

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

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

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1. INTRODUCTION

Travel bans and asset freezes, as well as trade and financial sanctions, are some of the current favourites 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,

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severance of financial ties, or an all-out embargo, sanctions are used when diplomacy fails, while military options appear too drastic. However, sanctions – or even the threat thereof – are not costless for the sanctioning economy, where domestic firms involved in business with the target countries might incur economic damages. It is, therefore, important for policymakers to have an assessment of the magnitude of economic costs and the channels through which a sanctions regime may inflict on their own country.

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

The sanctions regime has its origins in the escalating diplomatic conflict over the political and military crisis in Ukraine. Following the alleged involvement in separatist movements in eastern Ukraine and the annexation of Crimea after the ‘Maidan Revolution’ in the winter of 2013–4, 37 countries, including all EU countries, the United States and Japan, levied sanctions on the Russian Federation starting in March of 2014. The measures were intensified in successive ‘waves’ during the early summer of 2014. Russia then retaliated in August of the same year by imposing an embargo on certain food and agricultural products.

We conduct the analysis into the economic costs of this sanctions episode from a macro and micro perspective. We first gauge the global effects in a standard trade model – a structural gravity framework. Using monthly data on trade in goods, we evaluate the impact on exports of the Russian Federation and all major economies – sanctioning or not – and find the overall costs to total US\$96 billion, or about 0.7% of total predicted trade of the countries involved, from the beginning of the conflict until the end of 2015, with 56% being borne by the Russian Federation. The loss in exports in sanctioning Western countries¹ amounts to around US\$42 billion, of which 92% is incurred by EU countries. Intriguingly, we find the strongest negative economic consequences for Western countries in absolute terms not to be caused by the Russian embargo, which accounts for only 13% of total lost trade. Instead, the bulk of the losses in sanctioning Western countries is an indirect and likely unintended result of own policies and measures – an effect we coin *friendly fire*.

This is a trade shock starting from the beginning of the diplomatic conflict, which is specific to bilateral trade relations between the countries involved and which affects

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

goods whose trade is not subject to any restrictions under the sanctions. For the sake of simplicity, we sometimes refer to this fall in specific trade flows as the ‘impact of sanctions’. However, since the sanctions are unintended to affect the activity of Western exporters of non-embargoed products to Russia, this trade loss is unexpected and akin to a friendly fire.² Therefore, we cannot and do not affirm that the *friendly fire* is directly and solely the consequence of sanctions. On the contrary, the purpose of the last section of the paper is to understand the causes of the decline of Western exports of non-embargoed products to Russia coinciding with the escalating diplomatic tension. This section exploits global monthly product-level data from UN COMTRADE, as well as a data set of French firm-level exports. We rely on a number of indicators for characteristics associated with certain products, firms or sectors to study two mechanisms that could explain the emergence of *friendly fire*: a change in Russian consumers’ attitude towards French products and a sudden increase in *country risk* driven by political, legal and financial instability generated by the conflict itself and the sanctions.

The empirical analysis finds little evidence in favour of the consumers’ preference channels. Instead, we find that products that use trade finance instruments extensively have been relatively more impacted. This finding suggests that the diplomatic turmoil and the escalation of sanctions, by increasing legal instability and weakening the Russian banking system, have increased the cost of financing and securing international trade relations with Russia.

Our paper stands in direct line with a number of very recent works and contributes to a substantial literature on the use of sanctions as a foreign policy tool in both political science and economics. The bulk of the existent academic literature on sanctions has shed light on the determinants of the success or failure of such policies and the effect of sanctions on the *target* economy through which the intended outcome – change of certain policies – is supposed to work.³ A smaller number of papers have looked at the economic impact of sanctions in *sending* countries. The case of the Embargo Act of 1807 is particularly well studied, as it provided the first use of sanctions and embargoes in the modern era. Frankel (1982), Irwin (2005) and O’Rourke (2007) find effects in the range of 4%–8% of US 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 US GDP to hover around a much lower 0.4%. Caruso (2003) estimates the average effects of sanctions in the second half of the 20th century in a simple empirical set-up on aggregate trade flows. This current paper is also

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

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

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

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

Furthermore, this current study is also linked to the literature studying the connection between conflict and trade. [Glick and Taylor \(2010\)](#) show the disruptive effects of war on international trade and economic activity in general. Their approach – comparable to ours in the first part of the paper – relies on a general equilibrium trade model.⁵

4 For a detailed analysis of the consequence of the Russian embargo on agricultural and food products, see [Cheptea and Gagné \(2019\)](#).

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

Another strand of the literature analyses changes in the consumer preferences following political shocks more generally. [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 US 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.⁶

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

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

Section 5 provides the conclusion.

2. WESTERN SANCTIONS AND RUSSIAN COUNTER-SANCTIONS

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

In the following discussion, we denote a 'sanctioning country' as all countries that enacted sanctions against the Russian Federation and were thus the target of Russian counter-sanctions. As 'embargoed products', we define all products that were targeted by *Russian* counter-sanctions – an import embargo on certain agricultural and food products. Western economic sanctions were predominantly aimed at the access to

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

financial markets of a number of prominent Russian financial institutions, as well as defence and energy companies.⁷ Western sanctions 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.⁸

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.⁹ In terms of economic size, countries sanctioning the Russian Federation totalled roughly 55% of the 2014 world GDP. Switzerland, historically politically neutral, enacted legislation that made it more difficult to circumvent sanctions, for example, by transshipping European exports and imports through the country, yet did not introduce any measures of its own.

2.1. Winter 2013–4: 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 EU or accede to the Eurasian Customs Union.¹⁰ The former would entail closer ties to ‘the West’ and economic integration with the EU. The latter would lead to stronger economic integration with the Russian Federation and other former members of the Soviet Union, strengthening the historical bonds already in place. While on the surface both options appeared to be of economic consideration, the implications would run much deeper. Economic integration goes hand in hand with political and geopolitical ties (Martin *et al.*, 2012; Hinz, 2017), and thus the domestic and international political debate turned more heated quickly.¹¹

7 The companies in question are listed in Council Regulations No. 833/2014 Annex III and No. 960/2014 Annexes IV–VI. Financial institutions listed are Sberbank (Russia’s largest bank, then third largest bank in Europe), VTB Bank (nationwide operating bank in Russia), Gazprom Bank (Russia’s third largest bank, subsidiary of Gazprom), Vnesheconombank (VEB) (Russia’s ‘Bank for Development and Foreign Economic Affairs’) and Rosselkhozbank (state-owned bank with agricultural focus). Defence companies listed are OPK Oboronprom, United Aircraft Corporation and Uralvagonzavod. Energy companies listed are Rosneft (Russia’s largest publicly traded energy company, majority stake owned by the Russian government), AK Transneft (Russian state-owned pipeline company) and Gazprom Neft (oil subsidiary of Gazprom). Next to these companies, any majority-owned subsidiary is equivalently considered listed.

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

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

10 Ukraine already became an 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.

11 Already in August 2013, Russia voiced its opposition to Ukraine’s ambition to form an Association Agreement with the EU and blocked virtually all imports from Ukraine (Popescu, 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 Kyiv and the western part of the country. This protest movement known as the 'Euromaidan' led to the overthrow of the sitting Ukrainian government on 22 February 2014.¹² The overthrown government headed by President Yanukovich 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 rivalling factions.

2.2. Spring 2014: first two waves of sanctions – travel bans and asset freezes

The situation deteriorated further in southeastern Ukraine, in particular on the peninsula of Crimea. On 27 February 2014, separatists and armed men seized key government buildings and the main airport, and on 16 March 2014, a much-criticized referendum was held that aimed at the absorption of the Crimea into the Russian Federation. European and allied Western countries, most prominently the United States, imposed the first sanctions on the Russian Federation in mid-March 2014. This initial first wave of sanctions from Western countries, largely consisting of 'smart sanctions' in the form of individual travel bans and asset freezes, focused on implicated political and military personnel as well as first select Russian financial institutions (Ashford, 2016). A second wave in the weeks to follow expanded the list of sanctioned individuals and entities.¹³ See appendix 'Detailed timeline' for a detailed presentation of the content and the timeline of diplomatic decisions.

2.3. Summer 2014: the third wave of sanctions – trade and financial restrictions

In July 2014, after the crash of a civilian airplane (Malaysian airlines flight MH17), shot down over the separatist region of Donbass with the probable implication of pro-Russian insurgents, Western countries reinforced the sanctions.

12 See also Dreyer *et al.* (2015, pp. 44–7) for a timeline of events surrounding the 2014 Ukrainian revolution and the subsequent conflict in eastern Ukraine and Crimea.

13 The Russian Federation condemned the measures and on 20 March 2014, the Ministry of Foreign Affairs issued travel bans on nine high-ranking and influential US politicians and officials. Three days later, 13 Canadian politicians and officials were targeted in a similar fashion and on 27 May 2015, a *blacklist* of 89 politicians and activists from EU Member States emerged. See, for instance, <http://www.theglobeandmail.com/news/politics/russia-bans-entry-to-13-canadians-in-retaliation-for-ottawa-sanctions/article17635115/> and <http://uk.reuters.com/article/russia-europe-travelban-idUKL5N0YL07K20150530> for reference.

This third wave of sanctions went beyond previous measures in depth and scope. Not only were Russian individuals and entities targeted through ‘Individual Restrictive Measures’, EU parlance for travel bans and asset freezes, but also more severe ‘Economic Sanctions’ were implemented by the EU and allied countries.¹⁴ European entities were restricted from exporting certain goods, military and dual-use goods, as well as very specific mining equipment. More consequential, however, were the financial sanctions targeting five major Russian financial institutions, as well as a number of defence and energy companies, from refinancing on the European and US markets (Ashford, 2016).

The Russian side, unsurprisingly, retaliated and enacted sanctions on European and other sanctioning countries. On 7 August 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’.¹⁵ The targeted products (henceforth the ‘embargoed products’) were select agricultural products, raw materials and foodstuffs originating from the EU, the United States, Canada, Australia and Norway. The list of banned products was modified on 20 August 2014 and other sanctioning countries were successively included. See Table A.2 in Appendix 1 for the full list of four digit HS codes of embargoed products.

3. THE BIG PICTURE: GLOBAL IMPACT OF SANCTIONS ON RUSSIA

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

We exclude export flows of certain HS codes for which trade takes place only very infrequently and then in very large values. The respective HS codes are heading 8401 (‘Nuclear reactors and part thereof’) and Chapter 88 (‘Aircrafts, spacecrafts, and parts thereof’). Although the sales of these products are also very likely to be impacted by the political tensions, these transactions are usually one-off events resulting in enormous spikes of total export and import values in some months and zero flows in all other months. We also exclude those products that were marked by the EU as ‘energy-related equipment’ and are subject to prior export authorization: HS headings

14 See <http://www.consilium.europa.eu> on the EU’s official wording of different sanctions measures.

15 See the *Russian President’s Decree No. 560* of 6 August 2014 and the *Resolution of the Government Of the Russian Federation No. 830* of 20 August 2014.

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 four-digit level, that is, those codes that are not shown for reasons of confidentiality. Finally, we aggregate (for this section only) to embargoed and non-embargoed product-level and are left with a total of 335,451 non-zero observations.¹⁶

3.1. Quantification of lost trade

We quantify the cost of the diplomatic conflict in terms of 'lost trade'. We predict trade flows between Russia and sanctioning countries and calculate the difference to observed flows. This allows us to put a price tag on the escalating diplomatic tensions and the use of sanctions by both sides. The different sets of sanctions – imposed by the EU and other countries on the one hand, and by Russia on the other hand – are assumed to affect trade as a *bilateral* trade cost. As such, our approach is similar to [Hufbauer et al. \(2009\)](#) but improves upon the theoretical foundation of the model.¹⁷ Aside from the direct, or partial equilibrium impact, the changes in trade impediments due to the conflict and sanctions also had feedback effects on both involved and uninvolved countries. Changes in bilateral trade resistances between Western sanctioning countries and Russia affect all countries through what is known as inward and outward multilateral resistance terms that reflect a country's position in the global trade matrix ([Head and Mayer, 2014](#)). Additionally, the sudden increase in bilateral trade costs between sanctioning countries and Russia likely had a sizable impact on production and expenditure in Russia and, to a probably lesser degree, in sanctioning Western countries.

The methodology we employ is comparable to [Glick and Taylor's \(2010\)](#), who examine the effect of the two world wars in a gravity set-up and compute a counterfactual by modifying the multilateral resistance terms accordingly. Importantly, though, and in contrast to their work, we also explicitly take changes in production and expenditure figures into account, building on an approach initially pioneered by [Dekle et al. \(2007\)](#). We, therefore, conduct what [Anderson et al. \(2015\)](#) call a *full* GE exercise, as opposed to a *conditional* one that does not take into account these changes to production and expenditure.¹⁸ We describe the approach in detail in Appendix 3 and provide a short intuition in the following paragraphs.

16 We provide the list of countries and descriptive statistics in [Table B.1](#) in Appendix 2.

17 [Hufbauer et al. \(2009\)](#) employ what [Head and Mayer \(2014\)](#) coin a *naïve* gravity set-up.

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

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

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

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

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

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

We estimate [Equation \(1\)](#) with a Poisson pseudo-maximum likelihood procedure by regressing bilateral flows between country o and d at time t on origin $\times$ time, destination $\times$ time and origin $\times$ destination $\times$ month fixed effects, such that¹⁹:

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

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

Counterfactual bilateral resistances for treated country-pairs since the beginning of the crisis are thus simply the estimated ϕ_{odm} from the time before the crisis. Counterfactual multilateral resistance terms can simply be computed accordingly.

In order to account for explicit changes to countries' production and expenditure, we follow [Anderson et al. \(2015\)](#) and account for changes to product and expenditure Y_{ot} and X_{dt} by what they coin the adjustment of *factory-gate prices* (see Appendix 3).

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

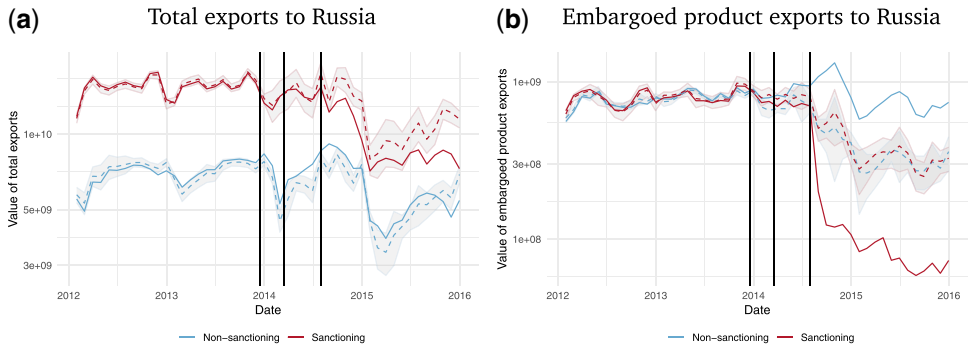


Figure 1. Predicted versus observed total value of exported goods to Russia from sanctioning and non-sanctioning countries by type of products

(a) Total exports to Russia; (b) Embargoed product exports to Russia.

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

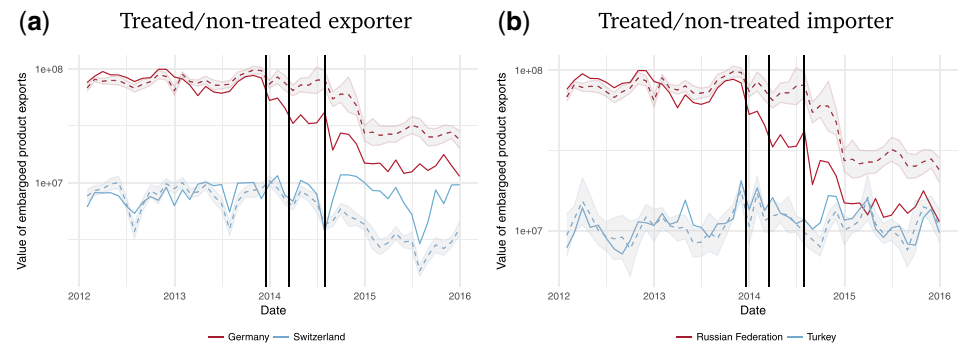


Figure 2. (Pseudo) placebo test with treated/non-treated exporter and importers

(a) Treated/non-treated exporter; (b) Treated/non-treated importer.

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

3.2. Estimated general equilibrium impact

Figures 1 and 2 show the results of performing the counterfactual analysis with total exports and those of embargoed products to Russia by all sanctioning and non-sanctioning countries. The solid line displays the observed value and the dashed one the predicted value using the procedure detailed above. The three vertical lines indicate the three dates at which the previously defined periods start: December 2013 for the beginning of the conflict, March 2014 for the first implementation of travel bans and asset freezes and August 2014 for the beginning of economic sanctions from both sides. The fit is remarkably good in the pre-conflict time between later ‘treated’ country pairs and between ‘untreated’ country pairs, suggesting precisely estimated fixed effects and

general validity for the results. The importer $\times$ time fixed effects in particular appear to capture well the overall turmoil in the Russian economy, as the observed drastic drop of imports from *non-sanctioning* countries in early 2015 is almost perfectly mirrored by a predicted drop.

As seen in [Figures 1a and 1b](#), the predicted values match the observed values very closely for the time prior to the initial beginning of political tensions in December 2013. This changes afterwards. While the observed flows from non-sanctioning countries do not fall beneath their predicted values, those of the sanctioning countries do so strongly. Total trade of those countries moves away from its prediction starting in January 2014 and 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 collapse 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.²⁰

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

To get a better idea of the magnitude of the impact, we compute the difference between predicted and observed trade flows by country, that is, the *lost trade*. We report the key findings in [Table 1](#) and refer to Appendix 4 for the results in full detail. The total global lost trade for the period between December 2013 and December 2015 amounts to US\$96 billion, or US\$4 billion per month. US\$53 billion is being borne by the

20 See [Tables D.1–D.3](#) of Appendix 4 for the quantification of lost trade with total, embargoed and non-embargoed goods trade by period and country.

Russian Federation, which amounts to 15% of Russia's predicted exports in a scenario without sanctions. On the other side, Western countries also bear a significant share of the global lost trade. One finding of particular relevance for the political debate is that only US\$5.4 billion, or 12.7% of Western lost trade, is accrued in embargoed products. The bulk of the lost trade from Western countries can, therefore, be considered *friendly fire*, a cost on private actors that were not directly targeted by the Russian embargo.²¹

The EU bears 92% of all lost trade of sanctioning countries and 95% of lost trade in non-embargoed products. The impact, however, is not evenly distributed among sanctioning countries: Figures 3a and 3d display the average monthly difference between predicted and observed exports in relative and absolute terms by country, broken down into trade of embargoed and non-embargoed products. In relative terms, Malta, Norway and Australia are hit hardest, with lost trade amounting to up to 85% of predicted flows to Russia. When comparing to total exports, however, Finland (1.5%), Poland (0.9%) and Germany (0.6%) are most affected.

Germany's exports are, on average, about US\$667 million lower per month compared to a counterfactual scenario without sanctions, most of it incurred by non-embargoed products. The United Kingdom (US\$153 million) and Poland (US\$151 million) follow, albeit in much smaller magnitudes. In percentage terms, Germany is bearing almost 38% of Western lost trade, while other major geopolitical players like the United Kingdom (8.7%), France (6.6%) and the United States (0.3%) are much less affected. Overall, the composition of the losses incurred varies widely by period and affected products.

As the counterfactual analysis predicts trade flows for all country pairs, we can also shed light on potential trade diversion at the macro level. Did some countries 'pitch in' when others could not export embargoed products to Russia anymore? Figure 4, highlighting the role of China, suggests that this was indeed the case. While Figure 4a shows only limited trade diversion in the grand scheme of things, zooming in to the smaller set of embargoed products in Figure 4b shows that China continued to export these products at about the same magnitude as before the sanctions, while predicted demand from Russia decreased significantly. Figure 4c strongly supports this narrative. Non-sanctioning countries increased their exports of embargoed products to Russia by up to 82% relative to predicted flows, as in the case of Armenia. In total exports, however, this effect is near zero. This suggests that the Russian Federation, as a result of its own policy measures, shifted its demand for these products away from Western countries, towards those with which diplomatic relations remained unharmed. For other non-embargoed products, however, trade diversion, by and large, could not make up for lost trade with Western countries.

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

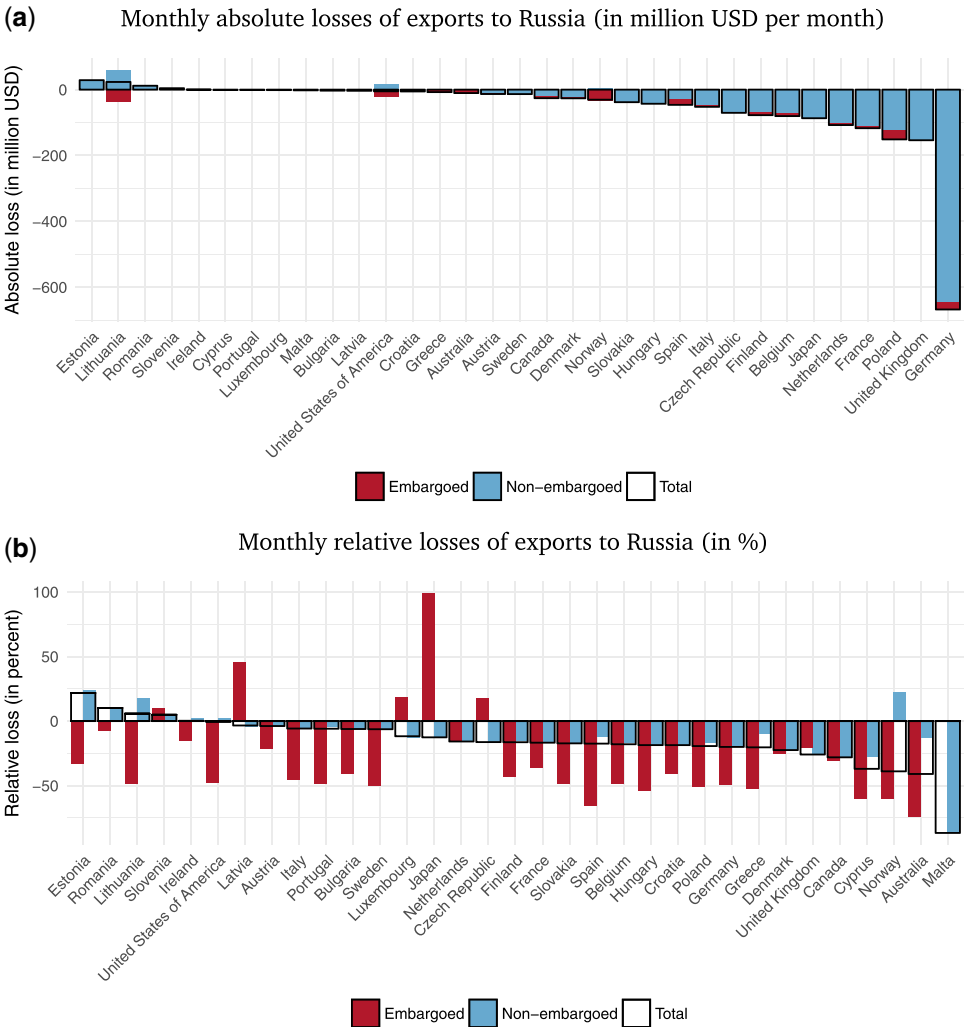


Figure 3. Composition lost exports to Russia of embargoed and non-embargoed products, by country

(a) Monthly absolute losses of exports to Russia (in million USD per month); (b) Monthly relative losses of exports to Russia (in percentage).

4. DRILLING DOWN: PRODUCT- AND FIRM-LEVEL IMPACT

We now investigate the drivers of the decline in trade flows between the Russian Federation and sanctioning countries. Of course, the Russian embargo on agricultural and food products had an unambiguous consequence on exports of targeted countries. It is much more difficult to determine why diplomatic turmoil surrounding the conflict in Ukraine and the complex sanctions regime imposed by Western countries have affected exports of non-embargo products. Indeed, except for the specific products that we excluded from our analysis, they do not contain any provisions that explicitly aimed at reducing exports to Russia. Therefore, the trade impact of the diplomatic tensions

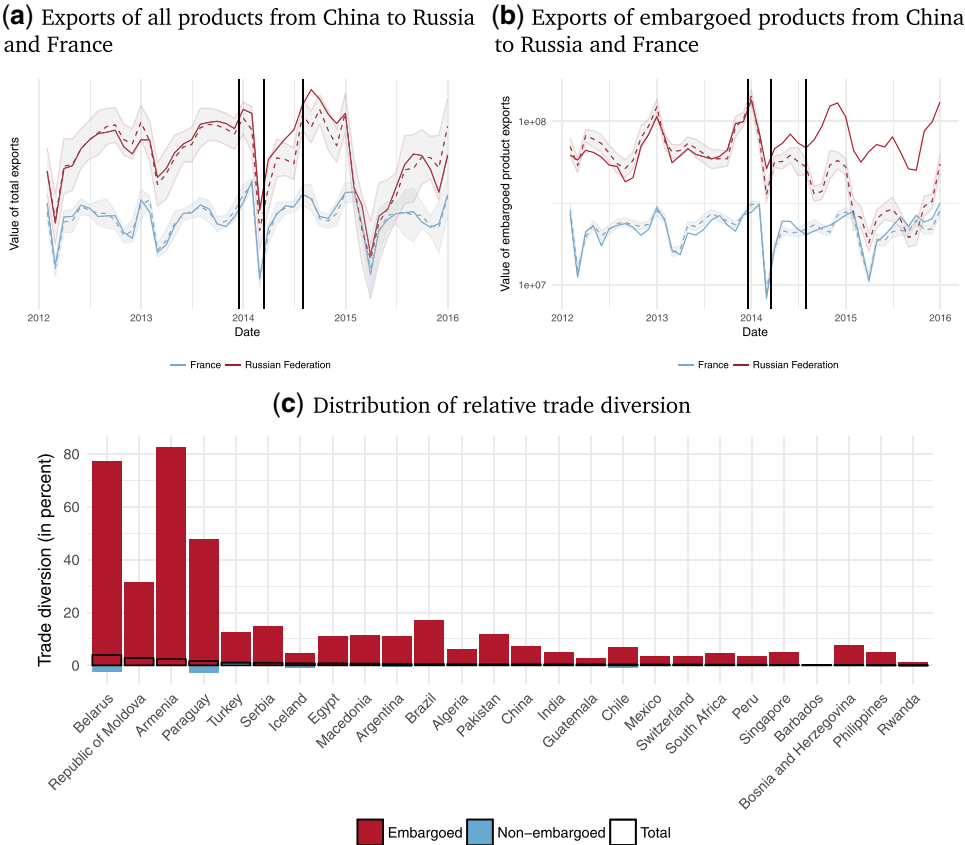


Figure 4. Trade diversion of embargoed products and total exports

(a) Exports of all products from China to Russia and France; (b) Exports of embargoed products from China to Russia and France; (c) Distribution of relative trade diversion.

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

estimated in the previous section must be the consequence of more indirect (and unexpected) mechanisms. We suspect two main mechanisms that may have been at work and contributed to the decline of exports. The first possible mechanism could be an abrupt change of Russian consumers' preferences resulting from a spontaneous boycott of Western products in reaction to the diplomatic gridlock. The second one is related to increasing country risk. The sudden rise of economic and political instability might have hindered firms in sanctioning Western countries to do business in Russia or with Russian firms. In this context, the sanctions themselves, which have may added legal ambiguity and weakened the Russian financial system, could have generated a disruption in the supply of trade finance services and lessened the ability to secure international payments.

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

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

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

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

In order to isolate the impact of the diplomatic conflict and the sanctions affecting sanctioning countries’ exports to Russia from possible confounding factors, we adopt a difference-in-differences approach which combines spatial and time differences. We focus on short-term effects and limit our treatment period to 2014.²² We decompose the period of interest into three sub-periods defined with respect to the implementation of sanctions described in Section 2:

- p_1 , from December 2013 until February 2014, in which political tensions were increasing while no sanctions were put in place yet;
- p_2 starts in March 2014 with the implementation of the first wave of sanctions, later succeeded by the ‘second wave’, and ends in July 2014. During this period, Western governments targeted people and institutions implicated in the events in eastern Ukraine and Crimea with asset freezes and travel bans; and

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

- p_3 starts in August 2014 with the implementation of harsher trade and financial sanctions, first by the EU and allied countries, and then in retaliation by the Russian Federation.

Our specifications also include a treatment dummy, p_0 , for the quarter preceding the start of the conflict (from September 2013 to November 2013). This variable allows to control for possible pre-treatment trends and see if exports to Russia had started to decrease some months before the treatment.³

4.1. Product-level analysis: empirical specification

We first describe our product-level analysis. We augment the gravity model from above, in particular Equation (2), by adding a product-level dimension. We again exploit bilateral export data from UN COMTRADE by all sanctions countries, Russia and the 40 other largest exporters, but now disaggregated at the four-digit product level of the HS classification.

Adding a product dimension increases the sample size dramatically. With 77 reporting countries, 233 partner countries and 1,227 products,²³ and after eliminating all origin-destination-product triads for which we do not observe any trade over the sample period, we have more than 123 million observations.

While a general equilibrium counterfactual analysis is not feasible at this level of disaggregation, recent advances in the estimation of generalized linear models with high-dimensional fixed effects (Hinz *et al.*, 2019) make the estimation of partial equilibrium effects possible. Hinz *et al.* implement a Gauss–Seidel-type iteratively reweighted least squares estimation procedure for generalized linear models. More specifically, they make use of convenient properties of certain family-link combinations – the Poisson distribution with a log link function among them – to partial out the fixed effects from the estimation of the parameters of interest. This means that the model matrix does not include the fixed effects, which otherwise tends to make fixed-effect Poisson pseudo estimations with large numbers of observations infeasible. Making use of this new estimator, we can, therefore, estimate

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

where Ψ_{okt} is an origin-product-time fixed effect, Θ_{dkt} a destination-product-time fixed effect and ϕ_{odkm} an origin-destination-product-month fixed effect. Γ_{od} is a dummy

23 As before, we exclude from the analysis trade of oil and gas and all the products that are subjected to export restrictions within the framework of European sanctions (Table A.1). We also exclude ‘Nuclear reactors and part thereof’ (HS 8401) and ‘Aircrafts, spacecrafts, and parts thereof’ (HS 88). The reason for this exclusion is that the trade of these products is very granular, which makes a robust identification of a trend in export flows very difficult.

variable taking the value 1 when the exporter is a Western sanctioning country and the destination country is Russia. P_t is a vector of dummies indicating the periods of interest: p_0 , p_1 , p_2 and p_3 . γ is the corresponding vector of parameters. As in the previous section, and as customary in the gravity literature following Egger and Tarlea (2015), errors are clustered by origin, destination and date.

Table 2 shows the results for estimating Equation (3) for three groups of products. In column (1), we estimate coefficients on the interaction of the pre-period and three treatment periods and affected country-pairs on all HS four product categories. In column (2), we subset the sample to only those product categories that are directly affected by the embargo, and in column (3), to those that are not. The results naturally confirm those shown in the previous section that exports to Russia of sanctioning countries dropped significantly with the diplomatic conflict, compared to the ones from non-sanctioning countries. Not surprisingly, the impact is particularly dramatic for embargoed products during period p_3 , with a decrease of more than 96%. Non-embargoed products again also see a decline in exports by up to 5.7%.

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

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

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

4.2. Firm-level analysis: empirical specification

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

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

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

where i denotes exporting firms and Γ'_d indicates export flows to Russia.²⁴ Our empirical specification, hence, compares the trend of exports of a given firm to Russia to its trend of exports to alternative destinations. In consequence, we restrict our sample to firms that export to Russia at least once between January 2013 and December 2014. We aggregate all individual trade flows at the four-digit level of the HS product classification. Again, we exclude from the analysis the goods that are subjected to European export restrictions within the framework of European sanctions against Russia along with HS categories 8401 and 88.²⁵

In order to control for unobserved determinants of time-varying individual supply capacities (with the firm $\times$ product $\times$ date fixed effect Ψ'_{ikt}), we need a control group consisting of alternative destinations of French exports. The difficulty is that export flows to any other country are potentially affected by the treatment. The limitations on trade with Russia can influence the exports towards other destinations in two different ways. On the one hand, French firms that had to cut exports to Russia because of the sanctions may have tried to compensate for their losses by expanding their sales to other countries. In this case, the measures would have boosted the French export to non-Russian markets, which were to lead us to overestimate the impact of the treatment on French exports towards Russia. On the other hand, the diversion of trade towards 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 downwards 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.²⁶ For the

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

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

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

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

Sample	(1) All Products	(2) Embargoed	(3) Non-embargoed
$\Gamma \times$ September 2013–November 2013	−0.015** (0.006)	−0.211** (0.089)	−0.014 (0.012)
$\Gamma \times$ December 2013–February 2014	−0.100*** (0.022)	−0.513*** (0.095)	−0.055** (0.025)
$\Gamma \times$ March 2014–July 2014	−0.094*** (0.023)	−0.520*** (0.104)	−0.046*** (0.014)
$\Gamma \times$ August 2014–December 2014	−0.282*** (0.047)	−3.260*** (0.230)	−0.059** (0.024)
Sample size	123,274,955	4,192,704	119,082,251

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

period 2012–2014, our main sample contains observations for 9,822 firms, 1,015 products and 30,211 firm-product pairs.

4.3. Change in consumers’ attitude

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

Existing studies on the consequences of boycotts on international trade lead to diverging conclusions. However, several recent studies, including [Michaels and Zhi \(2010\)](#), [Pandya and Venkatesan \(2016\)](#) and [Heilmann \(2016\)](#),²⁷ confirm that boycott 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

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

Table 3. Interaction with brand visibility – non-embargoed products

Sample	(1) Products	(2) Firms	(3) Firms	(4) Firms
			Consumption products	Luxury products
$\Gamma \times$ September 2013–November 2013 $\times$ Consumption goods	0.079** (0.040)	0.151 (0.145)		
$\Gamma \times$ December 2013–February 2014 $\times$ Consumption goods	0.167*** (0.028)	0.102 (0.097)		
$\Gamma \times$ March 2014–July 2014 $\times$ Consumption goods	0.052* (0.027)	0.067 (0.085)		
$\Gamma \times$ August 2014–December 2014 $\times$ Consumption goods	0.197*** (0.052)	0.097 (0.143)		
$\Gamma \times$ September 2013–November 2013 $\times$ Luxury goods			0.144 (0.254)	
$\Gamma \times$ December 2013–February 2014 $\times$ Luxury goods			0.190 (0.117)	
$\Gamma \times$ March 2014–July 2014 $\times$ Luxury goods			–0.020 (0.127)	
$\Gamma \times$ August 2014–December 2014 $\times$ Luxury goods			0.157 (0.220)	
$\Gamma \times$ September 2013–November 2013 $\times$ Luxury firms				–0.072 (0.080)
$\Gamma \times$ December 2013–February 2014 $\times$ Luxury firms				0.180** (0.084)
$\Gamma \times$ March 2014–July 2014 $\times$ Luxury firms				–0.011 (0.073)
$\Gamma \times$ August 2014–December 2014 $\times$ Luxury firms				–0.066 (0.091)
Sample size	116,540,394	2,043,861	771,494	636,050

Notes: Non-embargoed products only. PPML estimates. Γ is a dummy indicating export flows from sanctioning countries to Russia (in column 1) or export flows to Russia (columns 2)–(4). Column (1): coefficients on interaction of Γ and p_0 (September 2013–November 2013), p_1 (December 2013–February 2014), p_2 (March 2014–July 2014) or p_3 (August 2014–December 2014) not reported. Fixed effects are included for origin $\times$ destination $\times$ product $\times$ month, origin $\times$ product $\times$ time and destination $\times$ product $\times$ time. Columns (2)–(4): Fixed effects are included for firm $\times$ destination $\times$ product, firm $\times$ product $\times$ time and destination $\times$ product $\times$ time. Robust standard errors in parentheses are clustered by destination $\times$ product. Significance levels: *** $p < 0.01$; ** $p < 0.05$; and * $p < 0.1$.

government set up a media campaign on its decision to ban Western food products in retaliation to the Western sanctions, organizing, for instance, the public destruction of illegally imported food. These official messages might have influenced consumers' decisions.

If a part of the impact estimated above is the consequence of a loss of popularity of Western products, we would expect a more severe trade disruption for consumer goods and varieties that are easily identified as Western products. Indeed, [Heilmann \(2016\)](#) shows clearly that boycotts have larger effects on highly-branded products and consumer goods than on capital or intermediate ones. Building on these results, we base our identification strategy on the expected heterogeneous effect of the change in consumers' attitudes across firms and products. In [Table 3](#), we interact the treatment variables with various indicators that characterize products that are more likely to be subject to a change in Russian consumers' preferences. We propose three tests.

In columns (1) and (2), we add interactions with a dummy set to one for consumer goods.²⁸ In column (3), we focus on French exports of consumer goods and break up the analysis according to whether it is relatively easy for consumers to identify the brand, and thus the geographical origin, of the products. This distinction is based on the presence of exporters of French luxury brands within an HS4 product category. The idea here is that luxury firms need to invest substantially in their brand image, which is possible only for products that are easily branded. The list of French exporters of luxury goods is provided by [Martin and Mayneris \(2015\)](#).²⁹ In order to identify the producers of luxury goods, they exploit the list of French firms that are members of the 'Comité Colbert', a French organization gathering the main brands of the French luxury industry with the objective to promote these high-end products. We go further in column (4). Here, we retain the HS4 products goods that are exported by 'Comité Colbert' members and we look at whether impact of the diplomatic conflict is different for these high-end producers, within their HS4. The underlying assumption here is that, within a given product category that may include luxury varieties (e.g. wines, perfumes, bags, etc.), French luxury brands are more visible and easily identified as typically French. Therefore, they may be potential targets of boycott calls and/or more sensitive to worsening attitudes towards French products.³⁰ As column (1) shows, consumer products

28 We use the classification by broad economic categories (BEC) provided by the UN to identify consumer products. The BEC groups the sections of the Standard International Trade Classification (SITC) according to 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 the majority of HS6 identified in the BEC as 'consumer goods', 'food', 'Passenger motor cars'.

29 We thank Julien Martin and Florian Mayneris for sharing their data.

30 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.

were on average *less* affected than the average product and hence cannot explain the drop of non-embargoed export to Russia. The picture is confirmed by looking at the firm-level effect. Except for a small and unexpected positive coefficient in column (4), none of the interaction terms are significantly different from zero. This discards the hypothesis that sudden changes in consumer preferences are the driver of the drop in Western exports to Russia after December 2014.

4.4. Country risk and trade finance

We now turn to the exploration of the role of country risk and ‘de-risking’ behaviours (Ahn and Ludema, 2017). In times of political and legal instability, firms may be inclined to reduce their exports and stop or delay their search for new business opportunities, until they are reassured on the legality of their transactions and the security of their shipments and payments. Similarly, financial intermediaries may be cautious to facilitate transactions, fearing repercussions in case of accidental breach of sanctions. This section, therefore, focuses on the specific role of trade finance during this diplomatic crisis. Growing political instability in Russia might have limited the issuance and/or increased the price of trade finance services aiming at mitigating the risk affecting international transactions. These restrictions logically raised the transaction costs and reduced the volume of trade.

In our case, this channel might be particularly important since the sanctions imposed by Western countries on major Russian businesses and financial institutions could have directly affected the provision of trade finance services by Russian banks.³¹ Of course, the sanctions imposed by Western countries – since they were explicitly designed to spare Western exports as much as possible – did not directly target the provision of trade finance services. There is reason to believe that they impacted this business, however. First, the financial sanctions imposed after August 2014 undoubtedly weakened the major Russian banks, reducing their capacity to offer competitive financial services. Second, even before these financial sanctions were put in place, it is possible that the initial diplomatic conflict and the first implemented sanction measures generated a climate of political and legal insecurity, leading both Western and Russian banks to stop or delay pending transactions until having guarantees on their legality. Existence of serious concerns about the scope of the sanctions and the resulting legal instability regarding trade finance is revealed, for instance, by the fact that the EU commission felt the need to publish a guidance note in December 2014 concerning the implementation of certain provisions of the financial sanctions.³² The purpose of this note was to clarify some

31 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.

32 See also the ‘Commission Guidance note on the implementation of certain provisions of Regulation (EU) No 833/2014’.

aspects of the regulation establishing the sanctions, including those relating to the provision of financial services by Russian banks. The note confirmed that ‘EU persons can process payments, provide insurance, issue letters of credit, extend loans, to sanctioned entities.’ At the same time, the note remarks that the clarification followed questions that had been brought forward to the EU Commission, suggesting that some actors were facing legal uncertainty.

In order to assess the role of this possible link between the sanctions and trade, we look at whether the magnitude of the impact of the sanctions is related to the importance of the usage of trade finance instruments. Unfortunately, we face serious data limitations. We do not have any direct and comprehensive information about the usage of trade finance instruments. In fact, information of this kind is very rare. Most of the existing empirical literature on the importance of trade finance is based on partial and very limited data,³³ or on data reporting bank activities which contain very incomplete information about the international trade transactions.³⁴ Only a few papers exploit very detailed data on the usage of trade finance instruments (see, e.g. [Demir and Javorcik \(2018\)](#) for Turkey and [Ahn \(2015\)](#) for Colombia and Chile). The latter 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,³⁵ the identification of the role of trade finance is based on an interaction between our variables of interest and a product-level indicator of dependence on trade finance.

The indicator we use is calculated from the data exploited by [Demir and Javorcik \(2018\)](#).³⁶ Their data cover 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 credit. 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 Gross Domestic Product (GDP) per capita. More

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

34 See, for example, [Paravisini et al. \(2014\)](#) and [Niepmann and Schmidt-Eisenlohr \(2017a,b\)](#).

35 See, for example, [Rajan and Zingales \(1998\)](#) and [Manova \(2013\)](#).

36 We are deeply indebted to Banu Demir for providing us with these indicators.

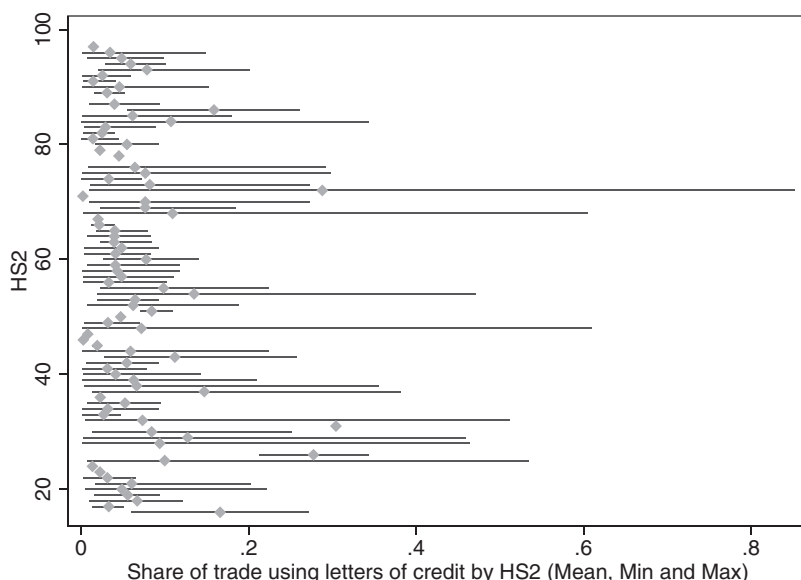


Figure 5. Trade finance dependence: share of trade using letters of credit by HS2 (mean, max and min)

importantly for the choice of the financing terms that support international trade, they are equally distant to France and they have quite comparable levels of development of their financial systems.³⁷ According to the financial development indicator proposed by Svirydenka (2016), Russia is ranked 32nd in the world and Turkey is 37th.³⁸ Furthermore, the use of Turkish data is not only motivated by the lack of data for Russia. It is also a way to obtain indicators that are exogenous to the economic and political situation in Russia.

After matching this source with our trade data, we have information on the use of letters of credit for 723 HS4-level products, all of which are not embargoed by the economic sanctions imposed by the EU or the Russian Federation. For most products, the share of trade using letters of credit is very small. The average is about 7.2% and the median value is only 4.1%. However, this share varies a lot across HS4. The coefficient of variation is 134%. The variance is also substantial within broader categories of products. In Figure 5, we report the average value across chapters of the HS classification (HS2), along with the maximum and minimum levels. There are clearly some categories of products for which it is relatively common to rely on letters of credit. This is mainly the case for raw materials such as minerals, basic chemicals or metals. Within most

37 The recent literature on trade finance has revealed that these two variables influence greatly the usage of letters of credit.

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

Table 4. Interaction with share of letter of credit financing – Non-embargoed products

Sample	(1) Products	(2) Firms	(3) Firms
$\Gamma \times$ September 2013–November 2013 $\times$ LC share	–0.005 (0.018)	–0.049 (0.035)	
$\Gamma \times$ December 2013–February 2014 $\times$ LC share	–0.059* (0.035)	–0.089** (0.041)	
$\Gamma \times$ March 2014–July 2014 $\times$ LC share	0.017 (0.021)	–0.092** (0.037)	
$\Gamma \times$ August 2014–December 2014 $\times$ LC share	–0.051*** (0.018)	–0.147** (0.061)	
$\Gamma \times$ September 2013–November 2013 $\times$ LC share $\times$ Small			–0.174 (0.112)
$\Gamma \times$ December 2013–February 2014 $\times$ LC share $\times$ Small			–0.051 (0.114)
$\Gamma \times$ March 2014–Jul 2014 $\times$ LC share $\times$ Small			–0.106 (0.130)
$\Gamma \times$ August 2014–December 2014 $\times$ LC share $\times$ Small			–0.164 (0.130)
$\Gamma \times$ September 2013–November 2013 $\times$ LC share $\times$ Large			–0.047 (0.035)
$\Gamma \times$ December 2013–February 2014 $\times$ LC share $\times$ Large			–0.090** (0.042)
$\Gamma \times$ March 2014–July 2014 $\times$ LC share $\times$ Large			–0.091** (0.038)
$\Gamma \times$ August 2014–December 2014 $\times$ LC share $\times$ Large			–0.147** (0.061)
Sample size	101,260,881	1,831,356	1,831,356

Notes: Non-embargoed products only. PPML estimates. Γ is a dummy indicating export flows from sanctioning countries to Russia (in column 1) or export flows to Russia (columns (2) and (3)). Column (1): coefficients on interaction of Γ and p_0 (September 2013–November 2013), p_1 (December 2013–February 2014), p_2 (March 2014–July 2014) or p_3 (August 2014–December 2014) not reported. Fixed effects are included for origin $\times$ destination $\times$ product $\times$ month, origin $\times$ product $\times$ time and destination $\times$ product $\times$ time. Columns (2) and (3): fixed effects are included for firm $\times$ destination $\times$ HS4, firm $\times$ time $\times$ HS4 and destination $\times$ time $\times$ HS4. Robust standard errors in parentheses are clustered by destination $\times$ product. Significance levels: *** $p < 0.01$; ** $p < 0.05$; and * $p < 0.1$.

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

If a part of the impact estimated above is the consequence of higher perceived country risk and hence more costly trade finance instruments, we expect the drop in exports

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

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

It could also be, however, that rather than securing financing for specific trade transactions, the production of certain products is generally more dependent on external financing (Manova (2013), for example, finds that credit constraints impact both entry of firms and the volume of exports). In this case, the sanctions targeting Russian banks may have reduced the ability of financially constrained importers to maintain their trade relations. We, therefore, interact a widely used indicator of financial dependence proposed by Rajan and Zingales (1998) and expanded by Braun (2005) with the treatment $\times$ period dummies separately and in addition to our previous indicator of the share of use of letter of credit by product. Columns (1) and (2) of Table 5 show that products associated with higher financial dependence do not exhibit a stronger decrease than other products, in fact they may, surprisingly, fare better than the average. The inclusion of financial dependence variables has little to no influence on the estimated impact of the share of letter of credit use by product. Columns (3) and (4) show that the coefficients are virtually unchanged compared to those in Table 4.

5. CONCLUSION

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

Table 5. Interaction with measure of financial dependence – Non-embargoed products

Sample	(1) Products	(2) Firms	(3) Products	(4) Firms
$\Gamma \times$ September 2013–November 2013 $\times$ Financial dependence	0.002 (0.008)	0.203* (0.072)	0.004 (0.015)	0.213* (0.073)
$\Gamma \times$ December 2013–February 2014 $\times$ Financial dependence	−0.021 (0.022)	0.065 (0.044)	−0.021 (0.023)	0.082*** (0.045)
$\Gamma \times$ March 2014–July 2014 $\times$ Financial dependence	0.048* (0.016)	0.107** (0.042)	0.045* (0.017)	0.128* (0.043)
$\Gamma \times$ August 2014–December 2014 $\times$ Financial dependence	0.126* (0.019)	0.038 (0.065)	0.122* (0.020)	0.070 (0.067)
$\Gamma \times$ September 2013–November 2013 $\times$ LC share			−0.004 (0.019)	−0.060*** (0.032)
$\Gamma \times$ December 2013–February 2014 $\times$ LC share			−0.057 (0.036)	−0.092** (0.041)
$\Gamma \times$ March 2014–July 2014 $\times$ LC share			0.012 (0.022)	−0.100* (0.037)
$\Gamma \times$ August 2014–December 2014 $\times$ LC share			−0.043** (0.018)	−0.153** (0.061)
Sample size	11,171,4955	1,895,253	99,094,437	1,821,759

Notes: Non-embargoed products only. PPML estimates. Γ is a dummy indicating export flows from sanctioning countries to Russia (in columns (1) and (3)) or export flows to Russia (columns (2) and (4)). Columns (1) and (3): coefficients on interaction of Γ and p_0 (September 2013–November 2013), p_1 (December 2013–February 2014), p_2 (March 2014–July 2014) or p_3 (August 2014–December 2014) not reported. Fixed effects are included for origin $\times$ destination $\times$ product $\times$ month, origin $\times$ product $\times$ time and destination $\times$ product $\times$ time. Columns (2) and (4): fixed effects are included for firm $\times$ destination $\times$ HS4, firm $\times$ time $\times$ HS4 and destination $\times$ time $\times$ HS4. Robust standard errors in parentheses are clustered by destination $\times$ product. Significance levels: * $p < 0.01$; ** $p < 0.05$; and *** $p < 0.1$.

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

The analysis is conducted from two perspectives: we first gauge the global effects in a traditional trade framework, highlighting the heterogeneous impact on the different countries involved. Using monthly trade data from UN Comtrade and ITC TradeMap, we perform a general equilibrium counterfactual analysis that allows us to put a price tag on the policies put in place. We find that the global *lost trade* – the difference between predicted and observed trade flows – amounts to US\$4 billion per month, US\$1.8 billion being borne by sanctioning Western countries. This cost on private actors is unevenly distributed among countries, with EU Member States

bearing 92% of the sanctioning countries' impact. Interestingly, the bulk of the lost trade, 87%, is incurred through non-embargoed products, and can hence be considered *friendly fire*.

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

Discussion

Alberto Martin

European Central Bank, CREI, and Barcelona GSE

In 2013, Ukraine was politically divided between signing an Association Agreement with the EU, which would strengthen ties with the EU, or acceding to the Eurasian Customs Union, which would lead to stronger economic integration with the Russian Federation (Russia) and other former members of the Soviet Union. The ruling government's decision against further integration with the EU fuelled a protest movement, the 'Maidan Revolution', which ultimately led to its downfall. Political tension grew as the EU and the United States backed the revolution, while Russia supported government sympathizers.

In February of 2014, amidst the tension, separatists and armed men seized key government buildings in the Crimea Peninsula and on 16 March 2014, a referendum was held to annex Crimea into Russia. In response to the perceived violation of international law, 37 countries – including all EU countries, the United States and Japan – imposed sanctions on Russia. These measures were initially restricted to travel bans and asset freezes, but they were subsequently intensified to the point of prohibiting major Russian financial institutions and companies from accessing EU and US financial markets. Russia retaliated in August by imposing an embargo on certain food and agricultural products and raw materials from the EU, the United States, Canada, Australia and Norway.

In this paper, Crozet and Hinz use monthly trade data to analyse the impact of sanctions on trade between Russia and the West. In particular, they analyse the evolution of trade from January 2012 until December 2015 between all 37 sanctioning countries, Russia and the 40 other largest exporters in the world. The approach relies exclusively on a fixed-effects estimation. In particular, building on an Armington-type gravity structure, they estimate the following equation,

$$x_{odt} = \exp(\psi_{ot} + \theta_{dt} + \phi_{odm}) + \mu_{odt}, \quad (6)$$

where x_{odt} represents bilateral trade flows between origin o and destination d , ψ_{ot} and θ_{dt} , respectively, represent origin- and destination-time fixed effects and ϕ_{odm} represents an origin-destination-month fixed effect to capture seasonally varying bilateral trade frictions. The main idea is to use Equation (6) to obtain the ‘predicted’ evolution of trade among country pairs, which can then be compared with the actual one to assess the loss of trade induced by the sanctions.

The main findings are as follows. First, the total lost trade between December 2013 and December 2015 amounts to US\$96 billion. Of this total, about 55% (US\$53 billion) is borne by Russia, which amounts to 15% of Russia’s predicted exports in a scenario without sanctions. The rest is borne by Western countries. The authors also use granular product-level data to show that proportional fall in trade is especially severe for embargoed goods. Since these goods are a small share of overall trade, however, they make up only 12.7% of the total loss of trade by Western countries. The bulk of the loss, therefore, happens in non-embargoed products and can be the result of sanctions only indirectly.

But what are these indirect effects of sanctions? To address this question, the authors resort to product- and firm-level data. They do not find trade in consumer or luxury goods to be especially affected, which they interpret as evidence that consumer boycotts are not a big driver of the disruption in trade. They do find that sectors that rely more on trade finance, measured as the share of trade that is paid through letters of credit, suffer disproportionately from the fall in trade. Their favoured interpretation is that sanctions and heightened political tensions raised the perceived risk of doing business with Russia and thus the cost of trade finance instruments.

I enjoyed reading and discussing the paper, which deals with an important and timely topic. I found the main results convincing, moreover, although I am not a specialist in empirical trade. Precisely as a non-specialist, I want to focus on a few general questions and comments regarding the methodology used and the interpretation of the results.

First, I found the main body of the paper lacking in a more detailed methodological discussion. In particular, to estimate the effects of sanctions, the authors mention the importance of taking into account general equilibrium effects. But all they say about this presumably significant point is ‘in order to account for explicit changes to countries’ production and expenditure, we follow [Anderson et al. \(2015\)](#) and account for changes to product and expenditure Y_{ot} and X_{dt} by what they coin the adjustment of factory-gate

prices'. But all discussion is relegated to the Appendix! For a journal like *Economic Policy*, it would have been useful for the reader to have a short, accessible discussion of this methodological point in the main body of the text.

Second, I am not exactly sure how to interpret the paper's headline result that US\$96 billion of trade was lost due to sanctions between December 2013 and December 2015. As I mentioned earlier, this number comes from comparing actual trade with that predicted by the model in Equation (6). But how can we rule out the possibility that the fixed effects are themselves affected by the imposition of sanctions? Consider, for instance, that the imposition of sanctions creates economic uncertainty in Russia and leads to a *generalized* decline in the country's demand for imports. This will be captured through a lower estimated coefficient for θ_{dt} , that is, as a fall in the model's *predicted* volume of trade: thus, it will not be attributed to the sanctions. In fact, this is consistent with Figure 1, which shows that predicted trade flows appear to fall significantly after the third wave of sanctions. In light of this concern, how should we interpret the paper's main result? Is it a lower bound for the effects of sanctions?

Third, as I mentioned earlier, the paper finds that trade falls not only for embargoed but also for non-embargoed goods. In fact, these appear to make up the bulk of the trade lost due to the sanctions. The authors attribute these losses to trade credit. In particular, they identify three types of financing terms for international trade contracts: '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 credit' (a bank intermediary secures the payment on behalf of the importer confirming that the exporter meets the requirements specified in the contract). The paper then shows that the fall in trade is stronger for those sectors that rely more heavily on letters of credit. But the 'open account' category also appears to entail trade credit. Why is not it taken into account?

In a related vein, perhaps the use of letters of credit does not just capture trade credit but a more general dependence on external finance. The published version of the paper now addresses this concern by running a 'race' between the use of letters of credit and the indicator of financial dependence proposed by [Rajan and Zingales \(1998\)](#) and expanded by [Braun \(2005\)](#). The key takeaway is that products associated with higher financial dependence do not exhibit a stronger decrease in trade than other products. Moreover, the inclusion of financial dependence as an explanatory variable has little impact on the estimated coefficients on the share of use of letters of credit by product. In my view, this new exercise strengthens the authors' interpretation that trade credit is somehow linked to the fall in trade.

Overall, Crozet and Hinz have written a very interesting paper, which provides a thorough analysis of the effects of trade sanctions mutually imposed by Russia and the West. Ultimately, they make a convincing case that these sanctions had a significant effect on trade, and that this effect appears to have been linked to trade credit. Perhaps a suggestion for future research is to complement the analysis with a simple model of trade credit that can be used to further refine the empirical inquiry (e.g. Which types of firms/

sectors should be more effected by a disruption in trade credit? What type of trade credit should be most affected by the sanctions?). Given the amount of firm-level data that the authors have access to, this seems like a promising avenue going forwards.

The views expressed here are my own and do not reflect those of the ECB.

Robert Stehrer

The Vienna Institute for International Economic Studies – wiiw

First of all, the paper provides a thorough assessment of the economic effects of the sanctions against Russia in the wake of Russia's behaviour in the Ukrainian crisis and the corresponding counter-sanctions of Russia on specific products for many countries (the 'embargoed products'). The results – based on a structural gravity general equilibrium framework – indicate that Russia was with 7.4% of the predicted total exports hardly hit by the sanctions against them, whereas the Western sanctioning countries have faced on average smaller trade losses with 0.3% of their total exports (of which 92% is accounted for the EU countries). The estimates suggest that the main part of these losses (87%), however, stems from the non-embargoed products. In a second step, therefore, the drivers behind these patterns are identified with the results showing that the increasing legal instability and weakening of the Russian banking system are the most important factors.

The paper employs a very interesting and advanced approach in assessing the impacts of the sanctions from a methodological point of view using two different data sets (trade data and French firm-level data) in a quantitative manner. Though technically well done, however, the paper also reveals by doing so how difficult it is to assess and disentangle the importance of the various channels (e.g. the various overall 'smart' sanctions, trade restrictions, the overall crisis of the Russian economy and the embargoed products) of the impacts on trade.

Particularly, though the authors provide an overview of the sequence of sanctions against Russia in the course of the aggression against Ukraine, the focus of the paper is on the narrower impact of the trade restrictions with a strong focus on the products embargoed from the Russian side. A (too) much promoted result is that the sanctioning countries (on which the Russian embargo was directed) faced larger losses in exports compared to non-sanctioning countries both for non-embargoed products, and particularly so for the embargoed products. Concerning the sanctioning countries, their main result is that the impact is even stronger for the non-embargoed products (which, however, only account for rather low shares in overall exports to Russia as indicated in Table 8), though this does not necessarily hold in relative terms as Figure 3b indicates. Also, results in Section 4 show that exports of the embargoed products declined by 96%, whereas for non-embargoed products by 5.7% only. The authors dub this as 'friendly fire' which in my opinion is not the appropriate wording. (The losses from 'backfiring' should not be confused with one's own losses of the own fire. Thus, a better description in my view would be 'unintended' or 'collateral' impacts or damage.) The

discussion of these results then in my view misses important aspects, particularly on the effects of the other than the product-specific sanctions. As such, I would have expected a more detailed assessment of the “smart sanctions” (travel bans, asset freezes, sanctions against major Russian financial institutions, etc.), which I think played a very important role. Given that, the negative impacts on exports to Russia for non-embargoed products would not at all be surprising. Though this is partly addressed in the second part of the paper, some assessment would have been in order in this part as well. In addition, there is a surprisingly little account of the overall situation of the Russian economy (economic crisis, oil price decline, exchange rate movements, etc.), the Russian geopolitical stance with its general move away from Europe, the role of the behaviour of Russian state-owned firms, or impacts on FDI flows. (For a more detailed assessment of the results, the reader would appreciate more details concerning the overall structure of trade.) Also missing are details and a critical discussion of results for non-sanctioning countries (which, like Belarus, have specific relations to Russia). Though some trade diversion effect becomes apparent, but this is only shown for the embargoed products, not for the other ones.

The second part of the paper employs French firm-level data and tests two different hypotheses concerning the explanation of the trade decline: a change in consumer attitudes and a change in ‘trade finance’. For the first, no empirical support is found. In this context, one however might wonder whether the focus on French luxury products is the right category to capture this (e.g. other categories like cars, durable equipment would be more important to capture the ‘preference’ and income effect). The second hypothesis finds more support. Therefore the conclusion is that the export loss in the non-embargoed products is due to changes concerning ‘trade finance’ issues and country risk and related ‘de-risking’ strategies of firms. These results of course point back to the important role of the ‘smart sanctions’ and the general political and economic situation of Russia in this phase.

Summarizing, the paper provides a heroic effort in quantifying the effects of sanctions and countersanctions on trade in the wake of the Ukrainian crisis and disentangling the various channels based on available data. By doing so, this approach however also documents the limitations of a purely quantitative analysis for assessing and disentangling the role of overall political and macro-economic developments, and the behaviour of the various agents and the complex interactions of these. Nonetheless, such analysis yields important insights to be used in more general and also qualitative assessments of such situations or developments.

Panel discussion

Beata Javorcik suggested two alternative explanations for why non-embargoed products see a decline in trade. First, the Russian Administration is told to harass imports,

including those not subject to restrictions, coming from countries that are less friendly to Russia in order to send a message. Second, firms misclassify products. She stressed that the former would be difficult to distinguish from the overall uncertainty but proposed that the latter could be investigated through discrepancies in bilateral trade statistics.

Atish Ghosh inquired how sanctions might impact non-sanctioning countries, for example, an Indian firm using City Bank that might not want to violate Russian sanctions. He suggested that this may explain the sudden collapse in imports from non-sanctioning countries.

Neeltje Van Horen argued that financing is an important element, and that we know from Antràs and Foley that a lot of trade is financed through cash-in-advance when institutionally weak countries are involved. She, therefore, questioned how much letters of credit would capture and proposed that an interaction with industry financial independence might capture more of the collapse of the Russian banking sector that prevented firms from importing.

Regarding misclassified products, Banu Demir explained that one can look at whether products in the same four-digit category are affected rather than those which are quite different from each other (a common approach in the tariff evasion literature). She agreed that to identify the relevant mechanism as working through trade financing one must control for the overall financing channel, proposing that this could be done using industry-time fixed effects. She added that if the authors really want to capture the trade financing channel, they should use the sum of open account and letter of credit financing, rather than just letter of credit as the latter is really about non-payment risks.

Also regarding financing, Benjamin Born proposed looking at Swiss firms, who are not from a sanctioning country, and then comparing non-targeted goods exported from Switzerland and France. He wondered whether trade financing also gets more difficult for Swiss firms because there is more country risk in Russia, stressing that this approach may disentangle the demand factor from Russia.

Kevin O'Rourke raised the question of whether we would expect 100% immediate adjustment with monthly data or whether the adjustment would be sluggish. He acknowledged that the direct response to sanctions might be immediate but that we might expect some adjustment for the trade credit channel.

Responding to questions, Julian Hinz first clarified that the authors use monthly data as they would annual data, only including bilateral fixed effects varying by month to account for different trade patterns over the year. He acknowledged that trade financing seemed to be the big question, and that identifying sectoral financial dependence and looking for data on open account and cash in advance financing may be ways to address this. Regarding other things happening in Russia, he argued that this is why they need general equilibrium adjustment. He emphasized that other papers looking at the macro situation in Russia seem to conclude that the sanctions were not the main driver of the recession. On product misclassification, he clarified that the authors are currently only using export data but that this could be easily

extended to comparisons with import data. He finally stressed that the paper only requires that the bilateral monthly fixed-effect is stable, a much less strong assumption than on something that is Russia specific.

APPENDIX A: A DETAILS ON EU AND RUSSIAN SANCTIONS

Detailed timeline

The initial EU measures were implemented through *Council Decision 2014/145/CFSP* and *Council Regulation (EU) No 269/2014* on 17 March 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 21 March 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 28 April 2014. Until the end of 2015, this list of persons was amended 12 times.³⁹

The US 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).⁴⁰

Other countries allied with the EU and the United States followed a similar path and introduced comparable measures at around the same time.⁴¹ These lists of individuals and entities were successively appended over the spring and summer of 2014.⁴²

39 See <http://www.consilium.europa.eu> for a list of currently sanctioned people and entities.

40 See the current *Sectoral Sanctions Identifications List* of the US Office of Foreign Assets Control and the list of *Specially Designated Nationals* here <https://www.treasury.gov/ofac>.

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

42 Compare, for example, Ashford (2016) and Dreger *et al.* (2016).

The restrictions in the third wave of sanctions were enacted through *Council Decision 2014/512/CFSP* and *Council Regulation (EU) No 833/2014* on 31 July 2014.⁴³ 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.⁴⁴

The US State Department announced a 'third wave' of sanctions on 17 July 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'.⁴⁵ On 29 July 2014, these were broadly expanded, with the State Department announcing that new measures prohibited US persons from 'providing new financing to three major Russian financial institutions', while at the same time 'suspend[ing] US export credit and development finance to Russia'.⁴⁶ Further amendments in the same vein were announced on 9 September 2014.⁴⁷

Other Western countries reciprocated the measures taken by the United States and EU and enacted similar trade sanctions and financial restrictions (Dreyer *et al.*, 2015; Dreger *et al.*, 2016). 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).⁴⁸ All measures, from the Western and the Russian side, were extended multiple times and continue to be in place as of July 2017.

43 The 'third wave' had been in the making – publicly – for some time then, presumably as a threat, see <http://www.euractiv.com/section/global-europe/news/eu-prepares-more-sanctions-against-russia/>. The United States had implemented its measures on 17 July 2014 already and were pushing EU leaders to reciprocate.

44 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 Table A.1 of Appendix 1 for the affected HS 8 codes.

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

46 See <https://www.treasury.gov/press-center/press-releases/Pages/jl2590.aspx>.

47 See <https://www.treasury.gov/press-center/press-releases/Pages/jl2629.aspx>.

48 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.

EU sanctions: list of embargoed products

Table A1. 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 stainless 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 stainless steel, of an external diameter of not exceeding 406.4 mm
7306 29 00	Casing and tubing of a kind used in drilling for oil or gas, welded, of flat-rolled products of iron or steel, of an external diameter of not exceeding 406.4 mm (excl. products of stainless steel or of cast iron)
8207 13 00	Rock-drilling or earth-boring tools, interchangeable, with working parts of sintered metal carbides or cermets
8207 19 10	Rock-drilling or earth-boring tools, interchangeable, with working parts of diamond or agglomerated diamond

(continued)

Table A1. Continued

Commodity Code	List of products
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)

Russian sanctions: list of embargoed products

Table A2. 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

(continued)

Table A2. Continued

Code	Simplified description	Code	Simplified description
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, Brazil 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

* indicates HS4 products that are not fully subject to a strict embargo.

APPENDIX B: COUNTRY-LEVEL DATA

Table B1. 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		85,936,844.44	197,924,523.56	0.08	0.01	0.47
Australia	Yes	205,707,651.90	494,726,706.29	0.06	0.00	0.43
Austria	Yes	220,764,492.46	557,218,071.68	0.03	0.04	0.02
Belgium	Yes	617,637,152.89	1,316,207,812.62	0.04	0.02	0.05
Bulgaria	Yes	31,939,457.69	55,577,654.42	0.02	0.03	0.02
Belarus		64,413,678.69	207,544,443.25	0.08	0.37	0.20
Brazil		234,022,075.64	400,358,142.02	0.06	0.02	0.51
Canada	Yes	623,423,426.84	3,596,935,498.37	0.03	0.00	0.34
Switzerland	Yes	304,466,773.18	605,830,039.27	0.01	0.02	0.03
Chile	Yes	80,309,298.54	158,724,013.16	0.16	0.01	0.74
Cyprus	Yes	1,812,282.86	4,964,067.33	0.17	0.02	0.53
Czech Republic	Yes	230,067,416.74	580,859,985.37	0.01	0.04	0.00
Germany	Yes	1797,757,171.46	2,395,402,034.14	0.02	0.04	0.02
Denmark	Yes	134,782,890.19	258,790,895.56	0.12	0.02	0.19
Algeria		181,442,939.77	281,827,423.79	0.00	0.00	0.97
Egypt		27,333,880.56	49,966,805.49	0.05	0.01	0.76
Spain	Yes	362,108,402.99	688,523,013.01	0.09	0.02	0.16
Estonia	Yes	21,400,343.19	43,996,414.14	0.03	0.14	0.04
Finland	Yes	90,274,628.90	140,606,107.32	0.01	0.12	0.05
France	Yes	719,828,711.96	1,269,325,175.19	0.04	0.02	0.03
The United Kingdom	Yes	562,873,529.56	948,700,405.10	0.02	0.02	0.01
Greece	Yes	35,408,947.64	60,060,038.86	0.10	0.02	0.29
Hong Kong		267,318,172.27	552,285,734.77	0.00	0.01	0.01
Hungary	Yes	134,769,157.04	290,265,649.69	0.02	0.04	0.02
India		265,377,176.61	468,848,332.57	0.03	0.01	0.03
Ireland	Yes	167,607,783.06	391,717,896.69	0.06	0.01	0.13
Israel		84,691,965.41	214,869,220.08	0.02	0.02	0.23
Italy	Yes	653,521,902.30	1,030,007,953.49	0.03	0.03	0.02
Japan	Yes	783,779,172.96	1,742,077,240.97	0.00	0.02	0.00
Lithuania	Yes	42,252,718.62	84,478,097.32	0.08	0.21	0.21
Luxembourg	Yes	27,667,347.86	65,477,511.40	0.03	0.01	0.02
Latvia	Yes	17,212,301.84	33,097,346.94	0.05	0.13	0.03
Mexico		530,570,389.84	3,213,093,116.40	0.03	0.00	0.23
Malta	Yes	4,515,775.09	9,635,479.58	0.04	0.02	0.00
Malaysia		264,526,826.04	536,756,014.55	0.01	0.00	0.01
The Netherlands	Yes	728,404,996.38	1,625,683,062.31	0.05	0.02	0.05
Norway	Yes	237,596,744.02	580,380,158.33	0.05	0.01	0.70
New Zealand	Yes	38,658,455.77	98,748,116.65	0.33	0.01	0.72
Peru		54,107,656.23	110,929,621.26	0.06	0.00	0.66
Philippines		66,173,955.01	164,194,209.35	0.03	0.00	0.19
Poland	Yes	264,345,582.72	546,322,353.76	0.05	0.06	0.09
Portugal	Yes	73,857,553.20	185,021,337.50	0.04	0.00	0.03
Romania	Yes	76,829,394.34	148,349,731.86	0.01	0.03	0.00
Russian Federation		1,137,025,212.19	1,965,612,051.97	0.00		
Singapore		541,328,587.51	1,138,393,953.36	0.01	0.00	0.01

(continued)

Table B1. Continued

Country	Sanctions	Mean exports	SD exports	Share of emb. exports	Share of exports to Russia	Share of emb. exports to Russia
Slovakia	Yes	119,105,277.97	253,360,661.49	0.01	0.04	0.00
Slovenia	Yes	34,178,206.68	7,6910,359.20	0.01	0.05	0.02
Sweden	Yes	227,719,042.18	348,826,924.42	0.03	0.02	0.00
Thailand		250,066,747.56	436,249,497.74	0.03	0.01	0.04
Turkey		140,334,455.76	208,323,719.86	0.05	0.07	0.14
Ukraine	Yes	78,363,287.03	210,179,801.50	0.02	0.35	0.04
The United States	Yes	1,719,068,879.73	3,883,586,752.98	0.03	0.01	0.12
South Africa		74,507,956.47	127,316,187.76	0.05	0.01	0.31
Indonesia		214,679,843.24	437,697,384.15	0.02	0.01	0.08

APPENDIX C: GENERAL EQUILIBRIUM EFFECTS

We estimate Equation (1) *without* ‘treated observations,’ that is, 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 set-up 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 Tenreiro (2006). Aside from the usual benefits, the PPML estimator is particularly relevant in the present case in order to account for the ‘adding-up problem’ of the OLS estimator as described by Fally (2015).⁴⁹ 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.⁵⁰ Using these estimated fixed effects then, the predicted *partial equilibrium* flows can be constructed simply as

49 The property of the PPML estimator described by Fally (2015) posits that estimated production and expenditure figures, that is, the sum of exports and imports, respectively, remain equal to observed figures with the PPML estimator. This stands in contrast to the Ordinary Least Squares (OLS) estimator that does not produce matching figures, hence yielding an ‘adding-up’ problem.

50 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.

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

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 as⁵¹

$$\begin{aligned}\hat{Y}_{ot}^{\text{PE}} &= \sum_{l \in d} \exp(\hat{\Psi}_{ot} + \hat{\Theta}_{lt} + \hat{\phi}_{olm}) \quad \text{and analogously} \\ \hat{X}_{dt}^{\text{PE}} &= \sum_{l \in o} \exp(\hat{\Psi}_{lt} + \hat{\Theta}_{dt} + \hat{\phi}_{ldm}),\end{aligned}\tag{C.1}$$

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

$$\begin{aligned}\hat{\Omega}_{ot}^{\text{PE}} &= \sum_{l \in d} \exp(\hat{\Theta}_{lt} + \hat{\phi}_{olm}) \quad \text{and} \\ \hat{\Phi}_{dt}^{\text{PE}} &= \sum_{l \in o} \exp(\hat{\Psi}_{lt} + \hat{\phi}_{ldm}).\end{aligned}\tag{C.2}$$

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

$$\begin{aligned}\hat{\Omega}_t &= \hat{\phi}_m(\hat{X}_t \otimes \hat{\Phi}_t^{-1}) \\ \hat{\Phi}_t &= \hat{\phi}_m^T(\hat{Y}_t \otimes \hat{\Omega}_t^{-1}),\end{aligned}\tag{C.3}$$

where $\hat{\Omega}_t$ and $\hat{\Phi}_t$ are vectors of outward and inward multilateral resistances⁵² at time t and $\hat{\phi}_m$ the trade cost matrix for calendar month m .⁵³ The conditional general equilibrium counterfactual trade flows can then be computed as

51 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 a multiplicative form.

52 $\hat{\Phi}_t^{-1}$ and $\hat{\Omega}_t^{-1}$ are vectors of elementwise inverses of $\hat{\Omega}_t$ and $\hat{\Phi}_t$, and $\otimes$ denotes the elementwise product.

53 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 set-up with counterfactual flows incorporating updated production and expenditure figures yields the same results as the present methodology. Computationally, however, solving

$$\hat{X}_{odt}^{CE} = \frac{\hat{\gamma}_{ot}^{PE}}{\hat{\Omega}_{ot}^{CE}} \cdot \frac{\hat{X}_{dt}^{PE}}{\hat{\Phi}_{dt}^{CE}} \cdot \hat{\phi}_{odm}, \quad (C.4)$$

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 that⁵⁴

$$\hat{\gamma}_{ot}^{GE} = \hat{\gamma}_{ot}^{PE} \cdot \left(\frac{\hat{\Psi}_{ot}^{GE}}{\hat{\Psi}_{ot}} \right)^{\frac{1}{1-\sigma}} \quad \text{and} \quad \hat{X}_{dt}^{GE} = \hat{X}_{dt}^{PE} \cdot \left(\frac{\hat{\Psi}_{dt}^{GE}}{\hat{\Psi}_{dt}} \right)^{\frac{1}{1-\sigma}}, \quad (C.5)$$

where σ is the elasticity of substitution and $\hat{\gamma}_{ot}^{PE}$ and $\hat{X}_{dt}^{PE}$ and production and expenditure figures constructed using Equation (C.1) 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 five 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 $\hat{\Psi}_{ot}^{GE}$ and $\hat{\Psi}_{dt}^{GE}$ 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 (C.4) yields the counterfactual flows between all countries.

iteratively the system of matrices is far less demanding than a PPML gravity estimation with a full set of fixed effects.

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

APPENDIX D: QUANTIFICATION OF LOST TRADE

Table D1. Losses of total trade by period and country

Country	Total		Conflict		Smart sanctions		Economic sanctions	
	Absolute	Relative	Absolute	Relative	Absolute	Relative	Absolute	Relative
Australia	-10.48	-40.97	7.46	31.95	-8.06	-25.40	-13.31	-55.35
Austria	-13.36	-3.83	190.36	87.58	-10.03	-2.19	-38.31	-11.55
Belgium	-80.39	-17.95	-64.20	-11.96	-88.97	-15.51	-79.77	-19.93
Bulgaria	-3.11	-6.16	4.28	8.83	-1.03	-1.69	-4.60	-9.63
Canada	-25.99	-28.08	-2.52	-2.33	9.47	8.19	-39.18	-46.67
Cyprus	-1.06	-37.00	-3.00	-57.07	-0.23	-8.99	-1.07	-40.15
Czech Republic	-70.47	-16.27	-0.53	-0.11	-20.97	-4.13	-93.25	-23.01
Germany	-667.69	-20.03	-425.03	-11.72	-421.33	-10.32	-768.70	-24.97
Denmark	-26.42	-22.47	-16.48	-11.94	-13.50	-8.99	-31.39	-29.72
Spain	-46.28	-17.45	-30.14	-9.58	2.34	0.73	-62.47	-25.65
Estonia	28.69	21.78	89.54	78.25	58.23	36.95	12.84	10.18
Finland	-77.57	-16.37	-14.99	-3.08	-25.94	-4.53	-100.12	-22.61
France	-117.16	-16.74	12.27	1.45	-145.83	-15.68	-123.96	-20.14
The United Kingdom	-153.72	-25.90	-117.68	-17.54	-93.42	-13.38	-175.69	-31.74
Georgia	9.79	120.79	18.36	534.88	15.95	244.36	6.97	76.43
Greece	-7.55	-20.34	-7.01	-20.74	-5.56	-10.58	-8.20	-24.86
Croatia	-5.54	-18.61	0.21	0.78	-3.51	-12.09	-6.81	-22.46
Hungary	-42.91	-18.60	-20.33	-7.46	-44.78	-16.01	-45.01	-21.30
Ireland	0.09	0.16	11.22	18.88	44.12	68.43	-14.17	-26.10
Italy	-52.22	-5.78	66.83	7.15	20.47	1.80	-87.60	-10.53
Japan	-86.88	-12.60	-16.56	-1.80	6.69	0.78	-122.68	-20.05
Lithuania	23.27	5.77	91.27	24.91	113.33	22.80	-11.22	-2.95
Luxembourg	-1.47	-11.75	-7.08	-32.67	0.14	1.02	-1.28	-11.61
Latvia	-3.51	-3.42	12.12	13.50	-1.32	-1.15	-5.99	-5.95
Malta	-2.14	-86.65	-0.43	-86.78	-2.29	-91.44	-2.30	-85.34
Montenegro	-0.14	-28.09	0.31	107.71	-0.01	-2.38	-0.22	-44.27
The Netherlands	-107.63	-15.81	-168.86	-20.40	-67.93	-8.22	-112.10	-18.06
Norway	-30.55	-38.93	-12.33	-11.05	3.87	4.00	-42.82	-61.87
Poland	-151.18	-19.36	-76.97	-9.19	-68.66	-7.61	-184.18	-24.93
Portugal	-1.17	-5.93	1.74	7.19	1.44	5.98	-2.29	-12.69
Romania	11.78	10.20	32.61	26.42	40.02	28.89	1.03	0.96
Russian Federation	-2227.71	-10.10	557.11	2.53	479.57	1.79	-3351.60	-16.20
Slovakia	-38.15	-17.26	-17.28	-6.89	23.19	9.43	-58.65	-27.91
Slovenia	4.32	4.89	9.11	10.03	8.05	7.29	2.65	3.26
Sweden	-13.60	-6.31	44.56	21.91	7.21	2.69	-26.56	-13.19
The United States	-5.14	-0.69	114.90	14.46	165.09	19.96	-69.33	-9.62
Cumulative	-3,993.25	-11.57	262.85	0.74	-24.21	-0.06	-5661.33	-17.58

Notes: Losses are in per month. Absolute losses are in millions of USD. Relative losses are in percentages. '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 D2. Losses of embargoed products trade by period and country

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

Notes: Losses are in per month. Absolute losses are in millions of USD. Relative losses are in percentages. '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 D3. Losses of non-embargoed products trade by period and country

Country	Total		Conflict		Smart sanctions		Economic sanctions	
	Absolute	Relative	Absolute	Relative	Absolute	Relative	Absolute	Relative
Australia	-1.71	-12.46	-0.86	-7.19	2.44	16.95	-3.03	-22.09
Austria	-12.11	-3.53	185.51	87.05	-8.50	-1.90	-36.43	-11.13
Belgium	-71.78	-16.69	-65.33	-12.94	-84.98	-15.61	-68.66	-17.72
Bulgaria	-2.79	-5.61	4.29	9.00	-0.54	-0.90	-4.29	-9.07
Canada	-19.54	-27.36	-17.19	-22.01	-10.58	-12.46	-22.45	-33.68
Cyprus	-0.55	-27.43	-0.20	-27.64	-0.23	-14.38	-0.69	-30.10
Czech Republic	-70.60	-16.33	-1.28	-0.27	-22.03	-4.35	-93.04	-22.99
Germany	-644.82	-19.61	-395.19	-11.14	-383.61	-9.57	-751.02	-24.67
Denmark	-21.86	-21.93	-20.28	-18.66	-10.19	-8.30	-25.48	-27.76
Spain	-28.18	-11.86	-4.05	-1.57	16.47	6.02	-44.16	-19.66
Estonia	30.24	23.82	87.94	81.55	59.69	39.99	14.79	12.06
Finland	-69.27	-15.24	-17.55	-3.86	-33.13	-6.07	-85.98	-20.11
France	-111.50	-16.29	13.03	1.59	-144.61	-15.98	-116.41	-19.28
The United Kingdom	-152.83	-25.94	-118.83	-17.95	-94.14	-13.62	-174.10	-31.62
Georgia	8.33	107.24	17.51	513.29	15.75	245.77	5.07	58.41
Greece	-2.81	-10.02	-2.09	-9.70	-3.65	-10.97	-2.65	-9.71
Croatia	-5.32	-18.20	0.17	0.65	-3.73	-12.98	-6.43	-21.67
Hungary	-40.55	-17.92	-20.98	-7.84	-42.09	-15.47	-42.40	-20.40
Ireland	1.13	2.26	5.28	10.45	45.25	86.38	-12.34	-25.05
Italy	-47.31	-5.30	67.06	7.31	20.85	1.86	-80.82	-9.81
Japan	-87.36	-12.68	-17.36	-1.89	6.88	0.80	-123.31	-20.16
Lithuania	58.99	17.91	116.41	48.27	128.45	34.27	31.80	9.75
Luxembourg	-1.53	-12.57	-6.86	-32.53	0.05	0.38	-1.36	-12.65
Latvia	-4.58	-4.57	4.63	5.32	-6.50	-5.83	-5.10	-5.18
Malta	-2.14	-86.65	-0.43	-86.78	-2.29	-91.44	-2.30	-85.34
Montenegro	-0.15	-30.83	0.31	107.71	-0.01	-2.38	-0.24	-48.06
The Netherlands	-102.30	-15.81	-177.18	-22.66	-76.24	-9.83	-101.15	-17.05
Norway	4.45	22.13	10.05	112.26	16.32	167.21	0.31	1.25
Poland	-122.04	-16.88	-81.09	-10.88	-52.74	-6.57	-147.24	-21.13
Portugal	-0.83	-4.32	1.17	4.97	1.13	4.86	-1.64	-9.43
Romania	11.79	10.21	32.56	26.38	40.06	29.00	1.04	0.96
Russian Federation	-2228.23	-10.13	556.76	2.53	478.78	1.79	-3352.06	-16.24
Slovakia	-37.98	-17.21	-17.27	-6.90	23.27	9.48	-58.43	-27.84
Slovenia	4.17	4.81	9.54	10.77	8.73	8.08	2.20	2.74
Sweden	-13.11	-6.11	44.14	21.80	7.41	2.78	-25.87	-12.90
The United States	16.28	2.31	137.47	18.90	170.79	22.66	-43.43	-6.32
Cumulative	-3,768.40	-11.10	329.80	0.95	62.52	0.15	-5,377.28	-16.93

Notes: Losses are in per month. Absolute losses are in millions of USD. Relative losses are in percentages. '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.

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