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The Impact of Shadow Tanker Designations

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- **Designations of shadow fleet vessels have been employed by various members of the sanctions coalition, including the European Union and United States. This analysis finds that these measures have a significant impact, but that their effectiveness differs considerably, with US sanctions more and EU sanctions less disruptive, likely due to differences in their extraterritorial application.**
- **US sanctions drive severe disruptions to activities such as a marked drop in volumes and increase in voyage duration, resulting in structural adaptation to overcome operational constraints. This includes, for example, stronger reliance on STS transfers, voyages with unknown or offshore destinations, use of false flags or reflagging to Russia, and restructuring of port networks.**
- **EU sanctions cause marked volume reductions but are less disruptive to the system's operations, with ships maintaining similar activity patterns and voyage duration increasing only moderately. As China and India continue to accept EU-sanctioned ships, port networks do not need to adapt as much, STS operations rise marginally, and flagging does not undergo significant changes.**
- **Overall, US sanctions lead to a fundamental restructuring of activity patterns, resulting in a more concentrated system in which flows are channeled through a small number of hubs, with heavy reliance on opacity and concealment to avoid enforcement action. EU sanctions, by contrast, trigger more gradual shifts toward third-country actors that are willing to accept higher risks.**

Executive Summary

This analysis examines how US and EU sanctions on shadow fleet vessels have reshaped the maritime transport of Russian oil, focusing separately on crude oil and oil products by assessing changes in volumes, transport efficiency, voyage duration, routing patterns, and the behavior of actors in third countries.

The evidence shows a clear divergence in impact between US and EU sanctions. US sanctions generate immediate and severe disruption across both crude oil and oil products. Volumes collapse sharply, logistics chains are restructured, and transport efficiency deteriorates significantly, driven by longer routes, increased use of intermediaries, and reliance on STS transfers. For crude oil, volumes partially recover over time but within a more complex and less efficient system, whereas for oil products the contraction is so severe that activity largely collapses, limiting the scope for logistical adaptation. **By contrast, EU sanctions lead to more moderate logistical disruption**, with only partial deterioration in transport efficiency, suggesting that vessels largely remain within established operational frameworks. **Overall volumes, however, show a marked and persistent decline**, which illustrates the potential of EU measures in this sphere.

Operational indicators confirm that sanctions affect trade through changes in logistics in addition to volume effects. In the US case, longer voyage durations and increased STS activity signal a fundamental reorganization of transport chains, contributing to sustained inefficiencies. In the EU case, changes in voyage duration and STS use are more moderate, suggesting incremental adaptation rather than systemic disruption.

A key distinction lies in how transport networks adjust. Under US sanctions, trade becomes highly concentrated: the number of active ports collapses, flows are channeled through a small set of hubs, and routing becomes more opaque, including increased reliance on "unknown" destinations and offshore handling. **In contrast, EU sanctions lead to diversification rather than collapse:** the number of ports remains

relatively high, new locations emerge in regions such as West Africa, the Mediterranean, and Asia, and flows are redistributed rather than suppressed. This results in a more fragmented but still functional trading system.

The behavior of market participants further reinforces this divergence. EU sanctions trigger a clear shift toward more flexible and risk-tolerant actors, particularly independent ("teapot") refineries in China, which absorb a larger share of flows. This reflects a structural reorientation of demand. **Under US sanctions, by contrast, both traditional and marginal actors initially withdraw, and the system only partially recovers through a narrower set of high-volume nodes and state-linked channels**, including increased use of the Russian flag registry. Similarly, vessel behavior diverges: US sanctions drive concentration into high-risk flags and greater use of concealment strategies, while EU sanctions lead to dispersion across multiple registries with more limited reliance on false flags.

Methodology

The objective of this research is to evaluate the impact of vessel designations on maritime transport activity. The analysis examines how sanctions affect vessel operations, transport efficiency, and behavioral patterns, and the conduct of third-country actors. Importantly, the goal is not only to measure disruption, but also to identify the additional effect of layered, multilateral sanctions across jurisdictions.

Definitions: A designation refers to the formal listing of a vessel by a sanctions authority, which restricts its ability to enter certain ports, access certain services, and, to an extent, operate within global maritime systems. Consistent with previous KSE Institute analyses, **shadow vessels are defined as those without any known links to oil price cap coalition jurisdictions** (e.g., ownership, management, flagging, and insurance), in order to identify vessels that are structurally exposed to sanctions risk and evasion practices.

Samples: The empirical design is based on mutually exclusive treatment groups. The *first group* includes vessels sanctioned by the United States and the second includes vessels sanctioned by the European Union. To ensure clean identification, the sample consists only of vessels sanctioned by one jurisdiction that do not overlap with sanctions from the other. This avoids contamination from concurrent or sequential designations and helps isolate the effect of each regime. This approach results in **a sample of 144 vessels for the US group and 195 vessels for the EU group**. Designations by other sanctions coalition jurisdictions— Australia, Canada, New Zealand, Ukraine, and the United Kingdom—are not taken into account to identify the groups.

Analysis periods: To ensure causal interpretability, the analysis follows an event-study framework. Each sanction event is examined using a **symmetric observation window of 180 days before and 180 days after designation**. The **wind-down period is excluded** to avoid distortions related to contractual adjustments and transitional compliance. A subset of vessels has been sanctioned for more than 180 days. Therefore, the **post-period** is defined to capture activity beyond this threshold and also consists of 180 days. **The identification strategy combines within-vessel and cross-group comparisons.** *First*, before–after changes are measured at the vessel level. *Second*, a difference-in-differences framework is applied across treatment groups, allowing the analysis to distinguish between broader market trends affecting all vessels and sanctions-specific effects impacting only designated vessels.

Indicators: Instead of relying on a single composite indicator, the analysis uses several outcome variables that capture different dimensions of disruption. ***First*, we assess changes in total volumes of oil transported** by US and EU sanctioned vessels. ***Second*, we estimate how effectively vessels move cargo relative to time** before and after the imposition of sanctions. This indicator—"transport efficiency"—is defined as total cargo transported divided by the number of operational days, with changes in efficiency calculated as the percentage difference between periods. This metric captures whether sanctions lead to longer routes,

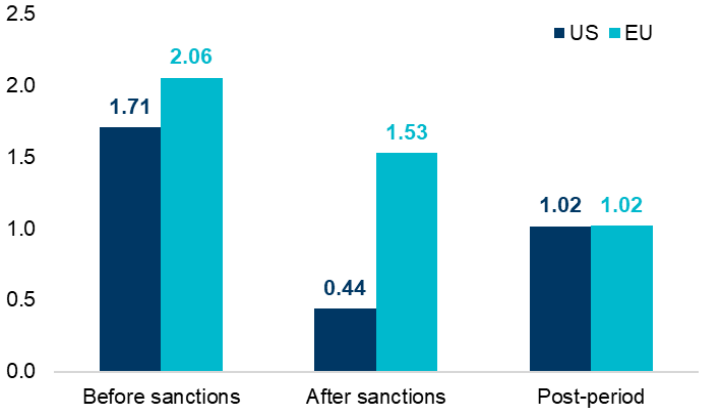
delays, or otherwise less efficient logistics. ***Third*, we look at behavioral adaptation, specifically the use of ship-to-ship (STS) transfers** as an evasion mechanism. The analysis measures the share of voyages involving STS operations, with changes calculated as differences between post- and pre-sanctions shares. Within the context of this outcome variable, we also look at voyage duration, which is closely linked to other indicators. ***Fourth*, we assess how sanctions affect access to destination markets, specifically ports.** A decline in destination ports indicates reduced commercial flexibility. ***Finally*, we look at flag state dynamics**, which are a reflection of the willingness of registries to continue involvement with sanctioned vessels.

Impact of Designations: Crude Oil

Total Volumes

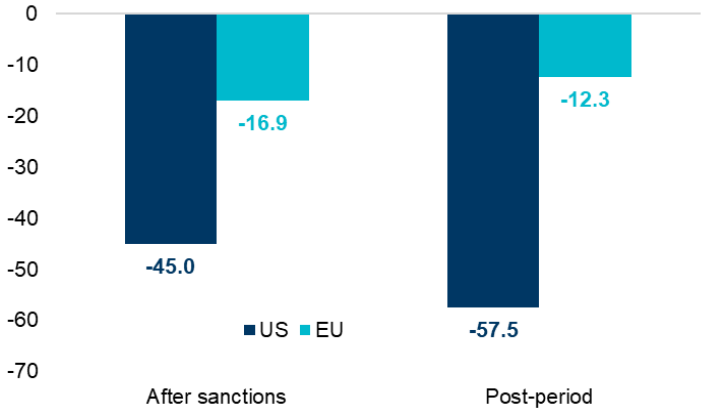
In the case of US sanctions, volumes fall sharply from 1.71 mb/d before sanctions to 0.44 mb/d (-74%) after, **before partially recovering** to 1.02 mb/d in the post-period (-40% vs. before sanctions). **For EU sanctions, the initial drop is less pronounced** with volumes declining from 2.06 mb/d to 1.53 mb/d (-26%), **but there is no subsequent rebound; rather volumes fall further** to 1.02 mb/d (-50% vs. before sanctions). Thus, EU sanctions have a larger and longer lasting effect on volumes, while US sanctions become somewhat less effective after the initial 180 days following the imposition of sanctions (see Figure 1).

Figure 1: Volume transported, mb/d



Source: KSE Institute

Figure 2: Change in transport efficiency, %



Source: KSE Institute

Transport Efficiency

A separate question concerns the efficiency with which cargo is transported. Here the **results differ significantly** from those shown above. As outlined in the methodology section, we divide the total volume transported by the total number of voyage days to calculate a measure of "transport efficiency."

In the US case, transport efficiency deteriorates in a pronounced and lasting way compared to the pre-sanctions period—by 45% in the immediate post-sanctions period and by 57% in the subsequent period (see Figure 2). This means that vessels transport less cargo per voyage day, indicating a less efficient system. The decline in efficiency reflects longer routes, additional handling steps, and more complex logistics chains, rather than optimization. Even though the system contracts in terms of volumes, the remaining flows are not executed more efficiently either. Instead, they require more time per unit of cargo, suggesting that sanctions force vessels to rely on indirect routing, potential ship-to-ship transfers, and less optimal infrastructure.

In the EU case, transport efficiency worsens less—by 17% in the immediate post-sanctions period and 12% thereafter, both relative to the pre-sanctions baseline. This suggests a more controlled adjustment, in

which vessels optimize routing within an already functioning system rather than being entirely forced out of it. The relationship between volume and voyage days remains relatively stable, indicating less disruption.

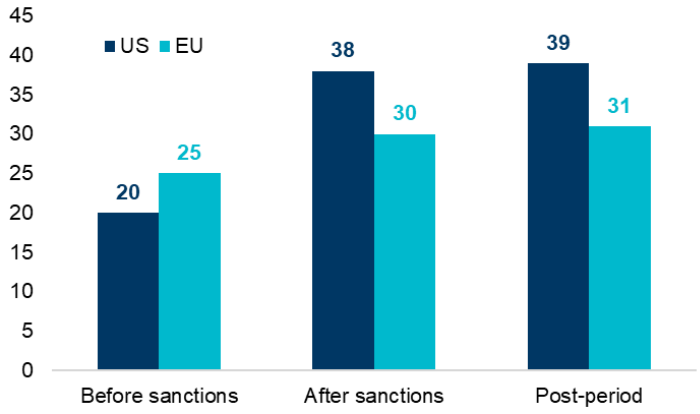
Both regimes show a deterioration in transport efficiency, but the underlying mechanisms differ. In the US case, changes are driven by market exit and route compression following a strong volume shock. In the EU case, they reflect optimization within a still-operational network. This distinction is critical: a smaller decline in transport efficiency does not necessarily imply a healthier system, but rather a restructured one, either through forced contraction (US) or gradual adaptation (EU).

Behavioral Adaptation

The US case shows a sharp increase in voyage duration following sanctions. Average voyage days rise from 20 to 38 and remain elevated at 39 in the post-period (see Figure 3). The effect is strongest in the Black Sea (31 to 60) and Baltic Sea (35 to 56), while even shorter Pacific routes expand. The persistence of longer voyages indicates a structural shift toward more complex and indirect routings. **In the EU case, changes are more limited.** Average voyage days increase from 25 to 30 and stabilize at 31 in the post-period. Regional increases are moderate, with the Black Sea (22 to 34) and Baltic Sea (35 to 44) showing some disruption, while the Pacific remains largely unchanged. Thus, routing adjustments are present but contained.

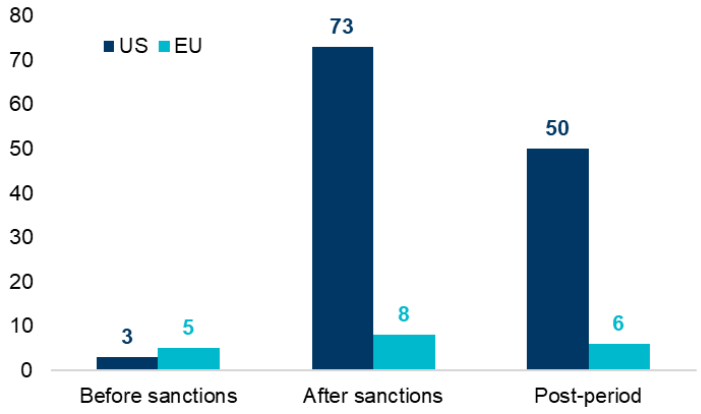
These results align with the transport efficiency findings. In the US case, longer durations directly explain the sharp decline in efficiency, reflecting more complex logistics chains. In the EU case, the smaller increase corresponds to a more limited deterioration in efficiency. Overall, the evidence suggests that sanctions affect efficiency primarily by extending voyage times, with stronger effects under more binding regimes.

Figure 3: Average voyage duration, days



Source: KSE Institute

Figure 4: Share of STS operations, %



Source: KSE Institute

In the US case, the sharp increase in STS activity indicates that sanctions impose binding constraints on operations. The share of STS rises from 3% before sanctions to 73% after, and remains elevated at 50% in the post-period (see Figure 4), while average voyage duration increases. This suggests that vessels are no longer able to rely on standard port-to-port shipments and are forced to adopt longer and more complex transport chains. The scale and persistence of these changes point to a structural shift in logistics, in which STS becomes a primary channel and contributes to a sustained decline in transport efficiency.

In contrast, the EU case shows only limited changes in STS usage and voyage duration. The share of STS increases modestly from 5% to 8% after sanctions and stabilizes at 6% in the post-period, while average voyage duration rises moderately. This indicates that vessels continue to operate largely within conventional transport systems, with only minor adjustments. The absence of a substantial shift toward STS, combined with

moderate changes in voyage duration, suggests that EU sanctions do not impose sufficiently strong constraints to disrupt established logistics patterns.

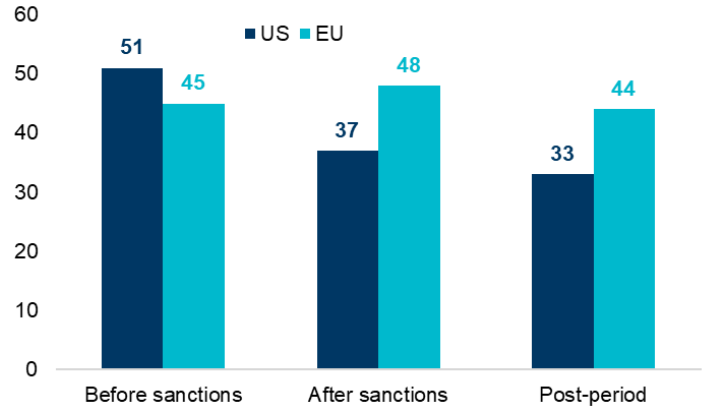
Overall, the results show that STS activity and voyage duration move together and reflect the binding nature of sanctions. In the US case, the sharp rise in STS amplifies the increase in voyage days, as more cargo is routed through longer and less efficient chains, although non-STS voyages also become longer. In the EU case, STS remains marginal and does not materially affect overall patterns. This reinforces the broader finding that sanctions affect maritime efficiency primarily by forcing a reorganization of transport routes.

Port Access

The data show two distinct adjustment pathways under US and EU sanctions, even though both converge to a similar post-period volume. Under **US sanctions**, flows collapse sharply immediately after designation, accompanied by a **reduction in the number of active ports** from 51 to 37, and further to 33 in the post-period (see Figure 5). This indicates a genuine disruption of the trading system rather than simple rerouting. However, in the post-period, volumes recover, suggesting rapid adaptation through alternative logistics, including the likely use of intermediaries, STS transfers and opaque routing. **EU sanctions do not produce a comparable shock**. Volumes decline gradually, but ultimately more strongly, while the **number of ports remains broadly stable** (45 to 48 to 44). This points to redistribution rather than disruption, in which flows are reallocated across destinations without collapsing the network.

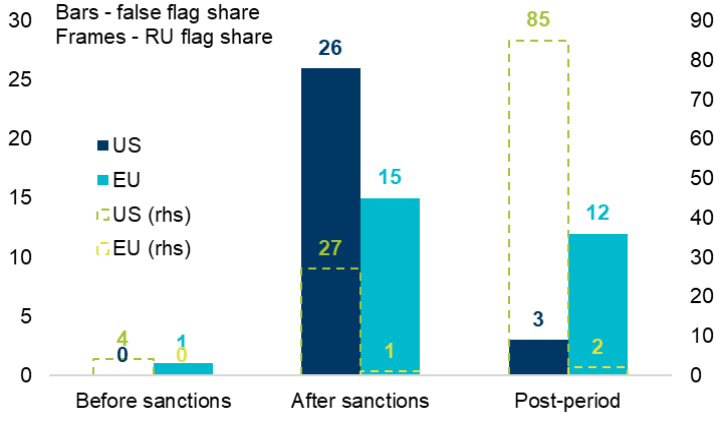
Under US sanctions, the geographical rebalancing is pronounced and concentrated. China emerges as the dominant buyer, absorbing the majority of residual flows, with its share increasing from 58% (2.06 mb/d) before sanctions to 63% (0.66 mb/d) after, before declining sharply to 0.25 mb/d in the post-period while maintaining a similar share. In contrast, India's role contracts significantly, falling from 37% (1.31 mb/d) pre-sanctions to 10% (0.10 mb/d) after, and further to 6% (0.03 mb/d) in the post-period. At the same time, smaller destinations largely disappear, while flows to "unknown" destinations expand from negligible levels to 20% (0.08 mb/d), indicating a growing reliance on opaque routing. **Overall, the US case reflects a sharp concentration of flows alongside increasing fragmentation and opacity in trade patterns.**

Figure 5: Destination ports, number



Source: KSE Institute

Figure 6: Volume share of flags, %



Source: KSE Institute

Under EU sanctions, the geographical distribution of crude oil flows remains relatively stable, with India and China continuing to dominate. India retains the largest share throughout, declining moderately from 56% (1.15 mb/d) before sanctions to 51% (0.78 mb/d) after, and further to 53% (0.54 mb/d) in the post-period. China's share increases from 32% (0.65 mb/d) pre-sanctions to 45% (0.69 mb/d) after, before stabilizing at

41% (0.42 mb/d) in the post-period. In contrast, smaller destinations such as Turkey effectively disappear, while "unknown" destinations expand from negligible levels to 6% (0.06 mb/d), indicating a growing reliance on opaque routing. **Overall, the EU case shows continuity rather than disruption, with core buyers remaining in place and adjustments occurring primarily at the margin.**

The most important structural shift, however, is visible within China itself, particularly in Shandong. **Under EU sanctions, there is a clear reorientation towards independent ('teapot') refining hubs.** Ports such as Dongjiakou, Longkou Chemicals, Shandong Yulong, and Xian Ren Dao increase their relative importance significantly. For example, Dongjiakou's share rose from 3.6% before sanctions to nearly 10% in the post-period, while Longkou Chemicals and Shandong Yulong also saw substantial increases. These are nodes associated with smaller, flexible refiners that are more willing to handle discounted or higher-risk crude. At the same time, traditional large, state-linked terminals show either stagnation or decline in relative importance. This indicates a structural shift in the buyer base, rather than simply a change in geography.

Under US sanctions, the pattern is more compressed and concentrated. Following the initial collapse, flows in the post-period are channelled through a smaller number of high-volume nodes such as Dongying, Yantai, and Gulei, rather than being widely distributed across many teapot ports. This suggests that adaptation under US pressure relies less on broad participation by many marginal actors and more on a narrower set of hubs capable of handling large volumes under constrained conditions. At the same time, the sharp increase in "unknown" destinations reinforces the role of offshore handling and concealment strategies in restoring flows.

The distinction between teapot and state refinery behavior is central to understanding sanctions effectiveness. EU sanctions appear to shift flows towards teapot refineries, increasing fragmentation, flexibility, and opacity of the system. US sanctions, by contrast, initially suppress teapot and state channels, but the system rebounds through a more concentrated and partially opaque network, rather than broad-based participation. In practical terms, EU measures reshape the structure of demand, while US measures temporarily disrupt it before a more resilient—and in some ways more opaque—configuration emerges.

Flagging Dynamics

Before the imposition of **US sanctions**, shipments are concentrated in established flags of convenience, with Panama accounting for 59%, followed by Liberia (15%) and Barbados (4%). After designation, the structure shifts immediately while volumes collapse. **Traditional registries effectively disappear and are replaced by a combination of opaque and high-risk jurisdictions.** In particular, flows move into Comoros (12%) and Comoros-linked false flags (20%), while the Russian flag begins to expand (27%). In the post-period, volumes partially recover, but under a fundamentally different configuration; the **use of false flags declines, while the Russian registry increases significantly**—to 3% and 85%, respectively—with Russian-flagged vessels becoming the dominant channel (see Figure 6). **This pattern indicates a two-stage adjustment, in which initial evasion through opacity is followed by consolidation under the Russian registry.**

In the **EU case**, flows are similarly concentrated in flags of convenience before sanctions, particularly Panama (40%), Barbados (12%), and Sierra Leone (7%). After sanctions, these **registries remain in use**, but there is a **noticeable increase in the use of false flags**, rising to 15% of total flows. At the same time, **alternative but still conventional registries expand**, including Sierra Leone (21%) and Cameroon (15%). In the post-period, the **share of false flags remains elevated** at ~15% and the **Russian registry limited** at 1%. **The overall structure remains diversified, with no dominant alternative replacing traditional flags of convenience.**

Taken together, the **results indicate that vessels respond to sanctions by reflagging, but the form of adjustment depends on the severity of constraints.** Under **US sanctions**, the loss of access to compliant

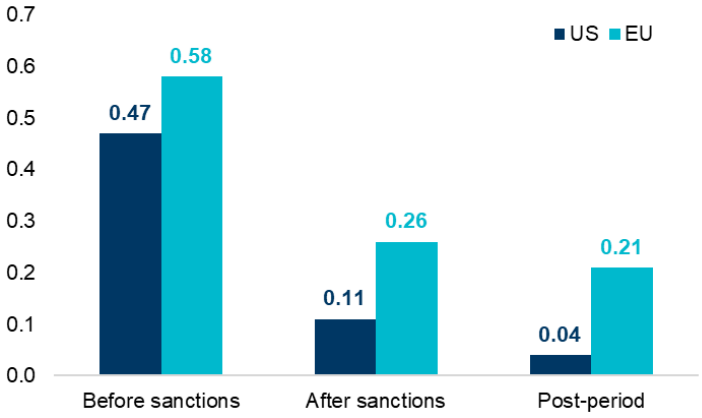
registries leads to a rapid shift into false flags, followed by a transition toward the Russian registry as a more stable solution. This results in a structural reorganization of flows, with a substantial share of shipments rerouted through a parallel system. Under **EU sanctions**, the increase in false flags indicates some level of evasion, but vessels continue to operate across a broad mix of registries, including secondary flags of convenience. The absence of a large-scale shift toward the Russian registry suggests that constraints are not binding enough to force a full relocation of shipping activity. As a result, the US regime produces a systemic transformation of transport patterns, whereas the EU regime leads to more limited and reversible adjustments.

Impact of Designations: Oil Products

Total Volumes

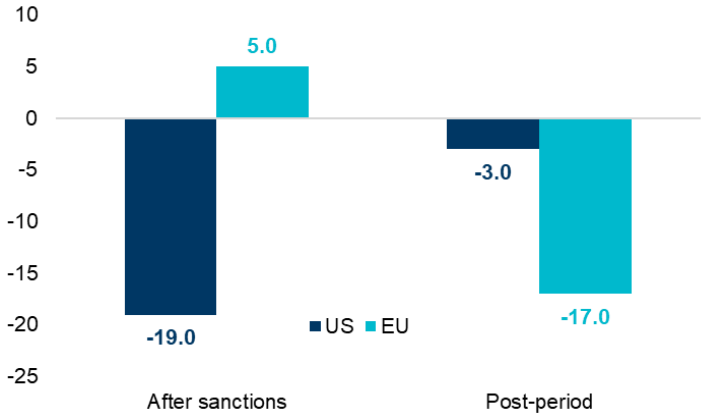
In the case of US sanctions, volumes fall sharply from 0.47 mb/d before sanctions to 0.11 mb/d (-77%) after, before almost completely disappearing at 0.04 mb/d in the post-period (-91% vs. before sanctions). **For EU sanctions, the decline is substantial but somewhat smaller** with volumes falling from 0.58 mb/d to 0.26 mb/d (-55%) and 0.21 mb/d (-64%). Thus, US sanctions have a stronger effect on volumes, almost entirely halting the activity of sanctioned vessels in the transport of oil products (see Figure 7).

Figure 7: Volume transported, mb/d



Source: KSE Institute

Figure 8: Change in transport efficiency, %



Source: KSE Institute

Transport Efficiency

In the US case, transport efficiency deteriorates in the immediate post-sanctions period alongside the drop in volumes, while the relative efficiency improvement in the post-period only affects a small residual volume (see Figure 8). Unlike for crude oil, the adjustment is driven by both reduced activity and weaker logistical performance. **In the EU case, transport efficiency shows a different pattern—**improving slightly in the immediate aftermath of sanctions (+5%) due to short-term optimization, but then deteriorates significantly in the post-period (-17%), indicating that longer-term adaptation involves more complex logistics.

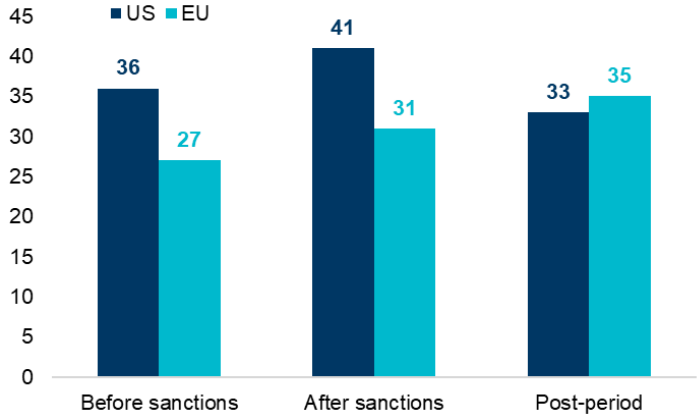
Overall, the results indicate two distinct adjustment dynamics (see Figure 8). **US sanctions** lead to sharp contraction and reduced efficiency, with shorter post-period voyages reflecting declining activity rather than improved logistics. **EU sanctions** allow continued trade but with increasing complexity, in which moderate volume declines are accompanied by longer voyages and eventual efficiency losses. The comparison shows that sanctions affect oil product trade primarily through changes in routing and operational structure, with stronger regimes generating disruption and weaker regimes producing gradual but persistent inefficiencies.

Behavioral Adaptation

In the US case, average voyage duration increases from 36 days before sanctions to 41 days after, before declining to 33 days in the post-period (see Figure 9). This pattern reflects an initial disruption, followed by a contraction of activity rather than optimization. Regionally, the Arctic remains consistently long-distance, increasing from 57 to 64 days in the post-period, while the Baltic shows a moderate decline from 43 to 34 days. The most notable shift occurs in the Black Sea, where duration drops sharply from 37 to 17 days, indicating a collapse of longer routes and a shift toward shorter or residual flows. The absence of Pacific activity in the post-period supports the view that US sanctions significantly reduce geographical reach, concentrating operations into fewer and shorter routes.

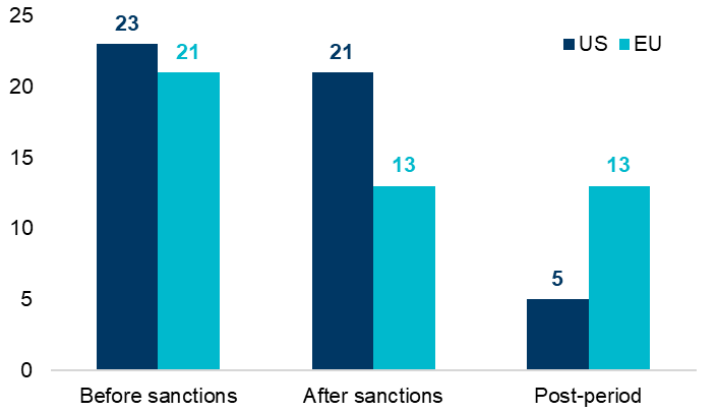
In the EU case, voyage duration follows a different trajectory, increasing steadily from 27 days before sanctions to 31 days after and further to 35 days in the post-period. This suggests a gradual adjustment toward longer and more complex routing rather than a contraction. Regionally, the Arctic remains relatively stable at high levels (51 to 53 days), while the Baltic shows a consistent increase from 43 to 44 days. The Black Sea experiences a moderate increase from 25 to 36 days, and the Pacific rises from 11 to 16 days, indicating that even traditionally shorter routes become more time-consuming. This points to incremental rerouting and additional handling rather than a collapse in activity. **Overall, the comparison highlights two distinct dynamics.** Under US sanctions, voyage duration initially increases but then declines, reflecting a contraction of trade and loss of longer-distance routes. Under EU sanctions, voyage duration increases steadily across regions, indicating continued operation with more complex and extended logistics chains.

Figure 9: Average voyage duration, days



Source: KSE Institute

Figure 10: Share of STS operations, %



Source: KSE Institute

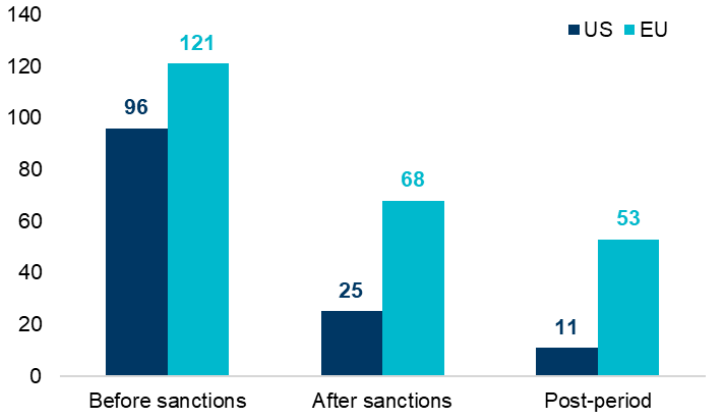
In the US case, STS activity declines alongside the contraction in overall flows, although the effect is less pronounced than in crude oil trade (see Figure 10). The share of STS falls from 23% before sanctions to 21% after and drops significantly to 5% in the post-period, while STS volumes decrease from 0.11 mb/d to 0.02 mb/d and effectively to zero. **In contrast, the EU case shows a more moderate and stable adjustment in STS usage**. The share of STS declines from 21% before sanctions to 13% after and remains stable at 13% in the post-period, while STS volumes decrease from 0.12 mb/d to 0.03 mb/d and stabilize at that level. This indicates that vessels continue to use STS as part of their logistics, even as overall activity declines. The persistence of STS at a meaningful level suggests that the system remains operational and adaptable, with only partial adjustments to routing and handling.

Port Access

Under US sanctions, the volume decline is accompanied by a collapse in unique ports from 96 to 25 and then to 11, indicating strong concentration (see Figure 11). The remaining flows become heavily clustered around a small number of hubs. In the immediate post-sanctions period, key locations include “unknown” destinations (0.02 mb/d), EOPL, Malaysia (0.02 mb/d), Damietta, Egypt (0.01 mb/d), and Jose, Venezuela (0.01 mb/d). These locations are typically associated with STS transfers, suggesting that transactions are increasingly routed through intermediated and less transparent channels. Rather than maintaining a broad network of destinations, flows are compressed into a limited set of logistical nodes that facilitate concealment and operational flexibility under constraints. This implies that sanctions do not eliminate trade, but instead force it into a narrower and more opaque system, in which a small number of hubs play a critical role in sustaining residual flows. STS-linked volumes decrease from 0.06 mb/d before sanctions to 0.03 mb/d after disappearing in the post-period. New locations do appear, but they are sparse and fragmented, often involving smaller terminals such as Sohar, Hamriyah, or niche African ports, and they do not scale in volume terms.

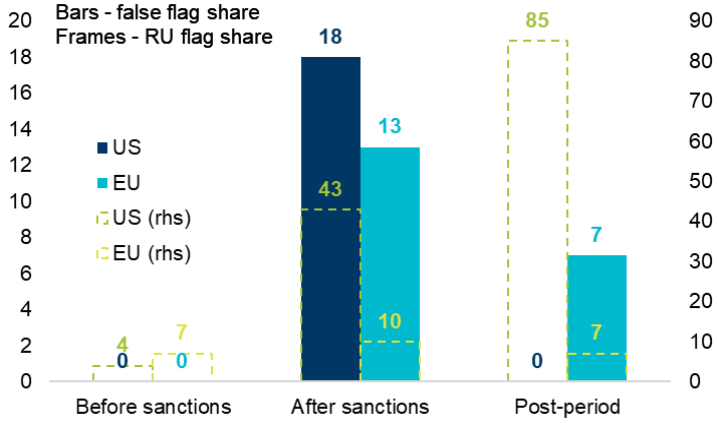
Under EU sanctions, the network remains much broader despite the overall volume decline. The number of ports decreases from 121 to 68 and then to 53, still indicating significant diversification. Flows are distributed across a wider set of destinations, with key hubs including Jamnagar, India (0.03 mb/d after),, Damietta, Egypt (0.02 mb/d), Dongying, China (0.02 mb/d), and Laizhou, China (0.01 mb/d). STS volumes decline from 0.08 mb/d before sanctions to 0.03 mb/d after and 0.02 mb/d in the post-period, suggesting reduced reliance on offshore transfers. New locations are more clearly visible than in the US case, including in Indonesia, and several West African and Mediterranean terminals.

Figure 11: Destination ports, number



Source: KSE Institute

Figure 12: Volume share of flags, %



Source: KSE Institute

Overall, the difference is structural. Under **US sanctions**, trade compresses into a narrow set of identifiable hubs (EOPL, Marmara, Damietta, Jose), with declining volumes and increasing reliance on STS-linked locations. Under **EU sanctions**, flows are redistributed across a broader geography, with multiple mid-sized hubs (Jamnagar, Singapore, Dongying, Laizhou, Damietta) and a wider set of new locations emerging. This shows that EU sanctions trigger diversification, while US sanctions force concentration and dependence on a limited number of logistical chokepoints.

Flagging Dynamics

Under US sanctions, the flag structure compresses sharply alongside the volume collapse. Before sanctions, the system is dominated by established open registries such as Panama (18%), Liberia (26%), and

Gabon (28%). After sanctions, these largely disappear and are replaced by a narrower set of higher-risk or politically aligned flags, most notably Russia (43%), along with Oman (12%) and Comoros (7%). Smaller registries such as Gambia and Guinea also emerge. The overall effect is a clear contraction toward fewer, less transparent flag states, indicating that vessels are being pushed out of mainstream registries into a more constrained ecosystem.

Under EU sanctions, the adjustment follows a different pattern, with the flag structure becoming significantly more dispersed. Traditional registries such as Panama and Liberia lose their dominant positions, yet instead of concentrating, flows spread across a wide range of alternative registries. These include Cameroon, Sierra Leone, Tanzania, Vanuatu, and other smaller or less regulated registries. Russia remains part of the system but with a smaller share than in the US case. This indicates a diversification strategy, in which vessels reflag across multiple jurisdictions to maintain operational flexibility rather than concentrating on a limited set of options.

The false flag component shows distinct dynamics and should be considered separately. In the **US case**, false-flag-linked volumes reach 18% of total post-sanctions flows, indicating substantial reliance on identity manipulation immediately after sanctions (see Figure 12). In the **EU case**, false flags account for 13%, and decline to 7% in the post-period, suggesting that, while misreporting is present, it is less structurally dominant and decreases over time. This difference points to a heavier reliance on concealment under US pressure, compared to a mix of reflagging and partial concealment under EU measures.

Overall, the comparison highlights two distinct responses. **US sanctions drive concentration into a limited set of high-risk flags, while EU sanctions encourage dispersion across a broader registry network.** The evolution of false-flag use reinforces this distinction: systemic under US sanctions, but supplementary under EU sanctions, reflecting different levels of pressure and adaptation pathways in maritime transport.

Conclusions

The analysis shows a clear divergence between US and EU sanctions, with both having distinct but meaningful impacts. US sanctions are more disruptive, sharply reducing volumes, increasing voyage duration, concentrating flows, and pushing vessels into opaque structures, including Russian and other high-risk flags. Even where crude volumes recover, this occurs through a narrower and less efficient system. **EU sanctions**, while less immediately disruptive, have a clear but more gradual structural effect. They reduce volumes over time, maintain broader trade networks, and drive changes in behavior. In particular, simultaneous diplomatic and sanctions pressure from the EU has weakened traditional flags of convenience while increasing reliance on alternative or false registries, signaling growing compliance pressure. Combined with more diversified routing and greater reliance on flexible market actors, this indicates that EU sanctions reshape rather than halt trade, exerting a slower but still significant influence on the maritime system.