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Research Article

Keywords: Russian oil, EU, sanction, circumvention, trade

Posted Date: October 27th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-11262878/v1>

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Additional Declarations: No competing interests reported.

Circumventing EU Sanctions through Third-Country Refining: Evidence from Russian Oil Trade

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Abstract

The European Union's post-2022 sanctions prohibited direct imports of Russian oil but left a loophole: third countries can legally export refined products derived from Russian crude to the EU. Since the origin of refined oil is not directly verifiable, we examine this form of sanction circumvention using a gravity-model and event-study framework for global oil trade. We identify potential intermediary countries—China, India, and Turkey—based on political alignment with Russia, complex refining capacity, and pre-sanction trade relationships. After 2022, these countries exhibit sudden, large, and synchronized increases in their imports of Russian crude and their exports of refined oil to the EU. Such trade patterns are absent among sanctioning non-EU countries and non-sanctioning EU members but clearly evident for China and India, suggesting that these countries serve as key refining intermediaries through which Russian crude indirectly enters the EU market. Therefore, robust traceability mechanisms are essential to effective sanction design.

Key words: Russian oil, EU, sanction, circumvention, trade

JEL Classification: F13, F14, F51, Q41, Q48

1. Introduction

Following Russia's invasion of Ukraine in February 2022, the European Union (EU) adopted sanction packages against Russia in June 2022 to ban seaborne imports of Russian crude oil into the EU countries from December 2022 and Russian refined oil products from February 2023.¹ Although the EU's embargo on Russian oil was implemented on an unprecedented scale to stifle Russia's war efforts, there is no clear evidence of a decline in Russia's war-fighting capability (Raghunandan et al., 2025). A series of news reports and descriptive analyses such as Thieriot et al. (2023), Itskhoki and Ribakova (2024), and Babina et al. (2026) indicate that Russian crude oil has been increasingly exported to third countries and subsequently rerouted to sanctioning EU members, typically after being processed into refined petroleum products. Because the origin of imported oil is not directly verified, it is largely unexplored as to whether the EU's sanctions allowed for circumvention of Russian crude through refining intermediary countries.

In this paper, we seek to provide inference-based evidence for sanction circumvention using the case of Russian oil trade. Our central hypothesis is that rerouting of Russian crude operates through third-country intermediaries, thereby bypassing the EU sanctions on Russian oil. In response to Russia's invasion of Ukraine, the EU sharply curtailed direct imports of Russian crude and diversified its supply sources, which depressed the international price of Russian crude and created strong incentives for refining intermediary countries to increase their purchases. By importing discounted Russian crude, these countries can lower the cost of refined petroleum products, which are further exported to the EU, effectively allowing Russian oil to enter the EU through indirect channels. This circumvention exploits a loophole in the EU's post-2022 sanctions regime: while direct imports of Russian crude are banned, refined oil products derived from Russian oil are not explicitly prohibited, enabling refining intermediaries to legally export them to the EU. To investigate this hypothesis, we examine structural shifts in trade patterns of crude oil and refined petroleum products following the EU's post-2022 sanctions. Specifically, the circumvention hypothesis yields two testable predictions: first, exports of Russian crude should rise significantly in potential refining intermediaries with sufficient refining capacity of Russian Urals crude; and second, the EU should simultaneously exhibit a marked increase in imports of refined petroleum products from these countries. If these shifts occur suddenly in a synchronized timing on a large scale, we interpret them as empirical evidence of sanction circumvention of Russian oil through third-country refining intermediaries.

To examine these predictions, we estimate a standard gravity model of international trade separately for crude and refined oil products. Specifically, we examine an event-time change in intermediaries' imports of Russian crude and that in EU imports of refined oil products from refining intermediaries. This specification allows us to examine the structural shifts in crude and refined oil trade among Russia, the EU, and refining intermediary countries following the EU's post-2022 sanctions. If trade patterns are consistent

¹ For details, see Council Regulation (EU) 2022/879 of 3 June 2022 amending Regulation (EU) No 833/2014 concerning restrictive measures in view of Russia's actions destabilising the situation in Ukraine and Council Decision (CFSP) 2022/884 of 3 June 2022 amending Decision 2014/512/CFSP concerning restrictive measures in view of Russia's actions destabilising the situation in Ukraine.

with sanction circumvention, we should observe no significant shift in these patterns before the EU’s sanctions, but a significant shift subsequently. Estimating a gravity model allows us to provide inference-based evidence for sanction circumvention after accounting for a wide range of unobserved determinants of crude and refined oil trade across exporters, importers, and periods.

To identify refining intermediaries involved in sanction circumvention, we construct a candidate list using four criteria. First, intermediaries must be politically aligned with Russia; we begin with Russia’s 2023 list of 32 “friendly and neutral countries.” Second, they must have sufficient refining capacity to process high-sulfur Urals crude; we retain countries that overlap with the world’s top 50 refining countries from the Energy Institute Statistical Review of World Energy 2025. Third, intermediaries should have established trade ties with Russia; we use UN Comtrade data for 2012–2021 to identify the top 50 destinations for Russian exports and keep countries appearing in both sets, yielding Algeria, Brazil, China, India, Kazakhstan, Singapore, the UAE, and Turkey. Finally, we examine import volumes of Russian crude; only China and India recorded substantial volumes, while Turkey’s non-reporting prevents its exclusion. Thus, we classify China, India, and Turkey as the most plausible refining intermediaries.

The event-study analysis shows that crude oil imports from Russia into refining intermediaries remained stable before 2022 but surged dramatically afterward, rising by 272% in 2022, 5,204% in 2023, and 10,134% in 2024. While this surge occurred from 2022, this result shows formal econometric evidence of extraordinary reorientation in Russian crude following the EU sanctions. Meanwhile, EU imports of refined petroleum products from refining intermediaries exhibit no significant changes before 2022, but increase by 63% in 2022, 194% in 2023, and 133% in 2024. The synchronized timing and large scale of these shifts support the circumvention hypothesis that refining intermediaries appear to export refined petroleum products made from discounted Russian crude to the EU, enabling indirect circumvention of the sanction on Russian oil.

We investigate heterogeneity in sanction circumvention. First, we find that trade patterns in China and India align most strongly with the circumvention of Russian crude. EU imports of refined oil from these countries began to increase substantially from 2022, suggesting that China and India are key refining intermediaries of Russian crude. Second, we find no evidence that other sanctioning countries—the U.S., Canada, Australia, and Japan—increase imports of refined oil from the refining intermediaries. In addition, we conduct placebo tests by exploiting the fact that EU members such as Czechia, Hungary, and Slovakia were allowed to continue importing Russian crude via the southern branch of the Druzhba pipeline (Levi et al., 2025).² We find that the non-sanctioning EU members did not significantly increase imports of refined oil from the refining intermediaries, as compared with the significant increase of refined oil products in sanctioning EU members.

The rest of this paper is organized as follows. Section 2 reviews related studies on economic sanctions

² While the EU granted Bulgaria an exemption from the embargo of Russian crude oil until the end of 2024, Bulgaria officially ceased all imports of Russian crude oil on March 1, 2024.

and trade circumvention and highlights our contributions to related literature. Section 3 provides background of the EU’s sanction on Russian oil. Section 4 discusses the sanction-circumvention hypothesis and describes an empirical framework to estimate a structural shift in oil trade. Section 5 presents data sources and a descriptive analysis of import shifts in crude oil and refined petroleum products for the EU and refining intermediaries. Section 6 presents the estimation results. Finally, Section 7 concludes.

2. Literature Review

This paper relates to the literature on the economic consequences and transmission mechanisms of the post-2022 EU sanctions and the G7 price cap on Russian oil. More broadly, the economics and political-science literature documents a dramatic rise in the use of sanctions since 1950 and a shift from broad trade embargoes toward more targeted instruments—financial, travel, and other “smart” trade sanctions)—while emphasizing the challenge of aligning economic-impact metrics with political-success criteria (Morgan et al., 2023). Syropoulos et al. (2024) introduce Release 3 of the Global Sanctions Data Base, covering 1950–2022. Using this dataset, Gutmann et al. (2023) quantify macroeconomic impacts on countries subject to sanctions, whereas Gutmann et al. (2024) examine whether trade with China and Russia attenuates the effectiveness of Western sanctions. Egger et al. (2024) synthesize recent theory, data, and empirical strategies, and highlight remaining challenges concerning sanctions’ effectiveness, enforcement, and measurement.

On the design and operation of oil sanctions, Johnson et al. (2023) explain how the “G7 price cap” differs from a conventional price ceiling: rather than controlling a consumer price, the mechanism conditions access to Western maritime services (shipping, insurance, finance, and brokering) on compliance attestations that the purchase price of Russian oil is at or below the cap. This framework clarifies how the coalition sought to curb Russian export revenues while sustaining global supply, and why effective enforcement depends on auditing and documentation across complex supply chains.³ Kilian et al. (2026) quantify the impact of the EU embargo and the price cap on Russian export prices and find that the embargo induced a large discount on Urals crude, with important role of higher shipping costs and buyer bargaining power. Spiro et al. (2025) likewise emphasize that the embargo reduced Russian oil revenues largely by increasing transport costs and creating a buyers’ discount, while the price cap operated mainly through restrictions on transport services.

Babina et al. (2026) use Russian customs transaction data to examine export prices, volumes, and revenues around the embargo and price-cap implementation. They document a sharp decline in Russian oil-export revenues in early 2023 and a major redirection of Russian crude from Europe toward alternative markets—especially China, India, and Turkey. Meanwhile, Partsvania (2025) examines the policy

³ de Souza et al. (2024) examine the cost-efficient way to impose trade sanctions against Russia in a quantitative trade model with international input-output connections and show that an embargo on Russia’s mining and energy products is the most cost-efficient policy for countries with high willingness to pay for sanctions.

loopholes that allow petroleum products refined from Russian crude in third countries to enter the EU under new customs codes and origins, and discusses enforcement challenges related to shadow fleets, port logistics, and re-documentation.⁴ These studies suggest that third-country refining is a legally and logistically plausible route for sanction circumvention, but provide little direct evidence of this channel.⁵ We contribute by providing formal, trade-based evidence consistent with the circumvention hypothesis. Our findings imply that sanctions targeting crude oil (an upstream product) can be undermined unless flows of refined petroleum products (downstream outputs) or traceability mechanisms are also strictly regulated.

This paper also relates to the literature on trade circumvention through third countries. To identify rerouting, a common strategy is to detect synchronized co-movements in imports and exports through intermediary countries following the introduction of trade barriers such as tariffs, quotas, or the U.S.-China trade war (e.g., Rotunno et al., 2013; Liu and Shi, 2019; Ito, 2024; Iyoha et al., 2024; Hayakawa and Sudsawasd, 2025). In the context of sanctions on Russia, Chupilkin et al. (2026) show that EU-sanctioned goods entered Russia by rerouting through neighbouring countries such as Armenia, Kazakhstan, and the Kyrgyz Republic. Egorov et al. (2025) use Russian customs transaction data including both shipment and production origins to distinguish evasive rerouting—imports produced in sanctioning countries but shipped from neutral ones—from production relocation, captured by increased imports manufactured and shipped from non-sanctioning countries.

Prior studies focus on rerouting the same product through a third country with zero or minimal physical modification. By contrast, we examine sanction-driven circumvention that operates through processing: inputs shipped from a sanctioned country are transformed into different finished products and then exported to sanctioning countries. Although processing-based rerouting can empirically be examined by using input-output data for manufactured goods, it is extremely difficult to distinguish circumvention from genuine production relocation. Our setting allows us to isolate a distinct form of circumvention that operates precisely through product transformation: crude oil is physically processed in refineries into refined petroleum products and this production relationship is technologically well defined (Kaiser, 2016; Farrokhi, 2020). We exploit this predetermined input-output relationship to link the post-sanctions redirection of Russian crude to the subsequent expansion of refined-product exports from third-country refiners to the EU. In this respect, our approach is distinctive from the analysis on rerouting of the same products across borders.

3. The European Union’s Sanctions against Russian Oil

Following Russia’s invasion of Ukraine in February 2022, the EU progressively expanded energy-related sanctions against Russia. On 8 March 2022, the EU proposed the outline of a plan to phase out its

⁴ Ghironi et al. (2024) utilize a dynamic macroeconomic model and show that non-sanctioning third countries mitigate the welfare impact of sanctions on Russia and worsen economic costs for sanctioning countries.

⁵ Sanctions also induce covert circumvention strategies such as “dark shipping”: tankers disabling automatic identification system transceivers (Fernández-Villaverde et al., 2025).

dependency on Russian fossil fuels well before 2030.⁶ Although it is not a formal embargo, this announcement signalled a clear political commitment that altered expectations for refiners, traders, and insurers in EU energy markets and encouraged diversification away from Russian oil supply. On 15 March 2022, the EU imposed restrictive measures on financing, investment, and business services for Russian state-owned energy firms such as Rosneft, Gazprom Neft, and Transneft.⁷ These measures limited EU companies' ability to contract Russian crude and triggered widespread self-sanctioning. On 8 April 2022, the EU prohibited Russian-flagged vessels from entering EU ports, disrupting logistics and increased shipping costs for Russian cargoes.⁸ Together, these restrictive measures encouraged broad self-sanctioning in dealings with Russian shipments and crude.

The cornerstone measures for oil were (i) an embargo on seaborne imports of Russian crude into the EU from 5 December 2022 and of refined petroleum products from 5 February 2023, and (ii) the G7/EU price-cap regime applied to Russian seaborne exports to third countries, which was implemented for crude oil since 5 December 2022 and for refined petroleum since 5 February 2023. Under the price-cap framework, access to Western maritime services is conditional on documentation that the purchase price is at or below the cap, which is designed to keep Russian oil flowing to global markets while reducing the revenue per barrel (Johnson et al., 2023).

As Russia relied on a large fleet of opaque shipping networks and re-export channels, the EU introduced further restrictions on "shadow fleet" tankers and circumvention activities on 18 December 2023.⁹ These regulations include port bans for vessels suspected of transporting Russian oil above the price, restrictions on ship-to-ship transfers used to conceal origin, penalties for automatic identification system manipulation, due-diligence obligations for maritime service providers, and sanctions on entities facilitating deceptive shipping practices such as flag-hopping, and falsified cargo documentation. They also strengthened controls on the re-exports of sanctioned goods via third countries. Together, these measures reflect concerns that illicit supply chains could continue to sustain Russia's military production despite formal prohibitions.

4. Empirical Framework

This section discusses the hypothesis that third-country refining of Russian crude is an indirect channel of sanction circumvention of Russian oil. To assess this channel, we present an empirical model of trade

⁶ See European Commission, "REPowerEU: Joint European action for more affordable, secure and sustainable energy," press release, March 8, 2022.

⁷ See "Official Journal of the European Union," L 087I, March 15, 2022.

⁸ See Council Regulation (EU) 2022/576 of 8 April 2022 Amending Regulation (EU) No 833/2014 Concerning Restrictive Measures in View of Russia's Actions Destabilising the Situation in Ukraine, 2022 O.J. (L 111) 1.

⁹ See Council Regulation (EU) 2023/2878 of 18 December 2023 Amending Regulation (EU) No 833/2014 Concerning Restrictive Measures in View of Russia's Actions Destabilising the Situation in Ukraine, 2023 O.J. (L 2023/2878).

designed to test whether observed structural shifts in global oil trade align with the circumvention hypothesis.

4.1. Sanction Circumvention Hypothesis

Our central hypothesis is that sanction circumvention of Russian crude operates through third-country refining intermediaries. Following Russia’s invasion of Ukraine, the EU sharply curtailed direct imports of Russian crude and diversified its supply sources. This shift depressed the international price of Russian crude, creating a strong incentive for third countries to increase their purchases. Refining intermediaries import discounted Russian crude, reducing the cost of refined products derived from it. These refined oil products are then exported to the EU, effectively allowing Russian oil to enter the EU through indirect channels. This circumvention is made possible by a loophole in the EU sanctions: while direct imports of Russian crude were banned, refined oil products *made from* Russian oil were not explicitly prohibited, enabling third countries to legally export them to the EU.

We investigate the sanction-circumvention hypothesis of Russian oil by examining structural shifts in global trade flows of crude oil and refined petroleum products. The hypothesis yields two testable predictions about these trade flows. First, following the EU sanctions against Russian oil, exports of Russian crude should rise significantly in third-country refining intermediaries with adequate capacity to refine Russian Urals crude. Second, during the same period, the EU should exhibit a marked increase in imports of refined petroleum products from these refining intermediaries. If these shifts in trade patterns occur with synchronized timing on a large scale, they provide empirical support for the sanction circumvention of Russian oil via refining intermediaries.

Some caveats are in order. First, trade statistics do not report the origin of imported refined petroleum products at the molecular level. While third-country intermediaries can export refined petroleum products made from both Russian and legitimate non-Russian crude to the EU, there is no direct evidence for the Russian share embedded in these imports and the illicit blending of sanctioned and legitimate oil streams. Because the Russian content of imported oil is not directly verifiable, we seek to provide inference-based empirical evidence using observed trade flows. Second, sanction circumvention can take multiple forms—including ship-to-ship transfers, falsified customs documentation to obscure the origin of crude oil, and transshipment of oil products through third-party countries. These practices may not be fully captured in trade statistics, making it difficult to precisely quantify the extent of entire circumvention.

4.2. Refining Intermediary Countries

To examine trade flows through refining intermediary countries, we construct a list of potential candidates based on four criteria. First, refining intermediaries do not cooperate with the sanction against Russia but maintain political alignment with Russia. We set an initial pool of potential candidates using the Russian government’s list of 32 “friendly and neutral countries,” announced on 21 September 2023. Second,

refining intermediaries must possess sufficient refining capacity to process Russian Urals crude, which has a high sulfur content. Using country-level refinery capacity (barrels per day) from the Energy Institute Statistical Review of World Energy 2025, we identify the top 50 refining countries and retain those that overlap with the above diplomatic list.

Third, established trade relationships with Russia can facilitate third-country refiners' purchases of discounted Russian crude by lowering trade frictions in communication, financial transactions, and logistics with Russia. We use UN Comtrade to compile the top 50 destinations for Russian exports during the pre-invasion period (2012–2021) and retain countries that overlap with the previous list.¹⁰ This yields Algeria, Brazil, China, India, Kazakhstan, Singapore, UAE, and Turkey.

Finally, we screen these countries based on whether they import Russian crude in meaningful volumes because a third country with little crude import cannot plausibly export refined oil made from Russian crude. Table A1 reports the import values and quantities of Russian crude for these countries, showing negligible levels during the post-2022 period for all except China and India. Because Turkey does not report import statistics on crude oil, we cannot rule it out as a potential intermediary country.¹¹ Taken together, we define China, India, and Turkey as intermediary countries.¹²

4.3. Empirical Model

To empirically investigate the sanction-circumvention hypothesis of Russian oil, we estimate a standard gravity model of international trade separately for crude oil and refined oil products.¹³ First, we examine an event-time change in refining intermediaries' imports of Russian crude by estimating the following model for exporter i , importer j , and year t :

$$E_{ijt} = \exp \left(\alpha + \sum_{k \neq -1} \beta_k RU_i \cdot RI_j \cdot \mathbf{1}(t = 2022 + k) + \pi_{ij} + \kappa_{it} + \theta_{jt} \right) \cdot \varepsilon_{ijt}, \quad (1)$$

where E_{ijt} is the export value of crude oil—goods in HS code 2709—from exporter i to importer j in year t . RU_i is a dummy variable that takes on unity for Russia, and zero otherwise. RI_j is a dummy variable that takes on unity for refining intermediary importer j , and zero otherwise. To define pre- and post-invasion periods, we use a time dummy variable for k periods relative to the year 2022; the year 2021 is the reference

¹⁰ We exclude Belarus from the final set as the EU imposed trade restrictions concerning petroleum products from 24 June 2021. See Council Regulation (EU) 2021/1030 of 24 June 2021 amending Regulation (EC) No 765/2006 concerning restrictive measures in respect of Belarus.

¹¹ Turkey does not report customs data on crude oil imports for several reasons. It receives blended crude oil through multiple pipelines originating from various sources. It also imports oil from politically sensitive regions such as Russia and Iran. Additionally, a portion of imported crude may be intended for re-export.

¹² Thieriot et al. (2023) use Kpler shipment-tracking data to trace crude oil flows and argue that trade patterns in China, India, Turkey, Singapore, and the UAE are consistent with sanction circumvention of Russian oil. Similarly, Jia and Wu (2026) use international maritime petroleum data from Signal Ocean and document substantial increases in Russian petroleum import by India, China, Turkey, and Greece since 2022.

¹³ Bělin and Hanousek (2021) examines the trade impact of the EU and Russian reciprocal sanctions since 2014 using a difference-in-differences model for trade flows.

period. π_{ij} is exporter-importer fixed effects; κ_{it} and θ_{jt} are time-varying exporter and importer fixed effects, respectively. This combination of fixed effects accounts for a wide range of unobserved determinants of crude oil trade across countries and helps to identify a structural shift in crude oil trade between Russia and intermediary countries. ε_{ijt} is an error term. Since the standard OLS estimator may be biased in the presence of heteroscedasticity in exports, we use Poisson pseudo-maximum likelihood (PPML) estimation for all specifications.

The coefficient β_k is of main interest and shows a structural difference in crude oil imports from Russia to intermediary importer j for k periods before or after the year 2021. Pre-invasion coefficients β_k for $k < 0$ capture a pre-invasion trend in crude oil trade between Russia and intermediary importers. Post-invasion coefficients β_k for $k > 0$ show a post-invasion trend in crude oil trade between Russia and intermediary importers. If intermediary importers increase Russian crude imports for sanction circumvention motives during the post-invasion period, we predict that the post-invasion coefficients will be positive in sign. Meanwhile, the pre-invasion coefficients would not be statistically different from zero.

We estimate the coefficients β_k by comparing a change in crude oil trade between Russia and intermediary importers with a change in crude oil trade among other trading partners. This comparison group includes the EU markets with a substantial decline in Russian crude import from 2022, suggesting that the EU countries in the sample may lead to overestimating a structural increase in crude oil trade between Russia and intermediary countries. We address this issue in two ways. First, we estimate equation (1) by excluding the EU importers from the sample. Second, we control for a dynamic change in trade between Russia and the EU by including $\sum_{k \neq -1} \mu_k RU_i \cdot EU_j \cdot \mathbf{1}(t = 2022 + k)$, where EU_j is a dummy variable that takes on unity for EU importer j , and zero otherwise.¹⁴

Since a sudden inflow of Russian crude into refining intermediary countries is only a partial aspect of sanction circumvention, we also examine whether the EU markets substantially increase an import of refined petroleum products from intermediary countries in a synchronized timing. This prediction is examined by the following model for exporter i , importer j , and year t :

$$E_{ijt} = \exp \left(\gamma + \sum_{k \neq -1} \delta_k RI_i \cdot EU_j \cdot \mathbf{1}(t = 2022 + k) + \lambda_{ij} + \varphi_{it} + \rho_{jt} \right) \cdot e_{ijt}, \quad (2)$$

where E_{ijt} is the export value of refined petroleum products—goods in HS code 2710—from exporter i to importer j in year t . RI_i is a dummy variable that takes on unity for refining intermediary exporter i , and zero otherwise. λ_{ij} is exporter-importer fixed effects; φ_{it} and ρ_{jt} are time-varying exporter and importer fixed effects, respectively. These fixed effects control for a wide variety of unobserved determinants of refined oil trade across countries, including changes in refinery capacity utilization, energy price shocks, and domestic demand in third countries. e_{ijt} is an error term.

The coefficients δ_k show a structural shift in EU imports of refined oil products from intermediary

¹⁴ We include 28 EU members before the January 31, 2020, when the United Kingdom formally left the EU following the Brexit referendum.

exporter i for k periods before or after the year 2021. Pre-invasion coefficients δ_k for $k < 0$ reflect a pre-invasion trend in refined oil trade between intermediary exporters and EU importers. Post-invasion coefficients δ_k for $k > 0$ indicate a post-invasion trend in refined oil trade. If intermediary exporters were to increase the export of refined oil products made in Russia to the EU market for sanction circumvention during the post-invasion period, we predict that the post-invasion coefficients will be positive in sign. Meanwhile, the pre-invasion coefficients should not be statistically different from zero.

As discussed for crude oil, the coefficients δ_k are estimated by comparing trade between intermediary exporters and EU importers with trade among other trading partners. The latter includes Russian export of refined oil to the EU, which substantially declined following the EU post-2022 sanctions. These trade flows in the comparison group could lead to overestimating trade shifts between intermediary exporters and the EU. Thus, we exclude Russia from the sample or account explicitly for event-time effects of Russian exports to the EU.

5. Data Description

Our data come from the UN Comtrade, using import statistics reported by destination countries to construct a panel dataset covering the period 2018–2024. We focus on product-level data at the 4-digit level of the Harmonized Commodity Description and Coding System (HS) in HS codes 2709 and 2710.¹⁵ Specifically, HS 2709 covers crude oil derived from petroleum and bituminous minerals. These unrefined oils serve as feedstocks for fuel production (e.g., gasoline, diesel, jet fuel), petrochemical synthesis (e.g., ethylene, propylene), lubricants, and other industrial applications. HS 2710 includes refined petroleum oil and oil obtained from bituminous minerals, encompassing products such as gasoline, jet fuel, diesel oil, fuel oil, lubricating oil, and other refined derivatives.

We describe import trends for crude oil and refined petroleum products. To highlight potential structural shifts, we aggregate import values and quantities by key exporter groups and normalize the data to an index value of 100 for the year 2021. Given that import values may be significantly affected by annual price fluctuations, we report both import values and physical quantities. This descriptive analysis illustrates the relative importance of volume-driven and price-driven changes in the import trends.

Figure 1 shows the trend in EU imports of crude oil from Russia and other exporters for 2018–2024. Both import value and quantity from Russia declined sharply from 2022 onward. Relative to the year 2021, the EU imports from Russia declined by 87% in both value and quantity for 2024. Figure 2 presents the trend in the intermediary countries’ imports of crude oil—China and India—from Russia and other exporters. Relative to 2021, these countries increased Russian imports by 169% in value and 138% in quantity for 2024. Their imports from other exporters remained largely unchanged during the period;

¹⁵ We exclude countries and territories with very few trade records. Balanced panel is made by assigning zero import values to missing observations and excluding the exporters (importers) with zero export (import) values during the sample period.

specifically, the quantity trend shows no evidence of post-invasion increases in non-Russian crude imports. Together, the diverging trade patterns between the EU and intermediary countries suggest a sudden reorientation of Russian crude after 2022.

Figure 1. Import of Crude Oil in the EU



Notes: Import data are import statistics reported by destination countries. Crude oil indicates the goods in HS 2709.

Source: Authors' calculation using the UN Comtrade.

Figure 2. Import of Crude Oil in Refining Intermediary Countries



Notes: Import data are import statistics reported by destination countries. Crude oil indicates the goods in HS 2709. Intermediary countries include China and India. Turkey is not included for missing observations.
Source: Authors' calculation using the UN Comtrade.

Figure 3. Import of Refined Oil Products in the EU



Notes: Import data are import statistics reported by destination countries. Refined oil products indicate the goods in HS 2710. Refining intermediary countries include China, India, and Turkey.

Source: Authors’ calculation using the UN Comtrade.

Figure 3 shows the trend in EU imports of refined petroleum products from intermediary countries (China, India, and Turkey) and other exporters. The EU imports from the intermediary countries increased sharply from 2022 onward whereas the EU imports from other exporters remained largely unchanged. Relative to 2021, the EU imports from the intermediary countries surged by 273% in value and by 169% in quantity for 2023. Thus, these trade patterns align well with potential sanction circumvention of Russian oil following the EU’s post-2022 sanctions.

6. Estimation Results

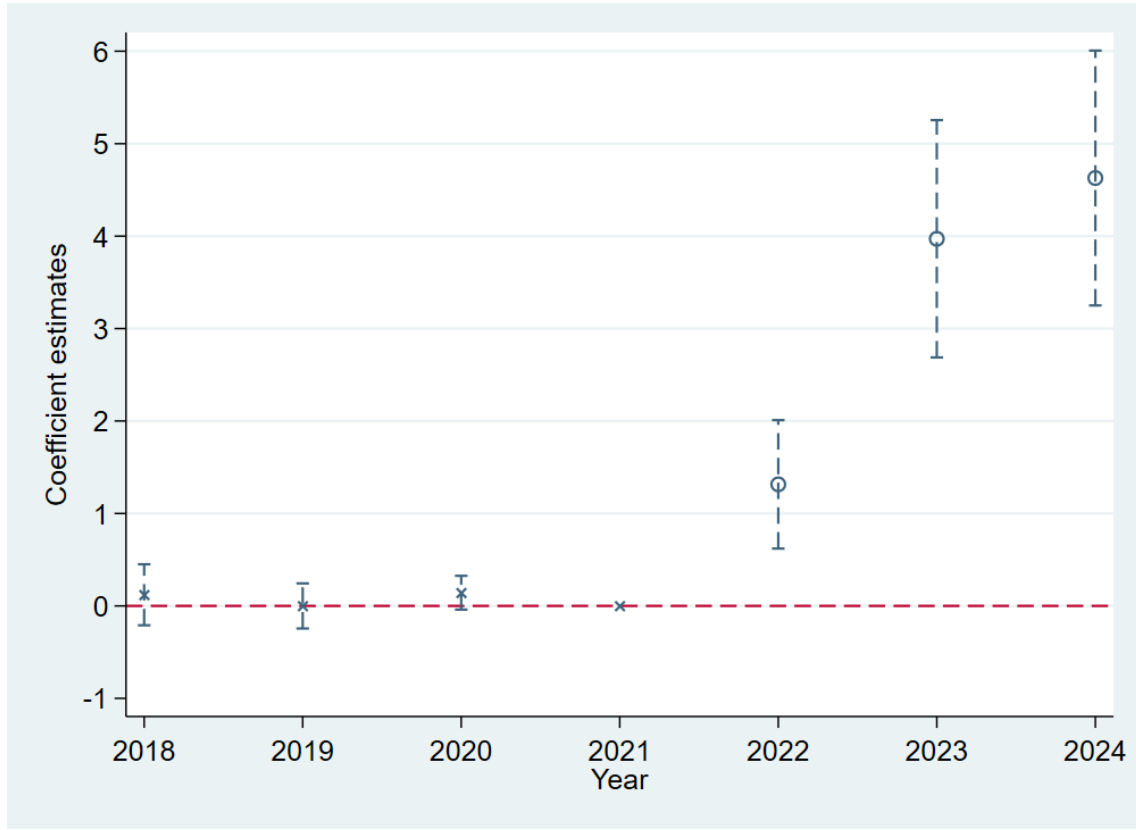
6.1. Main Results

We start by examining the event-study plot of the estimated coefficients β_k from equation (1) for crude oil, with the regression results reported in Table A2. Figure 4 shows that there is no significant change in crude oil imports from Russia into intermediary countries prior to the invasion, relative to the 2021 baseline. In contrast, the post-invasion coefficients are significant and positive, suggesting that the intermediary countries dramatically increased their imports from Russia—by 272% in 2022, 5,204% in 2023, and 10,134% in 2024.¹⁶ These extreme marginal effects are driven primarily by the exceptionally large inflow of Russian crude oil into India, which increased from negligible pre-invasion levels to exceptionally high volumes (see Table A1). Such growth far exceeds what a gravity model calibrated on pre-invasion trade patterns would predict, yielding unusually large estimated effects. While prior studies such as Thieriot et al. (2023) and Babina et al. (2026) offer descriptive evidence of export reorientation of Russian crude, we provide formal econometric evidence of this shift after accounting for unobserved heterogeneity across exporters, importers, and years.

Figure 5 presents the event-study plot of the estimated coefficients δ_k from equation (2), with the regression results given in Table A3. Relative to the 2021 baseline, there is no significant deviation in import values from zero during the pre-invasion period 2018–2020. In contrast, the post-invasion coefficients are significant and positive, suggesting that EU imports of refined petroleum products from intermediary countries increased by 63% in 2022, 194% in 2023, and 133% in 2024. Together with the surge of Russian crude into intermediary countries, the synchronized timing of these shifts is consistent with the roundabout inflow of Russian crude into the EU market via third-country refining—allowing refined products made from discounted Russian crude to enter the EU market through an indirect channel.

¹⁶ The marginal effects are computed by $100[\exp(\beta_k) - 1]$.

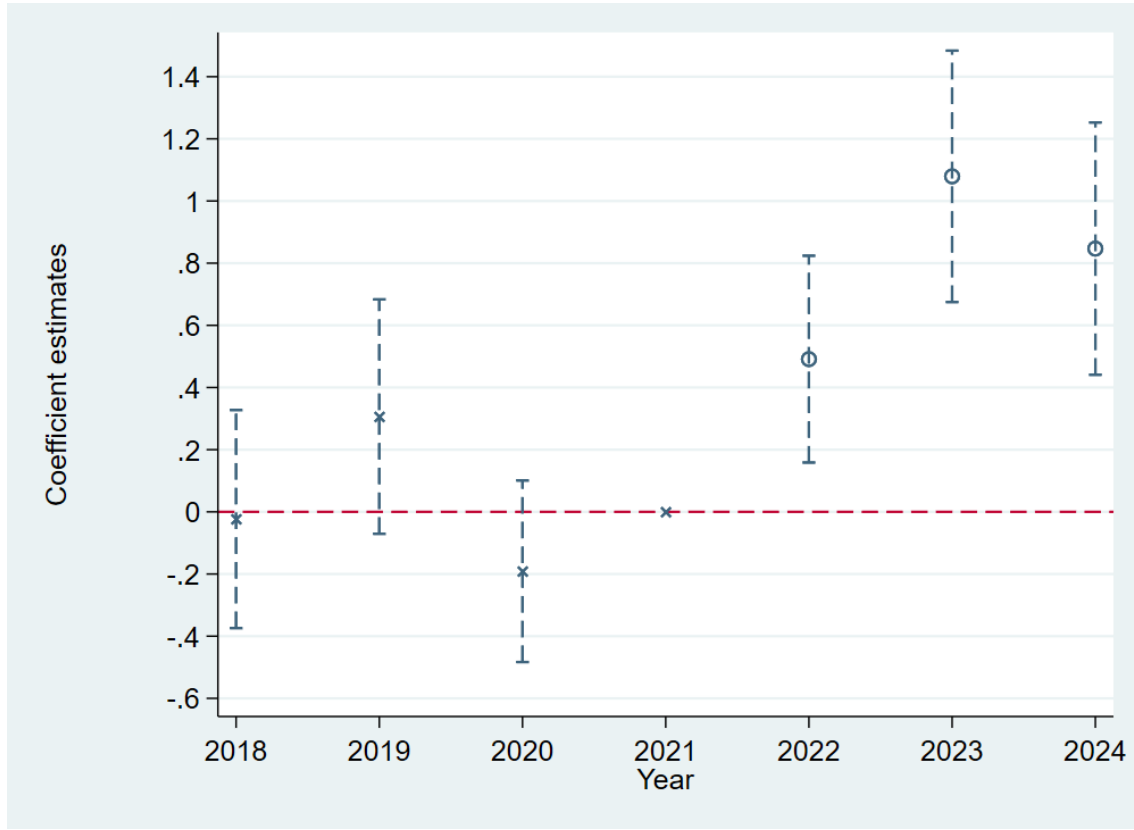
Figure 4. Event-Study Plot for Crude Oil Export from Russia to Intermediaries



Notes: The event study plot shows the estimated coefficients β_k from the Poisson pseudo maximum likelihood result of the empirical model for exporter i , importer j , and year t : $E_{ijt} = \exp(\alpha + \sum_{k=-1} \beta_k RU_i \cdot RI_j \cdot \mathbf{1}(t = 2022 + k) + \pi_{ij} + \kappa_{it} + \theta_{jt}) \cdot \varepsilon_{ijt}$. E_{ijt} is the export value of crude oil. RU_i is a dummy variable for Russian exporter. RI_j is a dummy variable for refining intermediary importers. 95% confidence interval is shown for each coefficient.

Source: Authors' calculation using the UN Comtrade.

Figure 5. Event-Study Plot for Refined Oil Export from Intermediaries to the EU



Notes: The event study plot shows the estimated coefficients δ_k from the Poisson pseudo maximum likelihood result of the empirical model for exporter i , importer j , and year t : $E_{ijt} = \exp(\gamma + \sum_{k \neq -1} \delta_k RI_i \cdot EU_j \cdot \mathbf{1}(t = 2022 + k) + \lambda_{ij} + \varphi_{it} + \rho_{jt}) \cdot e_{ijt}$. E_{ijt} is the export value of refined oil products. RI_j is a dummy variable for refining intermediary exporters. EU_j is a dummy variable for EU importers. 95% confidence interval is shown for each coefficient.

Source: Authors' calculation using the UN Comtrade.

To address confounding effects of post-invasion import changes in the control group, we conduct robustness checks. For crude oil, column (2) of Table A2 excludes EU imports of Russian crude. The post-invasion coefficients remain significant and positive. In column (3), we include the interaction terms $\sum_{k \neq -1} \mu_k RU_i \cdot EU_j \cdot \mathbf{1}(t = 2022 + k)$ to control for dynamic changes in Russian exports to the EU. The post-invasion coefficients remain unchanged. Additionally, Table A3 presents robustness checks for refined petroleum products. Column (2) excludes EU imports of refined oil products from Russia. In column (3), we control for dynamic changes in EU imports of refined oil from Russia. These results show that the post-invasion coefficients remain significant and positive. Thus, the observed increase in EU imports of refined petroleum products from intermediary countries is robust and coincides closely with the timing of the EU's sanctions on Russian oil.

6.2. Heterogeneity in Intermediary Exporters

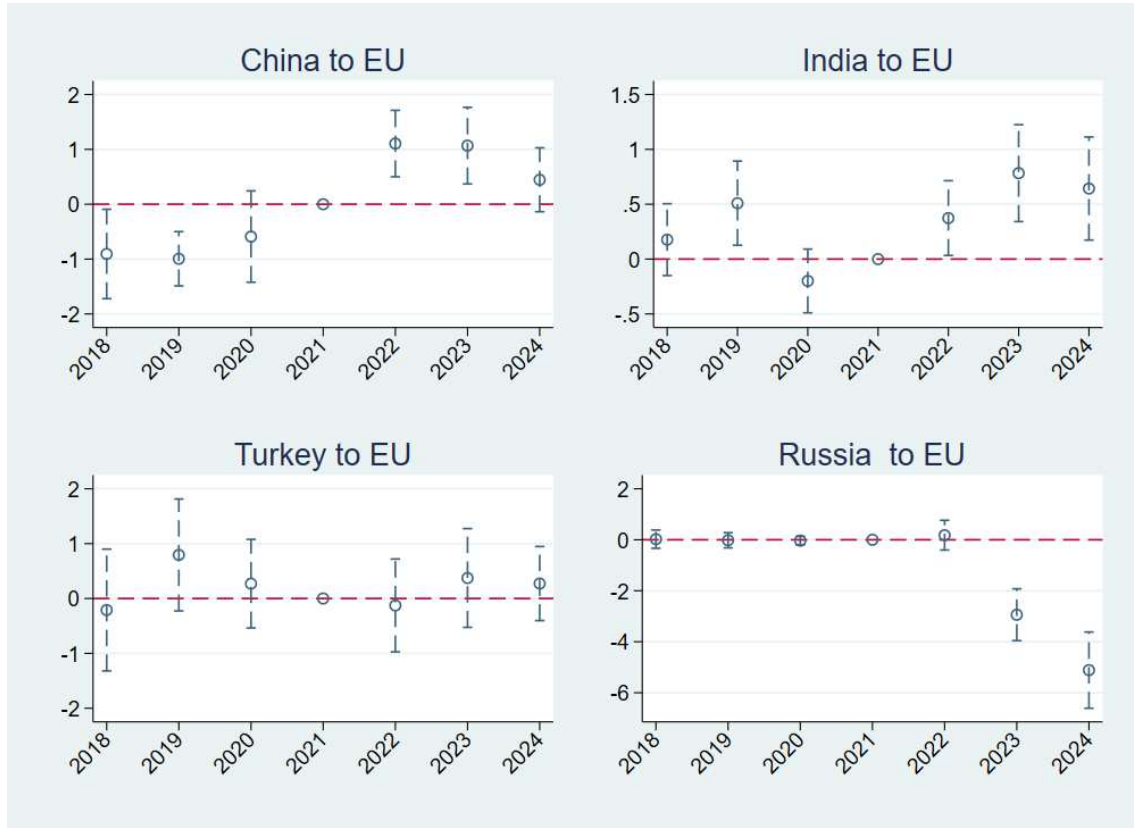
We next address the concern that aggregate results may mask heterogeneity across intermediary exporters. We extend equation (2) to estimate the following model:

$$E_{ijt} = \exp \left(\gamma + \sum_h \sum_{k \neq -1} \delta_{hk} RI_h \cdot EU_j \cdot \mathbf{1}(t = 2022 + k) + \lambda_{ij} + \varphi_{it} + \rho_{jt} \right) \cdot e_{ijt}, \quad (3)$$

where E_{ijt} is the value of refined petroleum products. RI_h is a dummy variable for each refining intermediary exporter—China, India, and Turkey. The coefficients δ_{hk} show heterogeneity across intermediary exporters, and this specification provides a test of the hypothesis that these countries play an intermediary role in sanction circumvention of Russian crude to varying degrees. To account for the substantial decline in EU imports of these goods from Russia from 2022, we also estimate the coefficients δ_{hk} for Russian exports to the EU.

Figure 6 presents event study plots for individual intermediary exporters, including Russia. The results indicate that post-invasion coefficients are significant and positive for China and India, but not for Turkey. EU imports of refined petroleum products from China and India increased sharply from 2022, coinciding with the timing of the EU's sanctions. Additionally, the EU imports of refined petroleum from Russia significantly decreased in 2023 and 2024 after the EU embargo took full effect. Taken together, these trends support the hypothesis that China and India emerged as key intermediaries in rerouting discounted Russian crude into the EU, thereby circumventing the EU sanctions. In Appendix, we present data for a surplus of refined petroleum products in India, consistent with the India's role of refining intermediary exporter.

Figure 6. Event-Study Plot for Refined Oil Export by Exporter



Notes: Event study plots show the estimated coefficients δ_{hk} from the Poisson pseudo maximum likelihood result of the empirical model: $E_{ijt} = \exp(\gamma + \sum_h \sum_{k=-1} \delta_{hk} RI_h \cdot EU_j \cdot \mathbf{1}(t = 2022 + k) + \lambda_{ij} + \varphi_{it} + \rho_{jt}) \cdot e_{ijt}$, where E_{ijt} is the value of refined petroleum products. RI_h is a dummy variable for refining intermediary exporters, including Russia. 95% confidence interval is shown for each coefficient. Source: Authors' calculation using the UN Comtrade.

6.3. Non-EU importers

Non-EU countries also imposed sanctions on Russian crude and refined oil products and price caps to reduce Russia's export revenues: e.g., the U.S., Canada, Australia, and Japan.¹⁷ This policy coordination raises a question of whether sanctioning non-EU countries also increases refined oil products from intermediary countries at a similar time. To this end, we estimate the following model for exporter i , importer j , and year t :

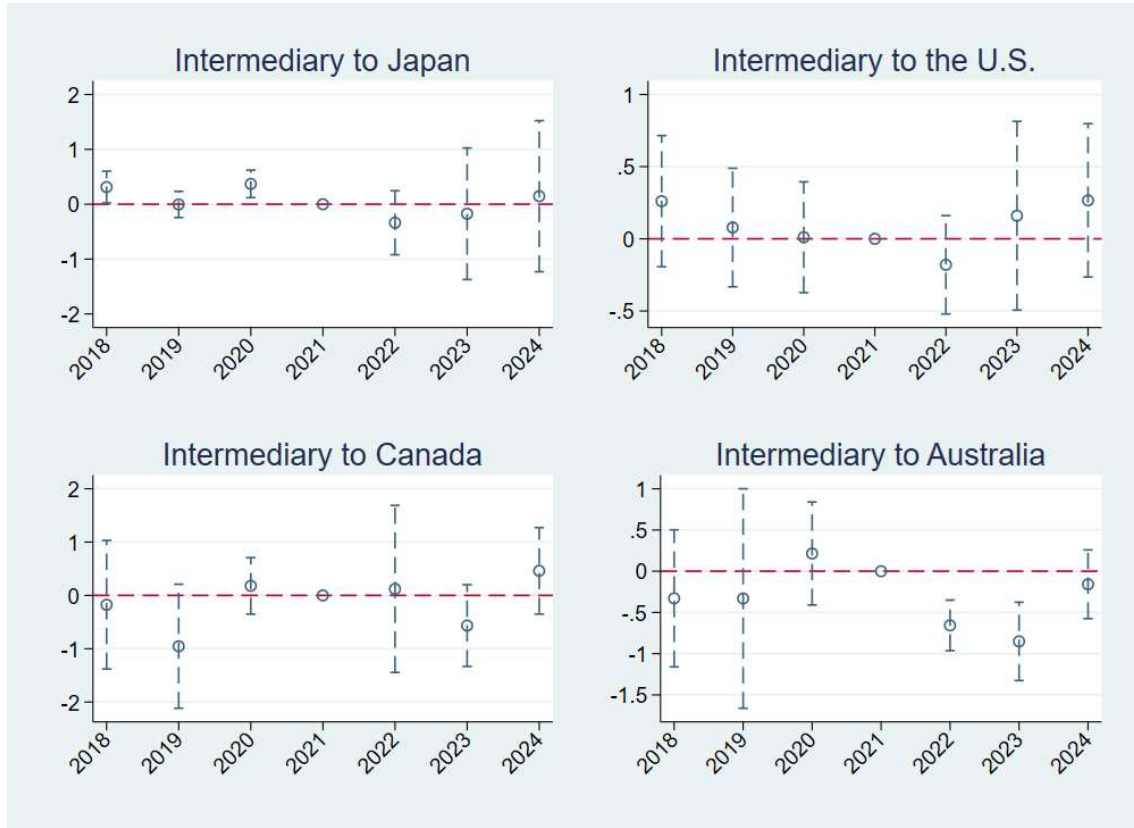
$$E_{ijt} = \exp \left(\gamma + \sum_g \sum_{k \neq -1} \psi_{hk} RI_i \cdot NonEU_g \cdot \mathbf{1}(t = 2022 + k) + \pi_{ij} + \chi_{it} + v_{jt} \right) \cdot u_{ijt}, \quad (4)$$

where E_{ijt} is the export value of refined petroleum products, and $NonEU_g$ is a dummy variable for non-EU importers, including Japan, the U.S., Canada, and Australia. The coefficients ψ_{hk} capture a dynamic trend in imports of refined oil products from intermediary countries into non-EU countries, providing a test of the hypothesis that these non-EU countries receive refined oil products made from Russian crude through refining intermediary countries following their sanctions against Russian oil.

Figure 7 presents event study plots of the estimated coefficients ψ_{gk} from equation (4). The post-invasion coefficients are not significant for Canada, Japan, and the U.S., suggesting that intermediary countries did not significantly increase their exports of refined oil products to these countries following the invasion. Meanwhile, the post-invasion coefficients are significant and negative in Australia, suggesting a significant decline in Australia's imports of refined oil products from the intermediary countries. Thus, these results present no evidence that sanctioning non-EU countries engage in roundabout imports of refined oils made from Russian crude.

¹⁷ These measures restrict imports of Russian oil, LNG, and coal in the U.S. from March 2022, Russian crude oil in Canada from March 2022, Russian crude oil and other energy products in Australia from April 2022, aligning with the G7 price cap from late 2022.

Figure 7. Event-Study Plot for Refined Oil Export by Non-EU importer



Notes: Event study plots show the estimated coefficients ψ_{gk} from the Poisson pseudo maximum likelihood result of the empirical model: $E_{ijt} = \exp(\gamma + \sum_g \sum_{k \neq -1} \psi_{hk} RI_i \cdot NonEU_g \cdot \mathbf{1}(t = 2022 + k) + \pi_{ij} + \chi_{it} + v_{jt}) \cdot u_{ijt}$, where E_{ijt} is the value of refined petroleum products. RI_i is a dummy variable for refining intermediary exporters. $NonEU_g$ is a dummy variable for non-EU importers, including Japan, the U.S., Canada, and Australia. 95% confidence interval is shown for each coefficient.

Source: Authors' calculation using the UN Comtrade.

6.4. Placebo Tests of EU Sanctions

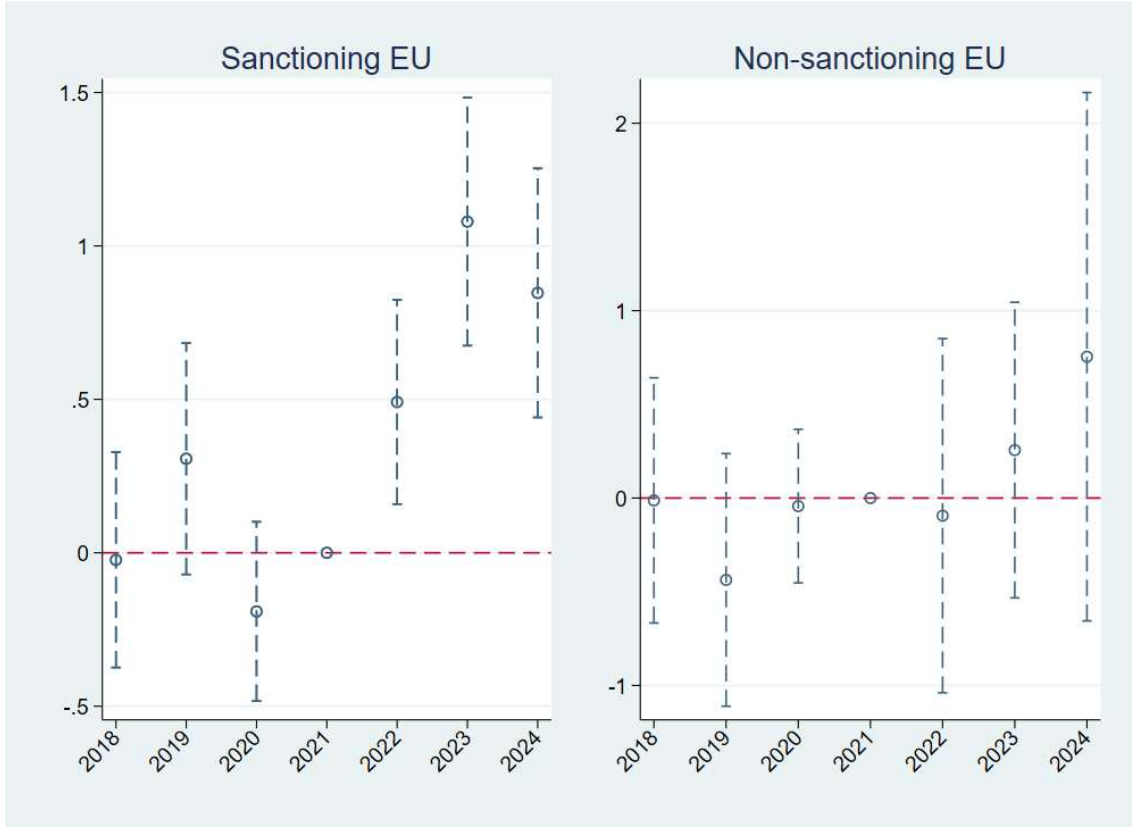
There remains a concern that unobserved heterogeneity in the EU market could explain a surge in imports of refined oil products from refining intermediary countries. Since this issue weakens our interpretation of sanction circumvention, we conduct placebo tests to check whether the EU's sanctions are a crucial determinant of roundabout inflow of Russian oil. Specifically, we exploit the fact that EU members such as Czechia, Hungary, and Slovakia are exempt from the EU's embargo on Russian oil: as these countries depend heavily on pipeline supplies for their energy supply, they were allowed to continue importing Russian crude via the southern branch of the Druzhba pipeline (Levi et al., 2025).¹⁸ Because these countries did not impose an embargo on Russian crude, they would not need to import refined oil made from Russian crude via third markets. This suggests that these non-sanctioning EU countries should not increase imports of refined oil from intermediary countries during the post-invasion period, as compared with other sanctioning EU members.¹⁹

To conduct a placebo check, we separate EU importers between sanctioning- and non-sanctioning countries and re-estimate equation (2). Figure 8 shows event-study plots of the estimated coefficients. The post-invasion coefficients for sanctioning EU importers remain significant and positive, while those for non-sanctioning EU importers are not significant. Assuming that sanctioning and non-sanctioning EU countries would experience similar unobserved positive shocks, these contrasting results would not likely be explained by the similar positive shocks in these markets. Thus, the placebo check supports our interpretation that the Russian crude circumvented the EU sanctions via refining intermediary countries.

¹⁸ The southern Druzhba pipeline is the branch of Russia's Druzhba oil pipeline network, which is split from the main line in Ukraine to transport crude oil to central Europe, including Czechia, Hungary, and Slovakia. Meanwhile, Czechia halted imports of Russian crude oil through the Druzhba pipeline in early 2025, which was made possible by the expansion of the Transalpine Pipeline connecting the Italian port of Trieste to Austria and Germany (*Central European Times*, 5 May 2025).

¹⁹ Because Bulgaria imposed a full ban on Russian crude oil on March 1, 2024, it is treated as an EU member state applying sanctions on Russian oil.

Figure 8. Placebo Tests of Non-sanctioning EU Countries



Notes: The event study plot shows the estimated coefficients δ_k^S and δ_k^{NS} from the Poisson pseudo maximum likelihood result of the empirical model for exporter i , importer j , and year t : $E_{ijt} = \exp(\gamma + \sum_{k \neq -1} \delta_k^S RI_i \cdot EU_j^S \cdot \mathbf{1}(t = 2022 + k) + \sum_{k \neq -1} \delta_k^{NS} RI_i \cdot EU_j^{NS} \cdot \mathbf{1}(t = 2022 + k) + \lambda_{ij} + \varphi_{it} + \rho_{jt}) \cdot e_{ijt}$. E_{ijt} is the export value of refined oil products. RI_j is a dummy variable for refining intermediary exporters. EU_j^S and EU_j^{NS} are a dummy variable for EU importers with and without the imposition of embargoes on Russian crude, respectively. Non-sanctioning EU include Czechia, Hungary, and Slovakia. Sanctioning EU includes other EU members and the U.K. 95% confidence interval is shown for each coefficient.

Source: Authors' calculation using the UN Comtrade.

6.5. Alternative Specifications

An alternative approach is to examine whether EU imports of refined petroleum products correlate positively with exporters' import reliance on Russian crude. The import reliance is measured by the import share and the value of Russian crude, respectively. We estimate equation (2) that replaces the dummy variable for refining intermediary countries, RI_i , with the import-dependence variable extending the sample period from 2015 and 2024.

Column (1) of Table 1 shows that the coefficient of the import share interacted with the EU importer dummy is significant and positive, suggesting that EU imports of refined petroleum products from intermediary countries correlate significantly and positively with exporters' reliance on Russian crude. When we restrict the sample period to 2015-2019, the result in column (2) shows that the coefficient of the import dependence is not significant, suggesting that the significant relationship is not observed before the invasion. In column (3), we use the import value of Russian crude and find a significant and positive coefficient, consistent with the result in column (1). The result in column (4) for 2015-2019 shows a significant and negative coefficient. Taken together, EU imports of refined petroleum products increased significantly from exporters with greater dependence on imports of Russian crude oil, supporting sanction circumvention of Russian oil.

Table 1. Results for Import Dependence on Russian Crude Oil

Dependent: value of exports

	(1)	(2)	(3)	(4)
Import share of Russian oil _{it} × EU _j	0.75*** (0.29)	-0.19 (0.44)		
Import value of Russian oil _{it} × EU _j			0.017*** (0.0032)	-0.042* (0.024)
Exporter-importer fixed effect	Yes	Yes	Yes	Yes
Exporter-year fixed effect	Yes	Yes	Yes	Yes
Importer-year fixed effect	Yes	Yes	Yes	Yes
Sample period	2015-2024	2015-2019	2015-2024	2015-2019
No. of obs.	87,138	33,978	87,138	33,978
Pseudo R-squared	0.97	0.98	0.97	0.98

Notes: The results show the Poisson pseudo maximum likelihood estimation for export values of refined petroleum products. The sample excludes Russia and EU exporters. Parentheses show standard errors clustered by the exporter-importer pair. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

6.6. Additional Explanations

We provide additional explanations for the empirical findings. First, Russia's Urals blend is commonly characterized as a medium-heavy sour crude, different from lighter, sweeter crudes such as Brent or West Texas Intermediate (SA Oil, 2019; Öhlinger et al., 2024). The EU had been a primary market for Urals and possessed refineries well-suited to processing medium-heavy sour crude. The EU's post-2022 sanctions abruptly forced Urals to seek alternative destinations, and India and China were particularly well positioned to absorb discounted medium-sour crude because many of their large refineries have high-complexity upgrading units—such as coking and hydrocracking—that enable efficient conversion of heavy, sulfur-rich feedstock into profitable refined products (Kaiser, 2016). These technical and structural features help explain the post-2022 shift in the regional distribution of Russian crude processing.²⁰

Second, EU supply diversification following the invasion may also explain the surge of refined petroleum products from intermediary countries. Prior to the EU sanctions, Russia supplied around 26% of EU imports of petroleum oil products in early 2022, making it the EU's largest external supplier.²¹ The sanctions abruptly removed this supply and forced the EU to source from any exporters with available refining capacity. This diversification shock can mechanically increase EU imports from non-Russian exporters precisely when the sanctions take effect. However, there is little evidence that the main non-Russian suppliers in the post-invasion period—Norway, the US, Libya, Kazakhstan, and Saudi Arabia—increased their import of discounted Russian crude from 2022, suggesting that supply diversification is separate from sanctions circumvention.

7. Conclusion

Following Russia's invasion of Ukraine in February 2022, the EU progressively expanded energy-related sanctions against Russia. However, a loophole in the oil sanctions permits the import of refined petroleum products, even when they are produced from Russian crude. This creates the possibility of sanction circumvention of Russian crude through third-country refining intermediaries, whereby third countries purchase discounted Russian crude, refine it, and legally export the resulting products to the EU. This paper investigates the sanction-circumvention hypothesis by testing two core predictions: first, that Russian crude exports to refining intermediary countries surge after the sanctions; and second, that EU imports of refined petroleum products from those same countries rise in parallel. Using a gravity-model and an event-study framework, we identify systematic shifts in global trade flows of crude and refined oil products surrounding the sanctions on Russian oil, isolating sanction-induced changes from other trade

²⁰ On the EU side, medium-sour Russian Urals was replaced by lighter crude grades such as US light-sweet West Texas Intermediate. Because the lighter crude slate is misaligned with the configuration of many European refineries, their limited capacity to process light fractions forced several plants to cap crude throughput. The resulting reduction in refinery runs contributed to tighter supplies of refined products in the EU (Argus Media, "Lighter Crude Slate Restricts European Refiners," Argus, 11 August 2023).

²¹ See Eurostat, "EU imports of energy products – latest developments," accessed June 29, 2026.

determinants.

The results show a dramatic reorientation of Russian oil trade following the invasion. Russia's exports of crude oil to intermediary countries were stable during the pre-invasion period and surged sharply by 272% in 2022, 5,204% in 2023, and 10,134% in 2024. Meanwhile, EU imports of refined petroleum products from intermediary countries exhibit no significant changes before the invasion, but increase by 63% in 2022, 194% in 2023, and 133% in 2024. The synchronized timing of these substantial shifts supports the hypothesis that the EU sanctions unintentionally enabled the circumvention of Russian crude via third-country refining intermediaries.

There remain unexplored issues for future research. First, trade data cannot identify the precise share of Russian crude embedded in EU imports of refined petroleum products. Because the true origin of refined outputs is unobservable, the exact scale of sanction circumvention cannot be precisely measured. Second, the circumvention mechanism hinges on the refining capacity for Russian Urals crude in intermediary countries, yet actual refinery utilization, technical constraints, and product-mix decisions regarding Russian crude are not directly observable. These limitations leave uncertainty about how much Russian crude is feasibly processed. Finally, the EU has recently taken steps to tighten enforcement and close loopholes in its oil embargo. Assessing the effectiveness of these policy adjustments—and whether they reduce the flow of refined products derived from Russian crude into the EU—remains an important avenue for future work.

Acknowledgements

This study is conducted as a part of the Project “Studies on the Current Issues for Firms’ Global Activities and the Impacts of Foreign Direct Investment” undertaken at the Research Institute of Economy, Trade, and Industry (RIETI). We would like to thank RIETI for the research opportunities. For insightful comments, we are grateful to Naoto Jinji, Banri Ito, Megumi Naoi, Mitsuo Inada, Isao Kamata, Yasuyuki Todo, Eiichi Tomiura, Fukunari Kimura, Kazunobu Hayakawa, Toshiyuki Matsuura, Hisamitsu Saito, Trang Tran, and participants at the RIETI workshop, Hokkaido University, the 2026 JSIE spring meeting, and the 2026 JEA fall meeting. The opinions expressed and arguments employed in this paper are the sole responsibility of the authors and do not necessarily reflect those of RIETI, METI, or any institution with which the author is affiliated. All remaining errors are our own.

Funding

This research received no external funding.

Statements and Declarations

The authors have no relevant financial or non-financial interests to disclose.

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Appendix

A.1. Refined Petroleum Products in Refining Intermediary

An implicit assumption of our analysis is that refining intermediary exporters possess sufficient capacity and a persistent surplus of refined petroleum products. Because domestic demand does not fully absorb this excess supply, the remaining volume is exported—plausibly to the EU. In this appendix, we provide supplementary evidence consistent with the role of these refining intermediaries.

Table A4 reports India's refined-petroleum balance sheet over six fiscal years: production, consumption, trade and surplus. All quantities are measured in million tons. Production increased from 262.9 to 283.8 million tons, while imports remained relatively small compared with production. Consumption increased from 214.1 to 239.2 million tons. Surplus is defined as production plus imports minus consumption, ranging from 82.5 to 95.4 million tons. Exports remained between 56.8 and 65.6 million tons and were consistently smaller than the surplus, suggesting that part of the surplus is absorbed through inventory accumulation or domestic stock adjustments. Overall, India's refining sector produces far more than domestic demand requires, producing a persistent surplus that supports India's role as an intermediary refining hub.

Table A1. Crude Oil Import from Russia into Potential Intermediary Countries

Year	2018	2019	2020	2021	2022	2023	2024
<i>Panel A: Import values in billion USD</i>							
Algeria	0	0	0	0	0	0	0
Brazil	0	0	0	0.02	0	0.21	0.08
China	38.1	37.4	27.7	40.5	58.4	60.7	62.6
India	1.2	1.46	0.93	2.31	25.5	48.6	52.7
Kazakhstan	0.008	0.011	0.004	0.0002	0.0003	0.011	0
Singapore	0.98	0.71	0.08	0.33	0.10	0.13	0
United Arab Emirates	0	0.04	0.02	0.04	0	0.25	0
Turkey	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
<i>Panel B: Import quantity in million ton</i>							
Algeria	0	0	0	0	0	0	0
Brazil	0	0	0	0.04	0	0.31	0.11
China	71.5	77.6	83.4	79.6	86.2	99.6	108.5
India	2.2	2.9	2.6	4.5	37.0	88.9	92.0
Kazakhstan	0.02	0.04	0.01	0.0005	0.001	0.49	0
Singapore	1.7	1.4	0.2	0.6	0.1	0.2	0
United Arab Emirates	0	0.07	0.08	0.09	0	0.4	0
Turkey	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Notes: Turkey does not report crude oil import. A value of zero shows no import.

Source: UN Comtrade

Table A2. Results of Trade in Crude Oil

Dependent: value of exports

	(1)	(2)	(3)
Russia _i ×Intermediary _j ×Year 2018	0.12 (0.17)	0.21 (0.32)	0.21 (0.32)
Russia _i ×Intermediary _j ×Year 2019	-0.00032 (0.12)	-0.082 (0.18)	-0.083 (0.18)
Russia _i ×Intermediary _j ×Year 2020	0.14 (0.093)	0.24 (0.18)	0.24 (0.18)
Russia _i ×Intermediary _j ×Year 2022	1.31*** (0.35)	1.64*** (0.44)	1.67*** (0.43)
Russia _i ×Intermediary _j ×Year 2023	3.97*** (0.65)	3.40*** (0.79)	3.45*** (0.78)
Russia _i ×Intermediary _j ×Year 2024	4.63*** (0.70)	3.84*** (0.98)	3.77*** (0.94)
Exporter-importer fixed effect	Yes	Yes	Yes
Exporter-year fixed effect	Yes	Yes	Yes
Importer-year fixed effect	Yes	Yes	Yes
Russia _i ×EU _j ×Year Dummies			Yes
Sample	All	Excluding EU importers	All
No. of obs.	15,177	8,975	15,177
Pseudo R-squared	0.98	0.98	0.98

Notes: The results show the Poisson pseudo maximum likelihood estimation of equation (1) for export values of crude oil. Parentheses show standard errors clustered by the exporter-importer pair.

Russia_i×EU_j×Year Dummies show a series of interaction terms for Russian exporter, EU importers, and year dummies with the base of year 2021. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Table A3. Results of Trade in Refined Petroleum Products

Dependent: value of exports

	(1)	(2)	(3)
Intermediary _i ×EU _j ×Year 2018	-0.023 (0.18)	-0.026 (0.18)	-0.022 (0.18)
Intermediary _i ×EU _j ×Year 2019	0.31 (0.19)	0.29 (0.19)	0.30 (0.19)
Intermediary _i ×EU _j ×Year 2020	-0.19 (0.15)	-0.19 (0.15)	-0.20 (0.15)
Intermediary _i ×EU _j ×Year 2022	0.49*** (0.17)	0.47*** (0.15)	0.49*** (0.16)
Intermediary _i ×EU _j ×Year 2023	1.08*** (0.21)	0.77*** (0.17)	0.80*** (0.18)
Intermediary _i ×EU _j ×Year 2024	0.85*** (0.21)	0.52*** (0.17)	0.54*** (0.19)
Exporter-importer fixed effect	Yes	Yes	Yes
Exporter-year fixed effect	Yes	Yes	Yes
Importer-year fixed effect	Yes	Yes	Yes
Russia _i ×EU _j ×Year Dummies			Yes
Sample	All	Excluding Russian exporter	All
No. of obs.	80,078	79,150	80,078
Pseudo R-squared	0.97	0.97	0.97

Notes: The results show the Poisson pseudo maximum likelihood estimation of equation (2) for export values of crude oil. Parentheses show standard errors clustered by the exporter-importer pair.

Russia_i×EU_j×Year Dummies show a series of interaction terms for Russian exporter, EU importers, and year dummies with the base of year 2021. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Table A4. Refined Petroleum Products in India

	2019-2020	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025
Export	65.6	56.8	62.8	61.0	62.4	65.1
Surplus	92.6	82.5	91.6	88.1	90.1	95.4
Production	262.9	233.5	254.3	266.5	276.1	283.8
Import	43.8	43.3	39.0	44.6	48.2	50.9
Consumption	214.1	194.3	201.7	223.0	234.3	239.2

Notes. Figures are measured in million tons. Surplus is production plus imports minus consumption.

Source: Ministry of Petroleum and Natural Gas, the government of India.