cBrief[1] number 2

ISOLATING THE RUSSIAN ECONOMY

THE OVERLOOKED ROLE OF INTERNATIONAL SHIPPING COSTS

Simon J. Evenett[2] and Marc-Andreas Muendler[3]

26 APRIL 2022

Just one-quarter of World Trade Organization (WTO) members, a total of 40 governments, have moved to impose additional tariffs on Russian exports following Moscow's invasion of Ukraine—an outcome that limits the punishment metered out to the Russian economy. This cBrief draws upon the precedent of medium-term sanctions on the Apartheid regime in South Africa, where a combination of trade and investment sanctions as well as elevated international transport costs isolated that nation's economy. We present evidence that sustained, modest increases in shipping costs reduce Russian GDP more over the medium-term than G7 and EU Member States imposing heavy tariffs on Russian exports. Strategies to isolate the Russian economy therefore need to keep the global shipping giants onside.

Three-quarters of the governments that are members of the World Trade Organization (WTO) have chosen not to impose trade sanctions on Russia. Before Russia's invasion of Ukraine, these economies together purchased half of Russia's exports. In the future they are likely to absorb additional exports as the Russian economy adjusts and its trade is diverted towards these destinations. Such considerations attenuate the expected medium-term damage resulting from

---

trade sanctions by the EU and G7 on Russian exports,[4] even if there have been noticeable adverse short-run effects.[5]

Indeed, our first estimates in cBrief 1 were that, if Canada's across-the-board 35% tariffs on Russian exports were copied by the EU and the rest of the G7, then Moscow would suffer a 0.9% GDP fall over the medium term. The WTO Secretariat recently estimated that, if Russia faced higher across-the-board tariffs, its GDP would fall by 2%.[6] Such estimates pale in comparison to the 3.3% GDP gain that Russia was expected to enjoy by joining the WTO in the first place.

Nevertheless, it would be wrong to conclude that the trade channel must contribute little to punishing Russia for its invasion of Ukraine. The experience of nations under long-term sanctions regimes suggests that they face unusually high international shipping costs to and from all their trading partners, not just the sanctioning nations. The effect of such higher shipping costs on all merchandise trade with the isolated nation needs to be taken into account.

The purpose of this brief is to demonstrate that the harm done to Russian living standards by sustained, modest increases in seaborne transport costs easily exceed that from higher tariffs on Russian exports by a group of WTO members. Without denying the gravity of increased tariffs, or financial sanctions against Russia, or any widespread state boycott of Russian oil and gas, here we highlight the contribution that a largely private-sector factor can play in reducing Russian output over the medium term.[7]

We deploy a cutting-edge computational model of the world trading system that incorporates detail on 170 industries (described in the Box at the end of this brief). The model we employ specifically takes account of where industries source parts, components, and energy, thereby allowing for economy-wide knock-on effects from transport cost increases. The upshot of our analysis is that it only takes a 4.5% increase in international shipping costs facing Russian importers and exporters to have the same impact as the 35% across-the-board tariff increases imposed by a quarter of WTO members. More importantly, sustained shipping cost increases in the order of 27.4% would reduce Russian GDP by 4%, the average national income loss found in a recent survey of the impact of comprehensive sanctions packages on 76 nations over the years 1960 to 2016.

---

[4] The WTO reports that, in addition to the European Union, the following 13 WTO members have imposed trade sanctions on Russian exports: Albania, Australia, Canada, Iceland, Japan, North Macedonia, Republic of Moldova, Montenegro, New Zealand, Norway, Republic of Korea, United Kingdom and United States. The EU has 27 members, so a total of 40 WTO members have imposed sanctions on exports from Russia. Note that other nations, such as Singapore, have imposed restrictions on exports to Russia.

[5] Press reports (see Bloomberg) suggest that Russian Urals oil is selling at heavily discounted prices in recent weeks. However, in the first quarter of 2022 Russia's current account surplus nearly tripled to $58.2 billion (as compared to the first three months of 2021). Rising commodity prices, including the price of oil, have cushioned the impact of trade sanctions to date on the Russian current account.

[6] The difference between ours and the WTO estimates is not due to the size of the estimated increase in MFN tariff rates (the WTO assumed such tariff rates would increase 32%). The WTO report does not state precisely which countries are assumed to impose high tariffs on Russian exports. Consequently, differences in the set of sanctioning nations may account for the divergent estimates of the GDP impact. Differences in the underlying economic model used to simulate the impact of such trade sanctions on Russian exports may also play a role.

[7] We write "largely" because some European governments have closed their ports to Russian ships or have announced their intention to do so. This too may increase the cost of shipping goods from Russia to European destinations.

Precedent case: shipping costs and South Africa's isolation under Apartheid

The isolation of South Africa resulting from the sanctions imposed on the Apartheid regime highlights the critical role of international transport costs. In the decade before Apartheid fell in 1990 a total of 25 nations imposed trade sanctions on South Africa. The subsequent reintegration of South Africa into the world economy was associated with a profound reduction in seaborne shipping rates. Properly measured, these freight rates fell by about one-third from the end of the sanctioning period (1986-1991) to the post-Apartheid era (1992-2002).[8]

How might similar shipping cost dynamics play out in the present-day Russian case? Several factors are at work. First, leading shipping companies have significantly reduced the range of products they are willing to transport to and from Russia and are scaling back or selling off their operations in the Russian Federation. Second, the end of rail shipment across the Eurasian landmass has increased demand for seaborne container shipping, putting additional upward pressure on Russia's shipping costs. Third, given the economies of scale inherent in shipping, any declines in Russian export volumes are likely to result in even higher international transport costs. So multi-year increases in shipment costs of goods to and from Russia are on the cards.

Looking at the recent evidence on international freight rates, most indices show that global rates peaked in the fourth quarter of 2021 (or later) and have slightly declined since. Some reports indicate, however, that intra-European rates have risen since the invasion of Ukraine, in particular the cost of shipping containers to and from Russia. Insurance costs have simultaneously gone up for international shipping, especially for vessels passing through the Black Sea. These developments have laid the foundations for elevated international transport costs facing Russia.

We now turn to the economic impact of higher transport costs in absolute terms and in comparison to the effects of announced G7 and EU tariff hikes on Russian exports.
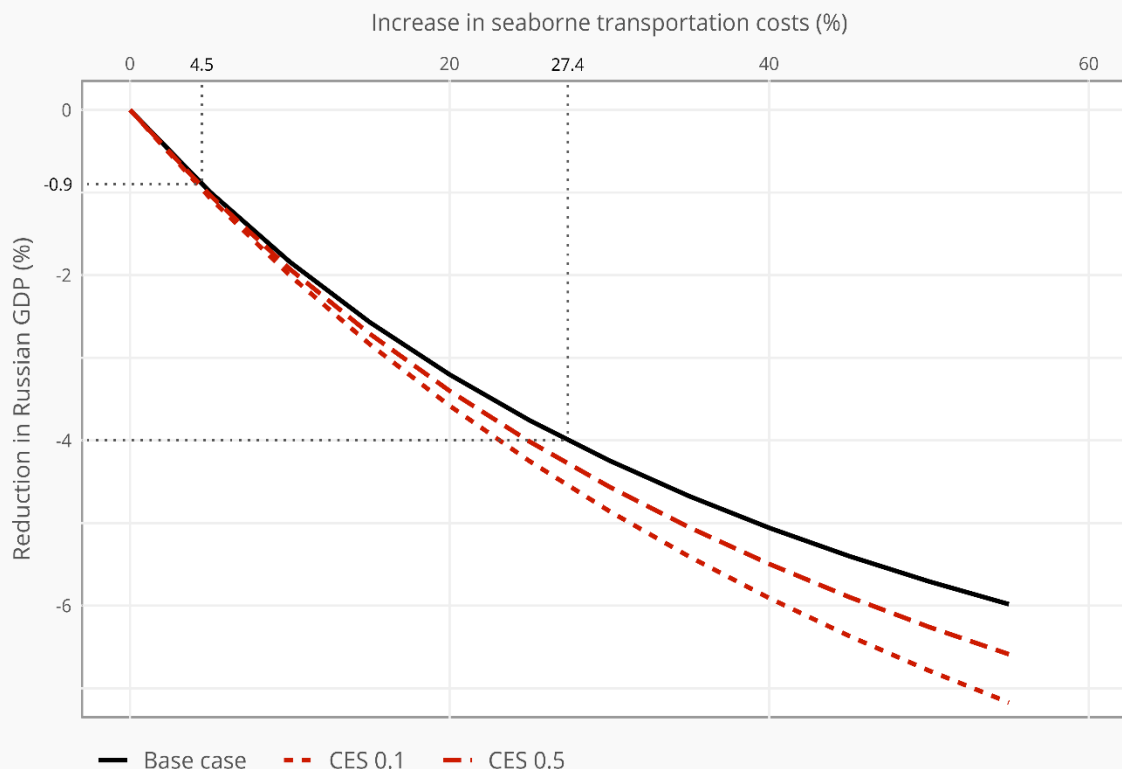
Modest increases in international shipping costs have the same effect as tariff increases on Russian exports by the EU and G7

To measure the impact of increased seaborne shipping costs, we identify the industries with seaborne shipments (applying the relevant [IMF](#) product classification).[9] There are 152 industries in our model where seaborne trade occurs, and they make up about 89 percent of Russian exports and 85 percent of Russian imports. We simulate the effects of increasing across-the-board the international cost of shipping goods in these 152 industries into and out of Russia, while keeping trade costs fixed for the remaining 18 mostly services industries.

---

[8] A widely referenced analysis of South African trade flows at the University of Kawzulu-Natal ([Chasomeris](#), Figure 5.3) shows that seaborne shipping rates faced by South Africa increased markedly as sanctions intensified in the 1980s. reaching double the levels of the 1970s. After the fall of Apartheid a sharp fall in seaborne shipping costs came about.

[9] Electricity generation, maintenance activities and all services industries are examples of industries with no seaborne trade.

UC San Diego

SGEPT

Figure 1: A 5% increase in seaborne transportation costs would reduce Russian GDP as much as the G7 and EU revoking MFN status and imposing 35% higher tariffs across-the-board.

To start, we do not consider differential international transport cost increases across types of cargo vessel (we distinguish between shipping modes in the next section). Instead, we consider common shipping cost increases across all shipping modes of up to 55%.[10] We use our computational model to predict the resulting reductions in Russian GDP as we vary the shipping cost increases. The severity of transport cost shocks to the Russian economy, and to the economies trading with Russia, depends on the flexibility of these economies---formally, on the elasticity of substitution between imported inputs and between the products across industries. In Figure 1 we therefore plot the resulting Russian GDP losses as shipping cost increases vary for a conservative base case of highly flexible economies (rates of substitution of one-to-one for all inputs and products) and two other cases where there is less substitution between inputs and products.[11] Not surprisingly, as

---

[10] Recall South African shipping costs dropped by one-third after the fall of Apartheid. That implies that during Apartheid those shipping costs were about one-half above their "normal" level. 50% is within the range of transport costs increases shown in Figure 1, which range from zero to 55%.

[11] Formally, the elasticity of substitution is taken to equal 1 in the base case and 0.1 and 0.5 in the two other cases.

Russia's economic isolation grows with higher seaborne transportation costs, the hit to Russian GDP becomes more severe.

The first important finding is that it only takes a 4.5% increase in shipping costs for Russian GDP to fall by as much as the estimated impact of revoking Russia's Most Favoured Nation (MFN) status and the imposition of additional 35% import tariffs on Russian exports across-the-board by the EU and the G7. We show that benchmark case in the upper left part of the plot.

The second finding is that the relationship between increasing shipping costs and Russian GDP losses is not linear. It takes a small transport cost increase to reduce Russian GDP by 1% but a much larger shipping cost increase to reduce Russian GDP from 3% to 4%. It is therefore important to consider the cumulation of other measures—including financial sanctions, air transport bans, and tariff hikes to date---that may have taken a toll on Russian GDP already. Raising seaborne shipping costs adds to the trade cost increases from those measures.

In the March 2022 update to its Trade Indicator, the Kiel Institute predicts from real-time seaborne shipping patterns that Russian imports fell almost 10 percent while exports dropped 5 percent when compared to February 2022. Our computation model predicts that such a trade pattern change is associated with a loss of about 1% of Russian GDP and equivalent to an increase of only about 5 percent in across-the-board transport costs for industries using seaborne shipping. In other words, the announced sanctions, which have already raised the cost of trading internationally since the invasion, keep us in the range indicated in Figure 1 where additional transport costs continue to have adverse consequences for the Russian economy. Concerted action on seaborne shipping costs can therefore do a lot of additional damage to Russian living standards.

The third finding follows in part from the second. A 27.4% increase in shipping costs into and out of Russia would result in Russian GDP falling 4%, the average GDP loss associated with comprehensive sanction packages. Indeed, if the isolation of the Russian economy elevates shipping costs to and from that country by the same amount as in South Africa during the Apartheid-related sanctions regime, then changes in shipping costs alone will be responsible for lowering Russian GDP by more than 4%. In summary, the medium-term response of the world's leading shipping firms to the Russian invasion of Ukraine will have important implications for Russian livelihoods.

Findings robust to differential cost increases across shipping modes

Seaborne shipping takes many forms. For a more granular analysis, we differentiate between three main seaborne shipping modes. In this refined analysis we consider 10% increases in transport cost for all 152 industries using seaborne shipping—partly reflecting existing restrictions on air and rail shipment, European port closures for Russian-owned or operated vessels, financial sanctions and select tariff hikes that have already indirectly raised the cost of trading internationally. Table 1 shows, in descending order of GDP losses for Russia, 12 scenarios of trade cost increases beyond the common 10% rise for individual shipping modes. All reported scenarios are based on the assumption that economies are highly flexible (with rates of substitution of one-to-one for all inputs and products), which generates the most conservative (lowest) estimates of GDP loss for Russia.

UC San Diego

SGEPT

Table 1: Reducing Russian GDP by 2% is possible under a wide range of scenarios where shipping cost increases vary across transport modes.

Scenario number	Russian GDP losses with asymmetric cost increases across shipping mode			
	Transport cost increase (%)			Reduction in Russian GDP (%)
	Dry bulk, break bulk and specialized cargo ships	Container and general cargo ships	Oil, LPG & LNG tankers	
1	30	30	10	3.82
2	10	30	30	3.63
3	10	30	10	3.23
4	20	20	10	2.96
5	30	10	30	2.90
6	10	20	20	2.85
7	10	20	10	2.61
8	20	10	20	2.45
9	30	10	10	2.44
10	10	10	30	2.27
11	20	10	10	2.19
12	10	10	20	2.09

The most damaging regime of transport cost hikes is found in scenario 1, where shipping costs rise 30% for industries that heavily rely on bulk shipping or specialised cargo (except oil and gas) and on container shipping. The bulk shipping and specialised cargo segment in the first column of Table 1 is less concentrated than the better-known container shipping market, and the main carriers have so far responded in varying ways since sanctions were announced.[12]

The container and general cargo shipping segment in the second column is the predominant shipping mode in 102 of the 152 industries in our model that use seaborne shipping, and it is highly concentrated. According to the OECD, the top four container shippers alone accounted for more than half of container capacity in 2018, up from less than one-fifth in 1998. Alliances between operators in the container segment are common on multiple routes and may crimp competition. The top two carriers, MSC (Switzerland) and Maersk (Denmark) form the 2M alliance and, together with CMA CGM (France), announced in early March that they are halting cargo bookings to and

---

[12] Dry bulk and break bulk shipping is the main seaborne transport mode in 29 of our 152 industries (following the IMF product classification). Important Russian industries that ship in the bulk mode are metal ore and grain producers, including wheat. Major global players in the shipping sector include Scorpio Bulkers (Monaco), Star Bulk Carriers (Greece), Pacific Basin Shipping (Hong Kong), Golden Ocean (Bermuda), Diana Shipping (Greece), Dampskibsselskabet Norden (Denmark), Western Bulk (Norway), DryShips (Greece), Oldendorff (Germany), and Marine Services (Saudi Arabia). Specialised foodstuff shipping dominates 15 agricultural industries. Chemicals tankers are the main mode of transport in three chemical and pharmaceutical industries. Roll-on-roll-off shipping predominate in the automobile industry.

from Russia until further notice.[13] Raising transport cost for the industries that heavily rely on these two shipping modes—bulk shipping or specialised cargo and container shipping—depresses Russian GDP by almost 4% (3.82%) in scenario 1.

As scenario 2 shows, international transport cost increases of 30% for oil and natural gas producing industries but not for the industries shipping mainly bulk or specialised cargo, would do less harm than scenario 1. Importantly, oil and gas are also transported by pipeline from Russia, so that impeding or discouraging oil and liquid gas tankers from visits to Russian ports might be less effective than in other industries, a factor that makes scenario 1 more realistic than scenario 2.[14]

Scenario 3 involves a 30% increase in international shipping costs in the highly concentrated container shipping market, while all industries with other main seaborne shipping modes suffer a smaller 10% increase. This scenario still cuts more than 3% off Russia's GDP (3.23%). Similar findings arise in the remaining scenarios: transport cost hikes for industries that predominantly ship bulk or specialised cargo, or by container, are more damaging to the Russian economy than comparable transport cost increases for oil and liquid gas tankers.

Even scenarios with modest transport cost increases, such as scenarios 11 and 12, result in a 2% cut to Russian GDP in the medium term. These predictions speak to the effectiveness of seaborne shipping restrictions, especially in the absence of rail, road, and air transport links to Europe.

Two further considerations

There is an important difference between the international transport cost regime experienced by South Africa during Apartheid and potential transport cost regimes facing Russia going forward. Shipments to South Africa by rail and road through the African continent were not plausible substitutes for seaborne transportation. For Russia, rail and road shipments to and from nearby East Asian and South Asian markets may be more readily available over time. Recall, however, the estimated declines in trade flows from the aforementioned March 2022 update to the Kiel Trade Indicator: those findings suggest that substitution to new markets and transport modes was not viable or possible in the near term.

In the short-term, the Russian economy is arguably less flexible than our simulations presume. In the long-term our simulations also likely understate the Russian GDP loss for another reason. In practice, merchandise trade embodies technological advances, and innovation results from shared ideas. Access to specialised components and machinery allows importing industries to advance process and product innovation (for a recent analysis see Bekkers and Góes). Our trade model omits such embedded knowledge flows. When those flows run dry, they may do considerable harm to long-term growth in ways not captured in our computational model.

---

[13] Maersk is ending non-essential shipping, CMA CGM all shipping, including in the Baltics, Black Sea and Far East Russia.

[14] Oil and liquid gas tanker are owned and operated by specialised shipping companies in a market that is also less concentrated than the container shipping market.

Implications for strategies to isolate the Russian economy

The sanctions imposed by 40 governments on Russia following its invasion of Ukraine garnered many headlines. So did the high-profile decisions by some multinationals to suspend or close down their subsidiaries in Russia. In contrast, the suspension of freight services by leading international shipping companies was less in the spotlight. Yet, the resulting increase in shipping costs borne by Russian importers and exporters will, if sustained, most likely have a larger medium-term effect on Russian GDP and living standards than the tariff hikes on Russian exports by a quarter of the WTO membership. The precedent case of the sanctions regime against Apartheid South Africa highlights the potency of these conflict-induced, private sector decisions.

The principal reason why shipping company decisions pack a greater punch is that they affect the cost of shipping to and from Russia for more trading nations than are imposing import tariff hikes on Russian exports. It will take time for Russia and other countries to build additional container ships, or to divert seaborne trade to land-based transport, so elevated transport costs won't be temporary. Consequently, any strategy to isolate Russia within the world economy ought to consider the incentives that keep onside the leading international shipping companies.

At a time of elevated international freight rates and concentrated markets for seaborne shipping modes and routes, global shipping companies may easily bear the forgone revenues from no longer serving Russia. But what happens when these shipping rates overshoot in the opposite direction (as tends to happen in this sector) and global shipping companies come under pressure from shareholders to raise revenues?

The potential private-sector contribution to "punishing Russia" goes well beyond closing down fast-food restaurants, retail stores, distribution centres, and production plants in the Russian Federation. As is so often the case in business and economics, attention to the intermediary is crucial. Seaborne shipping companies can play an outsized role in successful strategies to isolate Russia.

Box: Brief summary of the key features of the simulation model

Marc-Andreas Muendler and Fabian Trottner with Junyuan Chen and Carlos Góes, UC San Diego

The computational model (cModel) employed here is based on the Ricardian trade framework of Eaton and Kortum (2002), with competitive global markets for goods and services and with competitive local factor markets for labour and capital. Goods and services enter production as intermediate goods in addition to their final uses by households and government. In each industry and country, producers combine local labour and capital with globally sourced intermediate inputs and producers offer a set of varieties. An active government in each country collects revenues from taxes and tariffs, while government expenditure is spent on subsidies as well as goods and services procurement. Producers, households and governments globally source varieties within industries from the least costly producers. The simulation algorithm, implemented in Julia, calls equilibrium convergence for mutually consistent producer, household, and government decisions and budgets. Each country's observed net exports or imports (a trade surplus or deficit) are exogenous.

From the ITPD-E data by Borchert et al. (2020), we obtain production and trade flows for 170 supply industries in the benchmark year 2016, including services trade. To account for the input-output relationships across countries and activities, we employ the WIOD data by Timmer et al. (2015) for the year 2014, extracting shares of supply industries by source country in use industries by destination (under Cobb-Douglas production) as well as expenditure shares of supply industries in (Cobb-Douglas) household and government consumption. Using shares of supply industries within use industries preserves positive value added by use industry but can result in negative inventory changes for data consistency. We apply the Wolsky (1984) disaggregation to infer a consistent input-output structure for the 170 ITPD-E industries that map into 38 matching aggregates of the 56 sectoral activities in WIOD. Our model has 43 individual countries plus an aggregate of the rest of the world for mutual consistency between ITPD-E and WIOD datasets. The combined data allow us to infer all shares in production, consumption and procurement. To calibrate elasticities, including industry-specific trade elasticities that measure the responsiveness of trade flows to goods and services prices, we use WITS tariff data for goods and an average tariff to approximate services trade barriers in gravity equations (Head and Mayer 2014).

Detailed cModel documentation is available from the authors (Chen et al. 2022).

References

Borchert, Ingo, Mario Larch, Serge Shikher, and Yoto Yotov. 2020. "The International Trade and Production Database for Estimation (ITPD-E)." USITC Office of Economics Working Paper, 2020-05-C. U.S. International Trade Commission.

Chen, Junyuan, Carlos Góes, Marc-Andreas Muendler, and Fabian Trottner. 2022. "Globalization and Prosperity Lab: cModel." University of California, San Diego.

Eaton, Jonathan, and Samuel Kortum. 2002. "Technology, Geography, and Trade." *Econometrica*, 70(5): 1741–79.

Head, Keith, and Thierry Mayer. 2014. "Gravity Equations: Workhorse, Toolkit, and Cookbook." In *Handbook of International Economics*. Vol. 4, ed. Elhanan Helpman, Kenneth Rogoff and Gita Gopinath, Chapter 3, 131–195. Amsterdam: Elsevier.

Timmer, Marcel P., Erik Dietzenbacher, Bart Los, Robert Stehrer, and Gaaitzen J. de Vries. 2015. "An Illustrated User Guide to the World Input-Output Database: The Case of Global Automotive Production." *Review of International Economics*, 23(3): 575–605. Updated data through 2014 (release 2016).

Wolsky, Alan M. 1984. "Disaggregating Input-Output Models." *Review of Economics and Statistics*, 66(2): 283–291.