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Friendly Fire: The Trade Impact of the Russia Sanctions and Counter-Sanctions

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ABSTRACT

FRIENDLY FIRE: THE TRADE IMPACT OF THE RUSSIA SANCTIONS AND COUNTER-SANCTIONS*

Matthieu Crozet and Julian Hinz

Economic sanctions are a frequent instrument of foreign policy. In a diplomatic conflict, they aim to elicit a change in the policies of foreign governments by damaging their economy. However, sanctions are not costless for the sending economy, where domestic firms involved in business with the target countries might incur economic damages. This paper evaluates these costs in terms of export losses of the diplomatic crisis that started in 2014 between the Russian Federation and 37 countries, (including the United States, the EU, and Japan) over the Ukrainian conflict for the implicated countries. We first gauge the impact of the sanctions' regime using a structural gravity framework and quantify the trade losses in a general equilibrium counterfactual analysis. We estimate this loss at US$114 billion from 2014 until the end of 2015, with US$ 44 billion being borne by sanctioning Western countries. Interestingly, we find that the bulk of the impact stems from products that are not directly targeted by Russian retaliations (taking the form of an embargo on imports of agricultural products). This result suggests that most of the losses are not attributable to the Russian retaliation but to Western sanctions. We then investigate the underlying mechanism at the firm level using French customs data. Results indicate that neither consumer boycotts nor perceived country risk can account for the decline in exports of products that are not targeted by the Russian embargo. Instead, the disruption of the provision of trade finance services is found to have played an important role.

Keywords: Sanctions, trade, foreign policy, Boycott, Embargo, Trade finance
JEL classification: F51, F14, F13, F52

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1 Introduction

"Smart sanctions," the 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, these sanctions are used when diplomacy fails, while military options appear too drastic. However, sanctions also affect the sender country: For domestic exporters and importers the cross-border transfers of goods and money are made more costly.

The aim of this paper is to assess the consequence on international trade of the diplomatic conflict beginning in 2014 between 37 Western countries (including all EU countries, the United States and Japan) and the Russian Federation over the political and military crisis in the 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, these 37 countries levied sanctions on the Russian Federation starting in March of 2014. The measures were intensified in July 2014. Russia then retaliated by imposing an embargo on certain food and agricultural products. The strength of the pre-sanction economic ties—in 2012 Russia accounted for about 2.3% of all sanctioning countries' exports and 63.8% of Russian exports were destined for sanctioning countries—makes this episode unprecedented and particularly instructive. These aggregate numbers, however, mask the important heterogeneity in the bilateral importance of trade relations, as 19.9% of Lithuanian exports went to Russia, but only 0.7% were from the United States.

We conduct the analysis from two perspectives. We first gauge the global effects in a gravity setup, highlighting the heterogeneous impact on the different countries involved. Using monthly trade data from 78 countries, we estimate the average impact of the sanctions regime and then perform a general equilibrium counterfactual exercise that allows us to estimate precisely for each country the loss of exports to and from Russia resulting from the military conflict in the Ukraine, the Western sanctions, and the Russian retaliation. In order to gain a deeper understanding of the root causes of the impact for sanctioning countries, we then study how firms reacted to the sanctions using a rich dataset of monthly French firm-level exports. We estimate the effects on the intensive and extensive margins and examine possible channels through which firms' exports are affected. Finally, we analyze whether firms were able to partially recover their incurred losses by diverting their sales to alternate destinations.

The use of sanctions as a foreign policy tool has attracted substantial literature in both political science and economics. The bulk of the existent work 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. Drezner (1999), van Bergeijk (2009) and Hufbauer et al. (2009) provide instructive overviews over the state of research in this respect.[1] For empirical analyses, Hufbauer et al. (2009) also provide a thorough record of sanctions cases, with an emphasis on American- and European-imposed sanctions. The TIES database by Morgan et al. (2009) provides a second and very detailed source for sanctions encompassing more sender and target countries. Both datasets provide quantitative measures on the scope and intensity of applied measures, and attempt to judge their success or failure with respect to their political aims.[2] Caruso (2003) estimates the average effects of sanctions in the second half of the 20th century in a simple *naive* gravity setup on aggregate trade flows.

A 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%. Others look at the economic impact on the *target* economy. Related to our work, Dreger et al. (2015) also evaluate the economic impact of the sanction regime between Western countries and the Russian Federation. While we focus on the impact on trade flows, they estimate the consequences of the sanctions on the Russian macroeconomic performances. Dizaji and van Bergeijk (2013) study the macroeconomic and political impacts on Iran while aiming to quantify the effectiveness of the sanctions' regime. Also looking at the case of the Western-imposed sanctions on Iran, Haidar (2014) studies the impact of sanctions using firm-level data and employing an approach similar to ours.

Our paper is also related to the literature studying the link between conflict and trade. Martin et al. (2008a) and Martin et al. (2008b) analyze the prevalence and severity of interstate and civil wars through the lens of trade economists. They show that multilateral trade openness increases the probability of escalation with another country, while direct bilateral trade deters it. Similarly, small-scale civil wars are shown to be fueled by trade openness while it decreases the probability of large-scale strife. Glick and Taylor (2010) show the disruptive effects of war on international trade and economic activity in general. Their approach—comparable to ours—relies on a gravity setup and they quantify the losses by accounting for changes in bilateral and multilateral resistances.[3] Another strand of the

[1] See also Rosenberg et al. (2016) and Drezner (2011) for analyses of *smart sanctions*, the use of targeted travel bans and asset freezes against individuals, which were also used by Western countries in the beginning of the diplomatic conflict with Russia.

[2] We refrain from following their lead and *do not* make a statement on whether the sanctions achieve their intended political aims, we leave this feat to political scientists and pundits.

[3] Head and Mayer (2014) remark that this does not in fact constitute the general equilibrium impact, as it does not account for changes to production and expenditure. Head and Mayer and Anderson and Yotov (2010) coin this the *modular trade impact* or *conditional* general equilibrium effect. In our analysis below we

literature analyzes changes in the consumer preferences following political shocks. Fuchs and Klann (2013) show that high-level meetings with the 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. Studying the reaction of firms to the sanctions' regime, our study additionally contributes to the recent and active literature on exporter dynamics in rapidly changing environments responding to economic shocks. Berman et al. (2012) find a heterogeneous reaction of French firms to real exchange rate movements. Berman et al. (2015) go on to show that *learning* about local demand—and hence firm age and experience—appears to be a key mechanism of exporter dynamics. Relatedly, Bricongne et al. (2012) identify credit constraints as an aggravating factor for firms active in sectors of high financial dependence when faced with a sudden shock.

Our paper sets itself apart from the existing literature on sanctions by focusing on a recent and very large diplomatic conflict, which involves all the largest trading countries in the world but China. We also focus a large part of the analysis on the impact of sanctions from the perspective of the *sender* country's economy. By doing so, we shed light on the importance of possible "friendly fire" generated by these diplomatic tools, i.e., the costs that sanctioning countries can inflict on themselves. We also contribute to the existing literature by combining aggregate and firm-level data in order to better understand how financial and so-called "smart" sanctions disrupt international trade. By doing so, we highlight the impact of the shock to trade finance through financial sanctions as a key mechanism. We assess the effect of the sanctions regime vis-a-vis the Russian Federation from two angles: Using monthly UN Comtrade data, we evaluate the broad impact on exports to the Russian Federation by all major trading partners—sanctioning or not—in a structural gravity framework. We find the overall costs to total US$114 billion from the beginning of the conflict until the end of 2015, with 61% being borne by the Western-targeted Russian Federation and, on the opposing side, 90% incurred by EU countries. Importantly, the products that are targeted by the Russian embargo account only for a small fraction, 9%, of the total loss. This suggest that most of the impact of the diplomatic conflict on Western exports can be considered as "friendly fire". We then go further (and more micro) by using monthly French firm-level data and evaluate the effects on French firms. We find that the

explicitly do account for changes in production and expenditure figures, following and extending approaches by Dekle et al. (2007, 2008) and Anderson et al. (2015).

sanctions have decreased the individual firm's probability of exporting to Russia, the value of shipments, and their price. Furthermore, between boycotts, country-risk, and trade finance, the latter is found to best explain the stark decrease in French firms' exports.

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 estimate the country-level impact of the sanctions' regime in a gravity framework for implicated sanctioning Western countries and the Russian Federation and quantify the "lost trade" with a general equilibrium counterfactual analysis. In section 4, we then focus on the firm-level, identifying effects on intensive and extensive margins and disentangle different channels of impact at the firm-level using French customs data. In section 5, we explore possible trade diversion effects. Section 6 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. Broadly speaking, the episode can be broken down into three periods, a conflict period in which tensions started to grow between December 2013 and February 2014, followed by a period of "smart sanctions" starting in March 2014. A third period then started in August 2014 with the implementation of both Western economic sanctions in the form of trade restrictions and financial sanctions, and the Russian embargo on imports of food and agricultural products from the 37 sanctioning countries.
In the following discussion, we denote a "sanctioning country" as all countries that enacted smart and economic 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 almost exclusively aimed at Russian financial institutions and did not target any *commonly* traded goods in particular. 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.[4]

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.[5] Switzerland, historically politically neutral, enacted legislation that made it more

[4]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, military dual use, and certain manufacturing goods used in oil production and refinery, see section 3.

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

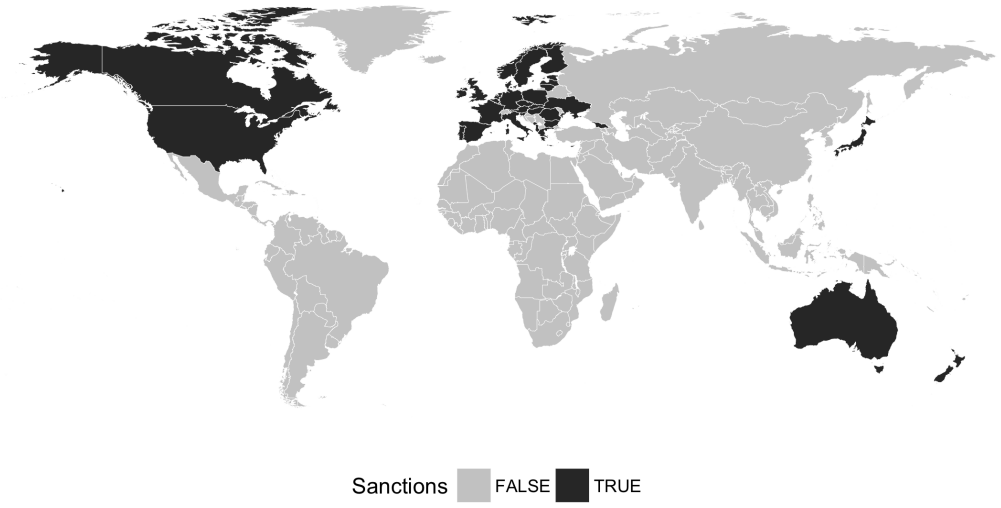


Figure 1: Countries imposing sanctions against Russia and being subject to counter-sanctions

difficult to circumvent sanctions, e.g., by transshipping European exports and imports through the country, yet did not introduce any of its own measures. Figure 1 shows a map of countries imposing sanctions towards the Russian Federation and being exposed to counter-sanctions. In terms economic size, countries sanctioning the Russian Federation totaled roughly 55% of the 2014 world GDP.

2.1 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)[6] or accede to the Eurasian Customs Union.[7] 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, 2014) and thus the domestic and international political debate turned more heated quickly.[8]

[6]The European Union has formed numerous so-called Association Agreements as part of its broader neighborhood policy. These agreements entail the development of economic, political, social, cultural, and security links (Smith, 2013).

[7]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.

[8]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 the Ukraine (Popescu, 2013; AP, 2013).

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. [9] The overthrown government headed by President Yanukovic was perceived as pro-Russian, drawing most of its support from the majority Russian-speaking 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 First two waves: Smart sanctions

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 (Dreyer et al., 2015). 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, dubbed smart sanctions, focused on implicated political and military personnel as well as select Russian financial institutions (Ashford, 2016). A second wave in the weeks to follow expanded the list of sanctioned individuals and entities.

The first and second wave of EU sanctions consisted of travel bans and asset freezes on several officials and institutions from Russia and Ukraine. The initial 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.[10]

[9] 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.

[10] 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.

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).[11]

Other countries allied with the European Union and the United States followed a similar path and introduced comparable measures at around the same time.[12] These lists of individuals and entities were successively appended over the spring and summer of 2014.[13]

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.[14] 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.[15]

2.3 The third wave: Trade restrictions and financial sanctions

After the crash of a civilian airplane (the Malaysian airlines flight MH17), shot down over the separatist region of Donbass with the probable implication of pro-Russian insurgents, trade sanctions were levied and existing financial restrictions further expanded. This third wave of EU sanctions went beyond previous measures in depth and scope. Not only were Russian individuals and entities targeted, but European entities were restricted from

[11] 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`.

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

[13] Compare, e.g., Ashford (2016) and Dreger et al. (2015).

[14] See `http://archive.mid.ru//brp_4.nsf/newsline/1D963ACD52CC987944257CA100550142` and `http://archive.mid.ru//brp_4.nsf/newsline/177739554DA10C8B44257CA100551FFE`. Among them, then Speaker of the United States House of Representative, John Boehner, the second in Presidential line of succession, then Senate Majority Leader Harry Reid, former Presidential candidate John McCain, as well as three assistants to the President (RT, 2014).

[15] See `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`.

exporting certain goods and buying certain Russian assets (Dreger et al., 2015).[16] The restrictions were enacted through *Council Decision 2014/512/CFSP* and *Council Regulation (EU) No 833/2014* on July 31, 2014.[17] European exporting firms were still mostly indirectly affected, as only a small number of industries' exports were directly targeted: Those firms that export products and technology intended for military and dual use and some equipment for the oil industry.[18]

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."[19] 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."[20] Further amendments in the same vein were announced on September 9, 2014.[21]

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."[22] 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:

[16] On June 23, 2014 the EU already enacted measures banning imports of goods originating in Crimea through *Council Decision 2014/386/CFSP* and *Council Regulation (EU) No 692/2014*. However, these are usually not regarded as the "third wave" of sanctions, as they did not target Russia proper. Bans on imports from Crimea were later amended by *Council Decision 2014/507/CFSP* as further trade bans designed to prohibit the development of infrastructure and industry, and later by *Council Decision 2014/386/CFSP* by expanding the restrictive measures to tourism.

[17] 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`.

[18] 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 12 for the affected HS 8 codes.

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

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

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

[22] 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.

- meat and meat products (HS headings 0201 to 0203 and 0207)
- certain types of fish and related products (HS headings 0302 to 0308)
- milk and dairy products (HS headings 0401 to 0406)
- certain types of vegetables (HS chapter 07, fruit and nuts of HS headings 0801 to 0813)
- sausages and similar products (HS headings 1601)
- certain other food products (HS headings 1901 and 2106)[23]

The list of banned products was been modified on August 20, 2014 and other sanctioning countries were successively included.[24]

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., 2015; 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).[25] All measures, from the Western and the Russian side, were extended multiple times and are in place until at least July 2016.

3 The big picture: Global impact of sanctions on Russia

We first investigate the global impact of the sanctions' regime against Russia using country-level data to gauge the overall consequences, before analyzing their different dimensions using firm-level data in section 4. We do so by relying on a simple theoretical framework that yields consistent gravity equations at the firm and country level. The different sets of sanctions imposed by the EU and other countries, on the one hand, and by Russia, on the other hand, enter 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.[26]

We estimate the partial equilibrium effects of sanctions and then quantify the "lost trade" due to the sanctions episode in a general equilibrium counterfactual framework. Our approach requires no additional data next to trade flows by fully relying on estimated fixed effects. This makes the estimations consistent with theory and immune to data collection

[23] Compare `http://www.bakermckenzie.com/sanctionsnews/blog.aspx?entry=3508`.

[24] See appendix table 13 for the 4 digit HS codes targeted.

[25] 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.

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

issues. For information on bilateral trade flows, we rely on 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. 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 to embargoed and non-embargoed product-level and are left with a total of 335451 non-zero observations. We provide the list of countries and descriptive statistics in table 11 in appendix A.

3.1 Theoretical framework

To analyze the impact of the imposed sanctions coherently on country and firm level, we now sketch a simple model that yields consistent estimatable equations for both levels. Consider a category of a good k where producers offer differentiated varieties. Demand in country d is governed by a constant elasticity of substitution sub-utility function over the set Γ_d of all varieties available in d, such that

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

In equation 1, subscript i denotes the firm, d the destination country, k the product, and t time. The elasticity of substitution is $\sigma > 1$, q_{idkt} is the quantity of the variety produced by i consumed in country d at time t, and a_{idkt} is a demand shifter. It captures the quality of a variety i as perceived by consumers in country d, but also the firm's network of connections with purchasers in market d. The demand in market d, perceived by a given firm i, is

$$x_{idkt} = [p_{ikt}/a_{idkt}]^{1-\sigma} A_{dkt} \tau_{odkt}^{1-\sigma}. \tag{2}$$

A_{dkt} is a term in which we collect all the characteristics of destination d that promote imports of product k from all countries, i.e., total expenditure on product k and multilateral resistance. The term p_{ikt} is the *fob* price charged by firm i at time t. Each firm i is located

in a country o so that τ_{odkt} is the ad-valorem trade cost between origin country o and destination country d. Assuming that firms incur a fixed costs to enter each foreign market, they decide to export if the export revenue is greater than a given threshold, F_{dkt}

$$P(\Lambda_{idkt} = 1) = P[x_{idkt} > F_{dkt}]. \tag{3}$$

where Λ_{idkt} a dummy set to one if firm i exports product k to country d at time t. With CES preferences and ad-valorem trade frictions, the *fob* price is a constant markup over a firm's marginal cost. We write $1/a_{idkt} = \psi_{idk}e^{\epsilon_{idkt}}$, where ψ_{idk} is an index of all time-invariant non-price determinants of firms' competitiveness on market d and ϵ_{idkt} is white noise. Finally, sanctions, noted S_{odt}, affect trade through changes in the trade costs: $\tau_{odkt} = \bar{\tau}_{odk}e^{\delta S_{odt}}$. Plugging all these elements into equation 2, we obtain firm exports:

$$x_{idkt} = [p_{ikt}\psi_{idk}e^{\epsilon_{idkt}}]^{1-\sigma}A_{dkt}[\bar{\tau}_{odk}e^{\delta S_{odt}}]^{1-\sigma}. \tag{4}$$

Summing all exports from a given origin country, we obtain the country-level bilateral exports of product k:

$$X_{odkt} = \sum_{i \in o} x_{idkt} = N_{okt}A_{dkt}[\bar{\psi}_{odk}\bar{\tau}_{odk}e^{\delta S_{odt}}]^{1-\sigma}e^{\epsilon_{odkt}}. \tag{5}$$

N_{okt} subsumes all exporter $\times$ product $\times$ time specific effects of firms from country o producing k at time t, hence the number of firms, their total production and overall production and distribution networks, i.e. the country's multilateral resistance. $\bar{\psi}_{odk}$ is the aggregate of various determinants of competitiveness of firms from country o in country d, and ϵ_{odkt} is an error term.

3.2 Country-level impacts of the sanctions

To get a first glance at the country-level impact of the sanctions, we estimate the average partial equilibrium effects of the measures put in place on trade between implicated countries. Equation (5) has the familiar look of a gravity equation. Using a PPML estimator following Santos Silva and Tenreyro (2006), the country-level impact of sanctions can be estimated as

$$X_{odkt} = \exp(\Psi_{okt} + \Theta_{dkt} + \phi_{odk} + \beta S_{odt}) + \epsilon_{odkt},$$

where Ψ_{okt}, Θ_{dkt} and ϕ_{odk} are fixed effects capturing all exporter $\times$ product $\times$ time, importer $\times$ product $\times$ time, and exporter $\times$ importer $\times$ product characteristics. In order to control for bilateral seasonal variations, very present in monthly trade data, we depart slightly from the structural model. We allow the bilateral product-level trade costs to vary

by calendar month and include an exporter $\times$ importer $\times$ calendar month fixed effect, denoted by subscript m (as opposed to t for year-month) [27] and estimate

$$X_{odkt} = \exp(\Psi_{okt} + \Theta_{dkt} + \phi_{odkm} + \beta S_{odt}) + \epsilon_{odkt}. \tag{6}$$

The coefficient of interest, β, is therefore estimated on the variation within country-pair-calendar month. It is the elasticity of trade to sanctions, i.e. the average *partial equilibrium impact* of sanctions on exports. In this setup the exporter and importer fixed effects control for all domestic effects, such as economic output or volatile exchange rates, in both exporting and importing countries. The effect of sanctions is therefore measured against trade flows of non-sanctioning countries, holding the importer and exporter-specific fixed effects Ψ_{okt} and Θ_{dkt} constant. This disregards any general equilibrium effects, primarily on the Russian economy, but also on every other country. The decrease in exports to the Russian Federation from Western countries has changed its composition of imports, possibly leading to increased imports from other places (trade diversion) and overall more costly input sourcing (change in multilateral resistance). An analogous effect occurs on the part of the sanctioning countries, shifting their exports to other markets and making sales overall more difficult. These first-order effect would have second-order effects on other non-involved countries. Furthermore, the sanctions regime is likely to have an impact on overall production and expenditure. As the partial equilibrium effects potentially tell only part of the story, we will take a closer look at possible general equilibrium effects in section 3.3.[28]

The vector of sanctions dummies is constructed as follows. The three distinct periods with respect to the implementation of sanctions described in section 2 are accounted for separately: a first period from December 2013 until February 2014, in which political tensions were increasing while no sanctions were put in place yet. A second period starts in March 2014 with the implementation of the so-called "first wave" of sanctions, later succeeded by the "second wave", and ending in July 2014. During this period Western governments targeted people and institutions implicated in the events in eastern Ukraine and Crimea, a policy dubbed "smart sanctions". Finally, a third period started 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. Each of the periods enters as a separate dummy into the regression of equation (6), i.e. is set to 1 during the respective time period and for implicated country pairs and 0 otherwise. Of course

[27] To be more explicit, we decompose the exporter $\times$ importer fixed effect into 12 fixed effects, one for each calendar month of the year. Therefore, the identification of the sanctions variables relies on changes of bilateral export flows between two countries during the same calendar month of different years.

[28] As Dreger et al. (2015) point out, however, the main driver of the deterioration of the Ruble is due to the collapse of the crude oil price and not due to the trade sanctions. This suggests that the estimated partial equilibrium effects may come close to the general equilibrium effects, as will also be seen below.

Table 1: Effect on value of trade with Russia by type of product and period

Dependent variable	log(exports) OLS			Exports PPML		
Products	All	Embargoed	Non embargoed	All	Embargoed	Non embargoed
	(1)	(2)	(3)	(4)	(5)	(6)
West → Russia	−0.150	−0.080	−0.207^{c}	-0.205^{a}	-0.200^{a}	-0.173^{b}
x Dec'13–Feb'14	(0.126)	(0.178)	(0.121)	(0.072)	(0.070)	(0.078)
West → Russia	−0.198^{a}	−0.099	−0.212^{b}	-0.153^{a}	-0.302^{a}	-0.121^{c}
x Mar'14–Jul'14	(0.080)	(0.129)	(0.101)	(0.059)	(0.065)	(0.064)
West → Russia	−0.350^{a}	−2.235^{a}	−0.164^{a}	-0.284^{a}	-2.021^{a}	-0.134^{a}
x since Aug'14	(0.054)	(0.130)	(0.057)	(0.042)	(0.077)	(0.044)
Russia → West	0.215	−0.116	0.212	-0.015	-0.168	-0.016
x Dec'13–Feb'14	(0.186)	(0.241)	(0.185)	(0.088)	(0.183)	(0.090)
Russia → West	−0.223^{c}	−0.060	−0.229^{c}	-0.030	0.413^{c}	-0.035
x Mar'14–Jul'14	(0.126)	(0.199)	(0.127)	(0.063)	(0.212)	(0.064)
Russia → West	−0.065	−0.273^{b}	−0.072	-0.214^{a}	0.203	-0.222^{a}
x since Aug'14	(0.089)	(0.115)	(0.090)	(0.054)	(0.144)	(0.054)
Observations	146,837	100,242	146,194	156,148	156,148	156,148
R^2	0.956	0.931	0.955			

Notes: All regression include exporter × date, importer × date and exporter × importer × month fixed effects. Robust standard errors in parentheses are clustered by exporter × importer × month. Significance levels: ^{c}: p<0.1, ^{b}: p<0.05, ^{a}: p<0.01.

the estimated coefficients may pick up other events that may have altered trade flows between sanctioning countries and Russia during the treatment period. However, our use of monthly data and exporter × date and importer × date fixed effects alleviates the risk over omitted variable biases.

Table 1 displays the results of regressing equation (6) with OLS (columns 1–3) and PPML estimators (columns 4–6). The upper half of the table shows the coefficients on Western countries' exports to Russia, the lower part those for Russian exports to Western countries. Note that the coefficients from these unweighted estimation can be interpreted as the average partial effect of the sanctions vis-a-vis the countries' trade in the respective month "in normal times." Standard errors are clustered at the country-pair-calendar month level. Columns (1) and (4) report the coefficients for total exports, (2) and (5) those of embargoed products, and (3) and (6) those of the non-embargoed ones. The results indicate that already during the first period from December 2013 to March 2014 Western exports to the Russian Federation on average experienced a significant drop, by about 18.5% for total exports.[29] The effects remain largely similar over the course of the period from March 2014 until July 2014, when first financial sanctions were introduced. With the introduction of tougher economic sanctions and the Russian embargo on certain

[29]The average partial effect is computed as $1 - \exp(-0.205)$.

Table 2: Effect on value of trade with Russia by type of product and period

Dependent variable	log(exports) OLS			Exports PPML		
Products	All	Embargoed	Non embargoed	All	Embargoed	Non embargoed
	(1)	(2)	(3)	(4)	(5)	(6)
non-EU → Russia	0.237	0.520	0.082	-0.116	-0.153	-0.085
x Dec'13–Feb'14	(0.164)	(0.360)	(0.163)	(0.077)	(0.120)	(0.083)
non-EU → Russia	0.0294	0.057	−0.024	-0.026	-0.238^{b}	0.009
x Mar'14–Jul'14	(0.128)	(0.255)	(0.147)	(0.074)	(0.095)	(0.081)
non-EU → Russia	−0.425^{a}	−2.789^{a}	−0.039	-0.279^{a}	-2.457^{a}	-0.080
x since Aug'14	(0.105)	(0.398)	(0.094)	(0.053)	(0.195)	(0.057)
EU → Russia	−0.250^{c}	−0.150	−0.283^{b}	−0.221^{a}	−0.221^{a}	−0.189^{b}
x Dec'13–Feb'14	(0.133)	(0.175)	(0.129)	(0.072)	(0.071)	(0.078)
EU → Russia	−0.257^{a}	−0.131	−0.262^{b}	-0.177^{a}	-0.334^{a}	−0.144^{b}
x Mar'14–Jul'14	(0.080)	(0.129)	(0.101)	(0.059)	(0.067)	(0.063)
EU → Russia	−0.335^{a}	−2.119^{a}	−0.1979^{a}	-0.287^{a}	-1.888^{a}	-0.144^{a}
x since Aug'14	(0.053)	(0.122)	(0.056)	(0.042)	(0.077)	(0.044)
France → Russia	−0.158	−0.103	−0.179^{c}	−0.221^{a}	−0.114^{c}	−0.189^{b}
x Dec'13–Feb'14	(0.112)	(0.168)	(0.106)	(0.081)	(0.062)	(0.087)
France → Russia	−0.199^{b}	−0.215	−0.204^{b}	−0.153^{b}	-0.196^{a}	-0.123^{c}
x Mar'14–Jul'14	(0.077)	(0.139)	(0.098)	(0.060)	(0.063)	(0.064)
France → Russia	−0.245^{a}	−1.909^{a}	−0.146^{b}	-0.250^{a}	-1.738^{a}	-0.114^{b}
x since Aug'14	(0.063)	(0.123)	(0.064)	(0.048)	(0.086)	(0.049)
Observations	146,837	100,242	146,194	156,148	156,148	156,148
R^2	0.956	0.931	0.955			

Notes: All regression include exporter × date, importer × date and exporter × importer × month fixed effects. Robust standard errors in parentheses are clustered by exporter × importer × month. Significance levels: ^{c}: p<0.1, ^{b}: p<0.05, ^{a}: p<0.01. "Non-EU" in rows 1-3 refers to Western sanctioning countries that are not EU members. "EU" in rows 4-6 refers to all EU countries but France.

agricultural and food products (i.e. since August 2014), the adverse effects on Western exports pick up pace: Total exports decrease by on average 24.7% (column 4), while embargoed goods—unsurprisingly—take an enormous hit with a drop in exports to the Russian Federation by on average 86.7% (column 5). For the Russian Federation, little impact on exports to Western countries is observed until the introduction of more severe economic sanctions in July and August 2014. Since then, total exports to sanctioning countries have decreased by on average 19.3% (column 4). Unsurprisingly, Russian exports of embargoed products are largely unaffected. Overall, the direction and magnitude of the effects estimated with the OLS estimator are comparable.

In table 2, we disentangle the impact on Western countries by groups of countries. The impact on non-EU and EU countries could differ, due to the intensity of pre-conflict trade ties as well as the different composition of flows. We additionally single out France in

order to receive comparable estimates for the firm-level analysis in section 4. The table is organized as before: Columns (1) and (4) displays the coefficients on total exports, while columns (2) and (5), and (3) and (6) show those for the exports of embargoed and non-embargoed flows. Exports of non-EU sanctioning countries, i.e., the United States, Canada, Japan and others, experienced a significant decrease in total exports only in the period after August 2014. While total flows have decreased by on average 24.3% (column 4), this is almost entirely driven by the 91.4% plunge in exports of embargoed products (column 5). These results differ from those of sanctioning EU countries and France. This is not surprising, as through Europe's proximity, Russia constitutes a major trading partner, especially for central and eastern European countries. Until March 2014 total exports of EU countries and France dropped by an average of 19.8%, between March and July 2014 by on average 16.2% (France 14.2%) and 24.9% (France 22.1%) since August 2014. Unlike non-EU exports, the decrease in EU exports was carried by drops in both embargoed and non-embargoed exports: Since August 2014, exports of non-embargoed products decreased by on average 13.7% (France 10.8%), while embargoed products exports plunged by 84.7% (France 82.4%).

The results suggest that the trade sanctions put in place by the Russian Federation in August 2014 wiped out most of the exports of those goods that were targeted, while the overall sanctions regime also took a toll on non-embargoed exports. In section 4 we will test these results against more detailed firm-level data and disentangle possible channels that explain this "friendly fire."

3.3 Quantification of lost trade

To put the results from above in perspective and allow for a heterogeneous effect on different countries, we now quantify the cost in terms of "lost trade." Using the gravity setup from above, we predict trade flows to Russia from sanctioning countries and calculate the difference to observed flows. This allows us to put a price tag on the use of sanctions employed by both sides. The partial equilibrium estimates from above, however, might conceal important feedback effects. The changes in trade impediments due to the conflict and sanctions also impacted the multilateral resistance terms. 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 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) term a *full* GE exercise, as

opposed to a *conditional* one that does not take into account these changes to production and expenditure.

Returning to equation (5) and abstracting from the product dimension k, assume that the importer and exporter-specific terms N_{ot} and A_{dt} were to have an Armington-type structure as in Head and Mayer (2014),[30] such that

$$N_{ot} = \frac{Y_{ot}}{\Omega_{ot}} \quad \text{and} \quad A_{dt} = \frac{X_{dt}}{\Phi_{dt}},$$

where $Y_{ot} = \sum_d X_{odt}$ is the value of production, i.e. all exports, in o at time t, $X_{dt} = \sum_o X_{odt}$ is the value of expenditure, i.e. all imports, in d time t. Ω_{ot} and Φ_{dt} are the respective multilateral resistance terms, such that

$$\Omega_{ot} = \sum_{l \in d} \frac{X_{lt}}{\Phi_{lt}} \cdot \phi_{olm} \cdot e^{\beta S_{olt}} \quad \text{and} \quad \Phi_{dt} = \sum_{l \in o} \frac{Y_{lt}}{\Omega_{lt}} \cdot \phi_{ldm} \cdot e^{\beta S_{ldt}}.$$

Plugging these into equation (5) then yields a structural gravity equation where bilateral exports X_{odt} between countries o and d at time t are governed by

$$X_{odt} = \frac{Y_{ot}}{\Omega_{ot}} \cdot \frac{X_{dt}}{\Phi_{dt}} \cdot \phi_{odm} \cdot e^{\beta S_{odt}} \cdot e^{\epsilon_{odkt}}, \tag{7}$$

where $\phi_{odm} = [\bar{\psi}_{odm}\bar{\tau}_{odm}]^{1-\sigma}$, subsuming all seasonally-varying bilateral trade barriers and facilitators. This setup allows us to compute counterfactual multilateral resistance terms and the corresponding trade flows by setting all $S = 0$, i.e., "switching off" sanctions. As Anderson and Yotov (2010) and Head and Mayer (2014) note, this is does not entail a full general equilibrium analysis as production and expenditure terms are unaffected. In order to account for explicit changes to countries' production and expenditure, we make use of a simple counterfactual general equilibrium framework that is similar to Dekle et al. (2007, 2008) and Anderson et al. (2015), with the added feature that it does not rely on any additional data next to observed trade flows.

3.3.1 Partial, conditional and full general equilibrium effects

We re-estimate equation (6) *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

[30] For the framework to be consistent with CES demand at the firm level, sales need to be Pareto distributed.

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).[31] 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.[32] 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[33]

$$\begin{aligned} \hat{Y}_{ot}^{\text{PE}} &= \sum_{l \in d} \exp\left(\hat{\Psi}_{ot} + \hat{\Theta}_{lt} + \hat{\phi}_{olm}\right) \quad \text{and analogously} \\ \hat{X}_{dt}^{\text{PE}} &= \sum_{l \in o} \exp\left(\hat{\Psi}_{lt} + \hat{\Theta}_{dt} + \hat{\phi}_{ldm}\right), \end{aligned} \tag{8}$$

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

$$\begin{aligned} \hat{\Omega}_{ot}^{\text{PE}} &= \sum_{l \in d} \exp\left(\hat{\Theta}_{lt} + \hat{\phi}_{olm}\right) \quad \text{and} \\ \hat{\Phi}_{dt}^{\text{PE}} &= \sum_{l \in o} \exp\left(\hat{\Psi}_{lt} + \hat{\phi}_{ldm}\right). \end{aligned} \tag{9}$$

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

[31] 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.

[32] 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.

[33] 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.

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:

$$\begin{aligned}\hat{\Omega}_t &= \hat{\phi}_m \left(\hat{X}_t \otimes \hat{\Phi}_t^{-1} \right) \\ \hat{\Phi}_t &= \hat{\phi}_m^{\mathrm{T}} \left(\hat{Y}_t \otimes \hat{\Omega}_t^{-1} \right),\end{aligned} \tag{10}$$

where $\hat{\Omega}_t$ and $\hat{\Phi}_t$ are vectors of outward and inward multilateral resistances[34] at time t and $\hat{\phi}_m$ the trade cost matrix for calendar month m.[35] The conditional general equilibrium counterfactual trade flows can then be computed as

$$\hat{X}_{odt}^{\mathrm{CE}} = \frac{\hat{Y}_{ot}^{\mathrm{PE}}}{\hat{\Omega}_{ot}^{\mathrm{CE}}} \cdot \frac{\hat{X}_{dt}^{\mathrm{PE}}}{\hat{\Phi}_{dt}^{\mathrm{CE}}} \cdot \hat{\phi}_{odm}, \tag{11}$$

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[36]

$$\hat{Y}_{ot}^{\mathrm{GE}} = \hat{Y}_{ot}^{\mathrm{PE}} \cdot \left(\frac{\hat{\Psi}_{ot}^{\mathrm{GE}}}{\hat{\Psi}_{ot}} \right)^{\frac{1}{1-\sigma}} \quad \text{and} \quad \hat{X}_{dt}^{\mathrm{GE}} = \hat{X}_{dt}^{\mathrm{PE}} \cdot \left(\frac{\hat{\Psi}_{dt}^{\mathrm{GE}}}{\hat{\Psi}_{dt}} \right)^{\frac{1}{1-\sigma}}, \tag{12}$$

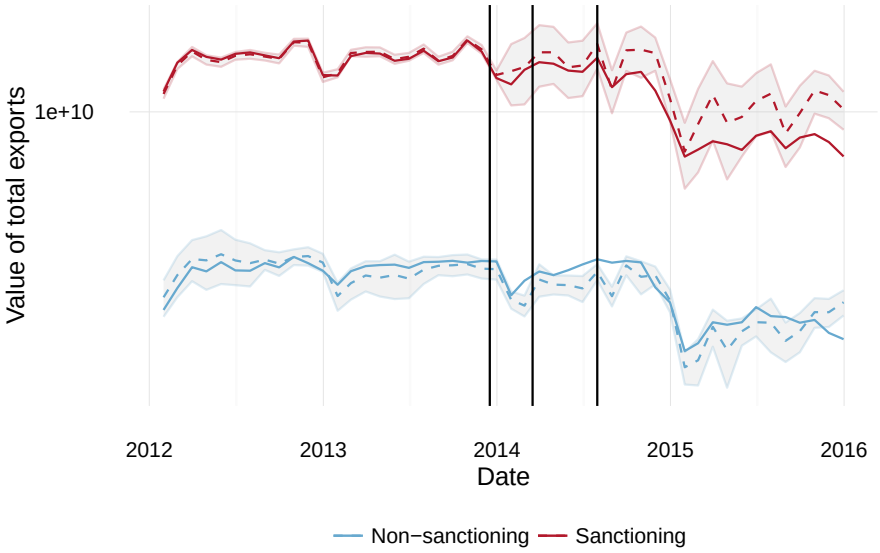
where σ is the elasticity of substitution and $\hat{Y}_{ot}^{\mathrm{PE}}$ and $\hat{X}_{dt}^{\mathrm{PE}}$ and production and expenditure figures constructed using equation (8) and estimated fixed effects from the initial partial equilibrium estimation. We take the value of $\sigma = 5$ from Head and Mayer (2014), who conduct a meta analysis of estimates of the elasticity of substitution and find 5 to be the median estimate. $\hat{\Psi}_{ot}$ and $\hat{\Psi}_{dt}$ are the exporter fixed effects from the same initial partial equilibrium estimation, while $\hat{\Psi}_{ot}^{\mathrm{GE}}$ and $\hat{\Psi}_{dt}^{\mathrm{GE}}$ 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 (11) yields the counterfactual flows between all countries.

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

[35] 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.

[36] The term "factory-gate price" should be understood as an aggregate, country-wide measure, as it implicitly incorporates not only effects on the intensive margin, as expressed through equation (4), but also the extensive margin, as in equation (3), at the individual firm level.

(a) Total exports to Russia



(b) Embargoed product exports to Russia

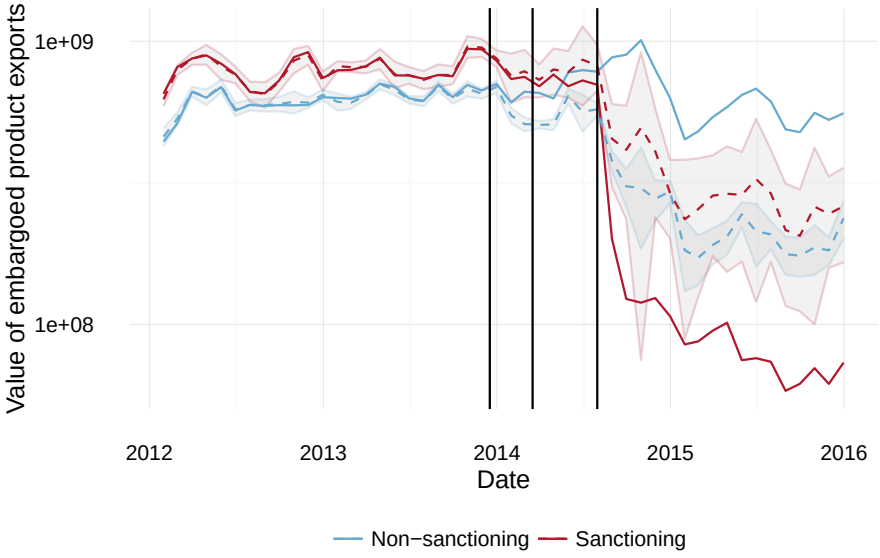


Figure 2: Predicted vs. observed total value of exported goods to Russia from sanctioning and non-sanctioning countries by type of products. Solid lines display observed trade flows, dashed lines predicted flows. Vertical lines indicate dates of interest. 95% confidence intervals based on bootstrapped standard errors.

	Total		Embargoed		Non embargoed	
	Loss		*Loss*		*Loss*	
	in $ bil.	*in %*	*in $ bil.*	*in %*	*in $ bil.*	*in %*
Sanctioning countries	-43.83	-14.81	-4.08	-38.04	-39.74	-13.94
EU	-39.65	-15.46	-2.75	-35.31	-36.91	-14.84
Russia	-69.86	-14.65	0.01	0.51	-69.87	-14.70

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.

Table 3: Losses by type of goods and country group

3.3.2 Estimated general equilibrium impact

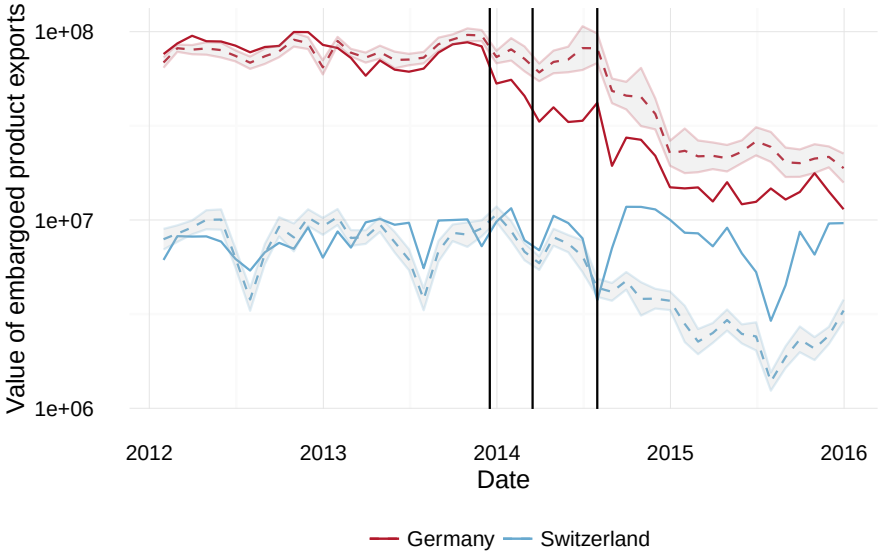
Table 3 gives an overview over the estimated lost trade—the difference between observed and predicted trade flows—over the period from early 2014 until the end of 2015 for the implicated (mostly Western) sanctioning countries and Russia, by type of product.[37] Figures 2 and 3 show the results of performing 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 "smart sanctions" 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 for the Russian Federation 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. We will use the estimated importer $\times$ time fixed effects later in section 4 to control for importer-specific shocks.

As seen in figures 2a and 2b, 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 beneith 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 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.[38]

[37] The results of the estimations of lost trade for each sanctioning country and product separately are shown in tables 14, 15, and 16 in the appendix.

[38] See appendix D, tables 14, 15 and 16 for the quantification of lost trade with total, embargoed and

(a) Placebo with treated/non-treated exporter



(b) Placebo with treated/non-treated importer

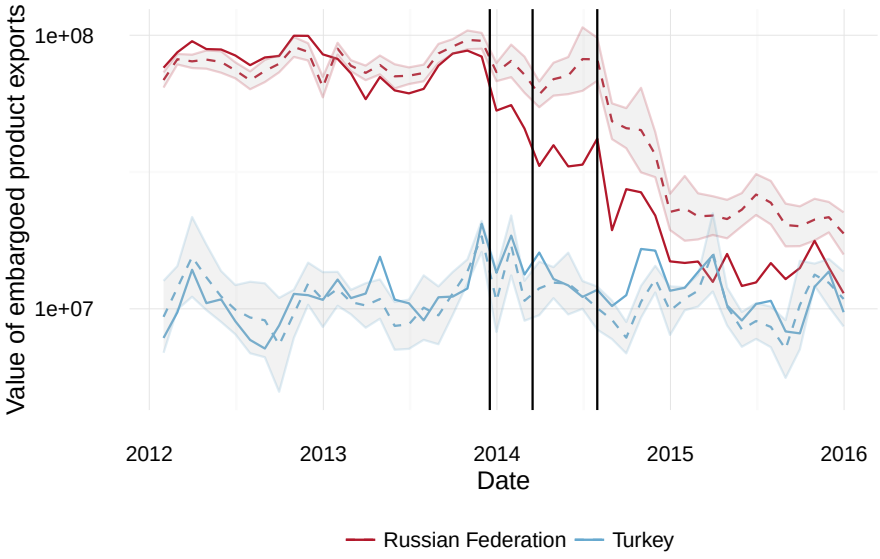


Figure 3: (Pseudo) placebo test with treated/non-treated exporter and importers. Solid lines display observed trade flows, dashed lines predicted flows. Vertical lines indicate dates of interest. 95% confidence intervals based on bootstrapped standard errors.

The picture is reinforced when zooming into two-country comparisons and performing (pseudo) placebo tests on non-treated importers and exporters. Figure 3a displays the total value of embargoed product exports to Russia from Germany and Switzerland—a

non-embargoed goods trade by period and country.

non-treated exporter. The two countries are highly similar: 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", as described in section 2. Exports from Germany decreased significantly after the beginning of the conflict and collapsed 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 3b, 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.

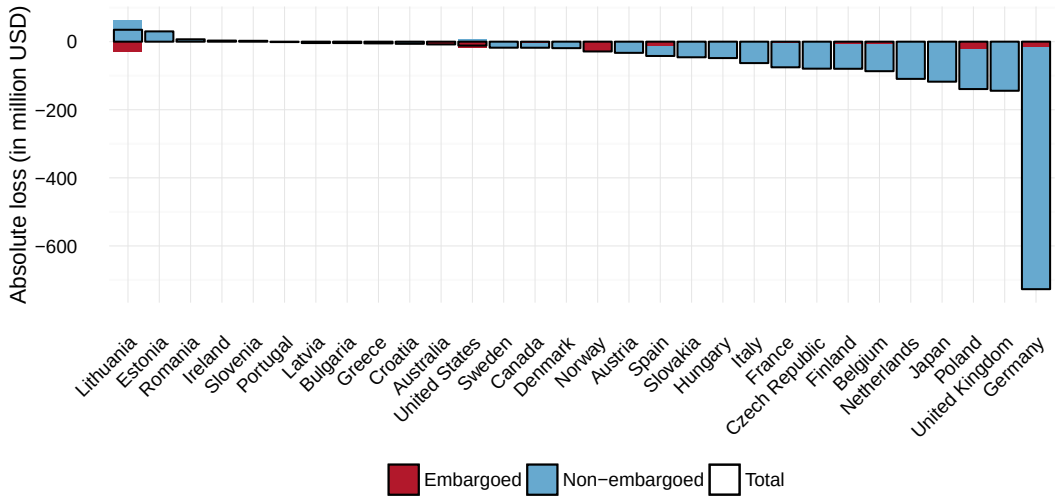
To get a better idea of the magnitude of the impact, we compute the difference between predicted and observed trade flows by country. This difference amounts to the "lost trade" between sanctioning countries and Russia. The global figure for the period we cover here, from December 2013 to December 2015, totals US$ 114 billion, of which US$ 70 billion are being borne by the Russian Federation (15 % of predicted exports). US$ 4.1 billion, or 9.3% of Western lost trade, are accrued in embargoed products. Of this lost trade in embargoed products, unsurprisingly, 92% was incurred after the imposition of trade sanctions by Russia. The bulk of the "lost trade" from Western countries, 91%, can therefore be considered *friendly fire*, a cost on private actors that were not directly targeted by the Russian embargo.[39]

This *friendly fire*, however, is not evenly distributed among countries: Figures 4b and 4a display the average monthly difference between predicted and observed exports—the "lost trade"—in relative and absolute terms for each sanctioning country, broken down into trade of embargoed and non-embargoed products. The European Union bears 90% of all lost trade of sanctioning countries and 93% of lost trade in non-embargoed products. For sanctioning Western countries, in terms relative to predicted exports to Russia, Norway and Australia are hit hardest, with lost trade amounting to up to 39% of predicted flows to Russia. When comparing to total exports, however, Finland (1.7 %), Poland (0.9 %) and Germany (0.8 %) are most affected. Germany is losing the most exports in absolute terms, about US$727 million per month on average, most of it incurred by non-embargoed products. The United Kingdom (US$ 144) and Poland (US$ 138) follow, albeit in much smaller values. In percentage terms, Germany is bearing almost 40% of Western lost trade,

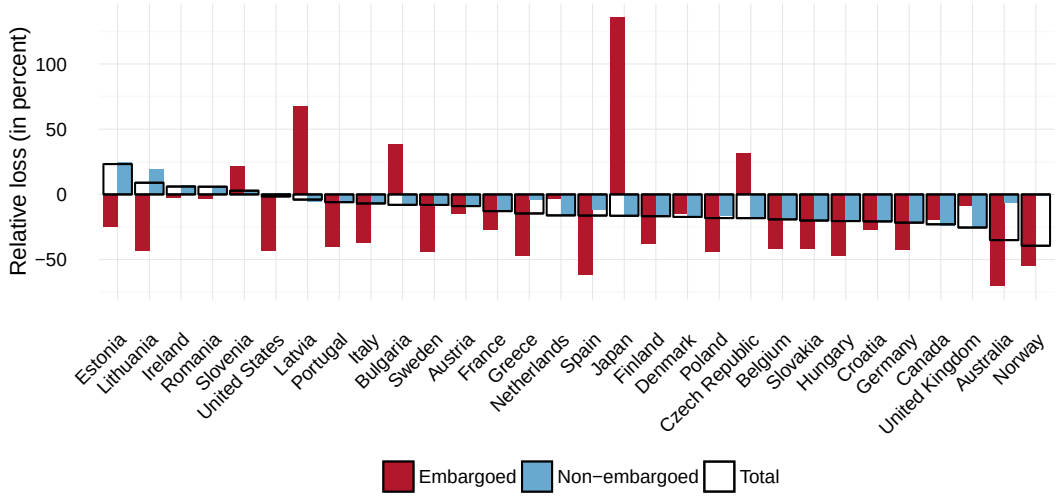
[39]Embargoed products are likely additionally exposed to the same factors that induced the decrease in exports of non-embargoed products, so that this number of "friendly fire" can be considered a lower-limit estimate.

Figure 4: Composition lost trade of embargoed and non-embargoed products by country

(a) Monthly absolute losses (in million USD per month)



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



while other major geopolitical players like the United States (0.6%), France (4.1%) and the United Kingdom (7.9%) incurred much less. Overall, the composition of the losses incurred varies widely by period and affected products.

4 Drilling down: firm-level impacts

We now explore more closely how firms reacted to the sanctions. By inspecting the response of exporters to the sanctions, we aim to shed light on the underlying mechanisms that gave rise to the export losses identified in the previous section. More precisely, the aim of this investigation is twofold. First, we want to estimate the impact of the sanction

on the trade margins, in order to determine to what extent the sanctions lead exporters from sanctioning countries to leave the Russian market or just to reduce the volume or the price of their shipments. This distinction is key to gauge the long term consequences of the sanctions and speed at which trade can recover after they are lifted. Second, we aim to provide indirect evidence about the exact nature of the trade impediments generated by the sanctions by looking at the heterogeneity of firms' responses depending on their own characteristics or the type of product they export.

To conduct these analyses, we focus on the case of France, for which we have detailed customs data providing monthly exports and imports at the firm-product-destination level. As mentioned above, 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.[40]

4.1 Empirical specification

The econometric analysis is a difference-in-differences approach, based on the simple and very general trade model described above. Log-linearization of equation 2 gives:

$$\ln x_{idkt} = (1-\sigma)\ln[p_{ikt}\psi_{idk}] + \ln A_{dkt} + (1-\sigma)\ln[\bar{\tau}_{odk}e^{\delta S_{odt}}] + \epsilon_{idkt},$$

or equivalently:

$$\ln x_{idkt} = \theta_{itk} + \theta_{idk} + \theta_{dkt} + \beta S_{odt} + \epsilon_{idkt}, \tag{13}$$

where θ_{idk} is a firm $\times$ product $\times$ destination fixed effect capturing $\ln \psi_{idk}$ and $\ln \bar{\tau}_{dk}$. We capture $\ln p_{ikt}$ by a firm $\times$ product $\times$ time fixed effect, θ_{itk}. As in equation 6, θ_{dkt} is a destination $\times$ product $\times$ time fixed effect that captures $\ln A_{dkt}$. The ideal difference-in-differences analysis based on the equation above would compare the trend of exports of French firms to Russia to the ones of firms originating from a country not involved in the diplomatic conflict. This would require two sets of monthly firm-level records, which is not feasible in practice. Instead, our firm-level analysis exploits micro trade data from one single origin country. Therefore, the impact of the sanctions (β) cannot be estimated jointly with the time-varying destination fixed effect, θ_{dkt}. To circumvent this problem, we use the destination $\times$ products $\times$ time fixed effect estimated in the previous section ($\hat{\Theta}_{dkt}$ in equation 6) as a proxy for $\ln A_{dkt}$. This variable captures the characteristics of any destination d that promote imports from all countries and for all goods. It is important to notice that the econometric analysis of firm-level response to the sanction will be conducted with individual export data aggregated at the 4-digit level of the HS classification (HS4).

[40] Russia was also the 15th major destination of French exports of food and agricultural products, and the 6th one outside the EU.

Unfortunately, it is not computationally feasible to estimate the fixed effects $\hat{\Theta}_{dkt}$ for all HS4 products. We therefore simply use variables $\hat{\Theta}_{dk't}$ defined—as done in the previous section—for the aggregates (k') of embargoed and non-embargoed products. In order to compensate the fact that our proxy for $\ln A_{dkt}$ is more aggregated than our dependent variable, we do not constraint the coefficient on $\hat{\Theta}_{dk't}$ to be equal to one. As before, the sanction variable S_{dt} is specific to trade with Russia and covers three distinct periods: From December 2013 to March 2014; From April 2014 to July 2014; and from August 2014 to December 2014. Finally, we estimate the following difference-in-differences specifications:

$$\ln x_{idkt} = \theta_{idk} + \theta_{itk} + \alpha\hat{\Theta}_{dk't} + \sum_{p=1,2,3} \delta_p \text{Event}_p \times (d = \text{Russia}) + \varepsilon_{idkt}, \tag{14}$$

and

$$P[\Lambda_{idkt} = 1] = P[\theta_{idk} + \theta_{itk} + \alpha'\hat{\Theta}_{dk't} + \sum_{p=1,2,3} \delta'_p \text{Event}_p \times (d = \text{Russia}) + \varepsilon'_{idkt} > \ln F_{dkt}]. \tag{15}$$

In equations 14 and 15, ε_{idkt} and ε'_{idkt} are the errors terms. The coefficients of interest, δ_p and δ'_p, are the average treatment effect for each period. They measure the impact of the conflict and sanctions regime on the trend of firms' exports to Russia.

4.2 Firm-level data

We exploit a dataset of the universe of monthly French exports at the firm level, provided by the French customs authorities. Our data covers more than 10 years until December 2014. Each observation records date (year and month), a unique firm code (*SIREN*), 8-digit product code (*nc8*), the destination country, value (in Euros) and quantity exported. Over the four years between 2011 and 2014, 160,677 individual French firms traded some 10110 different products.

Our empirical specifications, defined with equations 14 and 15, compare 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 2012 and December 2014. This leaves us with 20.7 million observations and 10,498 exporters. In order to reduce the sample size further, we aggregate all trade flows at the 4-digit level (HS4), the level at which the Russian counter-sanctions apply. We exclude from the analysis the goods that are subjected to export restrictions within the framework of European sanctions (see table 12) along with "Nuclear reactors and part thereof" (*HS 8401*) and "Aircrafts, spacecrafts, and parts thereof" (*HS 88*). All together, these products represented about 12% of French exports to Russia in 2012. However, the trade of these products is very granular. The exports are concentrated among a very

small number of large companies[41] which export very large amounts, in a very sporadic way. This granularity makes a robust identification of a trend in export flows very difficult. Finally, our analysis focuses on all months of 2012–2014. The final database then contains 7,455 firms, covers 995 HS4 products and counts 22,619 firm-HS4 groups.

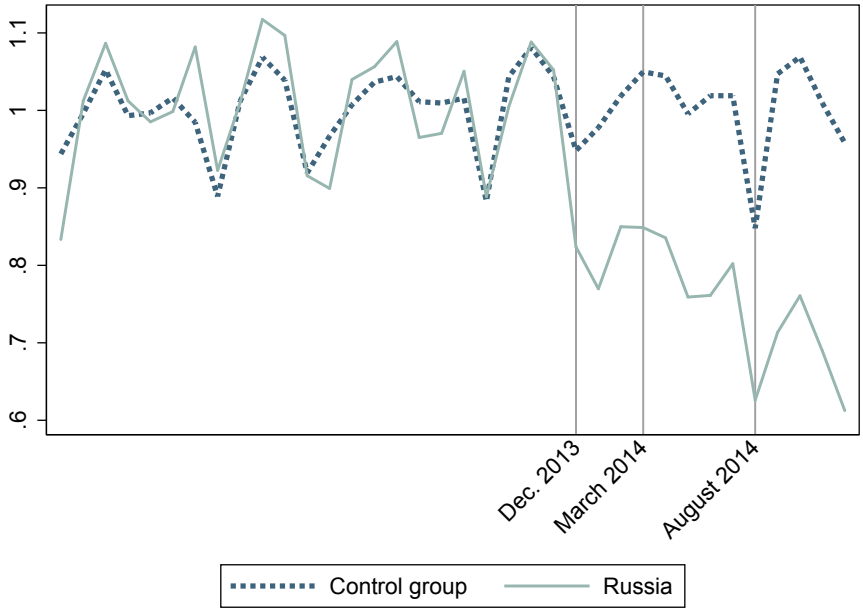
In order to be able to control for unobserved determinants of time-varying individual supply capacities (with the firm $\times$ product $\times$ date fixed effect, θ_{itk}), we need a control group consisting of alternative destinations of French exports. The difficulty is that export flows to any other 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. Moreover, figure 5 is supportive of the choice of this control group by showing that French exports to these destinations are not greatly affected by the treatment. Panels (a) and (b) show the number of French exporters and total French exports to Russia and the control group, respectively, normalized by the average levels during the pre-event period (from December 2012 to November 2013). While there is a clear drop in the intensity of export relationships with the Russian Federation starting in December 2013, there is no visible change in the trend of exports toward control group countries.

Given the nature of the data (and the presence of a high proportion of zeros in the monthly reports of trade flows), it may seem natural to resort to non-linear methods to estimate equations 14 and 15. However, our empirical specification imposes two very

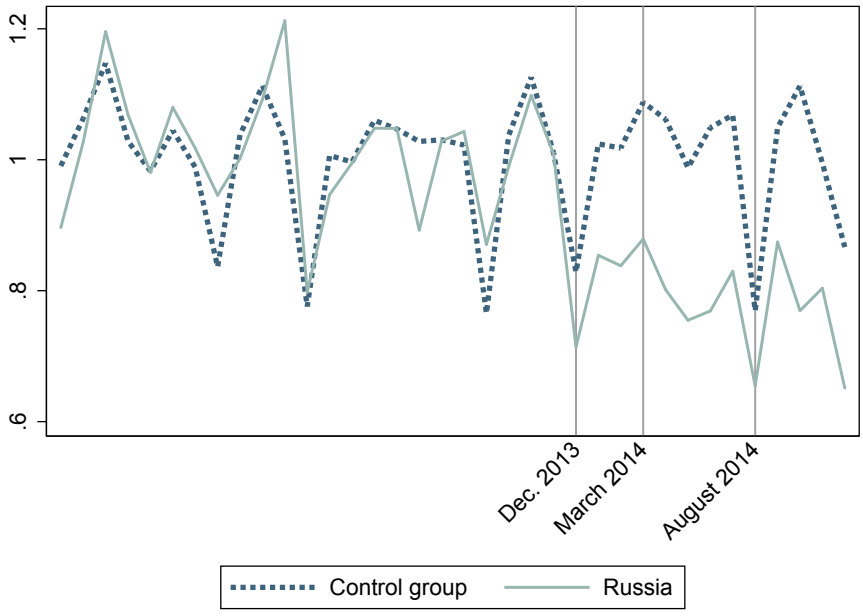
[41] In 2012, exporters of these products represent less than 2% of French firms exporting to Russia.

Figure 5: Trend in the number of French exporters and export value to Russia and control group countries

(a) Number of French exporters



(b) Total export value



large sets of fixed effects that may generate incidental parameters problems that would bias the non-linear estimates. For this reason, the estimations are carried out using linear estimators: Fixed effects OLS for equation 14 and linear probability model for 15. The error term in equation 2 (and consequently in 14 and 15) reflect unobserved idiosyncratic shocks in firm-product-destination-time demand shifters. Therefore, we cluster errors by firm-product to allow for possible correlation between disturbances of trade flows across

destinations and over dates within an exporter. Naturally, we check the robustness of our results to alternative choices of estimators.

4.3 Impact on trade margins

In this section, we investigate the consequence of the escalation of sanctions between Russia and Western countries on French firms' exports.

4.3.1 Extensive margin: Stopping to export?

Table 4: Benchmark regressions: Export probability - LPM

	(1)	(2)	(3)
HS 4	All	Embargoed	Non-embargoed
Russia × Dec '13 - Feb '14	-0.027^a	-0.057^a	-0.027^a
	(0.002)	(0.020)	(0.002)
Russia × Mar '14 - Jul '14	-0.032^a	-0.11^a	-0.031^a
	(0.002)	(0.020)	(0.002)
Russia × Aug '14 - Dec '14	-0.047^a	-0.314^a	-0.041^a
	(0.002)	(0.021)	(0.002)
$\hat{\Theta}_{dt}$	0.006^a	0.011^a	0.007^a
	(0.001)	(0.004)	(0.001)
Nb. Obs.	3579336	71028	3508308
R^2	0.590	0.633	0.589
% change in predicted conditional probability of exporting to Russia			
Dec '13 - Feb '14	-10.6	-13.4	-10.5
Mar '14 - Jul '14	-12.1	-26.3	-11.6
Aug '14 - Dec '14	-18.3	-79.0	-16.0

Notes: All regression include Firm × Destination × HS4 and Firm × time × HS4 fixed effects. Robust standard errors in parentheses are clustered by Firm × HS4. Linear probability estimates. Dependent variable is a dummy set to one for positive exports. Significance levels: ^{c}: p<0.1, ^{b}: p<0.05, ^{a}: p<0.01.

We focus first on the extensive margin. The benchmark results for the impact of sanctions on export participation are shown in table 4. The table reports linear probability model (LPM) estimates of equation 15. Column (1) reports the results for all HS4 together, column (2) shows the estimates for products targeted by the Russian embargo and column (3) the ones for non-embargoed products. All regressions corroborate the fact, established in section 3, that the diplomatic dispute impacted negatively French exports to Russia. Results in table 4 show that the impact is particularly strong on the extensive trade margin. While the results obtained with aggregated trade flows failed to show a significant drop in French exports between December 2013 and February 2014 (cf. table 2), the firm-level regressions reveal a significant and sizable decline in export participation during each of the three periods of interest. The bottom part of the table reports the percentage difference between the estimated average probability of exporting to Russia in presence of the treatment and

the one when the treatment dummy is set to zero. This difference measures the magnitude of the change in export probability resulting from the treatment. French exporters reacted strongly to the growing instability at the Russian border. On average for all products (column 1), the probability of exporting to Russia is reduced by 10.6% during the first period. The contraction of the export probability increased progressively in periods 2 and 3, with the implementation of the "smart sanctions" and later tougher economic sanctions. Compared to the benchmark level, the probability of exporting to Russia has been reduced by 12.1% during the time of Western "smart sanctions" (period 2) and by 18.3% during the last period. This means that most of the reduction of the propensity to export to Russia is attributable to the insecurity generated by the conflict at the Russian border. However, even if one assumes that the consequence of the conflict did not fade away during 2014,[42] the econometric results indicate that the sanctions had non-negligible repercussions on French exporters. For all products together, the Western "smart sanctions" reduced the probability of exporting by 1.5 percentage points and the economic sanctions by the West and Russian counter-sanctions by an additional 6.2 percentage points. Not surprisingly, the drop in export participation due to the uncertainty generated by the conflict in Ukraine is roughly the same for embargoed and non-embargoed products. However, the Russian embargo on agri-food products had a huge impact: After August 2014, the probability of exporting embargoed products was reduced by 79%.[43] It is noteworthy that the strong reduction in the probability of exporting embargoed products began before the implementation of the embargo. In other words, if it is true that the embargo almost eliminated the exports of embargoed products, the political instability in the region and—even more—the "smart sanctions" imposed by Western countries also struck a blow at French exporters of these products.[44]

Another interesting finding is that the drop in export participation increased between period 2 and period 3 for products that are not targeted by the Russian embargo (column

[42]Which is unlikely because the Minsk Protocol, signed in early September 2014, stopped the escalation of the violence to a certain degree and confined the war to the Eastern part of Ukraine. Moreover, the monthly estimates shown in figure 6 show that the export probability recovered partially after February 2014.

[43]The impact is less than 100%, however, as the list of products that are banned by the Russian authorities does not overlap exactly the HS classification, baby food for instance is explicitly exempt. In other words, our definition of the embargoed products is quite comprehensive (and conservative) and covers some varieties of products for which the export to the Russian Federation is not prohibited.

[44]This finding has important policy implications. France, as most European countries, faced a severe farming crisis in 2014–2015 and several political leaders blamed the Russian embargo for generating excess supply in the EU and depressing the agricultural goods prices. For instance, Xavier Beulin, the leader of the main French farmer union (FNSEA), in October 2014 wrote a public letter to the French president claiming that "the Russian Embargo generates, at least, a direct loss of 5.2 billion Euros per year." Not to mention the evident overestimation of this figure (from 2011 to 2013 the total French exports of agricultural and agri-food products to Russia was less than 1,2 billion Euros per year), our estimations show that most of the drop in exports of embargoed goods to Russia in 2014 is not the consequence of the embargo: A part of it (not estimated here because it is absorbed by the variable $\hat{\Theta}_{dk't}$) is the consequence of the economic crisis in Russia, and about a third of the rest can be attributed to the conflict and the "smart sanctions" imposed by the EU.

3), which indicates that the reinforcement of the EU sanctions in August 2014 increased the burden for French exporters. This is more visible in figure 6. Instead of considering three periods between December 2013 and December 2014, we now interact the dummy (destination = Russia) with 13 dummies for each of the months from December 2013. The figure reports the coefficients associated with these 13 treatment variables. We see the radical impact of the Russian embargo on targeted products. For non-embargoed products, we observe ups and downs. However, export participation drops suddenly every time the EU extended the sanctions, suggesting that the announcement of new restrictions generated institutional instability that disturbed business relationships.

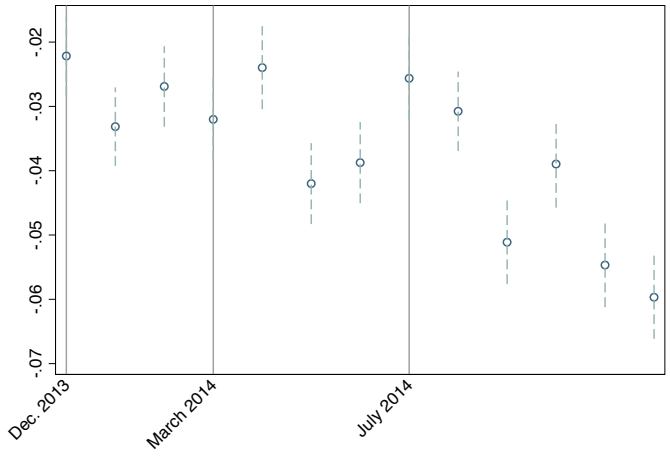
Tables 18 and 19 in the appendix test the robustness of the benchmark results. In table 18, we replicate the benchmark regressions with a different control group. Instead of European countries, the control group is composed of 19 countries that did not imposed sanctions on Russia or were targeted by Russians counter-sanctions. The average treatment effects on the export decision obtained with this alternative control group are slightly different than the benchmark results, but they are in same order of magnitude. As in table 4, the drop in the probability of exporting increases with the escalation of sanctions, including for non-embargoed products. In columns (1)–(3) of table 19, we report conditional logit estimates of the probability of exporting. Columns (4)–(6) of table 19, report PPML estimates of the impact of Ukrainian war and Russia sanctions on the export value. Because we cannot factor out anymore the two sets of fixed effects, the specification is slightly different. In order to have a computationally feasible specification, we replace the firm $\times$ time $\times$ HS4 fixed effects by a time fixed effect. In order to control for possible firm-product-destination seasonal effects. Again the results are in line with the ones shown in table 4.

4.3.2 Intensive margins: Exporting less or cheaper?

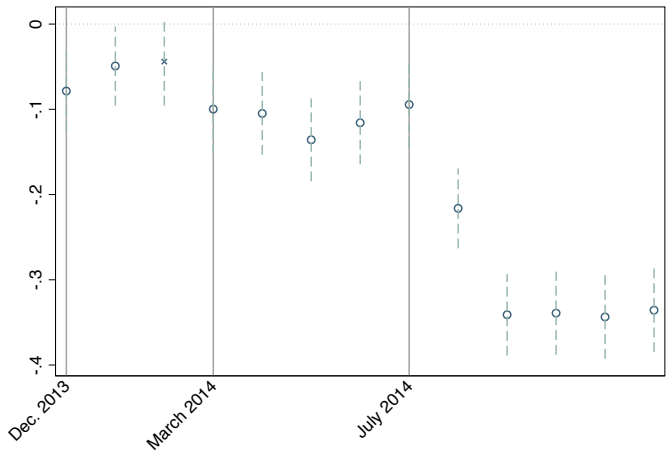
We now turn to the investigation of the impact of the sanctions on the intensive margins. It is noteworthy that our data do not report all exporter-to-importer transactions but only total custom declarations consolidated at the firm-product-destination-month level. A single observation in our data may aggregate several transactions. Therefore, a decrease in the observed export value may be either the consequence of a decrease in the shipment value or of the interruption of a fraction of the commercial relationships a firm may have in Russia. In other words, we cannot claim that the results shown in this section have to be strictly interpreted in terms of changes in the intensity of trade relationships. Columns (1)–(3) of table 5 show the OLS estimates of equation 14. The results confirms that the political crisis in Ukraine and Russia not only led French firms to stop or delay their shipments to Russia but also to reduce export values. For non-embargoed products, the average monthly value of export shipment to Russia decreased by 7.3%, i.e. $1 - \exp(-0.074)$, between the start of the conflict and the implementation of first European sanction against

Figure 6: Estimated coefficients on treatment variable, by month (Dec '13 - Dec '14) - LPM

(a) All HS4



(b) Embargoed HS4



(c) Non-embargoed HS4

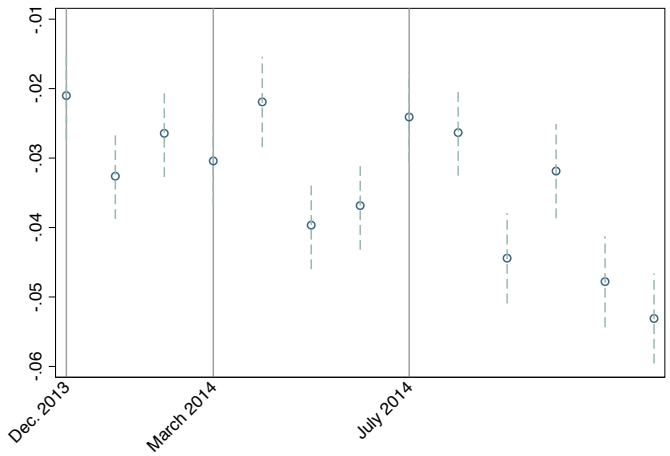


Table 5: Intensive margin: Export values - OLS

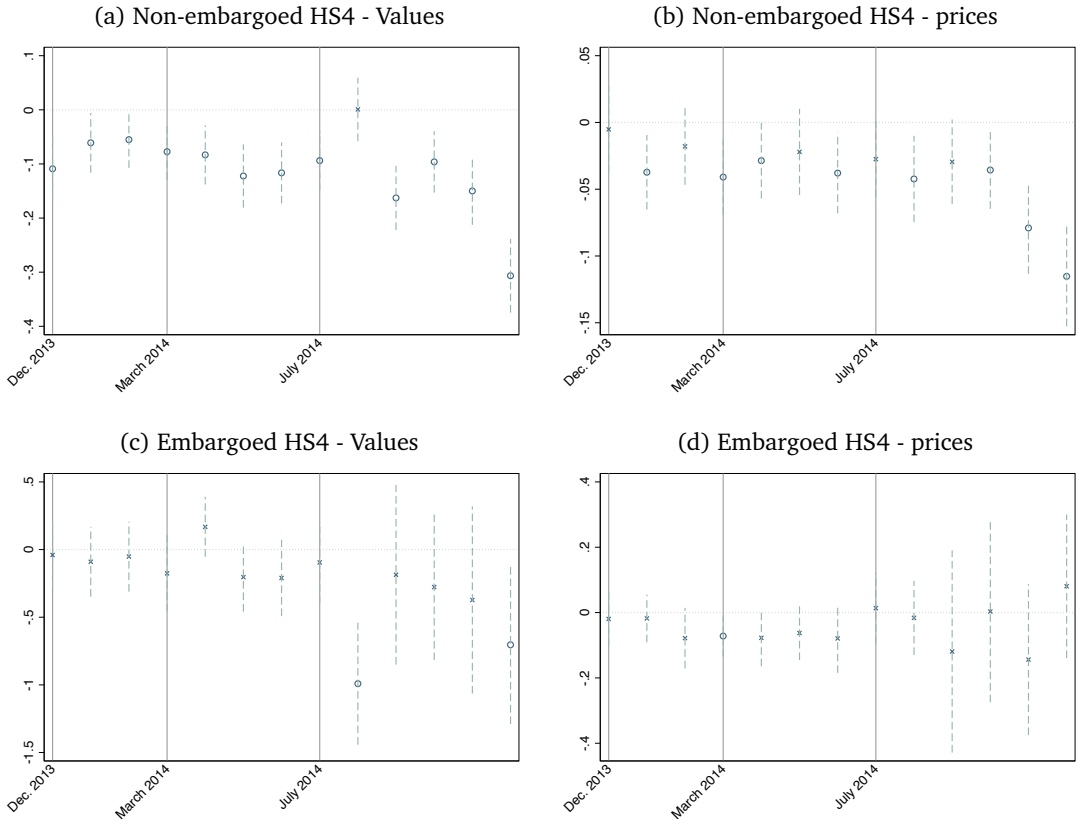
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var.		Value			Price	
HS 4:	All	Embargoed	Non-embargoed	All	Embargoed	Non-embargoed
Russia × Dec '13 - Feb '14	-0.074^{a}	-0.061	-0.074^{a}	-0.021^{b}	-0.038	-0.020^{b}
	(0.018)	(0.093)	(0.019)	(0.010)	(0.032)	(0.010)
Russia × Mar '14 - Jul '14	-0.098^{a}	-0.097	-0.098^{a}	-0.032^{a}	-0.057^{c}	-0.031^{a}
	(0.017)	(0.098)	(0.017)	(0.009)	(0.034)	(0.009)
Russia × Aug '14 - Dec '14	-0.145^{a}	-0.618^{a}	-0.139^{a}	-0.058^{a}	-0.034	-0.058^{a}
	(0.019)	(0.170)	(0.019)	(0.010)	(0.074)	(0.010)
$A_{d,t}$	0.031^{a}	-0.013	0.034^{a}	0.002	0.004	0.002
	(0.005)	(0.018)	(0.006)	(0.003)	(0.006)	(0.003)
Nb. Obs.	987864	22508	965356	987864	22508	965356
R^2	0.876	0.892	0.875	0.915	0.960	0.912

Notes: All regression include Firm × Destination × HS4 and Firm × time × HS4 fixed effects. Robust standard errors in parentheses are clustered by Firm × HS4. Significance levels: ^{c}: p<0.1, ^{b}: p<0.05, ^{a}: p<0.01.

the Russian Federation. The reduction in the export value reached 9.3% in the second period and 13% in the last one. For embargoed products, the impact is insignificant for the two first periods but, unsurprisingly, the Russian embargo had strongly negative consequences on export values. We suspect, however, that this effect is actually mainly driven by extensive margins effects for two reasons. First, as explained above, the Russian embargo covers most of the types of goods in each listed HS4, but not systematically all of them. Consequently, some firms may have had to stop exporting the products effectively banned by the embargo, but continued to sell other ones. Second, there might be a short period at the time of implementation during which some flows of products effectively banned could have crossed the border before its definitive closure.

In columns (4)–(6) of table 5 we estimate the same equation, but with the log of export prices (proxy by the ratio of export value over export quantity) as a dependent variable. Because OLS is a linear estimator and the log of the export value is the sum of the log of the export price and the log of the export quantity, the impact of the sanctions' regime on the quantity exported is simply the difference between the estimated average effects on export value and export prices. The results indicate that the price changes contributed a lot to changes in value of export flows to Russia. For non-embargoed products, the decrease of export prices explains almost exactly half of the decrease in export values. For the last period, the contribution of changes in export prices is much larger. It explains about 70% of the decrease in the value of individual shipments. Figure 7 displays the respective monthly coefficients.

Figure 7: Estimated coefficients on treatment variable, by month (Dec '13 - Dec '14) - OLS



4.4 Differential impact across firms and products and the causes of trade disruption

Our baseline estimation results provide us with an average effect of the impact of sanctions on the extensive and intensive margin of exports. This average effect could hide a strong heterogeneity across firms or products. In this subsection, we exploit this possible heterogeneity in order to shed light on the nature of the trade impediments generated by the sanctions.

We do not exactly know how the impact of sanctions may vary across firms, as we do not know the exact nature of the trade frictions they generated. Of course, the Russian embargo on agricultural and food products is unambiguous. It simply banned imports of these products and undoubtedly stopped trade from all firms, irrespective of their characteristics. But determining the precise consequences of the trade impediments generated by the complex scheme of economic sanctions imposed by Western countries is much more challenging. Since we have excluded from the analysis the products listed by the EU to be subject to trade restrictions, the impact of the sanctions estimated in the

previous sections must be channeled by less direct mechanisms. It seems very unlikely that the EU measures concerning economic cooperation (e.g., suspension of EU-Russia bilateral and regional cooperation programs), diplomatic relations (e.g., cancellation of a G8 summit, suspension of the negotiations over Russia's accession to the OECD), and asset freezes and visa bans applied to a handful of Russian citizens had an direct effect on the export flows to Russia. However, we suspect three mechanisms that may have been at work and contributed to the decline of export. 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 a sudden rise of economic, political, and legal instability that hindered business to do business in Russia or with Russian firms. Finally, it is possible that financial sanctions, i.e., restriction on dealings with Russian financial institutions, generated a disruption of the financing of trade. We cannot assess precisely the strength of each mechanisms because our data does not contain detailed information on the trading firms and the contractual agreement they have with their foreign partner. Nevertheless, the following subsections present three different tests aiming to provide suggestive evidence on whether any of these mechanisms had been at work. All these tests are conducted on the subsample of non-embargoed products.

4.4.1 Change in consumers' attitude

A first reason that could explain why the exports of non-embargoed products to Russia declined after the beginning of the conflict in the Ukraine (and further when the EU 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 has 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),[45] confirm that boycotts calls and, more generally, 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 communicated its intention to ban Western food products in retaliation to the Western sanctions, organizing, for instance, the public destruction of illegally imported food. These

[45]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 6: Interaction with brand visibility - Non-embargoed products

	(1)	(2)	(3)	(4)	(5)	(6)
Interaction term	Consumption goods		Goods w. luxury firms		Luxury firms	
Dep. var	$\Lambda = 1$	Value	$\Lambda = 1$	Value	$\Lambda = 1$	Value
Ru. × Dec '13 - Feb '14	0.002	0.020	-0.000	0.013	-0.007	-0.000
× Interaction	(0.004)	(0.037)	(0.004)	(0.038)	(0.008)	(0.072)
Ru. × Mar '14 - Jul '14	0.010^{b}	-0.028	0.010^{b}	-0.006	-0.005	-0.035
× Interaction	(0.004)	(0.034)	(0.004)	(0.034)	(0.008)	(0.060)
Ru. × Aug '14 - Dec '14	0.002	-0.0470	0.003	-0.037	-0.010	0.087
× Interaction	(0.004)	(0.038)	(0.004)	(0.039)	(0.010)	(0.062)
Ru. × Dec '13 - Feb '14	-0.028^{a}	-0.082^{a}	-0.027^{a}	-0.078^{a}	-0.024^{a}	-0.062^{b}
	(0.003)	(0.025)	(0.003)	(0.024)	(0.003)	(0.030)
Ru. × Mar '14 - Jul '14	-0.034^{a}	-0.087^{a}	-0.034^{a}	-0.096^{a}	-0.024^{a}	-0.107^{a}
	(0.003)	(0.022)	(0.003)	(0.021)	(0.003)	(0.028)
Ru. × Aug '14 - Dec '14	-0.042^{a}	-0.123^{a}	-0.042^{a}	-0.127^{a}	-0.038^{a}	-0.183^{a}
	(0.003)	(0.025)	(0.003)	(0.024)	(0.004)	(0.034)
$A_{d,t}$	0.007^{a}	0.034^{a}	0.007^{a}	0.034^{a}	0.006^{a}	0.034^{a}
	(0.001)	(0.006)	(0.001)	(0.006)	(0.001)	(0.009)
Nb. Obs.	3508308	965356	3508308	965356	1412244	360477
R^2	0.589	0.875	0.589	0.883	0.574	0.883

Notes: All regression include Firm × Destination × HS4 and Firm × time × HS4 fixed effects. Robust standard errors in parentheses are clustered by Firm × HS4. Significance levels: ^{c}: p<0.1, ^{b}: p<0.05, ^{a}: p<0.01.

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. Heilmann (2016) shows clearly that boycotts have larger effects on highly-branded products and consumer goods than on capital or intermediate ones. We base our identification strategy on the expected heterogeneous effect of the change in consumers' attitude across firms and products, by interacting our treatment variables with indicators of *made-in-label* visibility.

Table 6 shows the results for three different indicators of visibility. In columns (1) and (2) we take the export probability and export value equations 14 and 15 and add interactions with a dummy set to one for consumption goods.[46] In columns (3) to (4) we now break up the analysis by whether consumer goods tend to be branded. This distinction is based on the presence of exporters of luxury varieties within a product category. The idea here is that luxury firms need to invest substantially in their brand image, which is possible only for consumption products that are easily branded. The list of French exporters of luxury

[46]We use the classification by broad economic categories (BEC) provided by the United Nations to identify consumption 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."

goods is provided by Martin and Mayneris (2015).[47] 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 producers and defend their interests. Only 76 companies are members of this very select club, but Martin and Mayneris (2015) extend the list of luxury producers by identifying the firms that export the same goods in a comparable range of price. In columns (5) and (6), we focus on consumption goods but, instead of differentiating the impact of the sanctions across different types of products, we look at whether the impact is different for these high-end producers, within their HS4. The underlying assumption here is that French luxury brands are highly 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.[48] Except for small unexpected positive coefficients in columns (1) and (3), none of these interaction terms is significantly different from zero. This discards the hypothesis that sudden changes in consumer preferences contributed greatly to the drop of French exports to Russia after December 2014.

4.4.2 Firm size and country risk

A second explanation for the negative impact estimated in the previous sections could be a sudden rise of economic and/or political insecurity perceived by exporting firms. Until firms are reassured on the security of their shipments and know more about the new regulatory environment, businesses may be inclined to reduce their shipments and stop or delay their search of new business opportunities.

Again, our data do not offer a direct way to test whether this reaction of exporters to insecurity may have contributed to the decline of exports to Russia. However, looking at whether the impact of the political turmoil varies according to the size and the experience of exporters is a way to enlighten us on this question. It is indeed sensible to expect larger and more experienced exporters to be less affected by political instability, either because they can afford higher exports cost, they have a better ability to deal with complex situations in cross-border relationships, or because their international transactions are likely to be based on larger and more stable networks of customers. The existing literature on firms' dynamics on export markets confirms that persistence on export markets increases with the firms' size and length of export experience (e.g., Timoshenko (2015), Berman et al. (2015), Bricongne et al. (2012)). Haidar (2014) also shows that the sanctions against Iran affected most severely the small Iranian exporters.

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

[48] 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.

Table 7: Interaction with firm size and dependence to Russia - Non-embargoed products

	(1)	(2)	(3)	(4)	(5)	(6)
Interaction term		Size			Dependence	
Dep. var	$\Lambda = 1$	Value	Price	$\Lambda = 1$	Value	Price
Russia × Dec '13 - Feb '14	0.001^{c}	-0.001	-0.005	-0.046^{a}	-0.447^{a}	0.030
× Interaction	(0.001)	(0.008)	(0.004)	(0.006)	(0.070)	(0.039)
Russia × Mar '14 - Jul '14	-0.001	-0.020^{a}	-0.001	-0.072^{a}	-0.483^{a}	-0.068^{c}
× Interaction	(0.001)	(0.007)	(0.004)	(0.006)	(0.067)	(0.035)
Russia × Aug '14 - Dec '14	-0.003^{a}	-0.017^{b}	0.005	-0.100^{a}	-0.644^{a}	-0.160^{a}
× Interaction	(0.001)	(0.008)	(0.005)	(0.006)	(0.078)	(0.039)
Russia × Dec '13 - Feb '14	-0.023^{a}	-0.074^{a}	-0.027^{a}	-0.027^{a}	-0.076^{a}	-0.021^{b}
	(0.004)	(0.020)	(0.010)	(0.002)	(0.018)	(0.010)
Russia × Mar '14 - Jul '14	-0.035^{a}	-0.119^{a}	-0.033^{a}	-0.032^{a}	-0.101^{a}	-0.033^{a}
	(0.004)	(0.019)	(0.009)	(0.002)	(0.017)	(0.009)
Russia × Aug '14 - Dec '14	-0.059^{a}	-0.161^{a}	-0.052^{a}	-0.047^{a}	-0.147^{a}	-0.058^{a}
	(0.004)	(0.022)	(0.011)	(0.002)	(0.019)	(0.010)
$A_{d,t}$	0.006^{a}	0.031^{a}	0.002	0.006^{a}	0.031^{a}	0.002
	(0.001)	(0.005)	(0.003)	(0.001)	(0.005)	(0.003)
Nb. Obs.	3579336	987864	987864	3579336	987864	987864
R^2	0.590	0.876	0.915	0.590	0.876	0.915

Notes: All regression include Firm × Destination × HS4 and Firm × time × HS4 fixed effects. Robust standard errors in parentheses are clustered by Firm × HS4. Significance levels: ^{c}: p<0.1, ^{b}: p<0.05, ^{a}: p<0.01.

In columns (1)–(3) of table 7, we interact the three binary treatment variables with an indicator of firm size. This interaction variable is, for each firm and HS4, the log of the total export sales of the firm before the treatment period, i.e. between January 2011 and November 2013, over total French export of the HS4. This variable, which is invariant over time, is larger when the firm exported relatively large values compared to other French exporters of the same HS4, and/or when the firm has been active on foreign markets for a relatively long time. The results confirm that big exporters are more resilient when facing political uncertainty: The positive coefficient reported in the first row of column (1) indicates that their probability of exporting to Russia is relatively less impacted by the surge of the military conflict. However, this small advantage disappears in the second and third periods, when "smart sanctions" and economic sanctions are implemented. On the contrary, both their propensity to export and their intensive margin (columns 1 and 2) are significantly more affected by the sanctions than the one of smaller exporters. In columns (4)–(6), the interaction variable is an indicator of dependence on the Russian market. As dependence we define here for each firm its total sales of a given HS4 in Russia prior the political events (from January 2011 to November 2013), divided by the total exports of the firm during the same period. Again, we can reasonably expect firms that mainly export to Russia to have better knowledge of this market and are therefore less sensitive to the rise of political insecurity. However, the results are at odds with this hypothesis. Almost all the interaction terms are significantly negative, which indicates that firms that are more dependent on their export to Russia are more affected by the events. More

dependent firms are more likely to reduce the frequency of their shipments, to reduce the price they charge and the quantity exported. Importantly, the impact on these firms specialized on the Russian market increases over time: It is significantly larger in periods 2 and 3, when the sanctions are implemented. All together, these results indicate that growing uncertainty about the political environment is probably not the main cause of the fall of trade, at least as soon as the Western sanctions have been implemented. Instead, the negative signs on the interaction variables are in line with an alternative explanation based on the disruption of the provision of trade finance services induced by Western sanctions. The next subsection explores this question more thoroughly.

4.4.3 Disruption of trade finance

The financial sanctions imposed by Western countries on major Russian banks have partly disrupted the financial relationships between the sanctioning countries and Russia.[49] The measures did not directly target the provision of trade finance services, but aimed at putting constraints on the (re)financing of Russian banks.

As Western sanctions were generally aimed at coercing the Russian state into changing its political course through targeting these institutions, it is likely that the applied restrictions negatively impacted the provision of trade finance services and affected trade flows dependent on these. Three mechanisms are plausible: First, the sanction undoubtedly weakened major Russian banks financially, reducing their capacity to offer competitive financial services. Second, even before the sanction were put in place, it is possible that banks and trading firms internalized the risk of seeing some financial activities being forbidden. They may have stopped or delayed pending transactions, until having guarantees on their legality. Third, even after the release of the official EU resolution establishing the financial sanctions against Russia, some doubt persisted about their scope, constituting a source of uncertainty. This is underlined by the fact that the EU commission felt the need to publish a subsequent guidance note in December 2014 concerning the implementation of certain provisions of the financial sanctions.[50] The note aimed at clarify the interpretation of 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 felt legal uncertainty about the coverage of the sanctions and needed a clarification.

[49]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.

[50]Commission Notice of 16.12.2014, `http://europa.eu/newsroom/files/pdf/c_2014_9950_en.pdf`.

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 again face data limitations. We do not have any information about usage of trade finance instruments by French exporters directly. 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,[51] or on information on firm-bank links that are not specific to the provision of trade finance instruments.[52] There are also a few studies using detailed information, but restrict the analysis to a single country. Niepmann and Schmidt-Eisenlohr (2016a) and Niepmann and Schmidt-Eisenlohr (2016b) exploit data on U.S. banks allowing the provision of trade finance services for US international trade transactions across the world. Finally, two papers exploit very detailed firm-level data: Demir and Javorcik (2014) for Turkey and Ahn (2015) for Colombia and Chile. This literature shows 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,[53] 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 (2014).[54] 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.[55] 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

[51] 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.

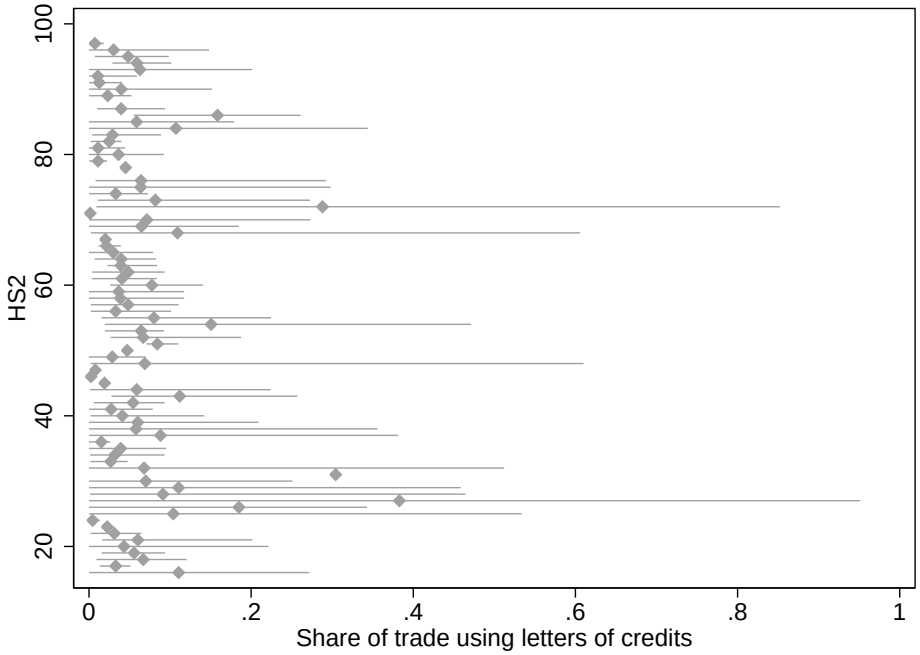
[52] See e.g. Paravisini et al. (2014).

[53] See e.g. Manova (2013).

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

[55] As a robustness check, we also used the share of French exports to Turkey using Letters of Credits. The results (unreported but available from the authors upon request) are very similar to the ones reported in table 8.

Figure 8: Trade finance dependence: Share of trade using letters of credits by HS2 (mean, max and min)



levels of development of their financial systems (the recent literature on trade finance has revealed that these two variables influence greatly the usage of letters of credits). According to the financial development indicator proposed by Svirydzenka (2016), Russia is ranked 32nd in the world and Turkey is 37th.[56] It is noteworthy that the use of Turkish data is not only motivated by the lack of data for most 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 794 HS4-level products, all of which are not targeted by the economic sanctions imposed by the EU or the Russian Federation. For most HS4, the share of trade using letters of credit is very small. The average is less than 7%, but the median value is only 3.7%. However, this share varies a lot across HS4. The standard deviation is 0.10, with a maximum reaching 95.1%. The variance is also substantial within broader categories of products. In Figure 8, we report the average value across chapters of the HS classification (HS2), along with 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,

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

Table 8: Interaction with dependence to trade finance - Non-embargoed products

Sample	(1)	(2)	(3)	(4)	(5)	(6)
		All			Large shipments	
	$\Lambda = 1$	Value	Price	$\Lambda = 1$	Value	Price
Russia × Dec '13 - Feb '14	0.007	0.332	0.031	0.032	0.200	0.148
× Trade Finance	(0.031)	(0.231)	(0.127)	(0.052)	(0.271)	(0.151)
Russia × Mar '14 - Jul '14	-0.062^{b}	-0.060	0.059	-0.072^{c}	0.019	-0.164
× Trade Finance	(0.026)	(0.193)	(0.095)	(0.042)	(0.238)	(0.102)
Russia × Aug '14 - Dec '14	-0.050^{c}	0.190	0.214^{b}	-0.104^{b}	0.200	0.268^{b}
× Trade Finance	(0.027)	(0.225)	(0.101)	(0.044)	(0.271)	(0.117)
Russia × Dec '13 - Feb '14	-0.028^{a}	-0.077^{a}	-0.021^{b}	-0.024^{a}	-0.136^{a}	-0.024^{b}
	(0.002)	(0.017)	(0.009)	(0.003)	(0.022)	(0.011)
Russia × Mar '14 - Jul '14	-0.030^{a}	-0.097^{a}	-0.031^{a}	-0.030^{a}	-0.207^{a}	-0.029^{a}
	(0.002)	(0.013)	(0.007)	(0.003)	(0.017)	(0.008)
Russia × Aug '14 - Dec '14	-0.040^{a}	-0.150^{a}	-0.058^{a}	-0.045^{a}	-0.276^{a}	-0.054^{a}
	(0.002)	(0.015)	(0.008)	(0.003)	(0.019)	(0.009)
$A_{d,t}$	0.008^{a}	0.032^{a}	0.002	0.005^{a}	0.044^{a}	0.001
	(0.001)	(0.006)	(0.003)	(0.002)	(0.009)	(0.004)
Nb. obs.	3407868	941135	941135	1065996	386343	386343
R^2	0.589	0.875	0.910	0.626	0.861	0.931

Notes: All regression include Firm × Destination × HS4 and Firm × time × HS4 fixed effects. Robust standard errors in parentheses are clustered by Firm × HS4. Significance levels: ^{c}: p<0.1, ^{b}: p<0.05, ^{a}: p<0.01.

however, and in particular in those showing high averages, the variance across HS4 is substantial.

In table 8 we report the coefficients for the export decision, value and price regressions with interaction terms between the treatment dummies and our product-level measure of dependence to trade finance. As expected, we find that the reaction to the political shocks is higher for product categories where the usage of trade finance instruments is more widespread. Interestingly, the coefficient on the interaction term is significantly negative for the export participation only (column 1) and for periods 2 and 3 during which financial sanctions against Russian banks are active. This coefficient is clearly insignificant during the first period, when country risk increased but the supply of financial services was not restricted yet. The average treatment effect on the value of the shipments (column 2) does not vary with trade finance dependence, but we observe a comparatively large effect on export prices (column 3) for the last period. Put together, these results suggest that those trade flows to Russia that rely on bank intermediation services have been disrupted or delayed by the implementation of EU financial sanctions, and demanded a risk premium when they managed to keep exporting.

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 preferred for larger transactions. Niepmann and Schmidt-Eisenlohr (2016a) 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 should expect that the impact of dependence on trade finance shown in table 8 is magnified for large transactions. We test this prediction in columns (4)–(6) by restricting the sample to firms that tend to send large shipments to Russia. Our proxy for the shipment size is the average monthly value of (strictly positive) firm-HS4 export declarations to Russia over the period covering all months between January 2011 and November 2013.[57] The sample used in columns (4)–(6) retains firms with an average shipment size above the 75th percentile of each HS4. Results confirm that firms that the overreaction of products with higher trade finance dependence is strongest for firms with larger shipments.[58]

5 Trade diversion

As exporting to the Russian Federation became more difficult, French firms may have found new business opportunities in other countries and partly compensated their losses on the Russian market. They may also have found ways to circumvent the sanctions by selling to some intermediary firms located in a country not involved in the diplomatic conflict—and not hit by counter-sanctions—in order to re-export to Russia.[59] However, it is also possible that the disruption of trade with Russia have affected exporters' cash-flow and their capacity to finance their activities in other markets. In this case, sales in different export markets would be positively correlated and we could expect an additional negative impact of the sanctions on exports of affected firms.[60] Our empirical strategy to evaluate the impact of the sanctions on exports of French exporters to Russia to alternative destinations is again a simple difference-in-differences estimation. Here, we compare the trends of export performances on non-Russian markets of firms that have been directly exposed to the sanctions to the ones of non-exposed firms. We estimate the following specification:

$$\text{TradePerformance}_{idkt} = \beta[\text{RUexporter}_{ik,t0} \times \text{PostSanctions}_t] + \theta_{idk} + \theta_{dkt} + \varepsilon_{idkt}, \quad (16)$$

where subscripts i, k, d and t as before denote firms, products, destinations and time, respectively. $\text{TradePerformance}_{idkt}$ is alternatively the probability that firm i exports good

[57] Unreported regressions confirmed the robustness of our results with proxies based on shorter (and more recent) periods.

[58] Unreported regressions show that the significant impact of trade finance dependence is entirely driven by those firms with shipment size above the 75th percentile. Regressions on the sample of firms with smaller shipment size provide non-significant coefficients on the interaction terms.

[59] Haidar (2014) observes very strong trade diversion effects in the case of Iran. Iranian firms that used to export to countries imposing an embargo have increased their exports of the same product to non-sanctioning destinations.

[60] Berman et al. (2015) provide empirical evidence of such a positive correlation between sales on different markets.

k to country d at time t, the log of the value exported or the log of the export unit value. θ_{idk} and θ_{dkt} are firm $\times$ product $\times$ destination and destination $\times$ product $\times$ time fixed effects. The treatment dummy is $[\text{RUexporter}_{ik} \times \text{PostSanctions}_t]$. It is set to one during the time when sanctions are active and when firm i exported the product k to Russian before the sanctions. We estimate this equation on the universe of French firm-level exports to any destination but Russia. Therefore, the average treatment effect, β, indicates whether firms that have been directly exposed to the sanctions—having exported to Russia the diplomatic conflict—performed better or worse than other French exporters on non-Russian markets. For the estimations, we focus on the months during which the sanctions are the most severe by retaining two periods only: the economic sanctions period (from August 2014 to November 2014) and the comparable pre-conflict period (from August 2013 to November 2013).

Equation 16 compares the trade performance of firms exporting to Russia in 2013 to the performance of firms that did not exported there. To be sure that the appearance or interruption of exports to a given destination is not the consequence of "newborn" or "dead" firms starting up or closing down, we eliminate firms which do not report any trade flows in one period or the other. We also refine the estimation by trimming the control group. Russia is an important destination for French exports, but it is clearly not the most common one. Therefore, firms that export to Russia prior to the sanctions may have unobservable characteristics that differ greatly from the ones that do not export to Russia. If those characteristics are also correlated with the evolution of firms' export performances on all markets the estimation results might be biased. We alleviate this potential source of bias by reducing the sample to firms that share a similar probability of being treated. To do so, we implement a simple matching strategy: We eliminate treated firms that have very different characteristics from non-treated firms and vice versa, based on the probability to export to Russia in 2013 computed for each firm. To obtain the probability of being treated, we regress the dummy $RUexporter_{ik}$ on the total exports of the firm i between August and November 2013, the number of destinations the firm exports to during this period, a dummy set to 1 if the firm exports to countries that are former soviet republics (except Ukraine and Russia) and a product fixed effect. Among the non-treated firms, we drop those firms that have a probability to be treated below the 10th percentile of the distribution. Among the treated ones, we drop all firms with a probability of being treated above the 90th percentile.

Table 9 shows the results for embargoed and non-embargoed products.
Lines (13) and (14) show a negative impact of the treatment on both the probability of exporting and the export value for non-emboargoed products. However, this negative impact disappears once we restrict the sample so that the probability to be treated for

Table 9: Trade diversion

			Embargoed Products				
	Dep. var.	Matched	Destinations	Coef.	s.e.	Nb. Obs.	R^2
(1)	$\Lambda = 1$	No	All	-0.026	(0.02)	75254	0.453
(2)	Value	No	All	-0.012	(0.037)	46798	0.948
(3)	Price	No	All	-0.018^{c}	(0.011)	46798	0.970
(4)	$\Lambda = 1$	Yes	All	0.046	(0.049)	29416	0.491
(5)	Value	Yes	All	0.174^{c}	(0.111)	18512	0.943
(6)	Price	Yes	All	-0.010	(0.029)	18512	0.974
(7)	$\Lambda = 1$	Yes	Sanctioning	0.032	(0.048)	22252	0.478
(8)	Value	Yes	Sanctioning	0.205^{c}	(0.123)	15254	0.945
(9)	Price	Yes	Sanctioning	-0.018	(0.024)	15254	0.975
(10)	$\Lambda = 1$	Yes	Not Sanctioning	0.076	(0.072)	7164	0.500
(11)	Value	Yes	Not Sanctioning	0.050	(0.143)	3258	0.935
(12)	Price	Yes	Not Sanctioning	0.024	(0.103)	3258	0.973
			Non-embargoed Products				
	Dep. var.	Matched	Destinations	Coef.	s.e.	Nb. Obs.	R^2
(13)	$\Lambda = 1$	No	All	-0.013^{a}	(0.003)	2073606	0.400
(14)	Value	No	All	-0.013^{c}	(0.007)	1096372	0.939
(15)	Price	No	All	0.002	(0.004)	1096372	0.955
(16)	$\Lambda = 1$	Yes	All	0.075^{a}	(0.008)	679474	0.411
(17)	Value	Yes	All	0.077^{a}	(0.023)	317754	0.934
(18)	Price	Yes	All	0.018	(0.013)	317754	0.952
(19)	$\Lambda = 1$	Yes	Sanctioning	0.061^{a}	(0.010)	461286	0.413
(20)	Value	Yes	Sanctioning	0.095^{a}	(0.025)	247696	0.935
(21)	Price	Yes	Sanctioning	0.026^{c}	(0.015)	247696	0.952
(22)	$\Lambda = 1$	Yes	Not Sanctioning	0.101^{a}	(0.013)	218188	0.392
(23)	Value	Yes	Not Sanctioning	0.015	(0.044)	70058	0.924
(24)	Price	Yes	Not Sanctioning	-0.011	(0.027)	70058	0.953

Notes: All regression include Firm × Destination × HS4 and Destination × Time × HS4 fixed effects. Robust standard errors in parentheses are clustered by Firm × HS4. Significance levels: ^{c}: p<0.1, ^{b}: p<0.05, ^{a}: p<0.01.

treated and non-treated firms has comparable support. With the matching approach, we observe a very small positive impact of the treatment on export performances for embargoed products. Firms that directly suffered the consequences of the Russian embargo on food and agricultural products compensate a bit their loss by increasing their exports to alternative destinations. For non-embargoed products, the matching approach reveals also a significant trade diversion effect: firms that have exported to Russia in 2013 have increased their probability of exporting to another destination in 2014.

The estimation results shown in table 9 suggest that the French firms exposed to the disruption of the Russian market shifted some of their sales to other markets. However,

Table 10: Trade diversion - Quantification

	Dep. var.	Matched	Coef.	s.e.	Nb. Obs.	R^2	% Exported to Russia
			Embargoed Products				
(1)	Value	No	-0.228^a	(0.079)	16858	0.949	19.15
(2)	Value	Yes	-0.381^a	(0.106)	6586	0.947	23.07
(3)	Quantity	No	-0.215^a	(0.079)	16858	0.955	18.85
(4)	Quantity	Yes	-0.352^a	(0.104)	6586	0.931	22.78
			Non-embargoed Products				
(5)	Value	No	-0.059^a	(0.013)	354632	0.931	14.14
(6)	Value	Yes	-0.049^b	(0.022)	179718	0.913	19.92
(7)	Quantity	No	-0.040^a	(0.014)	354632	0.940	13.83
(8)	Quantity	Yes	-0.010^a	(0.024)	179718	0.931	19.30

Notes: All regression include Firm $\times$ $\times$ HS4 and Time $\times$ HS4 fixed effects. Robust standard errors in parentheses are clustered by Firm $\times$ HS4. Significance levels: ^{c}: p<0.1, ^{b}: p<0.05, ^{a}: p<0.01. The last columns reports the average share of exports to Russia in total exports of exposed firms in period 1.

these results are only marginal effects which are silent about the magnitude of the trade diversion. If the firm's exports to Russia prior the events were small relative to the exports to other nations, a slight increase of the latter would be enough to compensate the losses incurred on the Russian market. In order to evaluate the total loss of sales for firms that have been exposed to the Russian conflict, we aggregate all exports at the firm-product-time level and estimate the following difference-in-difference specification:

$$\text{Total Exports}_{ikt} = \beta_2[\text{RUexporter}_{ik,t0} \times \text{PostSanctions}_t] + \theta_{ik} + \theta_{kt} + \varepsilon_{ikt}. \tag{17}$$

Again, we retain two periods: From August 2013 to November 2013 and from August 2013 to November 2013. Total Exports$_{ikt}$ is the sum of all export of product k by firm i in period t (including exports to Russia). The treatment dummy (RUexporter$_{ik,t0}$ $\times$ PostSanctions$_t$) is the same as the one in equation 16, and we include firm $\times$ product and period $\times$ product fixed effects. The average treatment effect, β_2, therefore measures the change in total exports of exposed firms, relative to non-exposed ones. A non-significant coefficient would indicates that firms exporting to Russia in 2013 managed to fully divert their trade to other destinations (or that the exports to Russia were totally marginal in their total exports). A negative β_2 would mean that these exposed firms incurred a net reduction in their export sales. As for tables 9, we performed the regressions on the whole sample and the sample of matched firms.

The regression results are shown in table 10. The estimated average treatment effects confirm the narrative from above. Firms that exported to Russia before the events, were not able to fully recover their lost trade by shifting to other markets. On the contrary, row

(2) shows that those firms that exported agricultural and food products targeted by the Russian embargo saw their total exports decrease by 31.7 % (=1-$\exp(-0.381)$), i.e. more than their pre-events share of exports to Russia (23.07 %). The results for non-embargoed products also saw a significant decline of total exports of firms caught up in the Russian turmoil. Since trade of these products to Russia has not been totally interrupted, the loss of foreign sales by exposed firms is less stark. The total export values for these firms (row 6) decreased by on average 4.78 % and total export quantities by almost 1 %.

Overall, trade diversion effects remain therefore very limited, especially for embargoed products. Unlike in previous related research looking at the impact in *target* countries as in Haidar (2014), the ability of firms to quickly respond and shift sales to new or existing other markets, aside from the sanctioned country, is inadequate to fully counter losses incurred.

6 Conclusion

In this paper, we evaluate and quantify the effects of the sanctions regime by the European Union and allied countries against the Russian Federation and their counter-sanctions. We complement the existing literature by extending our analysis on the impact on the *sender* countries of the sanctions. The case of the Western-imposed sanctions on the Russian Federation is particularly instructive due to the strength of pre-conflict trade ties and the variety of policy options employed.

We conduct the analysis from two perspectives: We first gauge the global effects in a gravity setup, highlighting the heterogeneous impact on the different countries involved. Using monthly trade data from UN Comtrade, 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$ 4.7 billion per month, US$ 1.8 billion being borne by sanctioning Western countries. This cost on private actors is very unevenly distributed among countries, with European Union member states bearing 90% of the sanctioning countries' impact. Interestingly, the bulk of the "lost trade," 91%, 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 heterogeneity in the global impact, we then drill deeper using a rich dataset of monthly French firm-level exports. We investigate the micro effects along the intensive and extensive margins and examine possible channels through which the exports of *non-embargoed* products are hurt. We find significant effects on both intensive and extensive margins—the probability to

export any given good to Russia drops by on 8.2%–14.1% and the average shipment values decreased by 3.5%–7.5%. Again, significant effects are found for non-embargoed products.

While a direct identification of a mechanism explaining this "friendly fire" is difficult, we find suggestive evidence that 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. The data reject plausible alternative mechanisms: We find that neither consumer boycotts, i.e., a sudden change in preferences, or perceived country risk can account for the decline.

Finally, we investigate whether affected French exporters diverted their sales to other markets after being hit with restrictions to the Russian market. Firms that were directly exposed to Russian counter-sanctions, i.e., previously exported certain agricultural or food products later targeted by counter-sanctions by the Russian Federation, were not able to recover their loss by expanding sales to new or existing destinations aside from Russia. These firms that were not directly hit by counter-sanctions, i.e., those previously exporting to the Russian Federation, did serve more markets afterwards, but did not increase flows to existing partner countries. Overall, trade diversion effects remain insignificant or very small in magnitude.

Shedding light on the impact of sanctions on the sender countries opens up new boxes of intriguing questions. What happens to firms in sender and target countries engaged in trade after the lifting of sanctions? Are previous business networks revived or do sanctions imply structural changes? We refer these to further research.

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A Country-level Data

Table 11: 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

B EU sanctions: List of embargoed products

Table 12: 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)
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

Table 12 – *Continued on next page*

Table 12 – *Continued from previous page*

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.
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)

C Russian sanctions: List of embargoed products

Table 13: 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

D Quantification of lost trade

Table 14: Losses of total trade by period and country

	Total		Conflict		Smart sanctions		Economic sanctions	
Country	*absolute*	*relative*	*absolute*	*relative*	*absolute*	*relative*	*absolute*	*relative*
Australia	-7.25	-30.64	10.57	40.76	-8.96	-27.45	-9.89	-47.96
Austria	-31.77	-8.62	43.69	11.72	-36.35	-7.62	-43.74	-13.03
Belgium	-85.08	-18.81	-64.13	-12.68	-111.54	-18.76	-80.99	-20.20
Bulgaria	-3.95	-7.65	2.11	4.42	-4.22	-6.65	-4.94	-10.11
Canada	-17.11	-21.68	-4.71	-4.43	8.10	7.66	-26.72	-40.35
Czech Republic	-77.01	-17.66	-28.18	-6.03	-31.18	-6.05	-99.11	-24.33
Germany	-705.79	-21.04	-395.33	-11.18	-661.20	-15.79	-773.69	-25.14
Denmark	-18.55	-16.69	-14.02	-10.28	-16.61	-10.88	-19.92	-21.08
Spain	-41.41	-15.95	-27.45	-9.34	-10.74	-3.27	-52.89	-22.67
Estonia	29.03	22.23	59.62	47.33	54.41	33.92	16.17	13.19
Finland	-76.98	-16.02	-22.92	-4.39	-55.14	-9.19	-92.94	-21.22
France	-73.22	-12.43	-22.19	-3.26	-58.50	-7.90	-86.56	-16.37
United Kingdom	-134.79	-23.69	-47.59	-7.54	-99.58	-14.60	-160.53	-30.61
Georgia	9.94	116.01	14.61	152.95	14.79	170.44	7.69	91.95
Greece	-4.91	-14.08	-5.67	-15.63	-6.87	-12.76	-4.20	-14.46
Croatia	-5.58	-17.80	3.12	8.69	-5.35	-17.33	-7.19	-23.41
Hungary	-45.80	-19.40	-13.12	-4.96	-56.47	-19.39	-48.42	-22.54
Ireland	3.02	5.67	6.66	11.62	42.00	63.29	-9.09	-18.72
Italy	-59.28	-6.49	43.78	4.52	1.21	0.10	-95.26	-11.44
Japan	-112.20	-15.65	-31.25	-3.61	-37.26	-4.11	-148.53	-23.40
Lithuania	33.79	8.48	43.26	9.52	88.91	17.07	15.91	4.51
Latvia	-3.70	-3.53	8.52	7.64	-5.32	-4.48	-5.38	-5.40
Montenegro	-0.11	-23.68	0.09	16.09	0.03	8.16	-0.19	-40.22
Netherlands	-107.25	-15.75	-140.50	-17.73	-97.07	-11.40	-104.37	-17.09
Norway	-27.89	-36.63	-18.24	-13.94	-16.87	-14.39	-32.83	-60.37
Poland	-134.90	-17.50	-66.63	-7.92	-98.17	-10.54	-157.75	-22.17
Portugal	-1.11	-5.63	1.04	4.64	0.77	3.11	-2.04	-11.50
Romania	7.11	5.95	23.62	18.28	27.07	18.83	-1.67	-1.51
Slovakia	-44.92	-19.55	-22.57	-8.90	10.64	4.12	-65.20	-30.04
Slovenia	2.77	3.08	6.88	7.20	5.76	5.13	1.16	1.41
Sweden	-16.44	-7.46	32.07	14.60	-1.48	-0.54	-29.40	-14.40
United States	-13.37	-1.77	46.32	5.21	135.77	15.87	-67.76	-9.69
average	-55.15	-14.27	-18.08	-4.24	-32.17	-6.70	-68.45	-19.45
cumulative	-1764.71	-14.27	-578.51	-4.24	-1029.40	-6.70	-2190.30	-19.45

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 15: 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	-8.61	-60.04	10.70	77.17	-10.64	-60.86	-12.95	-99.32
Austria	-0.75	-13.44	1.81	23.84	-1.43	-13.41	-1.00	-27.07
Belgium	-6.37	-38.77	1.66	5.35	-3.55	-12.26	-8.62	-84.75
Bulgaria	0.27	36.26	0.00	0.43	-0.48	-27.31	0.56	130.58
Canada	-3.58	-17.60	12.79	45.60	20.38	67.02	-14.85	-95.88
Czech Republic	0.21	31.35	0.63	53.07	1.07	90.70	-0.11	-24.66
Germany	-17.55	-41.70	-23.81	-31.67	-36.58	-50.18	-10.85	-39.91
Denmark	-2.02	-12.22	5.58	18.33	-2.73	-10.26	-3.15	-28.42
Spain	-14.85	-58.49	-18.88	-36.46	-13.38	-30.13	-14.57	-96.26
Estonia	-1.03	-22.94	1.18	16.18	-1.40	-16.97	-1.31	-45.64
Finland	-6.47	-35.10	3.94	12.64	7.25	26.50	-12.34	-91.05
France	-3.59	-24.87	0.96	3.70	-0.80	-3.26	-5.21	-55.32
United Kingdom	-0.40	-10.52	0.57	8.06	0.93	13.89	-0.96	-40.57
Georgia	1.56	308.52	0.95	52.49	0.25	163.97	1.97	552.89
Greece	-5.00	-45.28	-3.41	-29.19	-1.94	-10.06	-6.83	-95.98
Croatia	-0.12	-25.19	-0.00	-0.74	0.22	80.58	-0.24	-46.74
Hungary	-1.69	-42.30	1.14	21.05	-2.66	-35.77	-1.91	-69.41
Ireland	-0.07	-1.15	4.95	54.58	-0.77	-6.57	-0.75	-19.00
Italy	-3.42	-34.45	0.52	2.99	-0.10	-0.64	-5.10	-74.54
Japan	0.55	121.01	0.66	84.52	-0.13	-18.72	0.73	228.43
Lithuania	-28.14	-40.39	-18.46	-14.66	-15.92	-12.94	-33.44	-75.91
Latvia	1.47	64.85	6.19	145.96	5.21	155.06	-0.46	-28.82
Montenegro	0.05	405.72	-Inf	-100.00	-Inf	-100.00	0.05	673.97
Netherlands	-0.62	-2.02	9.84	20.44	9.43	18.99	-5.42	-24.71
Norway	-29.98	-50.12	-13.15	-12.21	-11.44	-13.30	-39.53	-95.18
Poland	-21.43	-40.48	5.87	6.41	-14.62	-14.99	-28.25	-85.60
Portugal	-0.44	-35.29	0.48	52.04	0.33	37.16	-1.75	-97.40
Romania	-0.00	-2.61	0.04	322.08	-0.05	-14.79	0.01	8.41
Slovakia	-0.13	-38.59	0.02	2.61	-0.07	-12.44	-0.17	-81.45
Slovenia	0.27	19.74	-0.29	-13.66	-0.67	-27.48	0.64	70.95
Sweden	-0.34	-38.87	0.49	46.57	-0.18	-11.63	-0.54	-82.68
United States	-17.78	-42.09	-16.14	-26.27	-6.63	-8.91	-21.35	-72.62
average	-5.50	-35.32	-0.75	-2.89	-2.63	-10.19	-7.28	-69.49
cumulative	-176.04	-35.32	-23.94	-2.89	-84.30	-10.19	-232.82	-69.49

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 16: 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	-0.70	-5.52	-0.13	-1.08	1.68	11.10	-1.51	-12.37
Austria	-31.03	-8.55	41.88	11.47	-34.91	-7.49	-42.75	-12.87
Belgium	-78.71	-18.06	-65.79	-13.86	-107.99	-19.10	-72.37	-18.52
Bulgaria	-4.21	-8.28	2.11	4.49	-3.74	-6.06	-5.47	-11.29
Canada	-13.82	-22.95	-17.51	-22.37	-12.27	-16.29	-13.62	-25.92
Czech Republic	-77.22	-17.74	-28.81	-6.18	-32.24	-6.27	-99.00	-24.33
Germany	-688.24	-20.78	-371.51	-10.73	-624.62	-15.18	-762.84	-25.01
Denmark	-16.54	-17.47	-19.60	-18.48	-13.89	-11.01	-16.77	-20.11
Spain	-26.56	-11.34	-8.57	-3.54	2.64	0.93	-38.32	-17.57
Estonia	30.06	23.83	58.44	49.25	55.81	36.67	17.48	14.59
Finland	-70.51	-15.26	-26.86	-5.48	-62.40	-10.89	-80.60	-18.99
France	-69.64	-12.12	-23.15	-3.54	-57.70	-8.06	-81.35	-15.67
United Kingdom	-134.39	-23.78	-48.15	-7.71	-100.51	-14.88	-159.57	-30.56
Georgia	8.44	104.47	13.66	176.50	14.59	170.53	5.72	71.41
Greece	-1.11	-4.18	-2.25	-9.17	-4.93	-14.27	0.22	0.90
Croatia	-5.46	-17.68	3.13	8.85	-5.58	-18.22	-6.95	-23.00
Hungary	-44.10	-19.00	-14.25	-5.50	-53.82	-18.96	-46.51	-21.93
Ireland	3.09	6.56	1.71	3.55	42.77	78.29	-8.34	-18.69
Italy	-55.86	-6.18	43.26	4.54	1.31	0.11	-90.16	-10.92
Japan	-112.75	-15.74	-31.91	-3.69	-37.12	-4.10	-149.26	-23.53
Lithuania	61.93	18.84	61.72	18.80	104.83	26.36	49.35	16.00
Latvia	-5.17	-5.04	2.33	2.17	-10.53	-9.14	-4.92	-5.01
Montenegro	-0.12	-26.27	0.10	17.85	0.03	8.16	-0.21	-44.34
Netherlands	-106.63	-16.40	-150.34	-20.20	-106.50	-13.28	-98.95	-16.80
Norway	-0.30	-1.43	-5.09	-21.99	-5.43	-17.40	2.05	11.57
Poland	-113.47	-15.80	-72.50	-9.68	-83.55	-10.02	-129.50	-19.09
Portugal	-0.88	-4.63	0.56	2.62	0.44	1.85	-1.53	-8.86
Romania	7.12	5.96	23.58	18.25	27.12	18.91	-1.67	-1.51
Slovakia	-44.80	-19.53	-22.59	-8.93	10.71	4.15	-65.04	-30.00
Slovenia	2.50	2.82	7.18	7.69	6.43	5.85	0.51	0.63
Sweden	-16.10	-7.33	31.59	14.45	-1.30	-0.47	-28.87	-14.19
United States	4.41	0.62	62.46	7.55	142.39	18.23	-46.42	-6.93
average	-50.02	-13.45	-17.35	-4.33	-29.63	-6.51	-61.79	-18.05
cumulative	-1600.77	-13.45	-555.32	-4.33	-948.26	-6.51	-1977.17	-18.05

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.

E Robustness checks

E.1 Country-level gravity estimation

Table 17: Effect on value of trade with Russia by type of product and period

	Dependent variable:		
	log(imports)		
	(1)	(2)	(3)
Dec '13 - Feb '14	0.188	−0.089	0.191
	(0.185)	(0.257)	(0.186)
Mar '14 - Jul '14	−0.311^{b}	−0.302	−0.312^{b}
	(0.124)	(0.192)	(0.124)
since Aug '14	−0.192^{c}	−0.242^{c}	−0.198^{c}
	(0.102)	(0.135)	(0.103)
Type of product	total	embargoed products	non-embargoed products
Observations	257,072	173,519	255,452
R^2	0.951	0.926	0.950
Adjusted R^2	0.932	0.891	0.930
Residual Std. Error	0.818 (df = 184710)	0.890 (df = 117744)	0.845 (df = 183380)

Notes: All regression include exporter × date, importer × date and exporter × importer × month fixed effects. Robust standard errors in parentheses are clustered by exporter × importer × month. Significance levels: ^{c}: p<0.1, ^{b}: p<0.05, ^{a}: p<0.01.

E.2 Firm-level estimation

Table 18: Robustness check (1): Alternative control group

	(1)	(2)	(3)	(4)	(5)	(6)
	Export probability			Ln(export value)		
HS 4:	All	Embargoed	Non-embargoed	All	Embargoed	Non-embargoed
Russia	-0.009^a	-0.042^b	-0.009^a	-0.116^a	0.053	-0.121^a
× Dec2013 - Feb2014	(0.002)	(0.020)	(0.002)	(0.019)	(0.103)	(0.019)
Russia	-0.005^a	-0.077^a	-0.004^b	-0.113^a	-0.013	-0.115^a
× Mar2014 - Jul2014	(0.002)	(0.021)	(0.002)	(0.017)	(0.115)	(0.018)
Russia	-0.021^a	-0.300^a	-0.016^a	-0.149^a	-0.602^a	-0.145^a
× Aug2014 - Dec2014	(0.002)	(0.023)	(0.002)	(0.019)	(0.167)	(0.020)
$\hat{\Theta}_{dt}$	-0.000^c	-0.002	-0.000	0.003	0.004	0.003
	(0.000)	(0.001)	(0.000)	(0.002)	(0.007)	(0.002)
Nb. Obs.	4121460	68364	4053096	657378	14753	642625
R^2	0.621	0.626	0.621	0.894	0.903	0.893

Notes: All regression include Firm × Destination × HS4 and Firm × time × HS4 fixed effects. Robust standard errors in parentheses are clustered by Firm × HS4. Significance levels: ^{c}: p<0.1, ^{b}: p<0.05, ^{a}: p<0.01.

Table 19: Robustness check (2): Alternative estimators

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.		$\Lambda = 1$			Value	
HS 4	All	Embargoed	Non	All	Embargoed	Non
	All	Embargoed	embargoed	All	Embargoed	embargoed
Russia	-0.355^a	-0.422^a	-0.357^a	-0.179^a	-0.228^a	-0.177^a
× Dec2013 - Feb2014	(0.016)	(0.096)	(0.016)	(0.000)	(0.000)	(0.000)
Russia	-0.464a	-0.854a	-0.456^a	-0.266^a	-0.308^a	-0.263^a
× Mar2014 - Jul2014	(0.012)	(0.081)	(0.013)	(0.000)	(0.000)	(0.000)
Russia	-0.618^a	-3.359^a	-0.565^a	-0.246^a	-1.619^a	-0.218^a
× Aug. 2014- Dec. 2014	(0.013)	(0.131)	(0.013)	(0.000)	(0.000)	(0.000)
$\hat{\Theta}_{dt}$	0.055a	0.092a	0.060a	0.040a	-0.013a	0.044a
	(0.007)	(0.033)	(0.007)	(0.000)	(0.000)	(0.000)
Nb. Obs.	3690900	70704	3620196	3690900	70704	3620196

Notes: All regression include Firm × Destination × HS4 fixed and time effects. Robust standard errors in parentheses are clustered by Firm × Destination × HS4. Columns (1)-(3): Logit estimates. Columns (4)-(6): Poisson estimates. Significance levels: ^{c}: p<0.1, ^{b}: p<0.05, ^{a}: p<0.01.