated diamond
8413 50	Reciprocating positive displacement pumps for liquids, power-driven (excl. those of subheading 8413 11 and 8413 19, fuel, lubricating or cooling medium pumps for internal combustion piston engine and concrete pumps)
8413 60	Rotary positive displacement pumps for liquids, power-driven (excl. those of subheading 8413 11 and 8413 19 and fuel, lubricating or cooling medium pumps for internal combustion piston engine)
8413 82 00	Liquid elevators (excl. pumps)
8413 92 00	Parts of liquid elevators, n.e.s.

Table 6 – *Continued on next page*

Table 6 – *Continued from previous page*

8430 49 00	Boring or sinking machinery for boring earth or extracting minerals or ores, not self-propelled and not hydraulic (excl. tunnelling machinery and hand-operated tools)
ex 8431 39 00	Parts of machinery of heading 8428, n.e.s.
ex 8431 43 00	parts for boring or sinking machinery of subheading 8430 41 or 8430 49, n.e.s.
ex 8431 49	Parts of machinery of heading 8426, 8429 and 8430, n.e.s.
8705 20 00	Mobile drilling derricks
8905 20 00	Floating or submersible drilling or production platforms
8905 90 10	Sea-going light vessels, fire-floats, floating cranes and other vessels, the navigability of which is subsidiary to their main function (excl. dredgers, floating or submersible drilling or production platforms; fishing vessels and warships)

A.3 Russian sanctions: List of embargoed products

Table 7: HS codes banned by the Russian Federation embargo

Code	Simplified description	Code	Simplified description
0201	Meat of bovine animals, fresh or chilled	0202	Meat of bovine animals, frozen
0203	Meat of swine, fresh, chilled or frozen	0207	Meat and edible offal, fresh, chilled or frozen
0210*	Meat and edible offal, salted, in brine, dried or smoked	0301*	Live fish
0302	Fish, fresh or chilled	0303	Fish, frozen
0304	Fish fillets and other fish meat, etc	0305	Fish, dried, salted, smoked or in brine
0306	Crustaceans, etc.	0307	Molluscs, etc.
0308	Other aquatic invertebrates	0401*	Milk and cream
0402*	Milk and cream, concentrated or containing sweetening matter	0403*	Buttermilk, yogurt and other fermented milk and cream
0404*	Whey ; products consisting of natural milk constituents	0405*	Butter and fats derived from milk; dairy spreads
0406*	Cheese and curd	0701*	Potatoes, fresh or chilled
0702	Tomatoes, fresh or chilled	0703*	Onions, leeks and other alliaceous vegetables, fresh or chilled
0704	Cabbages and similar edible brassicas, fresh or chilled	0705	Lettuce and chicory , fresh or chilled
0706	Carrots and similar edible roots, fresh or chilled	0707	Cucumbers and gherkins, fresh or chilled
0708	Leguminous vegetables, fresh or chilled	0709	Other vegetables, fresh or chilled
0710	Vegetables, frozen	0711	Vegetables provisionally preserved
0712*	Dried vegetables, whole, cut, sliced, broken or in powder	0713*	Dried leguminous vegetables, shelled
0714	Manioc, arrowroot and similar roots	0801	Coconuts, Brazisl nuts and cashew nuts
0802	Other nuts, fresh or dried	0803	Bananas, including plantains, fresh or dried
0804	Dates, figs, pineapples, avocados, guavas, mangoes	0805	Citrus fruit, fresh or dried
0806	Grapes, fresh or dried	0807	Melons (including watermelons) and papaws (papayas), fresh
0808	Apples, pears and quinces, fresh	0809	Apricots, cherries, peaches, plums and sloes, fresh
0810	Other fruit, fresh	0811	Fruit and nuts, frozen
0813	Fruit and nuts, provisionally preserved	1601	Sausages and similar products, of meat, meat offal or blood
1901*	Malt extract; food preparations of flour, groats, meal, starch or malt extract, etc.	2106*	Food preparations not elsewhere specified or included

B Country-level Data

Table 8: Descriptive statistics for exports to Russia in 2012

Country	Sanctions	Mean exports	SD exports	Share of emb. exports	Share of exports to Russia	Share of emb. exports to Russia
Argentina	FALSE	85936844.44	197924523.56	0.08	0.01	0.47
Australia	TRUE	205707651.90	494726706.29	0.06	0.00	0.43
Austria	TRUE	220764492.46	557218071.68	0.03	0.04	0.02
Belgium	TRUE	617637152.89	1316207812.62	0.04	0.02	0.05
Bulgaria	TRUE	31939457.69	55577654.42	0.02	0.03	0.02
Belarus	FALSE	64413678.69	207544443.25	0.08	0.37	0.20
Brazil	FALSE	234022075.64	400358142.02	0.06	0.02	0.51
Canada	TRUE	623423426.84	3596935498.37	0.03	0.00	0.34
Switzerland	FALSE	304466773.18	605830039.27	0.01	0.02	0.03
Chile	FALSE	80309298.54	158724013.16	0.16	0.01	0.74
Cyprus	TRUE	1812282.86	4964067.33	0.17	0.02	0.53
Czech Republic	TRUE	230067416.74	580859985.37	0.01	0.04	0.00
Germany	TRUE	1797757171.46	2395402034.14	0.02	0.04	0.02
Denmark	TRUE	134782890.19	258790895.56	0.12	0.02	0.19
Algeria	FALSE	181442939.77	281827423.79	0.00	0.00	0.97
Egypt	FALSE	27333880.56	49966805.49	0.05	0.01	0.76
Spain	TRUE	362108402.99	688523013.01	0.09	0.02	0.16
Estonia	TRUE	21400343.19	43996414.14	0.03	0.14	0.04
Finland	TRUE	90274628.90	140606107.32	0.01	0.12	0.05
France	TRUE	719828711.96	1269325175.19	0.04	0.02	0.03
United Kingdom	TRUE	562873529.56	948700405.10	0.02	0.02	0.01
Greece	TRUE	35408947.64	60060038.86	0.10	0.02	0.29
Hong Kong	FALSE	267318172.27	552285734.77	0.00	0.01	0.01
Hungary	TRUE	134769157.04	290265649.69	0.02	0.04	0.02
India	FALSE	265377176.61	468848332.57	0.03	0.01	0.03
Ireland	TRUE	167607783.06	391717896.69	0.06	0.01	0.13
Israel	FALSE	84691965.41	214869220.08	0.02	0.02	0.23
Italy	TRUE	653521902.30	1030007953.49	0.03	0.03	0.02
Japan	TRUE	783779172.96	1742077240.97	0.00	0.02	0.00
Lithuania	TRUE	42252718.62	84478097.32	0.08	0.21	0.21
Luxembourg	TRUE	27667347.86	65477511.40	0.03	0.01	0.02
Latvia	TRUE	17212301.84	33097346.94	0.05	0.13	0.03
Mexico	FALSE	530570389.84	3213093116.40	0.03	0.00	0.23
Malta	TRUE	4515775.09	9635479.58	0.04	0.02	0.00
Malaysia	FALSE	264526826.04	536756014.55	0.01	0.00	0.01
Netherlands	TRUE	728404996.38	1625683062.31	0.05	0.02	0.05
Norway	TRUE	237596744.02	580380158.33	0.05	0.01	0.70
New Zealand	TRUE	38658455.77	98748116.65	0.33	0.01	0.72
Peru	FALSE	54107656.23	110929621.26	0.06	0.00	0.66
Philippines	FALSE	66173955.01	164194209.35	0.03	0.00	0.19
Poland	TRUE	264345582.72	546322353.76	0.05	0.06	0.09
Portugal	TRUE	73857553.20	185021337.50	0.04	0.00	0.03
Romania	TRUE	76829394.34	148349731.86	0.01	0.03	0.00
Russian Federation	FALSE	1137025212.19	1965612051.97	0.00		
Singapore	FALSE	541328587.51	1138393953.36	0.01	0.00	0.01
Slovakia	TRUE	119105277.97	253360661.49	0.01	0.04	0.00
Slovenia	TRUE	34178206.68	76910359.20	0.01	0.05	0.02
Sweden	TRUE	227719042.18	348826924.42	0.03	0.02	0.00
Thailand	FALSE	250066747.56	436249497.74	0.03	0.01	0.04
Turkey	FALSE	140334455.76	208323719.86	0.05	0.07	0.14
Ukraine	TRUE	78363287.03	210179801.50	0.02	0.35	0.04
United States	TRUE	1719068879.73	3883586752.98	0.03	0.01	0.12
South Africa	FALSE	74507956.47	127316187.76	0.05	0.01	0.31
Indonesia	FALSE	214679843.24	437697384.15	0.02	0.01	0.08

C General equilibrium effects

We estimate equation (1) *without* "treated observations," i.e. those directly affected by the sanctions, allowing us to predict partial equilibrium trade flows without imposing a homogeneous impact on certain groups of countries or time periods. This effectively permits the elasticity to vary by country and time, equivalent to (but computationally less intensive than) setting β_{odt}. The setup of the general equilibrium exercise below demands a balanced panel, which restricts the number of countries to 53. We estimate the fixed effects using a PPML estimator following Santos Silva and Tenreyro (2006). Aside from the usual benefits, the PPML estimator is particularly relevant in the present case in order to account for the "adding-up problem" of the OLS estimator as described by Fally (2015).[48] Furthermore, owing to the structure of bilateral fixed effects varying at the calendar month level, we can slice up the panel along the calendar month dimension and estimate each separately. The estimated bilateral fixed effect $\hat{\phi}_{odm}$ captures bilateral monthly trade costs for "normal times," as the period and country pairs that are directly affected by sanctions are excluded. The importer and exporter fixed effects $\hat{\Psi}_{ot}$ and $\hat{\Theta}_{dt}$ are capturing everything country-specific at the respective time. This means that those fixed effects for the time during the sanctions period are also capturing sanctions-induced changes in multilateral resistance terms, production and expenditure figures.[49] Using these estimated fixed effects then, the predicted *partial equilibrium* flows can be constructed simply as

$$\hat{X}_{odt} = \exp\left(\hat{\Psi}_{ot} + \hat{\Theta}_{dt} + \hat{\phi}_{odm}\right).$$

Crucial for the *general equilibrium* analysis to follow, partial equilibrium (pseudo-) production and (pseudo-) expenditure figures can be backed out of the estimated fixed effects as[50]

$$\begin{aligned} \hat{Y}_{ot}^{\text{PE}} &= \sum_{l \in d} \exp\left(\hat{\Psi}_{ot} + \hat{\Theta}_{lt} + \hat{\phi}_{olm}\right) \quad \text{and analogously} \\ \hat{X}_{dt}^{\text{PE}} &= \sum_{l \in o} \exp\left(\hat{\Psi}_{lt} + \hat{\Theta}_{dt} + \hat{\phi}_{ldm}\right), \end{aligned} \tag{6}$$

[48] The property of the PPML estimator described by Fally (2015) posits that estimated production and expenditure figures, i.e. the sum of exports and imports, respectively, remain equal to observed figures with the PPML estimator. This stands in contrast to the OLS estimator that does not produce matching figures, hence yielding an "adding-up" problem.

[49] The estimated fixed effects are relative to one reference country and one bilateral country-pair-calendar month, for which either $\hat{\Psi}_{ot}$ or $\hat{\Theta}_{dt}$ is zero at all dates and one $\hat{\phi}_{odm} = 0$. The choice of these references has no impact on the results, however they have to remain the same in all following estimations and computations.

[50] We refer to the figures as pseudo-figures, as they are only proportional to the production and expenditures for countries present in the data. This departure from Anderson et al. (2015), who convert them into actual production figures with additional data, however, does not impact the results as all later general equilibrium adjustments to the figures enter in multiplicative form.

where *PE* denotes partial equilibrium, while inward and outward multilateral resistance terms can be constructed as

$$\hat{\Omega}_{ot}^{\text{PE}} = \sum_{l \in d} \exp\left(\hat{\Theta}_{lt} + \hat{\phi}_{olm}\right) \quad \text{and}$$
$$\hat{\Phi}_{dt}^{\text{PE}} = \sum_{l \in o} \exp\left(\hat{\Psi}_{lt} + \hat{\phi}_{ldm}\right). \tag{7}$$

As noted by Anderson and Yotov (2010), $\Omega \cdot \lambda$ and $\Phi \cdot \lambda^{-1}$ are unique for any λ, given a set of production figures Y, expenditure figures X and trade costs ϕ. The conditional general equilibrium impact, the change in trade flows due to the sanctions-induced change in multilateral resistance terms, can therefore be determined by recomputing the multilateral resistance terms accordingly. This is easily done via a contraction mapping algorithm, i.e. iteratively solving the following system of matrix equations:

$$\hat{\Omega}_t = \hat{\phi}_m \left(\hat{X}_t \otimes \hat{\Phi}_t^{-1}\right)$$
$$\hat{\Phi}_t = \hat{\phi}_m^{\text{T}} \left(\hat{Y}_t \otimes \hat{\Omega}_t^{-1}\right), \tag{8}$$

where $\hat{\Omega}_t$ and $\hat{\Phi}_t$ are vectors of outward and inward multilateral resistances[51] at time t and $\hat{\phi}_m$ the trade cost matrix for calendar month m.[52] The conditional general equilibrium counterfactual trade flows can then be computed as

$$\hat{X}_{odt}^{\text{CE}} = \frac{\hat{Y}_{ot}^{\text{PE}}}{\hat{\Omega}_{ot}^{\text{CE}}} \cdot \frac{\hat{X}_{dt}^{\text{PE}}}{\hat{\Phi}_{dt}^{\text{CE}}} \cdot \hat{\phi}_{odm}, \tag{9}$$

where *CE* denotes conditional general equilibrium figures. This *conditional* general equilibrium effect, however, still omits changes in the production and expenditures of exporters and importers due to the sanctions. In order to obtain the *full* general equilibrium impact, Anderson et al. (2015) propose an adjustment of *factory-gate prices* to production and expenditures, such that[53]

$$\hat{Y}_{ot}^{\text{GE}} = \hat{Y}_{ot}^{\text{PE}} \cdot \left(\frac{\hat{\Psi}_{ot}^{\text{GE}}}{\hat{\Psi}_{ot}}\right)^{\frac{1}{1-\sigma}} \quad \text{and} \quad \hat{X}_{dt}^{\text{GE}} = \hat{X}_{dt}^{\text{PE}} \cdot \left(\frac{\hat{\Psi}_{dt}^{\text{GE}}}{\hat{\Psi}_{dt}}\right)^{\frac{1}{1-\sigma}}, \tag{10}$$

where σ is the elasticity of substitution and $\hat{Y}_{ot}^{\text{PE}}$ and $\hat{X}_{dt}^{\text{PE}}$ and production and expenditure figures constructed using equation (6) and estimated fixed effects from the initial partial equilibrium estimation. We take the value of $\sigma = 5$ from Head and Mayer (2014), who conduct a meta analysis of estimates of the elasticity of substitution and find 5 to be

[51] $\hat{\Phi}_t^{-1}$ and $\hat{\Omega}_t^{-1}$ are vectors of elementwise inverses of $\hat{\Omega}_t$ and $\hat{\Phi}_t$, and $\otimes$ denotes the elementwise product.

[52] Alternatively, Anderson et al. (2015) show that the PPML estimator can be used to compute correct multilateral resistance terms with observed trade flows and counterfactual trade costs. Iteratively estimating a gravity setup with counterfactual flows incorporating updated production and expenditure figures yields the same results as the present methodology. Computationally, however, solving iteratively the system of matrices is far less demanding than a PPML gravity estimation with a full set of fixed effects.

[53] The term "factory-gate price" should be understood as an aggregate, country-wide measure, as it implicitly incorporates not only effects on the firm-level exports, but also the individual propensity to export.

the median estimate. $\hat{\Psi}_{ot}$ and $\hat{\Psi}_{dt}$ are the exporter fixed effects from the same initial partial equilibrium estimation, while $\hat{\Psi}_{ot}^{\text{GE}}$ and $\hat{\Psi}_{dt}^{\text{GE}}$ are constructed pseudo exporter fixed effects using current (initially partial) pseudo production figures and outward multilateral resistances incorporating the respective conditional general equilibrium effect. Iteratively determining these general equilibrium counterfactual production and expenditure figures with the corresponding multilateral resistance terms, equation (9) yields the counterfactual flows between all countries.

D Quantification of lost trade

Table 9: Losses of total trade by period and country

	Total		Conflict		Smart sanctions		Economic sanctions	
Country	*absolute*	*relative*	*absolute*	*relative*	*absolute*	*relative*	*absolute*	*relative*
Australia	-10.48	-40.97	7.46	31.95	-8.06	-25.40	-13.31	-55.35
Austria	-13.36	-3.83	190.36	87.58	-10.03	-2.19	-38.31	-11.55
Belgium	-80.39	-17.95	-64.20	-11.96	-88.97	-15.51	-79.77	-19.93
Bulgaria	-3.11	-6.16	4.28	8.83	-1.03	-1.69	-4.60	-9.63
Canada	-25.99	-28.08	-2.52	-2.33	9.47	8.19	-39.18	-46.67
Cyprus	-1.06	-37.00	-3.00	-57.07	-0.23	-8.99	-1.07	-40.15
Czech Republic	-70.47	-16.27	-0.53	-0.11	-20.97	-4.13	-93.25	-23.01
Germany	-667.69	-20.03	-425.03	-11.72	-421.33	-10.32	-768.70	-24.97
Denmark	-26.42	-22.47	-16.48	-11.94	-13.50	-8.99	-31.39	-29.72
Spain	-46.28	-17.45	-30.14	-9.58	2.34	0.73	-62.47	-25.65
Estonia	28.69	21.78	89.54	78.25	58.23	36.95	12.84	10.18
Finland	-77.57	-16.37	-14.99	-3.08	-25.94	-4.53	-100.12	-22.61
France	-117.16	-16.74	12.27	1.45	-145.83	-15.68	-123.96	-20.14
United Kingdom	-153.72	-25.90	-117.68	-17.54	-93.42	-13.38	-175.69	-31.74
Georgia	9.79	120.79	18.36	534.88	15.95	244.36	6.97	76.43
Greece	-7.55	-20.34	-7.01	-20.74	-5.56	-10.58	-8.20	-24.86
Croatia	-5.54	-18.61	0.21	0.78	-3.51	-12.09	-6.81	-22.46
Hungary	-42.91	-18.60	-20.33	-7.46	-44.78	-16.01	-45.01	-21.30
Ireland	0.09	0.16	11.22	18.88	44.12	68.43	-14.17	-26.10
Italy	-52.22	-5.78	66.83	7.15	20.47	1.80	-87.60	-10.53
Japan	-86.88	-12.60	-16.56	-1.80	6.69	0.78	-122.68	-20.05
Lithuania	23.27	5.77	91.27	24.91	113.33	22.80	-11.22	-2.95
Luxembourg	-1.47	-11.75	-7.08	-32.67	0.14	1.02	-1.28	-11.61
Latvia	-3.51	-3.42	12.12	13.50	-1.32	-1.15	-5.99	-5.95
Malta	-2.14	-86.65	-0.43	-86.78	-2.29	-91.44	-2.30	-85.34
Montenegro	-0.14	-28.09	0.31	107.71	-0.01	-2.38	-0.22	-44.27
Netherlands	-107.63	-15.81	-168.86	-20.40	-67.93	-8.22	-112.10	-18.06
Norway	-30.55	-38.93	-12.33	-11.05	3.87	4.00	-42.82	-61.87
Poland	-151.18	-19.36	-76.97	-9.19	-68.66	-7.61	-184.18	-24.93
Portugal	-1.17	-5.93	1.74	7.19	1.44	5.98	-2.29	-12.69
Romania	11.78	10.20	32.61	26.42	40.02	28.89	1.03	0.96
Russian Federation	-2227.71	-10.10	557.11	2.53	479.57	1.79	-3351.60	-16.20
Slovakia	-38.15	-17.26	-17.28	-6.89	23.19	9.43	-58.65	-27.91
Slovenia	4.32	4.89	9.11	10.03	8.05	7.29	2.65	3.26
Sweden	-13.60	-6.31	44.56	21.91	7.21	2.69	-26.56	-13.19
United States of America	-5.14	-0.69	114.90	14.46	165.09	19.96	-69.33	-9.62
cumulative	-3993.25	-11.57	262.85	0.74	-24.21	-0.06	-5661.33	-17.58

Note: Losses are per month. Absolute losses are in millions of USD. Relative losses are in percent. "Total" is the average monthly loss since December 2013; "Conflict" losses are the average monthly losses incurred during the time of conflict before the imposition of financial sanctions in mid-March 2014; "Smart sanctions" are the monthly losses during the time of conflict and financial sanctions before the imposition of economic sanctions in late July/early August 2014; "Economic sanctions" are average monthly losses incurred since the imposition of trade and banking restrictions.

Table 10: Losses of embargoed products trade by period and country

	Total		Conflict		Smart sanctions		Economic sanctions	
Country	*absolute*	*relative*	*absolute*	*relative*	*absolute*	*relative*	*absolute*	*relative*
Australia	-8.78	-73.87	8.32	73.40	-10.50	-60.55	-10.28	-99.44
Austria	-1.25	-21.39	4.85	114.05	-1.53	-14.19	-1.88	-41.23
Belgium	-8.61	-48.52	1.13	3.55	-3.99	-13.58	-11.11	-87.75
Bulgaria	-0.32	-40.74	-0.01	-1.62	-0.50	-27.85	-0.31	-60.85
Canada	-6.45	-30.49	14.67	48.95	20.05	65.24	-16.73	-96.74
Cyprus	-0.51	-59.73	-2.80	-61.87	0.00	0.14	-0.39	-99.58
Czech Republic	0.13	17.70	0.75	61.84	1.06	89.55	-0.22	-38.97
Germany	-22.87	-49.47	-29.84	-37.11	-37.73	-50.95	-17.68	-51.96
Denmark	-4.56	-25.46	3.80	12.92	-3.30	-12.16	-5.91	-42.71
Spain	-18.09	-65.76	-26.08	-45.97	-14.13	-31.29	-18.32	-97.01
Estonia	-1.55	-32.63	1.60	24.28	-1.46	-17.61	-1.95	-55.67
Finland	-8.31	-42.94	2.56	7.73	7.19	26.21	-14.14	-92.11
France	-5.67	-35.96	-0.75	-2.79	-1.23	-4.94	-7.55	-64.30
United Kingdom	-0.88	-20.53	1.16	13.21	0.72	10.36	-1.59	-53.07
Georgia	1.46	436.62	0.85	4171.81	0.20	168.62	1.90	437.84
Greece	-4.74	-52.10	-4.92	-40.19	-1.91	-9.92	-5.55	-96.77
Croatia	-0.22	-40.71	0.04	16.36	0.22	79.10	-0.38	-57.90
Hungary	-2.36	-53.55	0.65	13.59	-2.69	-36.04	-2.61	-75.62
Ireland	-1.04	-15.23	5.94	66.58	-1.13	-9.37	-1.83	-36.45
Italy	-4.91	-45.16	-0.23	-1.36	-0.38	-2.37	-6.79	-79.35
Japan	0.48	98.70	0.80	225.93	-0.19	-24.97	0.64	154.10
Lithuania	-35.72	-48.34	-25.14	-20.06	-15.11	-12.37	-43.03	-80.22
Luxembourg	0.06	18.41	-0.22	-37.85	0.09	15.96	0.08	36.59
Latvia	1.07	45.14	7.49	263.35	5.18	152.53	-0.89	-43.79
Montenegro	0.02	506.82	0.00				0.03	506.82
Netherlands	-5.33	-15.74	8.32	18.16	8.31	16.37	-10.94	-39.85
Norway	-35.01	-59.99	-22.38	-21.80	-12.44	-14.30	-43.13	-96.43
Poland	-29.13	-50.38	4.12	4.45	-15.92	-16.10	-36.93	-88.60
Portugal	-0.35	-48.61	0.57	80.99	0.31	34.96	-0.65	-97.93
Romania	-0.01	-7.59	0.05	584.67	-0.04	-12.58	-0.01	-9.89
Russian Federation	0.52	1.02	0.35	1.31	0.79	1.77	0.46	0.83
Slovakia	-0.17	-48.62	-0.01	-1.92	-0.07	-13.24	-0.21	-85.19
Slovenia	0.14	9.74	-0.43	-19.69	-0.68	-27.88	0.45	41.18
Sweden	-0.49	-50.28	0.42	43.69	-0.20	-12.64	-0.69	-85.93
United States of America	-21.42	-47.68	-22.57	-33.55	-5.70	-7.76	-25.90	-76.42
cumulative	-224.84	-40.63	-66.94	-8.00	-86.73	-10.22	-284.04	-65.59

Note: Losses are per month. Absolute losses are in millions of USD. Relative losses are in percent. "Total" is the average monthly loss since December 2013; "Conflict" losses are the average monthly losses incurred during the time of conflict before the imposition of financial sanctions in mid-March 2014; "Smart sanctions" are the monthly losses during the time of conflict and financial sanctions before the imposition of economic sanctions in late July/early August 2014; "Economic sanctions" are average monthly losses incurred since the imposition of trade and banking restrictions.

Table 11: Losses of non-embargoed products trade by period and country

	Total		Conflict		Smart sanctions		Economic sanctions	
Country	*absolute*	*relative*	*absolute*	*relative*	*absolute*	*relative*	*absolute*	*relative*
Australia	-1.71	-12.46	-0.86	-7.19	2.44	16.95	-3.03	-22.09
Austria	-12.11	-3.53	185.51	87.05	-8.50	-1.90	-36.43	-11.13
Belgium	-71.78	-16.69	-65.33	-12.94	-84.98	-15.61	-68.66	-17.72
Bulgaria	-2.79	-5.61	4.29	9.00	-0.54	-0.90	-4.29	-9.07
Canada	-19.54	-27.36	-17.19	-22.01	-10.58	-12.46	-22.45	-33.68
Cyprus	-0.55	-27.43	-0.20	-27.64	-0.23	-14.38	-0.69	-30.10
Czech Republic	-70.60	-16.33	-1.28	-0.27	-22.03	-4.35	-93.04	-22.99
Germany	-644.82	-19.61	-395.19	-11.14	-383.61	-9.57	-751.02	-24.67
Denmark	-21.86	-21.93	-20.28	-18.66	-10.19	-8.30	-25.48	-27.76
Spain	-28.18	-11.86	-4.05	-1.57	16.47	6.02	-44.16	-19.66
Estonia	30.24	23.82	87.94	81.55	59.69	39.99	14.79	12.06
Finland	-69.27	-15.24	-17.55	-3.86	-33.13	-6.07	-85.98	-20.11
France	-111.50	-16.29	13.03	1.59	-144.61	-15.98	-116.41	-19.28
United Kingdom	-152.83	-25.94	-118.83	-17.95	-94.14	-13.62	-174.10	-31.62
Georgia	8.33	107.24	17.51	513.29	15.75	245.77	5.07	58.41
Greece	-2.81	-10.02	-2.09	-9.70	-3.65	-10.97	-2.65	-9.71
Croatia	-5.32	-18.20	0.17	0.65	-3.73	-12.98	-6.43	-21.67
Hungary	-40.55	-17.92	-20.98	-7.84	-42.09	-15.47	-42.40	-20.40
Ireland	1.13	2.26	5.28	10.45	45.25	86.38	-12.34	-25.05
Italy	-47.31	-5.30	67.06	7.31	20.85	1.86	-80.82	-9.81
Japan	-87.36	-12.68	-17.36	-1.89	6.88	0.80	-123.31	-20.16
Lithuania	58.99	17.91	116.41	48.27	128.45	34.27	31.80	9.75
Luxembourg	-1.53	-12.57	-6.86	-32.53	0.05	0.38	-1.36	-12.65
Latvia	-4.58	-4.57	4.63	5.32	-6.50	-5.83	-5.10	-5.18
Malta	-2.14	-86.65	-0.43	-86.78	-2.29	-91.44	-2.30	-85.34
Montenegro	-0.15	-30.83	0.31	107.71	-0.01	-2.38	-0.24	-48.06
Netherlands	-102.30	-15.81	-177.18	-22.66	-76.24	-9.83	-101.15	-17.05
Norway	4.45	22.13	10.05	112.26	16.32	167.21	0.31	1.25
Poland	-122.04	-16.88	-81.09	-10.88	-52.74	-6.57	-147.24	-21.13
Portugal	-0.83	-4.32	1.17	4.97	1.13	4.86	-1.64	-9.43
Romania	11.79	10.21	32.56	26.38	40.06	29.00	1.04	0.96
Russian Federation	-2228.23	-10.13	556.76	2.53	478.78	1.79	-3352.06	-16.24
Slovakia	-37.98	-17.21	-17.27	-6.90	23.27	9.48	-58.43	-27.84
Slovenia	4.17	4.81	9.54	10.77	8.73	8.08	2.20	2.74
Sweden	-13.11	-6.11	44.14	21.80	7.41	2.78	-25.87	-12.90
United States of America	16.28	2.31	137.47	18.90	170.79	22.66	-43.43	-6.32
cumulative	-3768.40	-11.10	329.80	0.95	62.52	0.15	-5377.28	-16.93

Note: Losses are per month. Absolute losses are in millions of USD. Relative losses are in percent. "Total" is the average monthly loss since December 2013; "Conflict" losses are the average monthly losses incurred during the time of conflict before the imposition of financial sanctions in mid-March 2014; "Smart sanctions" are the monthly losses during the time of conflict and financial sanctions before the imposition of economic sanctions in late July/early August 2014; "Economic sanctions" are average monthly losses incurred since the imposition of trade and banking restrictions.