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THE TRADE EFFECTS OF CHINA'S SANCTIONS IMPOSED ON LITHUANIA: EVIDENCE FROM A QUASI-NATURAL EXPERIMENT

Authors: Baiba Bataraga
Viestards Pālens

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Baiba Bataraga

and

Viestards Pālens

Supervisor: Konstantins Benkovskis

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Name(s) of the author(s) in full: Baiba Bataraga, Viestards Palens

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Abstract

This paper analyses the trade effects on Lithuania's exports to China due to the trade sanctions imposed by China on Lithuania in December 2021. We apply the difference-in-differences methodology to study the effect of sanctions by using two control groups: Lithuania's neighbouring countries' exports to China and Lithuania's exports to China's neighbouring countries, while in both cases the treated group are Lithuania's exports to China. The results are obtained by applying OLS (ordinary least squares) and WLS (weighted least squares) estimators. The panel dataset employed consists of monthly commodity exports, categorised by their six-digit HS codes, as well as additional inflation and GDP figures as controls for the period January 2015 – July 2022. Our main findings are that the average commodity was exported by 93.75% to 99.88% less from Lithuania to China due to the sanctions, and the decline is the largest between January and April 2022. The most resistant to sanctions were goods that fall into the categories of machinery and mechanical appliances, as well as base metals and their articles, while the least resistant were wood products, live animals, and minerals. According to contract theory, these findings signal that more long-term trade contracts were among the resistant groups, and that a part of the sanction sender policy remained cost minimisation.

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I Introduction

Although sanctions have recently been widely discussed and studies, specifically in the context of Russia being sanctioned by the Western world (Mardones, 2023; Cui et al., 2023), an event of this kind that has received comparatively limited media coverage and scant academic research is the China-Lithuania trade dispute, initiated by the opening of a representative office of Taiwan in Lithuania in the last quarter of 2021, to which the Chinese government responded by imposing harsh trade restrictions on Lithuania (Barros, Sikora, 2022). The Chinese government committed to a ban on all imports from Lithuania, starting in December 2021, in addition to reducing diplomatic relations, which has been estimated by the Bank of Lithuania to decrease GDP growth of Lithuania by 0.1% in 2022 and 0.2% in 2023 (Bank of Lithuania, 2022). The European Union (EU) responded by filing a complaint with the World Trade Organisation (WTO), based on the claim that these sanctions were discriminatory and illegal, and this lawsuit is still on-going at the time of this writing.

As we do not know of any research papers that study the international trade or any other economic effects of the sanctions imposed by the Chinese government on imports from Lithuania, we believe this to be a worthwhile thing to do to contribute to the large and growing research body of sanctions, especially with China's rise as a global superpower (Dalio, 2021) and the potential disputes that may arise between China and other Western countries, who both have opposing ideologies and are relatively much smaller than China just as is in the case of Lithuania. In this sense, parallels can be drawn with the currently ongoing dispute between Russia and the West. Therefore, we arrive at the research question: **how have Lithuania's trade flows been affected by China's trade sanctions imposed on Lithuania?**

The research is conducted by studying the very disaggregated product-level trade data using the difference-in-differences methodology: the treated group are Lithuania's exports to China, while we use two control groups in our study – Lithuania's neighbouring countries' exports to China and Lithuania's exports to China's neighbouring countries. Our key findings are that the average commodity was exported by between 94.43% and 99.88% less from Lithuania to China each month after the sanctioning, and the effect was most pronounced between January and April 2022. As the estimated decrease of trade was not 100%, we have found that the most economically significant export groups, that were most resilient to these sanctions, are machinery

and mechanical appliances, as well as base metals and their articles, which probably arise due to China designing the sanctions in a way that minimises costs for local firms.

The paper is structured as follows. The literature review in part II summarises the event timeline as well as previous literature on sanctions; part III describes the data and methodology; part IV contains the discussion of results; and part V concludes.

II Literature review

2.1. The Timeline of the Events

On November 18, 2021, a representative office of Taiwan was opened in Lithuania (Reuters, 2021), which by the Chinese government was interpreted as acknowledging Taiwan's sovereignty and hence challenging the claim that Taiwan is simply a region in China. Due to this, on December 3, the Chinese government announced the imposition of sanctions on all imports from Lithuania, or even products that were imported from other countries but contained parts initially produced in Lithuania. According to Hyndle-Hussein and Jakobowski (2021), the Chinese government achieved this by removing Lithuania from their customs systems, closing Lithuanian companies' credit lines, even pressuring international corporations to reduce or halt operations that related to Lithuania. As a result, already in December 2021 Lithuanian exports to China fell by over 90%, compared to the previous year (Allen-Ebrahimian, 2021). It can be reasonably assumed that this act is intended as a show of force as to what extent the Chinese government is willing to uphold their ideology. The chronology of events is summarised in Table 1.

[Insert Table 1 here]

The latest round of the sanctions imposed on Lithuania's politicians in the summer of 2022 does not impact our analysis, however, because of the imposed sanctions being diplomatic, not economic, so their effects are reflected in the state's diplomatic capabilities (Maller, 2010), not trade.

2.2. The Economic Effects of Economic Sanctions in Literature

In this section, we will first briefly define sanctions; then we will look at papers studying the different variables affected and the methodologies used; and we finalise with a discussion focusing on the trade effects.

Unless specified otherwise, when talking about sanctions in this paper, we mean economic sanctions, which are defined by the European Council (n.d.) as sanctions that need to have legal grounds and are aimed at restricting some economic activities. In the case of trade sanctions, they aim to restrict trade flows. The legal grounds, on the other hand, arise from different agreements made between countries in the World Trade Organization (WTO). This is the basis on which the EU filed a complaint against China, and they referred to a multitude of such agreements: the General Agreement on Tariffs and Trade (GATT), the General Agreement on Trade in Services (GATS), and others (WTO, 2022).

Analysing sanction effects can be done through a variety of aspects, e.g., political, humanitarian, social, or others (Ozdamar, Shahin, 2021); however, to remain reasonably concise, we focus on the economic aspect of economic sanction effects. Additionally, according to Gutmann et al. (2021), the political and social effects of international sanctions have been studied more widely. The different aspects of sanctions' economic consequences in literature are covered broadly, therefore we do not aim to cover the entirety of research but rather give a number of examples for each category of studies to offer a notion of current discoveries.

The research on sanctions often looks at their effects on different economic variables. Gutmann et al. (2021) distinguish eight macroeconomic variables affected by sanctions: real GDP or its growth, which can be further divided into private consumption, government expenditures, and investment; foreign direct investment, official development assistance, trade openness as the total of imports and exports; and the composition of government expenditures. Additional measures included in Ozdamar and Shahin's (2021) overview of sanctions' economic consequences are inflation and unemployment, as well as welfare effects; they consider the effects on the sanction-imposing and third-party countries too. A few other affected variables discussed in some studies are currency strength, as well as firm performance.

The first often discussed variable to measure the impact of sanctions is **GDP growth**. Neuenkirch and Neumeier (2015) conduct a broad study of the effects on GDP growth in

countries economically sanctioned by the United States and the United Nations (UN) over a period of almost four decades. Their main findings are that a country's economic growth decreases after being sanctioned by an average of over two percentage points, and the effects last for around a decade, aggregating to a GDP decline of 25.5%. In addition, Neuenkirch and Neumeier (2015) point out that the magnitude of the effects depends on whether the sanctions are imposed by a single country or a group (like the UN), which helps to explain why the reductions differ in different cases.

Williams (2021) further decomposes GDP through analysing the effects on **private** and **government consumption** in a sample of 30 developing countries and finds that private consumption primarily decreases due to non-economic sanctions, while government expenditures, more specifically those on subsidies and transfers, reduce with more intense economic sanctions. Gutmann et al. (2021) in their sample of 162 countries over almost five decades too find an average private consumption growth reduction of 0.85 percentage points and a decrease in government expenditures in the first year after sanction imposition; however, the opposite is true in some cases, as pointed out by Boesler (2022), who finds that Russian consumers spent more in response to large shocks, including sanctions, because of the weakening of their domestics currency. These differing results may be supported by the fact that the **welfare effects** of sanctions depend on a number of economic factors (Black and Cooper, 1987).

A sanctioned country's **currency depreciation** can cause other economic deterioration as well, e.g. Tyll et al. (2018), find that the Russian ruble's weakening against the US dollar is the largest cause of **inflation** in the country, following the 2015 sanctions; however, according to Wang et al. (2019), **exchange rate volatility** remains significantly unchanged. Important to note is that the majority of research focuses on fiat currencies, therefore a gap in research exists to find the effects on cryptocurrency exchange rates and volatilities, with some preliminary studies done by Makhlouf and Selmi (2022).

Tyll et al. (2018) find increased **capital outflows** happened even before the 2015 imposition of sanctions on Russia, as the market had been seen by investors as worsening for months, also confirmed by Gurvich and Prilepskiy (2015) who estimate the net capital outflow from Russia to be 160-170 billion USD during the period around sanction imposition; however, in studies of broader samples, **foreign direct investment** flow effects appear to be contradictory (Ozdamar

and Shahin, 2021), as other research finds the capital outflow effect to be temporary, with investors retreating from sanctioned markets before sanctioning and the levels returning shortly after the imposition of sanctions. According to Ozdamar and Shahin (2021), the more permanent capital outflow conclusion is reached in papers that study effects on single countries, like Russia or China, and these results cannot be generalised due to possible sample selection bias.

The final variable worth looking at more closely is **firm** financial performance and papers that study how it has been affected by trade sanctions, e.g., Onderco and Van der Veer (2021) research the likelihood of Dutch sanctioned firms by Russia going bankrupt in the period 2013–2016 and find that the probability increases.

Sanctions tend to have **counter-effects** on the sanctioning country as well, e.g., in the simplest case by the sanctioned country applying counter-sanctions; however, as counter-sanctions are just sanctions created with the purpose to respond, their stand-alone economic effects are largely similar.

Consecutively, the affected can be not only the sanctioned but **third-party states** too if they have significant trade relations with the sanctioned state. In the case of the US sanctioning China in the early 2000's and limiting both imports and exports, some third party countries actually benefited as China diverted to importing from elsewhere (Yang, 2004); however, negative effects can prevail too if the neighbouring countries of the sanctioned state see a decrease in trade or if transportation costs increase for those whose trade was previously in relation with the sanctioner (Ozdamar and Shahin, 2021). Finally, some states can arrive at a situation where they are forced to impose sanctions, e.g. if they are part of the UN or EU, or another alliance where the majority's opinion rules.

Important to note when discussing sanctions are the so-called **sanctions' busters** – reasons why sanctions may lose intended effectiveness or fail altogether. Bonetti (1998) studies the effectiveness of over 100 sanctioning episodes and finds that the largest contributors to increased sanction failure are the help of a third party to the sanctioned state or a small initial trade relationship between the sanctioner and the target. Early (2011) points out that only commercially motivated sanction busters have an effect on sanction outcomes, while politically motivated ones do not.

2.3. The Trade Effects of Economic Sanctions in Literature

The final economic variable impacted by economic sanctions is **trade flows**. Considering that the economic sanctions imposed by China on Lithuania are focused on trade restrictions, trade flows are the primarily impacted economic measure, hence we focus our research on them. Trade effects can be studied in multiple levels, as trade data is available at different granularities, primarily, macroeconomic (i.e., total exports or imports), product-, or firm-level. Choosing one of the latter two allows for more in-depth analysis of either effects on trade by product categories or by firms.

Firstly, **macroeconomic** data is used by Gutmann et al. (2021), who estimates a decrease in international trade flow through aid. They estimate a decrease in total volume of total trade too, as do Ghodsi and Karameliki (2022) in studying sanctioned Iran's bilateral trade with the EU. Another decrease in exports due to sanctions is detected by Evenett (2022) in a recent study on South Africa during the 1990s; however, Simola (2022) who studies Russian trade in the following four months after its invasion of Ukraine in February, 2022, the exports were found to have risen, albeit the imports decreased drastically. This paper differs in that Russia had stopped publishing its trade data since the invasion, so analysis was done by using the import data from Russia's major trading partners.

The second approach is to use **product-level** trade data, which is used primarily in the case of specific product categories being sanctioned or to study the effects on some product groups. In one study, Belin and Hanousek (2021) analyse the trade flow effects of the 2014 EU–Russian sanctions, which were imposed on product categories, and the effects of counter-sanctions, where they detected a decrease in trade for the sanctioned goods. In another study, Luo et al. (2021) find evidence that China's 2012 sanctions imposed on fruit imports from the Philippines affected the sanctioned products' trade substantially between the countries. In addition, since sanctions tend to be aimed at all products of some broader categories, research can focus on different industries as well, e.g., in a sample of 243 countries over 16 years, Larch et al. (2021) in their working paper find that trade in agricultural products has decreased almost three quarters after the imposition of sanctions on agriculture, while mining trade has been reduced by 44%.

Finally, **firm-level** data can also be used to study trade data more granularly, similar to that of products. In a recently published paper, Cristea and Miromonova (2022) in a sample of Russian

firm trade over the years 2011-2015 find that joining the WTO, which allows for freer trade as opposed to sanctions restricting it, has increased both the number of exporting firms and countries being exported to. In an earlier paper by Crozet and Hinz (2020), they document a decrease in Russian trade and losses amounting to roughly 50 million USD to both Russia and Western countries each due to the sanctions imposed after the Crimea invasion. In both of these papers, both firm- and product-level data is used. Another note-worthy study has been done by Jung and Kim (2018) who use China's firm-level data, where the conventional data on total exports and the products exported is not available, to study China's trade with North Korea, and they find that South Korea's sanctions on North Korea are largely unsuccessful, as the sanctioned products came through China.

The papers discussed here that study the impacts on trade most often apply the difference-in-differences methodology. Gutmann et al. (2021) study the effects of a multitude of countries on different variables, and Fedoseeva and Herrmann (2019) study the effects on German exports after Russia's counter-sanctions on a macroeconomic level. Belin and Hanousek (2021) estimate the trade effects of the economic sanctions against Russia using product-level data, as do Luo et al. (2021) who study the trade effects of the China-Philippines dispute. Difference-in-differences can be used with firm-level data too, which is done by Cristea and Miromanova (2022) for Russia's access to WTO. Other approaches are the use of the gravity model of trade, which is most useful in samples of many countries, done by Larch et al. (2021) and Larch et al. (2022) who study the effects on different sanctioned industries, as well as applying a general equilibrium counterfactual analysis, done by Crozet and Hinz (2020) to estimate trade losses after sanctions.

III Data and methodology

3.1. Methodology

The imposition of economic sanctions due to political reasons, an exogenous shock, creates a quasi-natural experiment, which allows us to study the causal effects of the sanctions imposed on exports by using a difference-in-differences methodology, which, to the best of our knowledge, is also how most research about the effects of sanctions on trade flows is done (see Section 2.3).

The methodology employs a treated and a control group and has three main assumptions: a) the control group and the treated group follow parallel trends before the treatment; b) the shock is exogenous; and c) there are no spillover effects from the treated group to the control group. This creates some variability in the possibilities of how to conduct our research, which we will discuss now.

The first consideration is about the control group. In the case of China imposing trade sanctions on Lithuania, the treated group is Lithuania's exports to China; however, we identify two different approaches to choosing the control group. Firstly, with respect to differences in the supply side, the control group can be chosen as the exports from Lithuania's neighbouring countries with similar features, but not subject to sanctions from China, i.e., Latvia, Estonia, and Poland, albeit the latter highlights the need to control for the country size. Secondly, with respect to the demand side, Lithuania's exports to similar neighbouring countries of China can also be chosen as the control group. The main difference between the two groups is in where the variability between the control and the treated group comes from, i.e., the differences between Lithuania's, Latvia's, Estonia's, and Poland's exports to China arise from different supply factors, e.g., comparative advantages for producing some goods due to different opportunity costs, better technologies and hence higher productivity, or lower wages; while the differences between different product group exports from Lithuania to China and exports from Lithuania to other Asian countries mostly stem from demand factors, determined by the importer's currency purchasing power, as well as domestic production determinants (geography, natural resources, etc), although supply factor differences can be present too, as Lithuania's comparative advantages may differ among Lithuania's trading partners. In simpler terms, in the first case, the different exporting countries have different supply capabilities across products but China's demand remains the same; while, in the second case, Lithuania's supply capabilities are the same, while China and its neighbours have different demands.

The second consideration is whether to study the dependent variable, monthly exports of a commodity from one country to another, as it is in USD or to transform it by calculating its natural logarithm. We choose to transform the data into logarithms, since the transformation allows us to look at the effects in percentage changes, which are useful for comparison among different product categories that are significantly different in volume (and it allows us comparing

Lithuania with Poland despite considerable differences in size of the trade flows). However, introducing logarithms by definition removes all of the data points where no trade has happened, i.e., trade equals zero. To resolve this issue, we use the conventional approach and add a very small amount of trade volume (1 USD) to all data points, which does not have a significant economic impact but allows us to keep the otherwise zero values.

For our baseline estimates, we choose Lithuania's neighbouring countries as the control group, since Lithuania and its neighbouring countries (specifically, Estonia and Latvia) are much more similar than China is to any large Asian country, and look at data with the logarithm of exports. Latvia, Estonia and Poland are chosen to reduce variability in their supply determinants as much as possible, since the countries are and have historically been similarly economically situated (World Bank, 2010). The baseline estimation of a difference-in-differences model is shown in Equation 1, where *i* represents the exporting country, *j* represents the receiving country, g represents the good, according to its commodity group, exported, and *t* represents the time (month and year). Thus, $\text{Log}(Y_{i,j,g,t})$ is the logarithm of exported volume of a respective good from exporter *i* to importer *j* in the period *t*. $D_{i,j,g}^{Treated}$ is the dummy variable that takes the value of one if the exporting country is Lithuania and importing country – China, zero otherwise; and D_t^{Post} is a step dummy variable that takes the value of one if the date of the observation is December 2021 or later. $\epsilon_{i,j,g,t}$ denotes the error term. The main variable of interest to estimate the sanctions' effect on exports is the coefficient before the interaction term, β_3, which indicates the effect of China's sanctions on Lithuania.

$$\log(Y_{i,j,g,t}) = \beta_0 + \beta_1 D_{i,j,g}^{Treated} + \beta_2 D_t^{Post} + \beta_3 D_{i,j,g}^{Treated} D_t^{Post} + \epsilon_{i,j,g,t} \quad (1)$$

As a robustness check, we also reestimate the results with the second control group of Lithuania's exports to the following four largest economies of Asia after China as of 2021 – Japan, India, South Korea, and Indonesia (International Monetary Fund, 2021). The baseline estimate is the same as in Equation 1, and the definition of all variables remains unchanged.

To advance our estimation model further, we follow the methodology proposed by Belin and Hanousek (2021), who study EU–Russian sanctions at a product level, and by Luo et al. (2021), who study the sanctions imposed by China on Philippines' fruit exports. The main difference of their studied cases is that only certain products were sanctioned, while in our case the entirety of

trade/all products were officially targeted. This firstly implies different criteria for establishing our control group, which in these papers was the within-country product groups that were not sanctioned; and, secondly, requires some additional specifications like fixed effects and control variables in our regression equation.

Both Belin and Hanousek (2021) and Luo et al. (2021) add time-fixed effects to their regressions, and we add them as well as the term γ_t, which allows to completely control for the macroeconomic factors, mostly aggregate demand from China [aggregate supply from Lithuania] in the case of the first control group [second control group]. Then, Luo et al. (2021) add country-fixed effects, while Belin and Hanousek (2021) add exporter-good pair fixed effects. In our case, we add the more robust exporter–good fixed effects, $\lambda_{i\text{-}g}$. (in the case of using Lithuania's exports to other countries apart from China as the control group, instead of exporter-country fixed effects we would use importer-good fixed effects, $\lambda_{j,g}$,). Finally, as also done by Luo et al. (2021), a vector of control variables, X, is added to the regression to try capturing the rest of the effects that are not already in the fixed effects. The augmented specifications are shown in Equation 2.

$$\log(Y_{i,j,g,t}) = \beta_0 + \beta_1 D_{i,j,g}^{\text{Treated}} + \beta_3 D_{i,j,g}^{\text{Treated}} D_t^{\text{Post}} + X'\varphi + \lambda_{i/j\text{-}g} + \gamma_t + \epsilon_{i,j,g,t} \quad (2)$$

The control variables included by Luo et al. (2021) are the industrial output and effective exchange rate, which, as proposed by Du et al. (2017), are meant to replace GDP if that data were not available but in our case the data is available. In addition, they discuss a large number of other control variables that are country-specific, e.g., geographical parameters of the exporter or its distance to the trading partner, so introducing country-fixed effects includes the effects of such control variables and can be dropped from the regression. We follow Luo et al. (2021) proposed methodology of using a country's GDP as a control variable, and we also add the country's inflation as a second control variable. In the case where supply factors need to be controlled for, GDP and inflation will be controlled for the exporting countries, while in the demand factor case – for importing countries. In addition, the control variable GDP is modified into its natural logarithm (hereafter – log(GDP)), as is also done by Gutmann et al. (2021) who add GDP as a control variable to their difference-in-differences estimate of sanctions' trade effects.

Next up, to both segregate monthly effects and test the parallel trend assumption, we create multiple dummy variables, corresponding to a particular month from January 2021 to July 2022 each, D_t^{τ}, where τ corresponds to the respective month (see Equation 3). Each variable D_t^{τ} corresponds to one if the observation was made in a particular month (τ=t) and zero otherwise; e.g., for a dummy denoted as $D_t^{12/2021}$, all observations from December 2021 will have the value of one for this dummy but all others will equal zero. This gives us a total of 19 dummy variables. The ones that correspond to all months until November 2021 will serve as a placebo test to see whether any pre-treatment trends prevail. The dummies corresponding to December 2021 or later allow us to look at the segregated effects of the sanctions, since Equation 2 assumes that the sanction effects are homogenous for all consecutive months. The coefficient β_{τ} will denote the effect of sanctions on trade in a respective month. Thus, we expect the coefficient β_{τ} to be statistically insignificant prior to December 2021 (placebo test).

$$\log(Y_{i,j,t}) = \beta_0 + \sum_{\tau=12/2018}^{07/2022} \beta_{\tau} D_t^{\tau} D_{i,j,g}^{Treated} \sum + X'\varphi + \lambda_{i/j\text{-}g} + \gamma_t + \epsilon_{i,j,g,t} \quad (3)$$

As for the other two assumptions of difference-in-differences, firstly, the shock being exogenous is indicated by the sanctions being imposed due to political reasons, generally viewed as completely external, which explains the popularity of studying economic sanction effects with difference-in-differences. However, since some effects may have spilt over to trade due to expectations of sanctions in the months prior to them being imposed, this assumption will be supported by the placebo test, which looks at the monthly trade prior to sanctioning too. Secondly, the assumption of no spillover effects we cannot directly test it from the available data, however, they are possible to study with large equilibrium models, which is beyond the scope of this study.

Another limitation we face is the lack of exact information about which products were sanctioned and which were not, since despite the available information indicating a complete sanctioning of Lithuanian exports to China, the actual trade does not fall to zero. This means that some of the goods classified as sanctioned are actually not, so the sanctioning effects do not apply to all the groups homogeneously. To study the possible differences between broader

groups, we categorise each commodity into one of 21 HS sections and study their trade (World Customs Organization, 2018).

3.2. Data

We extract trade data from January 2015, when Lithuania adopted euro as its currency, until July 2022, from the United Nations Comtrade database. Out database consists of the monthly total exports from Lithuania, Estonia[1], Latvia, and Poland to China and from Lithuania to Japan, India, the Republic of Korea (hereafter – South Korea), and Indonesia. In UN Comtrade database, trade flows can be divided into two-, four-, or six-digit HS commodity code[2] categories, although products can be further divided into eight-digit categories; we follow Belin and Hanousek's (2021) approach, and extract data at the six-digit level, since this is the level that is used worldwide and so is less vulnerable to reclassification. According to Witte (2019), the eight-digit level classifications can differ per each country, and six-digit classification already provides a very disaggregated view on merchandise trade (more than 5000 unique product groups). The dataset contains monthly information about the exported goods' quantities (in kilograms, m3, litres, or units) and values in USD for each six-digit HS commodity. We choose exports data despite the possibility to analyse China's imports from Lithuania and other countries, as reported import values reflect not only the cost of goods, but their insurance and freight price as well. Continuing with Belin and Hanousek's approach, we utilise the values in USD for comparability and consistency among all groups. This gives us a panel dataset of 163,128 commodity-time observations of six variables – observation year; month; reporter country (exporter); partner country (importer); traded commodity code; trade value in USD, which we transform into its natural logarithm (also adding 1 USD, see Section 3.1).

The potential impact of sanctions is reflected in Figure 1, which shows exports as a percentage of GDP and total exports from Lithuania to China over the decade from 2012 to 2021 and a sharp decrease in 2021 (the additional data for this figure of Lithuania's exports as a

[1] *For June 2016 and December 2019, the Estonian exports to China are extracted from the Statistics Estonia database (Eesti Statistika, n.d.). As this database reports values in euro, they are transformed into US dollars at the average EUR/USD exchange rate of that month – 1.086 and 1.1113 USD/EUR accordingly (European Central Bank, n.d.).*

[2] *HS refers to the Harmonised Commodity Coding and Description system, used internationally by customs to classify product categories with different numbers.*

percentage of GDP is extracted from the World Bank database). Overall, in this period exports from Lithuania to China grew on average 13.6% per annum, but these exports fell by over 75% from November to December 2021, and continued to decrease on average 59% per month until February 2022, where it began to recover. Additionally, in 2021, Lithuania's exports to China equalled 0.53% of Lithuania's GDP, this corresponds to Bank of Lithuania's estimate of the sanctions' contribution to a 0.1% decrease in Lithuania's GDP in the following year 2022 (Bank of Lithuania, 2022).

[Insert Figure 1 here]

When decomposing the exports in the 21 HS group, the descriptions of which are reported in Appendix B, we firstly look at their summary statistics, reported in Appendix C. According to the monthly average traded values of these groups, the most traded were groups XX – miscellaneous manufactured articles; IX – wood and articles thereof; and XVI – machinery, appliances, electrical equipment; followed by XI – textiles and textile articles; and XV – base metals and their articles. These groups' exports from Lithuania to China averaged between 1.8 and 3.4 million USD in monthly traded value. If the sanctions are fully effective, these values are reasonable estimates for the magnitude of the effects. The exports by group for the period August 2021 – July 2022 are displayed in Figure 2 and Figure 3. Figure 3 displays the same values as Figure 2 but without the two outlier groups of footwear and accessories and vehicles for clarity. The monthly exports of both control group countries and Lithuania's exports to China for the period August 2020 – July 2022 are shown in Figure 4 and Figure 5. The main thing to note here is that Lithuania's exports to China prior to sanctions have been quite steady. A similar behaviour is represented among the exporter control group (Figure 5), while the importer control group exports are much more volatile (Figure 5). This also allows us to choose Lithuania's neighbouring countries' exports to China as the base case of our estimates, especially when considering how volatile Lithuania's exports to Indonesia and India have been.

[Insert Figure 2 here]

[Insert Figure 3 here]

[Insert Figure 4 here]

[Insert Figure 5 here]

For additional control variables, we gather quarterly nominal GDP data for Lithuania, Latvia, Estonia, and Poland from the Eurostat database; for China, India, Indonesia, Japan, and South Korea from the International Monetary Fund database. We link each month to its corresponding quarter's GDP, so, for example, January, February, and March 2019 all have the same GDP value associated with them. Monthly inflation data for these countries is extracted from the Organisation for Economic Cooperation and Development (OECD) database. To convert GDP figures from domestic currencies into US dollars, average quarterly nominal effective exchange rate with the US dollar data for the Chinese renminbi, Indian rupee, Japanese yen, South Korean won, Indonesian rupiah, Polish zloty and the euro, used in Latvia, Lithuania, Estonia, are retrieved from the International Monetary Fund database. This adds two more variables to our dataset – exporter/importer GDP in USD (depending on which control group is employed), exporter/importer inflation in percent.

The dataset requires a few transformations. First, we must consider that difference-in-differences is a comparative methodology where, just like in an experiment, the treated and the control group are compared. Due to some commodities being traded by only one of the country pairs, they are impossible to compare, so we only keep the commodities which are traded by most trading pairs, i.e., at least three out of four countries have exported the commodity in case of the first control group, and four out of five countries imported for the second control group; for both cases one of the trading pairs must be Lithuania–China. Secondly, we remove all commodities whose traded values were economically insignificant in 2021, the year leading up to the sanctions. We define economic insignificance as the traded value of the commodity in the year leading up (from December 2020) to November 2021 being less than 5% of the median yearly traded value for the whole data period until the sanctions (January 2015 – November 2021), e.g., we remove all commodities that were exported for less than 5,256 USD from Lithuania to China, since the median yearly value of an exported commodity from Lithuania to China is 105,120 USD in our data sample[3].

Before employing these transformations, our dataset consisted of 163,128 observations. Afterwards, the dataset where the exporter control group is employed consists of 43,498

[3] *Similarly, these cut-off rates are 6,641 USD for the trader pair Estonia–China, 6,119 USD for Poland–China, 6,506 USD for Latvia–China, 1,642 USD for Lithuania–Japan, 1,995 USD for Lithuania–Indonesia, 2,365 USD for Lithuania–India, 1,944 USD for Lithuania–South Korea.*

observations, and these adjustments decrease Lithuania's exports in 2021 by 37% in our sample. The dataset where the importer control group is employed consists of 28,574 observations, and the adjustments decreased Lithuania's exports to China by 38% in 2021 in our sample. While these adjustments seem broad, they are necessary to retain accuracy of estimates that would otherwise be biassed due to the less economically significant goods that are not traded at all in many months due to initially low volumes, not due to sanctions.

IV Analysis and discussion of results

4.1. Baseline regression analysis

The results of our baseline regression are summarised in Table 2[4]. Panel A shows the case when Estonia's, Latvia's, and Poland's exports to China form the control group (hereafter – exporter control group), while Panel B shows the case when Lithuania's exports to Japan, Indonesia, South Korea, India form the control group (hereafter – importer control group).

[Insert Table 2 here]

The results of the regressions are statistically significant at all significance levels. Firstly, without adding any fixed effects or controls to the regression, we estimate a decrease in the monthly exports of a commodity to be between 82.11% and 99.22%. Accounting for time-fixed effects and adding controls, the estimated decrease changes to be between 94.39% and 99.09%, while accounting for country-commodity fixed effects produces an estimated decrease of between 97.37% and 99.96%. Adding both fixed effects and control variables, we estimate that the monthly decrease in trade between Lithuania and China after the sanctions for each commodity is between 93.75% and 99.88%, holding all other variables constant. These findings contradict other previous research that finds a negative correlation between sanction

[4] *Since this type of a regression differs from the classical log-linear model as the independent variable is an interaction of dummies, the coefficient needs altering for correct interpretation (Derrick, 1984). To analyse the coefficient β before the interaction term* $D_{i,j,g}^{Treated}D^{Post}$ *as a percentage change in the dependent variable if the independent variable switches from zero to one (in our case, if the interaction does), we must modify the coefficient like shown in this equation:* $\beta^* = e^{\beta} - 1$.
Another thing worth to note is that $\beta^* \in [-1; +\infty]$, *since* $e^{\beta} > 0$ *for all real βs. This does not, however, limit our analysis, as trade, an always non-negative (real) number, can be multiple times higher than the benchmark but cannot be over 100% lower, as a 100% decrease implies trade falling to zero.*

effectiveness and the relative size between the sanction sender and receiver (Kaemper, Lowenberg, Jing, 2003).

To test this baseline result, in Table 3 summary statistics of commodity trade values are composed for the eight-month periods prior to sanctions being imposed (April 2021 to November 2021), as well as the period of sanctioning (December 2021 to July 2022). Here, the estimates are validated, as the median values from one period to the next decreases by 94.14%, which falls between the exporter and importer control group estimates. Moreover, reasons for total trade being impacted less is evident as well, since the median commodity trade value decreases by 68.11%, indicating the presence of some outlying large trades, which is evident in Figure 2 too.

[Insert Table 3 here]

In all of these cases, the larger decrease estimate is from the regression with the importer control group. The slight differences between estimates of the two control groups both in this section and the following ones arise due to the two datasets consisting of different baskets of commodities, since all exporting countries in our dataset do not export exactly the same goods to China, and Lithuania does not export all of the same commodities to the observed importer countries.

4.2. Monthly segregated effects

Next, we move on to looking at monthly effects – the monthly average differences between the sanctioned and the control group –, following Equation 3. The results for the months prior to sanctions serve as a placebo test to see whether there have been any pre-treatment effects, while the months after sanctions allow to analyse the sanction effects' magnitude each month. Both the regression results and the transformed coefficients are reported in Table 4. Panel A shows the case with the exporter control group, while Panel B shows the case with the importer control group. These results are visualised in Figure 6.

[Insert Table 4 here]

[Insert Figure 6 here]

Firstly, when looking at the monthly effects prior to the sanctions being imposed, we see that most estimates are statistically insignificant, which indicates that the parallel trend assumption

generally holds; however, some discrepancies persist. The two statistically significant estimates at the beginning of 2021 – January for the exporter control group and February for the importer control group – indicate some differences between the treated and the control group even after controlling for fixed effects, as well GDP and inflation. As for the months from August 2021 until November 2021, statistically significant estimates indicate that trade was affected already by the political feud between China and Lithuania prior to sanctions. According to the exporter control group estimates, a crunch in trade started in August 2021, decreasing in September and November too, while the importer control group estimates would indicate a decrease beginning only in November 2021 (with a slight indication of a decrease in trade in September), a month before the sanctions. These estimates correlate with the timeline before the official sanctioning took place, as August was the first time when the Chinese government revealed their disapproval of the intention to open a Taiwanese representative office in Lithuania, while in late October and November followed the second wave of condemnations, also accompanied by the office opening. This could mean that some of the more cautious firms found other trading partners outside of China due to rising uncertainty. Overall, although the parallel trend assumption does not hold perfectly, our estimates are still reasonably reliable.

Secondly, analysing the post-sanctions monthly effects, the results are all statistically significant at any significance level for both control groups. According to the exporter control groups' estimates, we can notice that the decrease in exports seems to be trending: it starts off with an estimated decrease in trade of 91.14% in December 2021, which then rises and peaks in February 2022, where the estimated decrease in trade is 97.78%. In the following months, the magnitude of the effect steadily decreases, until it reaches 85.61% in July 2022. A similar pattern is detected by Belin and Hanousek (2021) who see a recovery in Russian imports of some sanctioned products after two years after sanction imposition and remains like that for three years onward. As for the importer control group, the estimated decrease remains steadily above 99.74% in all months. Comparing these results with actual trade volumes reported in Figure 2, where some exported groups begin recovery in March 2022, while others never do in our sample period, we see indications that the exporter control group contains more commodities of those recovering groups than do those from the importer control group. Let us therefore analyse the segregated group effects in more detail.

4.3. Effects segregated by group

As a final step of our analysis, we categorise all the commodity codes into groups, as proposed by the World Customs Organization (December 2018). This categorisation is done by using two-digit HS commodity codes, which in our dataset are visible as the first two digits of the six-digit HS codes. For the purposes of clarity, shortened group names will be used in this and the following sections but the full list of these groups is shown in Appendix 2.

We obtain estimates by regressing the same difference-in-differences equation with time- and country-commodity fixed effects and controls as Equation 2, but using subsamples of our dataset, where each subsample corresponds to one of the 18 categories[5]. We perform this analysis with both control groups, and with the dependent variable in its logarithmic form. The regression results are shown in Table 5. Panel A shows the case with the exporter control group, while Panel B shows the case with the importer control group. Both regression coefficients and their transformations are reported.

[Insert Table 5 here]

Firstly, exports in groups of live animals, minerals, and wood are all estimated to have ceased completely, as their estimated decrease in monthly exports ranges between 99% and 100% (statistically significant at all significance levels).

Secondly, exports within groups of chemicals, textiles, precious metals (estimated only for the importer control group), instruments, and miscellaneous all decreased by over 90%, and these estimates were statistically significant at least at the 5% level. Out of these, worth pointing out are the group of chemical products and of textiles, as they were both one of the most traded in the months following up to the sanctions (Figure 2).

Thirdly, a smaller effect, although still highly economically significant, was estimated for the groups of spirits and tobacco, plastics and rubber, paper, and appliances and equipment, of which spirits' and tobacco estimates were only statistically significant for the exporter control group and

[5] *A few things to note are that, firstly, we have introduced an additional group zero, which consists of all the uncategorised items (HS two-digit code: 99; HS six-digit code: 999999) and which we will not consider in the regression analysis. Secondly, Lithuania did not export anything in group 19 to China in the entire sample period, so this group is excluded. Thirdly, groups three and 21 are excluded as they do not meet the criteria of being traded between enough countries in the control group at a sufficient volume. Additionally, due to these criteria, in some cases we can only obtain a single estimate, in which case we will only discuss that one.*

the paper group was only estimated for the exporter control group. Here, the estimated decrease in trade post sanctions was at least 80%, statistically significant at least at the 5% level. Looking at Figure 2, the most significant effect on overall trade would come from appliances and equipment, which was one of the most traded prior to the sanctions, and begins recovering in March 2022.

Fourthly, the groups of vegetables, stone and glass, and base metals were estimated to have decreased by a statistically significant amount in only one out of the two control groups, although the statistically significant estimates still were all over 85%. Out of these the only significantly traded group was base metals, which appears to have been the least affected one out of all, therefore here the importer control group could be viewed as having produced a more accurate estimate. Vehicles' exports are not estimated to decrease statistically significantly in any of the control groups but it is not an economically significant group possibly due to its smaller volume of trade.

Finally, the exports of the group of footwear and accessories, estimated only in the exporter control group case, appear to have increased, not decreased. Looking at Figure 2, it was not exported at an economically significant amount both before and after the sanctions, and its monthly average trade for the entire period has been tiny too, so this result is probably spurious due to a single outlier commodity.

As an additional sanction effects' magnitude check, we can not only look at the most exported groups in the period around the sanctioning, as we did with Figure 2, but also look at the overall most traded groups, reported in Appendix C[6], and compare them with the regression estimates. Among the top three most traded, paper and miscellaneous manufactured articles are exported by 95.67% to 100.00% less, while appliances and equipment may be more resilient and have decreased in exports by 85.79% to 98.91%. The following most exported groups are vegetables, chemicals, base metals, and different instruments. Out of these, vegetable, chemicals', and instrument exports quite reliably decrease by at least 90%, while base metals exports decrease almost entirely in the exporter control group estimates with the importer control group estimates being statistically insignificant.

[6] *Note that the summary statistics are depicted for all exports from Lithuania to China in our data sample, not the reduced form discussed in Section 3.2, where we removed economically insignificant commodities, as well as those that did not repeat in enough country pairs.*

To see how estimates match up with actual exports, we can compare estimated monthly decreases to absolute traded volumes in USD. To remain concise, we cherry pick one group estimated as less resistant to sanctions – chemicals and their articles – and one group more resistant – base metals and their articles, albeit both groups are among the most traded prior to sanctions in the period of analysis. These comparisons are depicted in Figure 7 and Figure 8 accordingly, and the estimated values are chosen for the exporter control group case, as this one is more likely reliable. In the case of chemicals, the trend is captured quite well, albeit overestimated during the autumn months leading up to the implementation of sanctions. As for base metals and their articles, while the direction of sanction effects generally seems to match up with actual trade, the predictions either lag behind actual trade or overestimate the predicted effect of sanctions.

[Insert Figure 7 here]

[Insert Figure 8 here]

To conclude, the two groups most resistant to sanctions, which had also been exported from Lithuania to China in significant amounts, were base metals and their articles, as well as appliances and equipment. These two groups have been the most significant catalysts of sanctions not being perfectly effective. Additionally, still economically significant but less resistant in relative terms were the groups of different instruments and miscellaneous manufactured articles, while economically less significant but also resistant to sanctions were groups of spirits and tobacco, plastics and rubber, paper, and stone and glass. When deliberating the linkages between these groups, an intuitive economic explanation would be that China is a net importer and hence cannot afford to lose even the relatively small Lithuania's supply due to inelastic demand for these goods; however, according to the UN Comtrade database, in 2021, China was a net exporter of both metals and appliances and equipment, where in both groups the exports were around twice as large as imports. Similarly, China is a net exporter of most other sanction resistant groups, except for instruments and paper and pulp, where imports are about 10% higher than exports. Looking for another explanation, a curious thing to note is the nature of base metals' trade, since the contracts for their purchase are signed multiple years in advance due to these raw materials' long lead-time of production (McKinsey, 2022), meaning that deliveries for them were agreed upon long before the imposition of sanctions, and they appear to have been

allowed to be completed. If some industries had stronger trade relationships between the suppliers and buyers, this explains why some groups were more resistant than others, although more concrete conclusions would require us to study firm-level data. Other research also finds that sanctions create costs for the sender country (Lindsay, 1986) and hence the governments of sanctioning countries still try to minimise the costs incurred locally, therefore they permit long-term contracts to be fulfilled (Kaempfer & Lowenberg, 1998).

An additional illation that can be made by comparing the two control group estimates relates to the explanation of why the two control group estimates have been slightly different in the sections prior to this one – the commodities considered in one case are not the same as those considered in the other. Perhaps the most obvious examples are those groups in Table 5 that could only be estimated in one case, meaning that only one control group had some exports of commodities in these groups.

4.4. Robustness check: weighted least squares estimates

We also use the weighted least squares (WLS) technique, an extension of the previously employed ordinary least squares (OLS), to check the robustness of the abovementioned findings. While OLS considers each observation equally, WLS does not by taking into account the weight of each observation and so deals with non-constant variance. In our case this means calculating each commodity's exports as a share (a weight) of total exports for each trading pair and obtaining the WLS estimates by using the same equations as before, only this time the estimates will include a consideration of how important each commodity is for that specific countries exports to another country. As for the result interpretation, while OLS estimates allow us to see by how much on average each commodity's monthly exports dropped due to sanctions, WLS considers the value-adjusted decrease, putting a larger weight on those commodities that were exported in larger USD volumes.

The results of the WLS estimates are reported in Table 6. Panel A reports the exporter control group, Panel B – the importer control group case. A slightly significant difference from the previous OLS estimates (Section 4.1) is in the exporter control group estimates, as the WLS estimates, accounting for time-, commodity-country fixed effects and controls and holding all other variables constant, predict a value-adjusted decrease in monthly exports of each

commodity due to sanctions to be 99.81%, which is a little over 5 percentage points above the OLS estimate. The importer control group WLS estimate differs from the OLS one only by 0.06 percentage points, albeit the WLS estimate is again the one of higher magnitude.

[Insert Table 6 here]

Moving on to the monthly effects, now both control group estimates show a homogenous effect of the expected decrease in trade to be at least 99.83% for all months after the sanctions, statistically significant at all significance levels. These results are reported in Appendix D.

Lastly, we obtain weighted estimates of the decrease in trade for each broader category/group. The results are reported in Table 7, where Panel A shows the exporter control group estimates, Panel B shows the importer control group estimates. The estimates that change significantly either in value or statistically are underlined. Since the majority of WLS estimates' differences from OLS are slight, those are not discussed here. Firstly, looking at changes in statistical significance, the importer control group estimate for category one and the exporter control group estimates for the groups of plastics and rubber and base metals lose statistical significance, while the importer control group estimates for the categories of spirits and tobacco and vehicles gain statistical significance, both of which now estimate a decrease in exports of over 99%. Here, worth to highlight are base metals, where the estimated change in exports is now statistically insignificant for both control groups, which is in line with what can be inclined from actual exports (Figure 2). Secondly, looking at the changes in economic significance, the exporter control group estimate for textiles and the importer control group estimate for stone and glass have increased by five and 10 percentage points respectively, but the exporter control group estimates for appliances and equipment – by 17 percentage points. The exporter control group estimate of fur and leather appears to have become spurious. The changed estimates for the groups of chemicals, textiles, stone and glass, and appliances and equipment are particularly interesting, because these indicate that the remaining textiles and stone and glass exports were in smaller volumes, i.e., the remaining trade is less valuable than the group's average. In contrast, the remaining chemical and appliances and equipment exports are worth more than the average pre-sanctions exports within that category per commodity. Both of these categories are among the most traded in our data sample for the entire period, which could indicate a higher resistance to sanctions by commodities traded more prominently.

[Insert Table 7 here]

4.5. Other robustness checks

As a final robustness check, the additional assumptions made should be stress-tested. While the choice of control group was broadened already in the methodology section, two other assumptions remain. Firstly, we have assumed that the economically insignificant commodities are those traded below 5% of the median in 2021. Secondly, a possible decrease in trade may have begun already in August 2021.

To deal with the first issue, the cut-off rate can be changed to either be larger or smaller, e.g., 2% or 10%. Returning to the base case OLS regressions, introducing a 2% cut-off rate reduces the magnitude of estimates slightly to 91.63% or 99.73%, depending on the control group (see Appendix E for full report of results). Introducing a 10% cut-off rate, on the other hand, increases the estimated magnitude of the decrease in exports due to sanctions to 96.44% or 99.88% (Appendix F). These stress tests show that our results are fairly inelastic to the choice of the cut-off rate.

To deal with the second issue, the month of sanction imposition can be moved to August 2021 when some indications of a decrease in trade were already present. This leaves our estimates practically unchanged from the base scenario, with an estimated monthly decrease in trade due to sanctions for a commodity is 93.93% or 99.89%. The results are reported in Appendix G.

Doing similar robustness checks but with the weighted least squares estimation technique too produce highly similar estimates. Out of the three cases (2% or 10% cut-off rate, treatment start in August), the estimated decrease in monthly exports differs from those of the WLS estimate with the 5% cut-off rate (Table 6) by 0.02 percentage points maximum for the exporter control group, and 0.15 percentage points for the importer control group case, therefore these results are unreported and available at the authors' request.

4.6. Limitations

The major limitation this work faces is the lack of a definitive analysis that assesses the second-order impacts on Lithuania's exports to other countries, as the goods produced and

intended to be shipped to China may have either been exported to other countries, perhaps with the aim to arrive in China anyway, or their production decreased or halted completely. Although a thorough analysis of parallel trade flows would require a firm-level trade dataset (we used the only available product-level), a production decrease is indicated by the estimates of a GDP crunch and other preliminary inclinations can be made.

Firstly, to consider whether major sanctions' bypassing happened, i.e., whether those same goods were exported from Lithuania to China through other countries, it could be reasonably assumed that the intermediaries would be Lithuania's geographical neighbours, i.e., Latvia, Poland, Estonia. While Figure 4 displays indexed values, by naively summing up the increase in exports to China from Lithuania's neighbours gives an increase of 13.4 million USD from November to December 2021, while Lithuania's exports to China fell by 17.1 million USD. Although this comparison by no means produces any reliable conclusion in this matter, the question remains of how effective the Chinese government's claims were on sanctioning all goods whose production chains make at least one stop in Lithuania. Secondly, it is fairly believable that a chunk of the sanctioned goods were exported to other countries than China, which would be an exciting opportunity for future research.

Another minor limitation arises from the choice of our dependent variable in its logarithmic form. As discovered in Section 4.2 about monthly effects, the drop in traded volumes happens primarily in the first two months of the sanctioning, and then another two months later begins recovering. If the growth of traded volumes instead of their logarithms were used as dependent variables, the dynamics of the effect may have been captured more effectively. Nonetheless, this does not discredit the results of the approach employed.

V Conclusions

While the trade sanctions imposed by China on Lithuania meant a predictable effect on the average commodity whose monthly exports decreased by 93.75% to 99.88%, this research has uncovered some not so obvious conclusions too. Firstly, the effect was not homogenous over time, and peaked during the first few months of the sanctions. Secondly, industries that depend on long-term supplier contracts have been able to bypass sanctions noticeably, especially when

considering the trade of base metals where the highest volume exports even increased. We add to the general literature of sanctions a specific case study of successful sanctions imposed by a large country on a small Western one due to a political dispute. These findings can be further compared in success with other similar cases, e.g., the EU-Russia sanctions, where imports from Russia actually increased not decreased between 2021 and 2022.

Although this is a valuable first step in studying the China-Lithuania dispute, there remain vast opportunities for future research. How did Lithuania's trade with other countries change? In particular, have Lithuanian firms started evading these sanctions by trading through a third country to bypass the export restrictions imposed by China? How were other economic variables affected? Since the imposition of sanctions, the Lithuanian company Teltonika has made an agreement with Taiwan's Industrial Research Institute for the production of Taiwanese semiconductor chips that, within a decade, has the potential to increase Lithuania's economic output by 5% (LTR, 2023). Will the imposed sanctions hold in the long term, or were they simply a demonstration of strength that, once proven, will slowly fade? And, finally, what are the implications beyond economics?

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Tables and Figures

Table 1

The timeline of the Chinese government sanctioning Lithuania

Date	Summary of Events
August 10-13, 2021	Three statements from China's Ministry of Foreign Affairs are released as a response to recent talks of the plan to open a Taiwanese representative office in Lithuania. The Chinese government condemns Lithuania for disregarding its territorial integrity (referring to the *one China* principle), recalls its ambassadors, and responds to other comments. This is the first warning for the possibility of sanction use (Davidson, 2021).
October 30, 2021	Another statement by the Chinese government is released, condemning Lithuania's stance.
November 18, 2021	The Lithuanian government formally supports the opening of the Taiwanese representative office (France-Presse, 2021). The Taiwanese representative office is opened.
November 19-21, 2022	The Chinese government responds by issuing another two statements and further reducing diplomatic ties (France-Presse, 2021).
December 3, 2021	The Chinese government announces the requirement for all companies to cease cooperation with Lithuanian companies or they would be excluded from further operation in Chinese markets. The Lithuanian government reports a full blocking of exports (Bounds, 2021). **Sanctions are imposed.**
January 31, 2022	The EU files a complaint to the WTO about China's restrictions on Lithuania (WTO, 2022).
February, 2022	Additional media announcements about China halting beef, dairy, and wheat imports from Lithuania.
August 12, 2022	Political sanctions imposed on the Lithuanian Deputy Minister of Transport and Communications due to her visit to Taiwan.

Note. This table shows the timeline of events regarding China imposing trade sanctions on Lithuania in December 2021. Unless referenced otherwise, the information regarding the announcements made by the Ministry of Foreign Affairs of the People's Republic of China is retrieved from their website (2022).

Table 2

Variations of the baseline difference-in-differences regression output for the estimation period January 2015 – July 2022 [Equation 1 & 2]

Panel A: exporters to China as control group				
	(1)	*(2)*	*(3)*	*(4)*
$D_{post} * D_{treated}$	-1.7208***	-2.8809***	-3.6396***	-2.7720***
$\beta^* = e^{\beta} - 1$	*-0.8211*	*-0.9439*	*-0.9737*	*-0.9375*
Log(GDP)	-	1.1676***	4.8252***	0.8358**
Inflation	-	-0.1055***	0.0412***	-0.1355***
Time-fixed effects	No	Yes	No	Yes
Country-good fixed effects	No	No	Yes	Yes
Observations	*43,498*	*43,498*	*43,498*	*43,498*
R^2	0.0022	0.1311	0.0532	0.0134
Adjusted R^2	0.0021	0.1292	0.0426	0.0003
Panel B: importers from Lithuania as control group				
$D_{post} * D_{treated}$	-4.8522***	-4.7029***	-7.7917***	-6.7514***
$\beta^* = e^{\beta} - 1$	*-0.9922*	*-0.9909*	*-0.9996*	*-0.9988*
Log(GDP)	-	0.5447***	0.6698***	0.0931
Inflation	-	-0.0603***	0.1767***	0.1192***
Time-fixed effects	No	Yes	No	Yes
Country-good fixed effects	No	No	Yes	Yes
Observations	*28,574*	*28,574*	*28,574*	*28,574*
R^2	0.0039	0.0927	0.0413	0.0350
Adjusted R^2	0.0039	0.0897	0.0306	0.0211

Note. This table shows the difference-in-differences regression output where the dependent variable is in its logarithmic form and its different variations by adding time- and commodity-exporter fixed effects (FE) and control variables: log(GDP) and inflation of the exporter country. β is the estimated coefficient of $D_{post} * D_{treated}$. Panel A reports the case where the control group consists of Estonia's, Latvia's, and Poland's exports to China. Panel B reports the case where the control group consists of Lithuania's exports to South Korea, Japan, Indonesia, and India.

***** *Significance codes.* * p < 10%, ** p < 5%, *** p < 1%.

Table 3

Summary statistics of commodities' traded values (USD) in the period prior to sanctions – from April 2021 to November 2021 – and the period during sanctions – from December 2021 to July 2022

	Trade Apr 2021 – Nov 2021, USD	*Trade Dec 2021 – Jul 2022, USD*	*Change, %*
Min	7	8	14.29%
Q1	9,582	8	-99.92%
Median	46,922	2,750	-94.14%
Mean	753,821	240,395	-68.11%
Q3	259,658	54,160	-79.14%
Max	15,212,840	17,337,469	13.97%

Note. This table shows the summary statistics of minimum, first quartile, median, mean, third quartile, and maximum traded values of six-digit commodity codes in the eight-month period leading up to sanctions and the first eight-month period of sanctions. The summary statistics are calculated for the dataset after conducting the manipulations described in Section 3.2. The percentage change is calculated as the difference between the periods, divided by the value for the period prior to sanction imposition.

Table 4

Difference-in-differences regression output, segregated by month for the estimation period January 2015 – July 2022 [Equation 3]

	Panel A: exporter control group		*Panel B: importer control group*	
	β	β*	β	β*
Treated x 01/2021	-0.7911**	-54.66%	-0.4135	-33.87%
Treated x 02/2021	-0.0966	-9.20%	1.0329**	180.91%
Treated x 03/2021	-0.4770	-37.94%	0.4743	60.68%
Treated x 04/2021	-0.2944	-39.01%	0.3340	39.65%
Treated x 05/2021	-0.3635	-30.48%	0.4423	55.63%
Treated x 06/2021	-0.3196	-27.36%	0.1479	15.93%
Treated x 07/2021	0.2592	29.59%	-0.4461	-35.99%
Treated x 08/2021	-1.0639***	-65.49%	-0.5105	-39.98%
Treated x 09/2021	-0.7230**	-51.47%	-0.7836*	-54.32%
Treated x 10/2021	-0.4235	-34.52%	-0.7652	-53.47%
Treated x 11/2021	-0.6917*	-49.93%	-0.9688**	-62.05%
Treated x 12/2021	-2.4239***	-91.14%	-5.9694***	-99.74%
Treated x 01/2022	-3.4864***	-96.94%	-7.8346***	-99.96%
Treated x 02/2022	-3.8091***	-97.78%	-7.8645***	-99.96%
Treated x 03/2022	-3.1200***	-95.58%	-7.6684***	-99.95%
Treated x 04/2022	-3.1692***	-95.80%	-7.2169***	-99.93%
Treated x 05/2022	-2.5554***	-92.23%	-6.1264***	-99.78%
Treated x 06/2022	-2.5953***	-92.54%	-6.5008***	-99.85%
Treated x 07/2022	-1.9388***	-85.61%	-6.2573***	-99.81%
Log(GDP)	1.1805***	225.60%	0.0606	6.24%
Inflation	-0.1295***	-12.14%	0.1332***	14.25%
Observations	*43,498*		*28,574*	
R^2	0.0145		0.0365	
Adjusted R^2	0.0010		0.0219	

Note. This table shows the difference-in-differences regression output where the dependent variable is in its logarithmic form for each month from January 2021 until July 2022 with added fixed effects and control variables. Panel A reports the case where the control group consists of Estonia's, Latvia's, and Poland's exports to China. Panel B reports the case where the control group consists of Lithuania's exports to South Korea, Japan, Indonesia, and India. β represents the estimated coefficient reported in the regression output, while β* – the adjusted coefficient for a log-dummy interpretation.

* *Significance codes.* * p < 10%, ** p < 5%, *** p < 1%.

Table 5

Difference-in-differences regression output, segregated by group for the estimation period January 2015 – July 2022 [Equation 2]

		Panel A: exporter control group		*Panel B: importer control group*	
		β	β*	β	β*
I	Live animals	-5.0646***	-99.37%	-12.4611***	-100.00%
II	Vegetable products	-6.0469**	-99.76%	-3.7805	-97.72%
IV	Spirits, tobacco	-1.7397***	-82.44%	-	-
V	Mineral products	-9.0973***	-99.99%	-7.1240***	-99.92%
VI	Chemical products	-3.5401***	-97.10%	-9.1113***	-99.99%
VII	Plastics, rubber	-1.9964***	-86.42%	-5.4074***	-99.55%
VIII	Fur, leather	-0.7694**	-53.67%	-	-
IX	Wood and products	-6.7735***	-99.89%	-10.6228***	-100.00%
X	Paper	-2.2628**	-89.59%	-	-
XI	Textiles and articles	-2.4811***	-91.64%	-5.2747***	-99.49%
XII	Footwear, accessories	2.8644**	1653.84%	-	-
XIII	Stone, glass products	-0.6014	-45.20%	-2.2427**	-89.38%
XIV	Precious metals	-	-	-4.8281**	-99.20%
XV	Base metals	-2.3377***	-90.34%	-0.4891	-36.38%
XVI	Appliances and equipment	-1.9971***	-86.43%	-4.9805***	-99.31%
XVII	Vehicles	-0.7371	-52.15%	-1.6737	-81.24%
XVIII	Medical, musical instruments	-2.9850***	-94.95%	-7.5633***	-99.95%
XX	Miscellaneous manufactured articles	-3.1405***	-95.67%	-7.3258***	-99.93%

Note. This table shows the difference-in-differences regression output for each of the 21 groups of commodities (see Appendix B for group explanations) with added fixed effects and control variables. Panel A reports the case where the control group consists of Estonia's, Latvia's, and Poland's exports to China. Panel B reports the case where the control group consists of Lithuania's exports to South Korea, Japan, Indonesia, and India. β represents the coefficient initially reported in the regression, while β* – the adjusted coefficient for a log-dummy interpretation. Groups three, 19, and 21 are not reported due to lack of data for their estimates. The full group descriptions are reported in Appendix B.

***** *Significance codes.* * p < 10%, ** p < 5%, *** p < 1%.

Table 6

Variations of the weighted least squares difference-in-differences regression output for the estimation period January 2015 – July 2022 [Equation 1 & 2]

Panel A: exporters to China as control group			
	(1)	*(2)*	*(3)*
$D_{post} * D_{treated}$	-6.80959***	-8.5683***	-6.2677***
$\beta^* = e^{\beta} - 1$	*-0.9989*	*-0.9998*	*-0.9981*
Log(GDP)	0.5757***	8.4743***	-2.0935***
Inflation	-0.3162***	0.1160***	-0.3505***
Time-fixed effects	Yes	No	Yes
Country-good fixed effects	No	Yes	Yes
Observations	*43,498*	*43,498*	*43,498*
R^2	0.1746	0.0519	0.0130
Adjusted R^2	0.1728	0.0413	0.0003
Panel B: importers from Lithuania as control group			
$D_{post} * D_{treated}$	-3.8912***	-8.8308***	-7.4243***
$\beta^* = e^{\beta} - 1$	*-0.9796*	*-0.9999*	*-0.9994*
Log(GDP)	0.3566***	0.8067***	0.1191**
Inflation	-0.1624***	0.2045***	0.1247***
Time-fixed effects	Yes	No	Yes
Country-good fixed effects	No	Yes	Yes
Observations	*28,574*	*28,574*	*28,574*
R^2	0.1020	0.0413	0.0350
Adjusted R^2	0.0991	0.0305	0.0211

Note. This table shows the difference-in-differences regression output with the additional weighted least squares methodology employed where the dependent variable is in its logarithmic form and its different variations by adding time- and commodity-exporter fixed effects (FE) and control variables: log(GDP) and inflation of the exporter country. β is the estimated coefficient of $D_{post} * D_{treated}$. Panel A reports the case where the control group consists of Estonia's, Latvia's, and Poland's exports to China. Panel B reports the case where the control group consists of Lithuania's exports to South Korea, Japan, Indonesia, and India.

***** *Significance codes.* * p < 10%, ** p < 5%, *** p < 1%.

Table 7

Weighted least squares difference-in-differences regression output, segregated by group for the estimation period January 2015 – July 2022 [Equation 2]

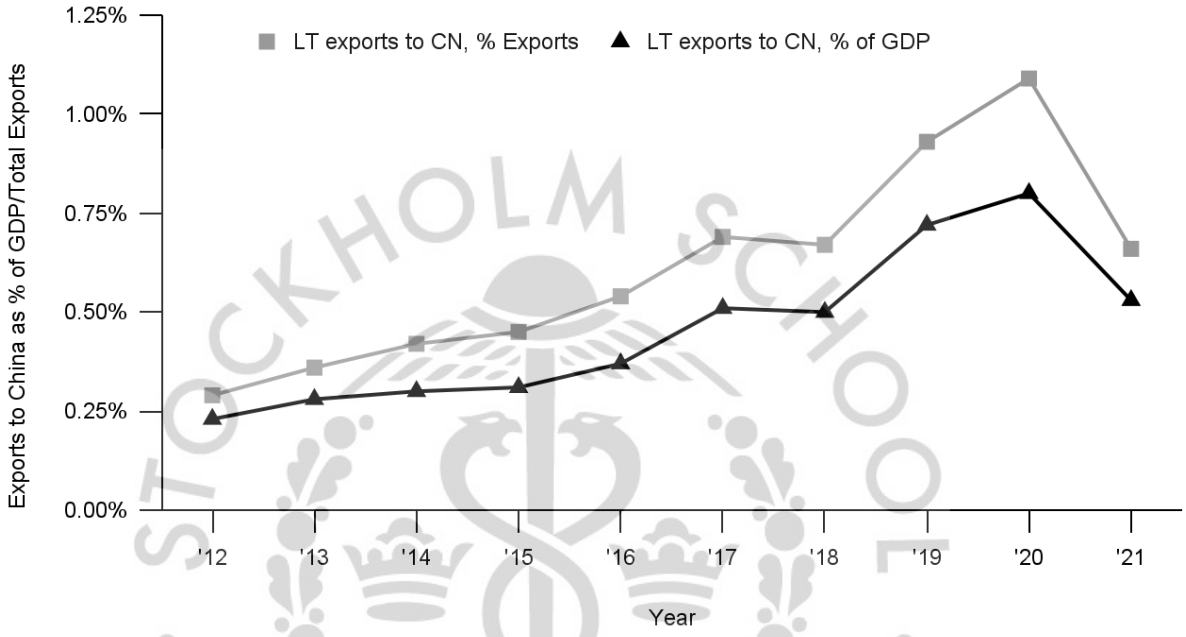
		Panel A: exporter control group		*Panel B: importer control group*	
		β	β*	β	β*
I	Live animals	-9.4436***	-99.99%	4.7547	11512.65%
II	Vegetable products	-5.3828*	-99.54%	-	-
IV	Spirits, tobacco	-5.6154***	-99.64%	-5.1440*	-99.42%
V	Mineral products	-7.5603***	-99.95%	-7.7072***	-99.96%
VI	Chemical products	-12.8026***	-100.00%	-8.0146***	-99.97%
VII	Plastics, rubber	-0.0052	-0.52%	-4.4073***	-98.78%
VIII	Fur, leather	4.6545***	10405.81%	-	-
IX	Wood and products	-8.6476***	-99.89%	-12.2396***	-100.00%
X	Paper	-1.8026*	-83.51%	-	-
XI	Textiles and articles	-5.5264***	-99.60%	-6.0154***	-99.76%
XII	Footwear, accessories	3.0343***	1978.60%	-	-
XIII	Stone, glass products	-0.7545	-52.98%	-2.9754**	-94.90%
XIV	Precious metals	-	-	-6.7900***	-99.89%
XV	Base metals	-1.3002	-72.75%	2.0258	658.21%
XVI	Appliances and equipment	-1.1856***	-69.44%	-5.7247***	-99.67%
XVII	Vehicles	-0.7224	-51.44%	-5.5612***	-99.62%
XVIII	Medical, musical instruments	-5.3089***	-99.51%	-8.0493***	-99.97%
XX	Miscellaneous manufactured articles	-7.1566***	-99.92%	-6.3374***	-99.82%

Note. This table shows the difference-in-differences regression output with the additional weighted least squares methodology employed for each of the 21 groups of commodities (see Appendix B for group explanations) with added fixed effects and control variables. Panel A reports the case where the control group consists of Estonia's, Latvia's, and Poland's exports to China. Panel B reports the case where the control group consists of Lithuania's exports to South Korea, Japan, Indonesia, and India. β represents the coefficient initially reported in the regression, while β* – the adjusted coefficient for a log-dummy interpretation. Groups three, 19, and 21 are not reported due to lack of data for their estimates. The full group descriptions are reported in Appendix B.

***** *Significance codes.* * p < 10%, ** p < 5%, *** p < 1%.

Figure 1

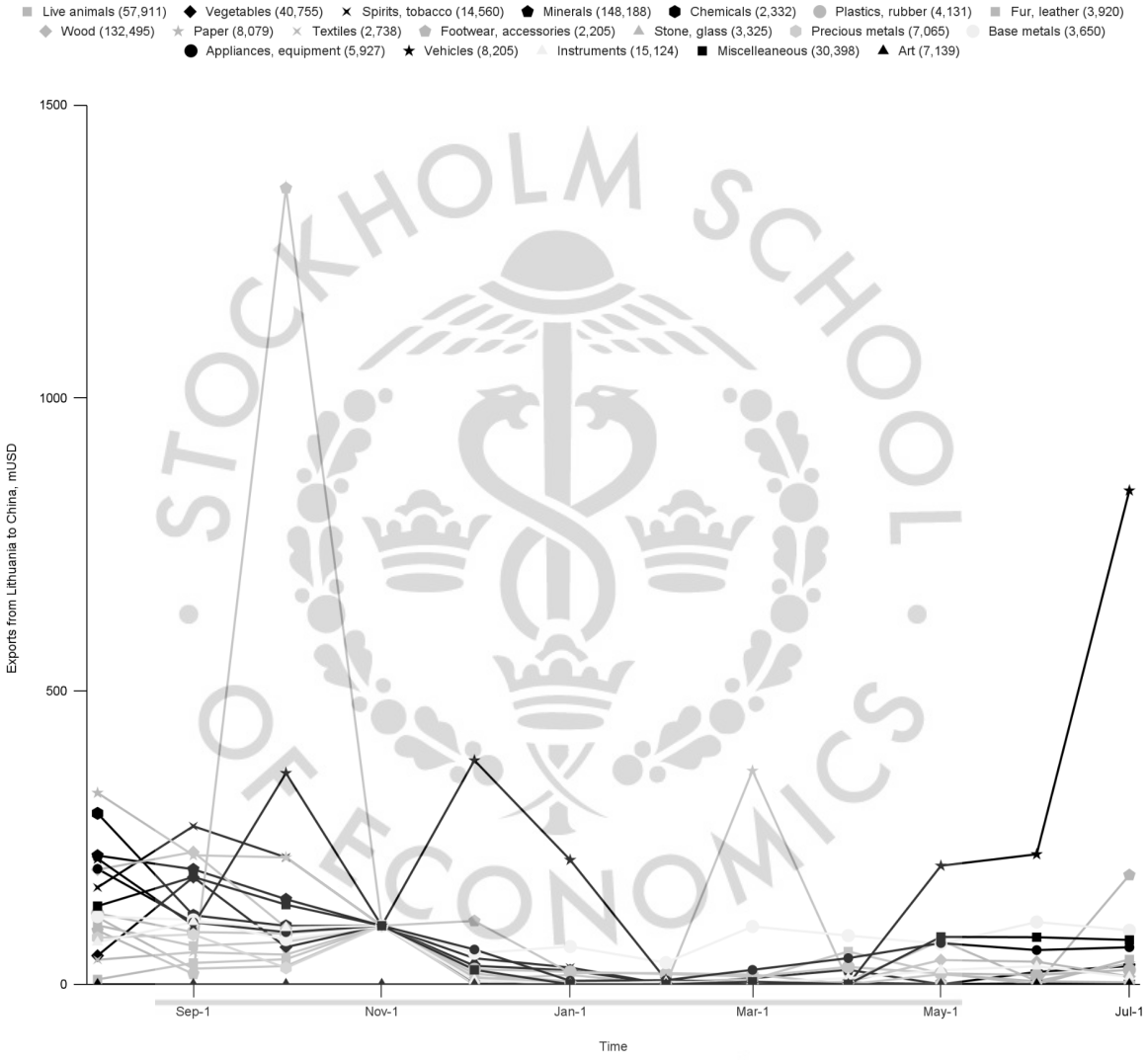
Total annual exports from Lithuania to China as percent of GDP and total exports, 2012-2021



Note. This figure shows the total yearly exports from Lithuania to China as a percentage of Lithuania's GDP and as a percentage of total exports during the period from 2012 to 2021. The lighter squared line shows Lithuania's exports to China as a percentage of total exports, while the darker line with triangles represents Lithuania's exports to China as a percentage of GDP. The vertical line represents the time of sanctions being imposed. The corresponding table of data and their calculations for this graph can be found in Appendix A. LT and CN are the two-letter country codes for Lithuania and China, respectively.

Figure 2

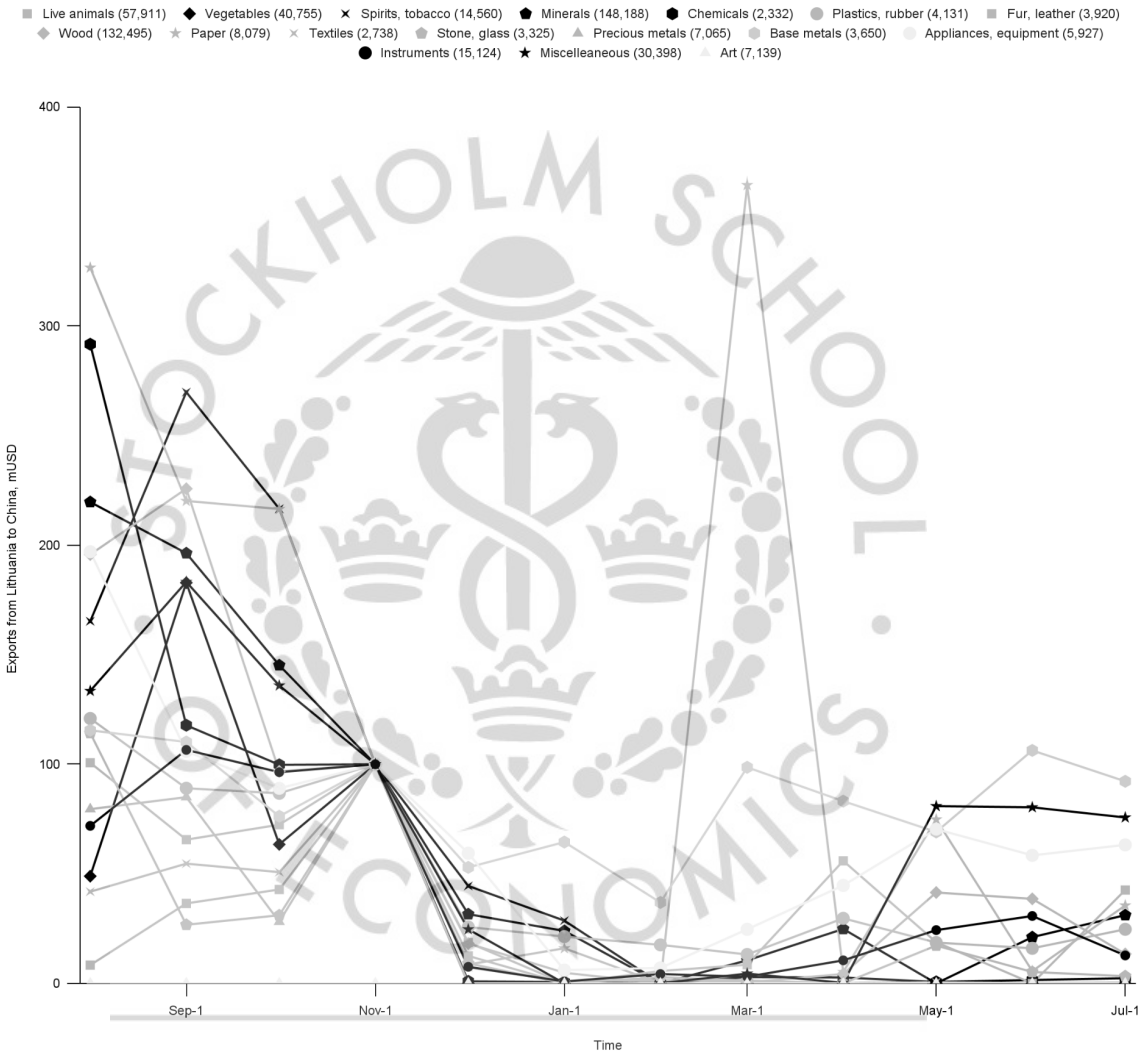
Monthly exports from Lithuania to China per group, August 2021 – July 2022, indexed to November 2021



Note. This graph shows the monthly exports from Lithuania to China for the period August 2021 – July 2022. All values are indexed to November 2021, where the exports equal 100 for all groups. The group descriptions are shown in Appendix C, while the legend at the top of the graph exhibits which line corresponds to which group. In the brackets next to each group are shown the median monthly traded volumes in USD of each group in the period prior to sanctions (January 2015 – November 2021).

Figure 3

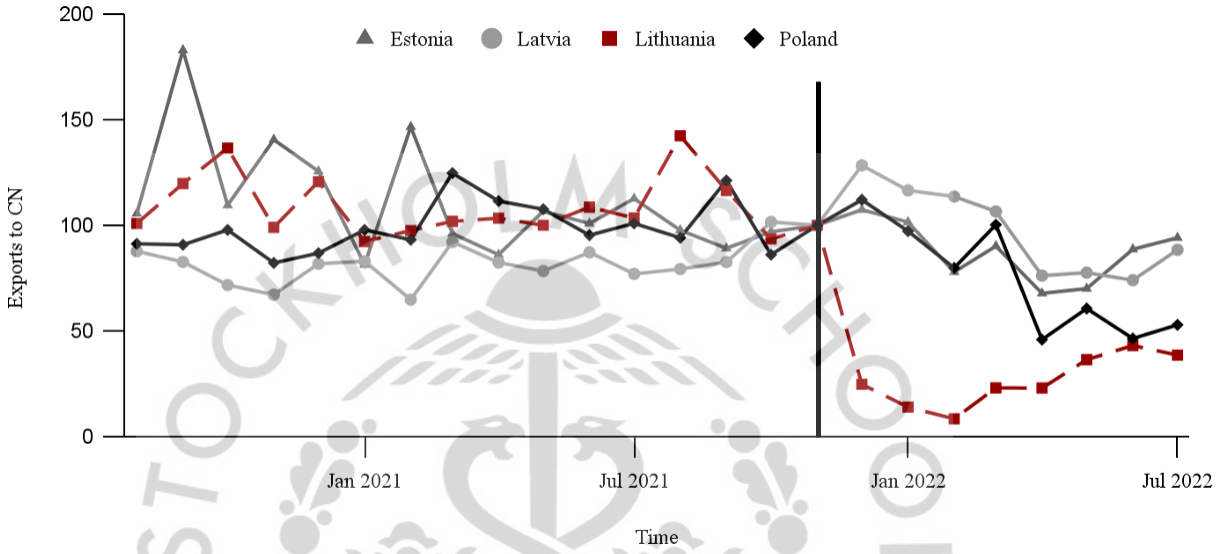
Monthly exports from Lithuania to China per group (except footwear and accessories; vehicles group), August 2021 – July 2022, indexed to November 2021



Note. This graph shows the monthly exports from Lithuania to China for the period August 2021 – July 2022. All values are indexed to November 2021, where the exports equal 100 for all groups, except for footwear and accessories; vehicles. The group descriptions are shown in Appendix C, while the legend at the top of the graph exhibits which line corresponds to which group. In the brackets next to each group are shown the median monthly traded volumes in USD of each group in the period prior to sanctions (January 2015 – November 2021).

Figure 4

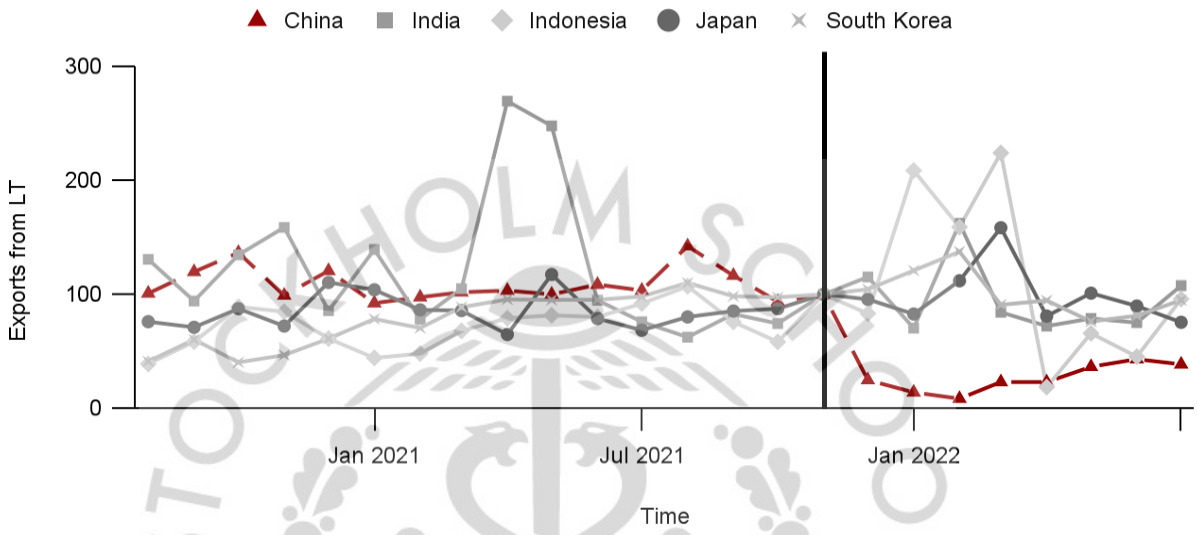
The monthly aggregated exports to China from Lithuania, Estonia, Latvia, and Poland from August 2020 until July 2022, indexed to August 2020, indexed to November 2021



Note. This graph shows the aggregate exports to China from Lithuania, Estonia, Latvia, and Poland for the period of August 2020 until July 2022 with black vertical line indicating the sanctions taking place. The exports are indexed to November 2021, when each country's exports equals 100, while the other months are calculated in respect to the index. The circled line shows the imports from Latvia, the triangle – imports from Estonia, the diamond – imports from Poland, and the dashed squared line - imports from Lithuania.

Figure 5

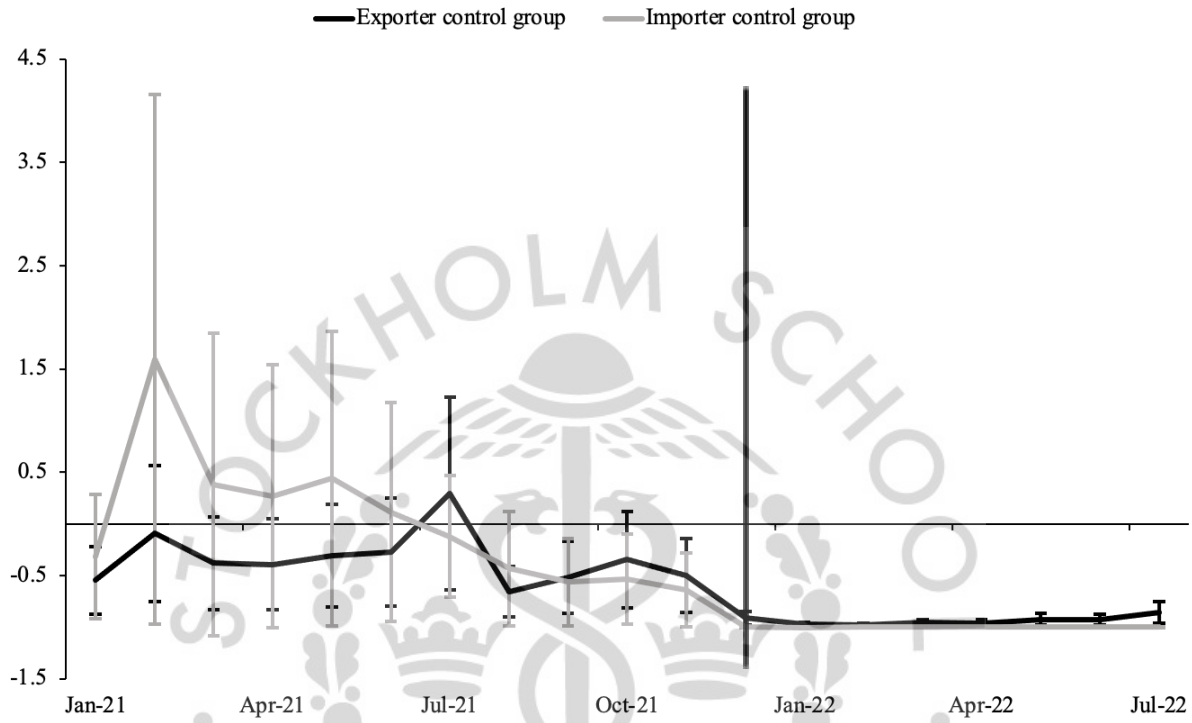
The monthly aggregated exports from Lithuania to China, India, Indonesia, Japan, and South Korea from August 2020 until July 2022, indexed to August 2020, indexed to November 2021



Note. This graph shows the aggregate exports from Lithuania to China, India, Indonesia, Japan, and South Korea for the period of August, 2020 until July, 2022 with black vertical line indicating the sanctions taking place. The exports are indexed to November 2021, when each country's exports equals 100, while the other months are calculated in respect to the index. The light squared line shows the exports from Lithuania to India, the diamond – to India, the circle – to Japan, the cross - South Korea, while the black triangle line shows exports from Lithuania to China.

Figure 6

The monthly estimated decrease of Lithuania's exports to China, January 2021 – July 2022

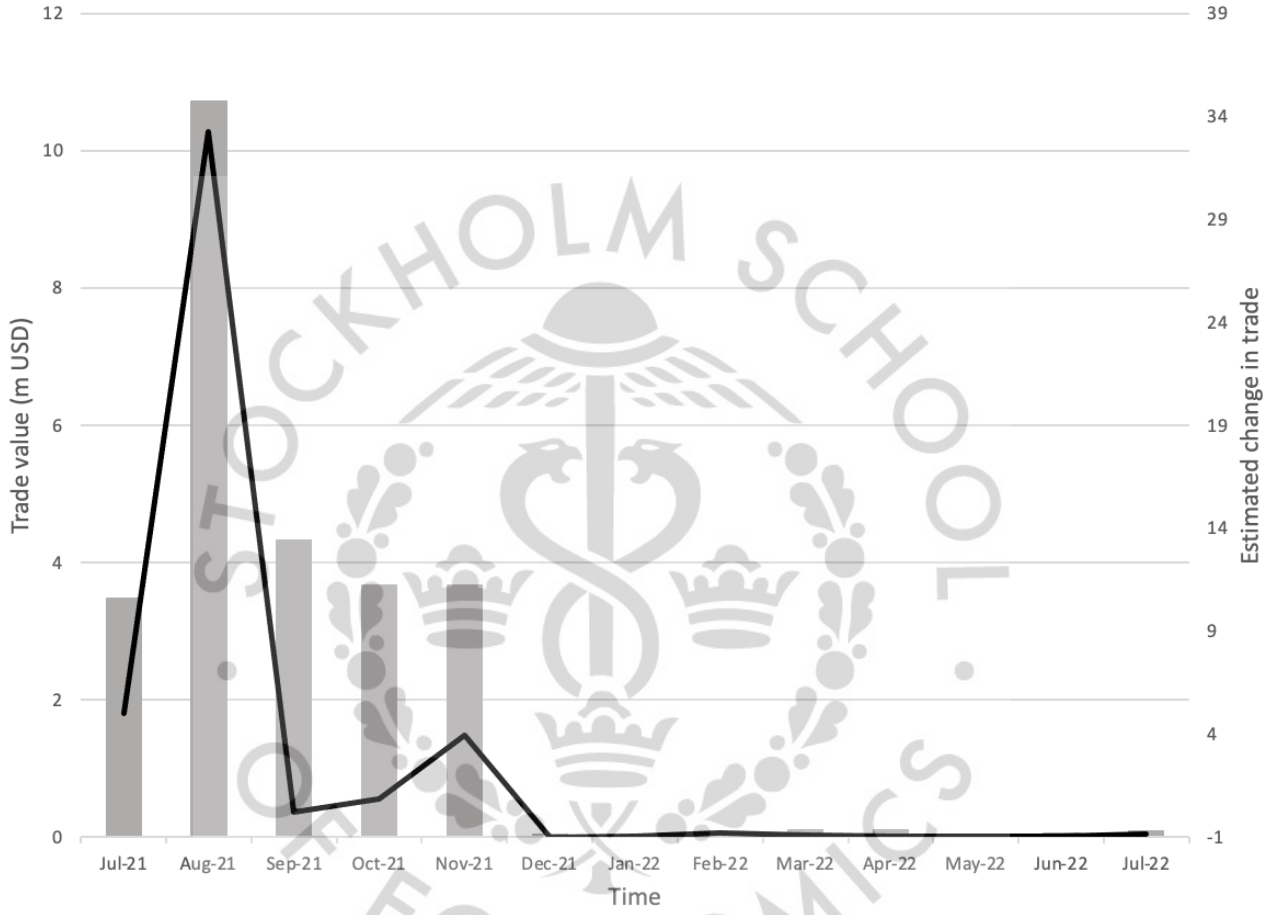


Note. This graph shows the monthly estimated decrease of Lithuania's exports to China in the period from January 2021 until July 2022. The lighter line represents the case of the control group being Lithuania's exports to Japan, South Korea, India, and Indonesia. The darker line represents the case where the control group is Estonia's, Lativa's, and Poland's exports to China. The black vertical line represents the time of the sanctioning, December 2021. The values in the graph correspond to β^* reported in Table 4. The error bars correspond to two standard deviations, adjusted to the regression output using the delta method[7].

[7] *The standard deviations of β^*, σ^*, are calculated using the delta method, where $\sigma^*=(\exp(\beta^*)-1)' * \sigma$.*

Figure 7

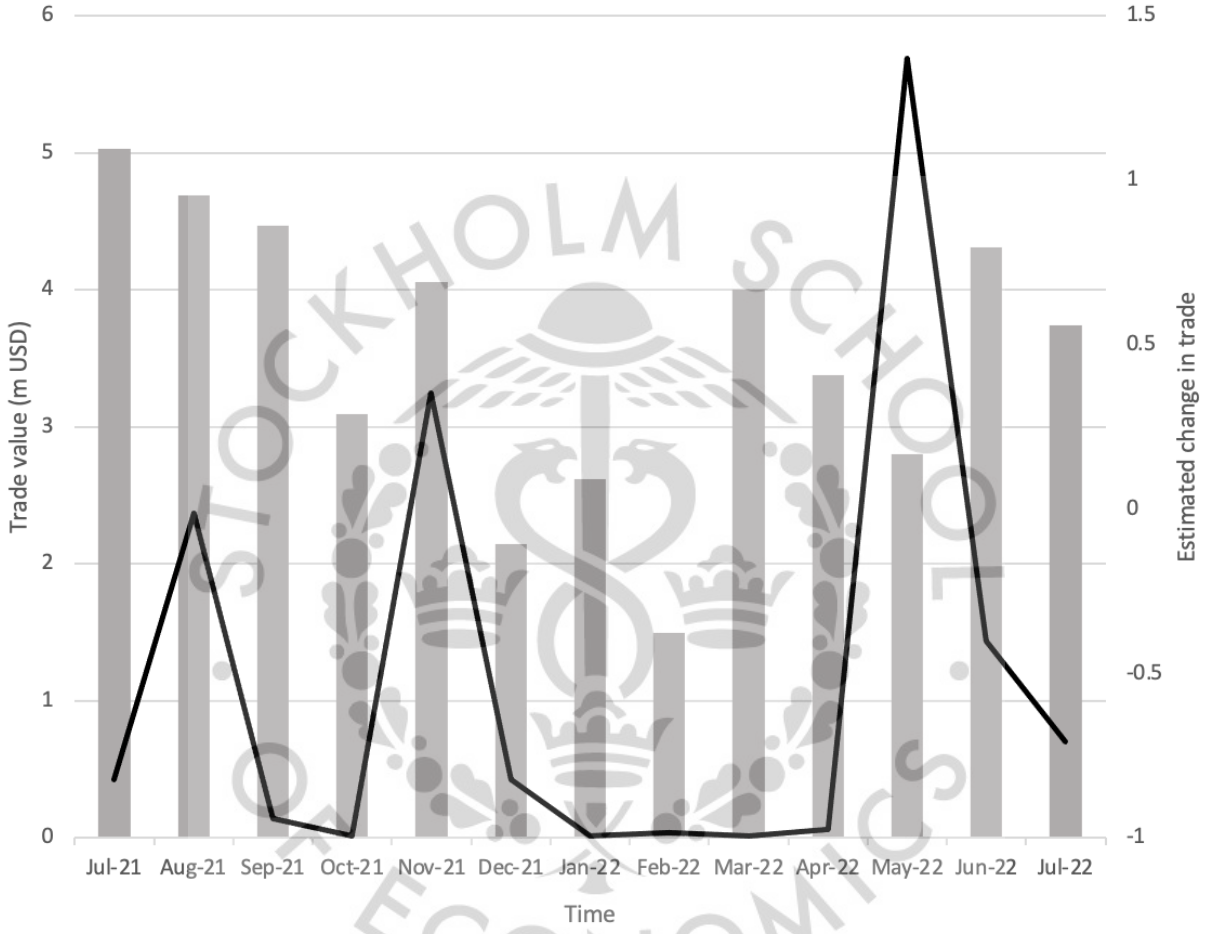
The monthly estimated decrease of Lithuania's exports of chemicals and their articles to China, plotted against actual trading volumes, July 2021 – July 2022



Note. This graph shows the monthly estimated decrease (black line) of Lithuania's exports to China for chemicals and their articles, according to the exporter control group (Latvia's, Estonia's, Poland's exports to China) estimates, plotted against the actual traded volume in millions of USD (grey bars) of this group for the period July 2021 – July 2022.

Figure 8

The monthly estimated decrease of Lithuania's exports of base metals and their articles to China, plotted against actual trading volumes, July 2021 – July 2022



Note. This graph shows the monthly estimated decrease (black line) of Lithuania's exports to China for base metals and their articles, according to the exporter control group (Latvia's, Estonia's, Poland's exports to China) estimates, plotted against the actual traded volume in millions of USD (grey bars) of this group for the period July 2021 – July 2022.

Appendices

Appendix A. Annual GDP, total exports, and exports to China from Lithuania, 2012-2021

This table shows Lithuania's yearly total exports and GDP, total exports as a percentage of GDP and exports from Lithuania to China, as well as Lithuania's exports to China as a percentage of its total exports and of GDP. The variables marked with an asterisk are calculated from the others. Lithuanian GDP is calculated from Lithuania's total export and export as a share of GDP data for calculated values to remain in historical USD terms. LT and CN are the two-letter country codes for Lithuania and China, respectively.

Year	LT Exports, % of GDP	LT Exports, bUSD	LT GDP, bUSD*	LT Exports to CN, mUSD	LT Exports to CN, % of LT Exports*	LT Exports to CN, % of LT GDP*
2012	78%	29,65	37,91	85,93	0.29%	0.23%
2013	79%	32,60	41,44	117,27	0.36%	0.28%
2014	72%	32,39	44,82	135,36	0.42%	0.30%
2015	69%	25,41	36,95	113,45	0.45%	0.31%
2016	68%	25,02	37,02	136,31	0.54%	0.37%
2017	74%	29,35	39,88	202,22	0.69%	0.51%
2018	75%	33,33	44,32	222,73	0.67%	0.50%
2019	77%	33,15	42,88	309,14	0.93%	0.72%
2020	74%	32,84	44,68	357,76	1.09%	0.80%
2021	80%	40,82	50,78	270,29	0.66%	0.53%

Appendix B. Grouping principles by two-digit HS commodity code

This table describes the principle for grouping commodities by their two-digit HS commodity codes, as proposed by the World Customs Organization (2018).

	HS	Group Description
I	01-05	Live animals, animal products
II	06-14	Vegetable products
III	15	Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes
IV	16-24	Prepared foodstuffs; beverages, spirits and vinegar; tobacco and manufactured tobacco
V	25-27	Mineral products
VI	28-38	Products of the chemical or allied industries
VII	39-40	Plastics, rubber, articles thereof
VIII	41-43	Raw hides and skins, leather, furskins and articles thereof; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut
IX	44-46	Wood, articles of wood; wood charcoal; cork, articles of cork; manufactures of straw, of esparto or of other plaiting materials; basketware and wickerwork
X	47-49	Pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard; paper and paperboard and articles thereof
XI	50-63	Textiles and textile articles
XII	64-67	Footwear, headgear, umbrellas, walking-sticks, seat-sticks, whips, riding-crops and parts thereof; prepared feathers and articles made therewith; artificial flowers; articles of human hair
XIII	68-70	Articles of stone, plaster, cement, asbestos, mica or similar materials; ceramic products; glass and glassware
XIV	71	Pearls, precious or semi-precious stones, precious metals and articles thereof; imitation jewellery; coin
XV	72-83	Base metals and articles of base metal
XVI	84-85	Machinery and mechanical appliances; electrical equipment; parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles
XVII	86-89	Vehicles, aircraft, vessels and associated transport equipment
XVIII	90-92	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; clocks and watches; musical instruments; parts and accessories thereof
XIX	93	Arms and ammunition; parts and accessories thereof
XX	94-96	Miscellaneous manufactured articles
XXI	97	Works of art, collectors' pieces and antiques

Appendix C. Summary statistics of monthly commodity trade for Lithuania's exports to China, January 2015 – July 2022

This table shows the summary statistics of the volume of monthly traded commodity volumes in USD, categorised in 21 groups, according to their two-digit HS commodity codes (World Customs Organization, 2018), of which six-digit HS commodity codes are subsets of. Group zero consists of all unspecified commodities (HS code: 99), while the descriptions of all other groups are shown in Appendix C. The final column shows the monthly average trade for the whole period, calculated as the sum of trade divided by the number of months.

Group	*Min*	*1st Quartile*	*Median*	*Mean*	*3rd Quartile*	*Max*	*Monthly average trade*
0	663	3,261	3,406	6,856	5,711	1,240	413
I	3	21,918	57,894	131,602	157,714	913,706	309,186
II	2	19,118	40,755	787,772	132,132	39,036,551	**1,955,194**
III	1,148	1,224	7,219	8,618	13,546	22,421	727
IV	2	3,116	14,560	40,917	43,040	787,690	335,716
V	2	5,349	160,620	271,014	482,396	1,364,600	894,673
VI	2	478	2,322	99,458	28,086	5,087,607	**2,116,175**
VII	2	376	4,131	18,407	19,058	383,937	220,218
VIII	2	1,500	4,172	42,807	31,288	423,182	58,795
IX	3	26,898	135,243	288,994	406,156	2,712,153	**2,893,421**
X	2	921	8,534	18,569	22,693	631,646	116,783
XI	2	671	2,863	40,499	14,216	1,508,184	834,860
XII	2	1,059	2,485	7,122	6,721	95,520	7,981
XIII	2	560	3,577	10,126	11,616	108,830	21,839
XIV	23	2,747	7,065	14,726	12,510	165,928	8,339
XV	2	592	3,631	165,139	38,969	5,451,588	**1,740,925**
XVI	2	1,209	6,166	55,173	38,925	6,502,674	**2,143,774**
XVII	2	1,250	7,120	32,979	34,138	767,274	121,984
XVIII	2	4,491	15,182	111,271	52,372	5,450,604	**1,965,339**
XX	2	5,860	31,634	213,125	103,088	3,892,888	**3,597,455**
XXI	450	3,950	7,390	18,680	11,972	167,830	8,552

Appendix D. Weighted least squares difference-in-differences regression output, segregated by month for the estimation period January 2015 – July 2022 [Equation 3]

This table shows the difference-in-differences regression output where the dependent variable is in its logarithmic form for each month from January 2021 until July 2022 with added fixed effects and control variables. Panel A reports the case where the control group consists of Estonia's, Latvia's, and Poland's exports to China. Panel B reports the case where the control group consists of Lithuania's exports to South Korea, Japan, Indonesia, and India. β represents the estimated coefficient reported in the regression output, while β* – the adjusted coefficient for a log-dummy interpretation.

***** *Significance codes.* * p < 10%, ** p < 5%, *** p < 1%.

	Panel A: exporter control group		*Panel B: importer control group*	
	β	β*	β	β*
Treated x 01/2021	-1.5987***	-79.78%	-0.9602**	-61.72%
Treated x 02/2021	-1.7610***	-82.81%	0.1816	19.91%
Treated x 03/2021	-0.7794**	-54.13%	-0.0118	-1.18%
Treated x 04/2021	-1.1851***	-69.43%	-0.0477	-4.65%
Treated x 05/2021	-0.6732*	-48.99%	0.1027	10.81%
Treated x 06/2021	-0.8473**	-57.14%	0.0995	10.46%
Treated x 07/2021	-1.1194***	-67.35%	-0.4375	-35.43%
Treated x 08/2021	-0.6238	-46.41%	0.0594	6.12%
Treated x 09/2021	-1.3046***	-72.87%	-0.1386	-12.94%
Treated x 10/2021	-1.3518***	-74.12%	-0.8667*	-57.97%
Treated x 11/2021	-1.2521***	-71.41%	-0.7325	-51.93%
Treated x 12/2021	-6.3500***	-99.83%	-6.9139***	-99.90%
Treated x 01/2022	-8.7384***	-99.98%	-8.9618***	-99.99%
Treated x 02/2022	-9.3437***	-99.99%	-8.4261***	-99.98%
Treated x 03/2022	-5.7555***	-99.68%	-8.4363***	-99.98%
Treated x 04/2022	-7.5478***	-99.95%	-7.3762***	-99.94%
Treated x 05/2022	-4.7112***	-99.10%	-6.1373***	-99.78%
Treated x 06/2022	-5.2541***	-99.48%	-6.6748***	-99.87%
Treated x 07/2022	-4.4859***	-98.87%	-6.4285***	-99.84%
Log(GDP)	-1.4323***	-76.12%	0.0815	8.49%
Inflation	-0.3332***	-28.33%	0.1234***	13.13%
Observations	*43,498*		*28,574*	
R^2	0.0136		0.0360	
Adjusted R^2	0.0000		0.0214	

Appendix E. Variations of the difference-in-differences regression output with a 2% cut-off rate for economically insignificantly traded commodity volumes for the estimation period January 2015 – July 2022 [Equation 1 & 2]

This table shows the difference-in-differences regression output where the dependent variable is in its logarithmic form for each month from January 2021 until July 2022 with added fixed effects and control variables. Panel A reports the case where the control group consists of Estonia's, Latvia's, and Poland's exports to China. Panel B reports the case where the control group consists of Lithuania's exports to South Korea, Japan, Indonesia, and India. β represents the estimated coefficient reported in the regression output, while β^* – the adjusted coefficient for a log-dummy interpretation.

***** *Significance codes.* * p < 10%, ** p < 5%, *** p < 1%.

Panel A: exporters to China as control group				
	(1)	*(2)*	*(3)*	*(4)*
$D_{post} * D_{treated}$	-1.6874***	-2.5906***	-3.2885***	-2.4803***
$\beta^* = e^{\beta} - 1$	*-0.8150*	*-0.9250*	*-0.9627*	*-0.9163*
Log(GDP)	-	1.2798***	4.6435***	0.8810**
Inflation	-	-0.1039***	0.0332***	-0.1318***
Time-fixed effects	No	Yes	No	Yes
Country-good fixed effects	No	No	Yes	Yes
Observations	*49,959*	*49,959*	*49,959*	*49,959*
R^2	0.0022	0.1379	0.0493	0.0114
Adjusted R^2	0.0022	0.1362	0.0387	-0.0015
Panel B: importers from Lithuania as control group				
$D_{post} * D_{treated}$	-4.2546***	-3.7727***	-6.8353***	-5.9222***
$\beta^* = e^{\beta} - 1$	*-0.9858*	*-0.9770*	*-0.9989*	*-0.9973*
Log(GDP)	-	0.5507***	0.8205***	0.0804
Inflation	-	-0.0603***	0.6003***	0.1010***
Time-fixed effects	No	Yes	No	Yes
Country-good fixed effects	No	No	Yes	Yes
Observations	*35,672*	*35,672*	*35,672*	*35,672*
R^2	0.0033	0.0817	0.0349	0.0293
Adjusted R^2	0.0033	-0.0867	0.0241	0.0160

Appendix F. Variations of the difference-in-differences regression output with a 10% cut-off rate for economically insignificantly traded commodity volumes for the estimation period January 2015 – July 2022 [Equation 1 & 2]

This table shows the difference-in-differences regression output where the dependent variable is in its logarithmic form for each month from January 2021 until July 2022 with added fixed effects and control variables. Panel A reports the case where the control group consists of Estonia's, Latvia's, and Poland's exports to China. Panel B reports the case where the control group consists of Lithuania's exports to South Korea, Japan, Indonesia, and India. β represents the estimated coefficient reported in the regression output, while β^* – the adjusted coefficient for a log-dummy interpretation.

** Significance codes.* * p < 10%, ** p < 5%, *** p < 1%.

Panel A: exporters to China as control group				
	(1)	*(2)*	*(3)*	*(4)*
$D_{post} * D_{treated}$	-2.0796***	-3.4148***	-4.2886***	-3.3350***
$\beta^* = e^{\beta} - 1$	*-0.8750*	*-0.9671*	*-0.9863*	*-0.9644*
Log(GDP)	-	1.1629***	5.2765***	1.1466**
Inflation	-	-0.1231***	0.0533***	-0.1559***
Time-fixed effects	No	Yes	No	Yes
Country-good fixed effects	No	No	Yes	Yes
Observations	*34,307*	*34,307*	*34,307*	*34,307*
R^2	0.0030	0.1298	0.0628	0.0177
Adjusted R^2	0.0030	0.1275	0.0523	0.0041
Panel B: importers from Lithuania as control group				
$D_{post} * D_{treated}$	-5.4942***	-4.5718***	-7.9408***	-6.7574***
$\beta^* = e^{\beta} - 1$	*-0.9959*	*-0.9897*	*-0.9996*	*-0.9988*
Log(GDP)	-	0.4124***	0.6316***	0.0637***
Inflation	-	-0.0967***	0.1588***	0.0899***
Time-fixed effects	No	Yes	No	Yes
Country-good fixed effects	No	No	Yes	Yes
Observations	*21,021*	*21,021*	*21,021*	*21,021*
R^2	0.0047	0.0942	0.0407	0.0357
Adjusted R^2	0.0047	0.0901	0.0299	0.0207

Appendix G. Variations of the difference-in-differences regression output assuming the treatment (sanctions) begins in August 2021 for the estimation period January 2015 – July 2022 [Equation 1 & 2]

This table shows the difference-in-differences regression output where the dependent variable is in its logarithmic form for each month from January 2021 until July 2022 with added fixed effects and control variables. Panel A reports the case where the control group consists of Estonia's, Latvia's, and Poland's exports to China. Panel B reports the case where the control group consists of Lithuania's exports to South Korea, Japan, Indonesia, and India. β represents the estimated coefficient reported in the regression output, while β^* – the adjusted coefficient for a log-dummy interpretation.

** Significance codes.* * p < 10%, ** p < 5%, *** p < 1%.

Panel A: exporters to China as control group				
	(1)	*(2)*	*(3)*	*(4)*
$D_{post} * D_{treated}$	-1.7801***	-2.9079***	-3.6695***	-2.8015***
$\beta^* = e^{\beta} - 1$	*-0.8314*	*-0.9454*	*-0.9745*	*-0.9393*
Log(GDP)	-	1.1741***	4.8727***	0.9017**
Inflation	-	-0.1036***	0.0419***	-0.1353***
Time-fixed effects	No	Yes	No	Yes
Country-good fixed effects	No	No	Yes	Yes
Observations	*42,952*	*42,952*	*42,952*	*42,952*
R^2	0.0022	0.1310	0.0540	0.0135
Adjusted R^2	0.0022	0.1291	0.0434	0.0004
Panel B: importers from Lithuania as control group				
$D_{post} * D_{treated}$	-4.8517***	-4.7247***	-7.7965***	-6.7782***
$\beta^* = e^{\beta} - 1$	*-0.9922*	*-0.9911*	*-0.9996*	*-0.9989*
Log(GDP)	-	0.5639***	0.6707***	0.0920
Inflation	-	-0.0596***	0.1767***	0.1210***
Time-fixed effects	No	Yes	No	Yes
Country-good fixed effects	No	No	Yes	Yes
Observations	*28,665*	*28,665*	*28,665*	*28,665*
R^2	0.0039	0.0929	0.0413	0.0351
Adjusted R^2	0.0039	0.0899	0.0306	0.0212