Global Economic Policy Lab

Assessing the effectiveness of dual-use goods sanctions against Russia

Russia's invasion of Ukraine Analysts

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Executive summary

In response to the Russian invasion of Ukraine, many countries—representing over 50% of global GDP—have imposed wide-ranging sanctions to punish Russia for the invasion of Ukraine and to impede their ability to wage war. Of particular importance to obstructing Russia's war effort are sanctions on dual-use goods – products that can be used in both civilian and military applications (e.g., GPS systems). Although Russia is a major arms manufacturer, Russian industry relies on foreign components for high-end products and can thus see their ability to continue manufacturing military equipment hindered by sanctions.

Although the sanctions are wide-ranging, 55% of Russian mechanical and electrical imports are from countries not participating in the sanctions. Our analysis of trade data from China and Taiwan suggests that in anticipation of international sanctions, Russia began stockpiling strategic dual-use technologies prior to the invasion. Exports of a wide range of goods including microprocessors, lasers, and radar parts from China have been increasing in the lead-up to the war. There is little evidence of a slowdown in exports to Russia since the invasion began, indicating that countries like China will continue to be a source of dual-use imports. Taiwanese data also demonstrates a significant rise in exports to Russia in late-2021 and early-2022 further demonstrating Russian stockpiling. Russia's imports for the period from December to March increased 57% year-over-year in 2021/22, coinciding with the movement of troops to the Ukrainian border. However, since March, there has been a steep 98% decline in exports to Russia. In other words, Taiwan is complying with international sanctions. Russian military spending further indicates stockpiling as Russia increased military spending by 2.1% in 2021. Furthermore, the "National Defence" budget line increased 14% above what had initially been budgeted. This line accounts for both operations and procurement. While this in part reflects troop movements, it is also illustrative of increased procurement—and therefore stockpiling—in anticipation of sanctions.

Two conclusions for the impact of sanctions on the ongoing war follow. First, **the current sanctions are insufficient to stop Russia's war machine** as third-party countries, like China, continue to supply Russia with the technology they need. That said, the quality of goods sourced from China may be lower than that of other countries, like Taiwan, that are complying with sanctions. This means the quality of supplies Russia will be able to manufacture will be reduced. Secondly, **Russia will likely be able to maintain their war effort longer than initially anticipated** as they were successfully able to stockpile technologies crucial to their military effort. Since it is highly unlikely that sanctions will also induce Chinese cooperation, and even more unlikely that any of Ukraine's allies will go into war for them, the best chance for Ukraine's sovereignty is to be armed with high-end military equipment against Russia's enduring lower end military. To this end, the west needs to not only continue their aggressive sanctions towards debilitating Russian capabilities, but also needs to simultaneously provide Ukraine with the best in technology and equipment.

Introduction

The globally coordinated push to economically ostracize the Russian Federation in response to their illegal invasion of Ukraine has been swift and expansive. The EU, US, Australia, Japan, the UK, Canada and New Zeal and have imposed financial, commercial, and personal sanctions in varying capacities. Together, around 30 nations, representing about 50% of Russian imports and 23% of Russian exports have enacted sanctions.[1] The purpose of these sanctions has primarily been to punish Russia for their unjust and unlawful behaviour and disincentivize them from further pursuing conflict.

A secondary goal, less frequently discussed, is to obstruct Russia's ability to continue waging war. This means limiting the import of weapons, ammunition, military vehicles, and technology that would be going towards any military purpose or function. While straightforward for products that only have a military application, it is challenging when that product could be utilized both for civilian/commercial purposes or for military/non-peaceful purposes. This set of products (increasingly falling under the category of technology) is what is referred to as "dual-use goods." Examples of which include microprocessors, highly specialized lasers, and GPS systems or modules like those manufactured by Swiss company u-blox AG[2]—typically made for civilian end uses like transportation, but found in a downed Russian drone near the border of the Donetsk region back in 2016 following the invasion of Crimea. Dual-use goods could also include materials used towards the manufacture of weapons of mass destruction (nuclear, chemical, or biological weapons), as well as items used for the manipulation of communications (e.g., surveillance technology).

Russian Manufacturing Capability

Hindering Russia's ability to source dual-use goods is crucial because Russia is a major manufacturer of arms and military technology. In fact, Russia is the world's second largest arms exporter—accounting for about 20% of global arms sales from 2016-2020 and around $15 billion in revenue per year over that timeframe. This includes the sale of a wide range of military goods from aircraft to tanks to missiles. Despite this domestic industry, Russia is heavily reliant on imports for the various components used—especially high-end items—in their own manufacturing. Although sanctions will not be able to completely stop the Russian war machine, they will likely hinder production as well as affecting the types of munitions and equipment available to the Russian military as the war continues.

Emerging data indicates that Russian manufacturing does appear to have been impacted by sanctions already. It is believed that Russia could produce as many as 250 tanks a year prior to

[1] Derived at from data from the World Bank's WITS Database. Percentages are pertaining to 2019 trade.
[2] Found in a 2021 report by the Conflict Armament Research organization titled, "Weapons of the war in Ukraine." The organization investigated weapons used towards the invasion of Crimea.

the invasion of Ukraine. However, shortages of some foreign inputs due to sanctions have slowed production since the start of the war leading some tank plants to shut down. One of the biggest challenges for Russia to overcome will be sourcing microchips—key components used in equipment ranging from tanks to missile-guidance systems.

Russia's domestic microchip production capacity is limited: the country relies on imports from the rest of the world for these crucial technological components. Approximately 70% of their microchips, smartphones , and computers are sourced from China, but these are mostly low-end products suitable for civilian applications such as automobiles. Russia's high-end, military-grade chips, like the Elbrus chip, are produced in Taiwan, thus threatening Russia's continued supply of military technology.

Given the importance of semiconductors and microchips to military applications, there has been a push to develop a chip industry within Russia. In partial response to international sanctions, the Russian government presented their plan for the development of said industry in April 2022. Calling for a 3.19 trillion roubles (US $53 billion) investment by 2030, including ₽420 billion on manufacturing technology, the Russian government is looking to reduce reliance on foreign manufacturing of microchips. The government is targeting that by 2030 the Russian industry will be capable of producing 28 nm chips, though multinational companies are currently producing chips as small as 2 nm.

Nevertheless, there are roadblocks ahead. Russia lacks the high-tech manufacturing tools required to produce and fabricate high-end microchips. The production of these tools may very well be disrupted by existing sanctions, further complicating Russia's push for self-sufficiency. Also, Russia does not have enough qualified workers to make self-sufficiency viable—all factors contributing to Russia's considerable lag behind other countries in their ability to produce these advanced microchips. Russia's target for 2030—a 28 nm chip—was achieved by Taiwan in 2011. Even if Russia is successful in developing their own semiconductor industry, they will still be significantly behind the rest of the world and therefore still not capable of producing the most advanced chips. With Russia's current isolation, the goal of establishing a domestic industry seems unlikely, affecting their supply of dual-use technology.

The Wassenaar Arrangement

In the Cold War's aftermath in 1996, the international community agreed on a mechanism to distinguish between strategic dual-use goods, and more common civilian goods. The motivation was to prepare for the eventual situation in which preventing destabilizing accumulations of dual-use goods towards any one side of a conflict was necessary without completely dismantling an increasingly globalized economy or sparking another world war.

The response to this problem was the Wassenaar arrangement—essentially a laundry list of the most strategic conventional arms and dual-use goods currently in circulation meant to be used as a guide for exports controls, as well as a forum for information exchange on conventional

arms and dual-use technology. Currently the arrangement has over 40 members, including the EU, The US, Japan, and Russia itself, who convene annually to update the list. The list currently includes 10 Categories for items:

1. Materials
2. Materials Processing
3. Electronics
4. Computers
5. Telecommunications and Information Security
6. Sensors and Lasers
7. Navigation and Avionics
8. Marine
9. Aerospace and Propulsion
10. Sensitive List (mostly related to nuclear weapons)
11. Very Sensitive List
12. Ammunitions List

Two issues are brought to light by the current invasion in Ukraine—firstly, "The decision to transfer or deny the transfer of any item is the sole responsibility of each Participating State," meaning that the arrangement does not actually mandate export controls. Secondly, all decisions including what items are added to the list are made via consensus—presenting a conflict of interest if any one arrangement member is involved in a conflict as is currently the case.

Foreign Direct Product Rule (FDPR)

One way to circumvent these issues is through legislation such as the United States' FDPR – which allows for expanded extra jurisdictional powers of the US Exports Administrations Regulations (EAR). The rules have gone through some evolution but essentially allow for the EAR to also apply export controls to products which are made in another nation utilizing US-controlled equipment, software, and blueprints. An example of their application is when they were used against Huawei and all related companies, prohibiting any transaction involving these companies when the product in question is manufactured using US-patented and controlled technology or services. The justification for the FDPR has always been National Security and the promulgation of the Wassenaar Arrangement goal of limiting destabilizing accumulations of weapons and dual-use technology.

The rule is enforced through the application of secondary sanctions on entities found in noncompliance with EAR. Licenses are required for products found destined for the defense, aerospace, and maritime industry in Russia and Belarus; or back in 2020, if the transaction involved any Huawei-related company. Naturally, widespread enforcement is hard to achieve by the US alone, but there is a strong disincentive when it comes to entities operating in the technology sector given US technology ubiquity and prominence. Few companies willingly risk being locked out of US capital markets and primary technology markets.

US Sanctions

The US has implemented a diverse set of sanctions against Russia in response to their invasion of Ukraine. These can be broadly categorized as:

- **Financial**—such as collaborating to block Russian financial institutions (FIs) from using SWIFT,[3] and freezing Russian FI's assets while prohibiting US nationals from engaging in transactions with them.
- **Sovereign-debt related**—prohibiting transactions involving the Central Bank of the Russian Federation and other national institutions, effectively freezing sovereign debt trade in secondary markets.
- **Relating to market access**—removing Russia's most-favoured-nation (MFN) status at the World Trade Organization (WTO) and banning foreign investment into Russia as well as service exports**.**
- **Sanctions on individuals**—targeting the Kremlin's elite that are benefitting from the war by freezing their assets and those of their close relatives, along with blocking them from capital markets and from US travel.

Although the US has now abolished Russia's most-favoured-nation status, and consequently raised import tariffs for Russia across the board, of primary interest are the sanctions imposed regarding dual-use technology destined for the defense, aerospace, and maritime sectors on February 24th, 2022. These sanctions are not solely for exports originating from the US itself, but also triggered the FDP rules on exports from third countries that use "US inputs such as equipment, software, and blueprints."

The FDP is paramount in this case, as we find that only about 2.9% of Russian imports originated in the United States in 2020, and only 3.48% when looking at mechanical and electrical imports. It would be inconsequential if the sanctions applied only to products originating from the US. Instead, we have seen a global consensus amongst 30 nations including those in the European Union, US, Canada, Japan, Australia, the United Kingdom, South Korea and New Zealand. Together the coordinated sanctions represent roughly 50% of global GDP, and approximately 45% of Mechanical and Electrical imports into Russia in 2019.

[3] A widely utilized interbank messaging system. More on how SWIFT works here.

Table 1 Russian Total Imports by partner country (USD 000's). Source: WITS.

Partner Name	2015	2016	2017	2018	2019
China	35,200,000	46,300,000	57,000,000	52,200,000	54,100,000
Germany	19,000,000	22,700,000	28,500,000	25,500,000	25,100,000
United States	8,000,000	10,200,000	13,300,000	12,900,000	13,700,000
Belarus	11,500,000	12,100,000	14,300,000	12,700,000	13,400,000
Italy	7,900,000	8,900,000	11,700,000	10,600,000	10,900,000
Japan	6,800,000	7,600,000	9,000,000	8,800,000	9,000,000

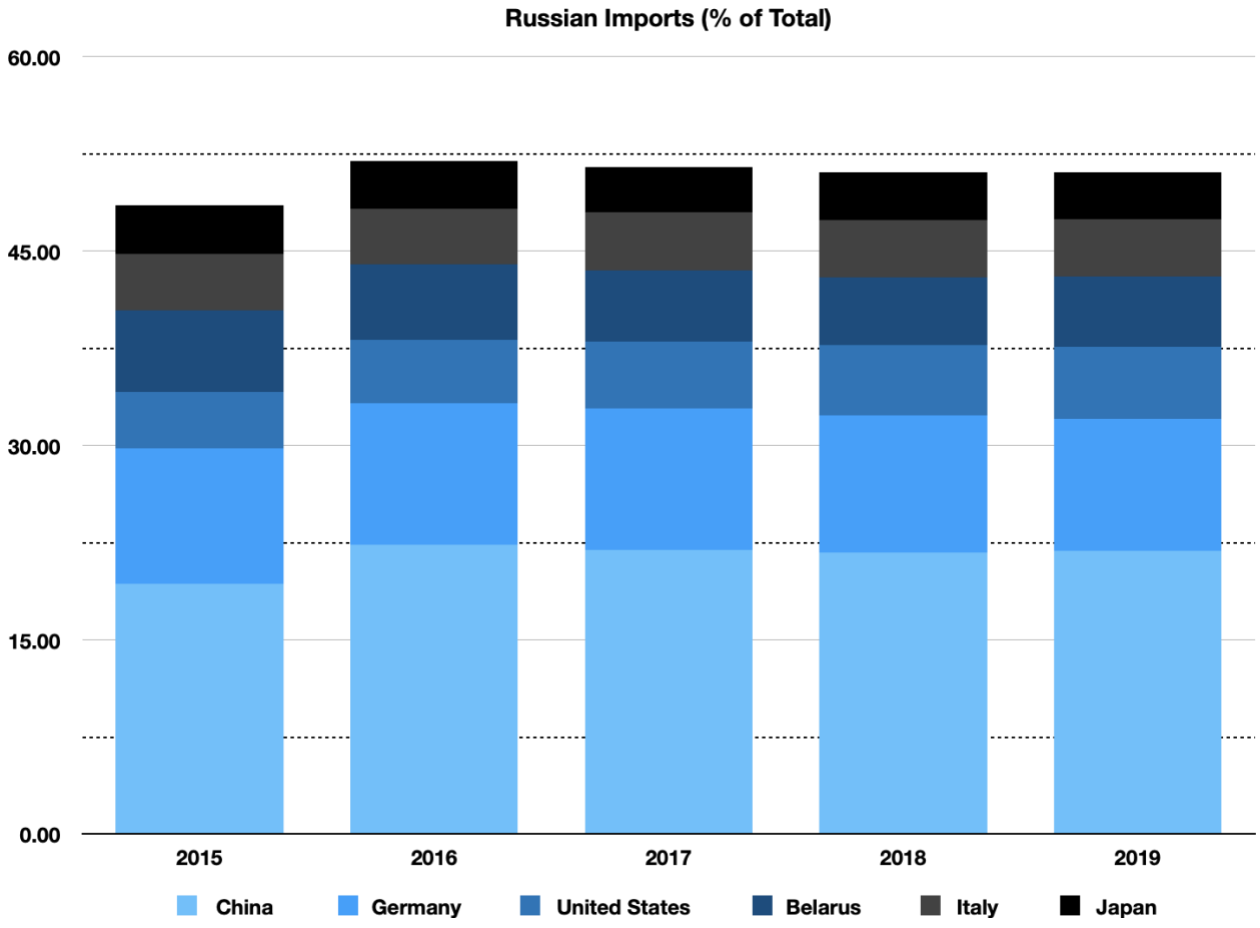
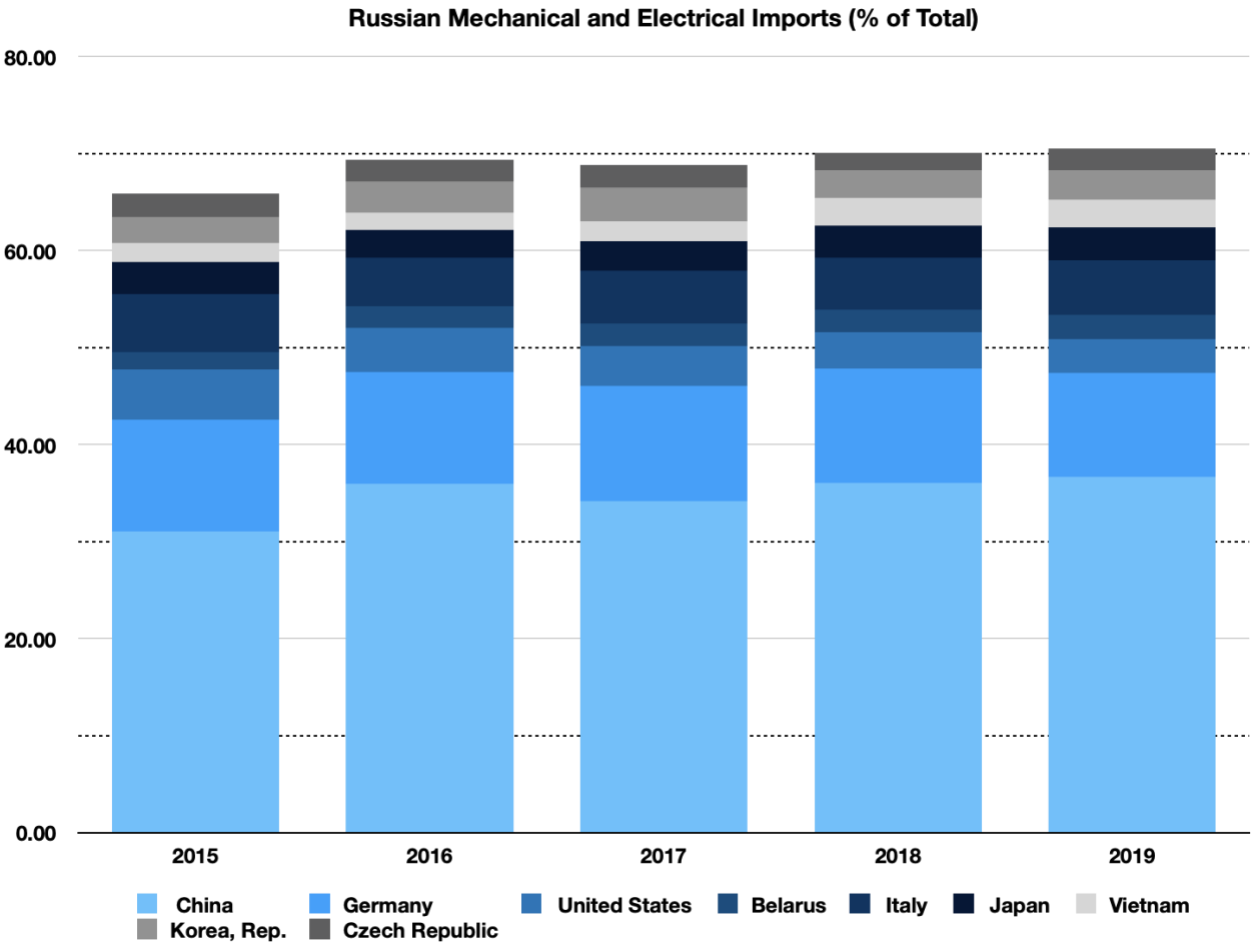


Table 2 Russian Mechanical and Electrical Imports by partner (USD 000's). Source: WITS.

Partner Name	2015	2016	2017	2018	2019
China	17,100,000	27,000,000	32,343,000	26,460,000	26,800,000
Germany	6,350,000	8,700,000	11,200,000	8,650,000	7,820,000
Italy	3,300,000	3,700,000	5,200,000	3,900,000	4,100,000
United States	2,850,000	3,400,000	3,900,000	2,800,000	2,500,000
Japan	1,800,000	2,150,000	2,850,000	2,460,000	2,500,000
Korea, Rep.	1,500,000	2,430,000	3,250,000	2,100,000	2,220,000
Vietnam	1,100,000	1,360,000	2,000,000	2,080,000	2,100,000
Belarus	1,000,000	1,700,000	2,180,000	1,720,000	1,825,000
Czech Republic	1,300,000	1,700,000	2,180,000	1,700,000	1,600,000

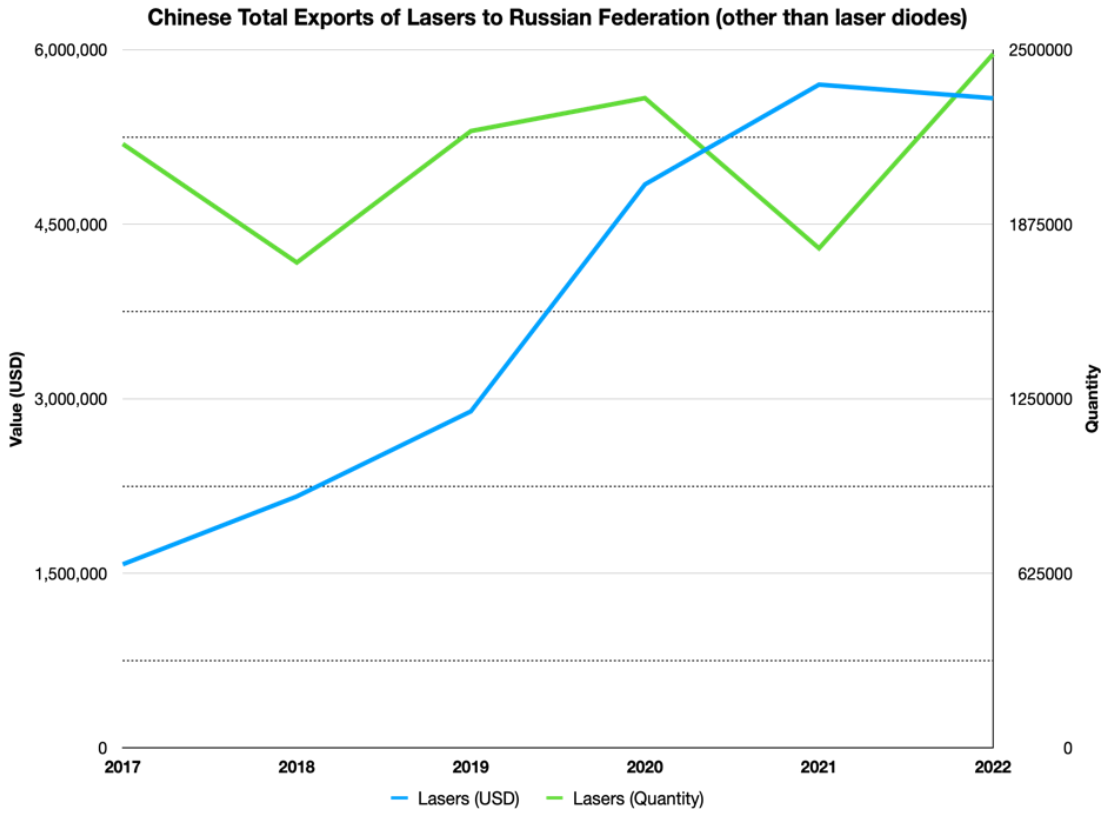


Russia-China Trade

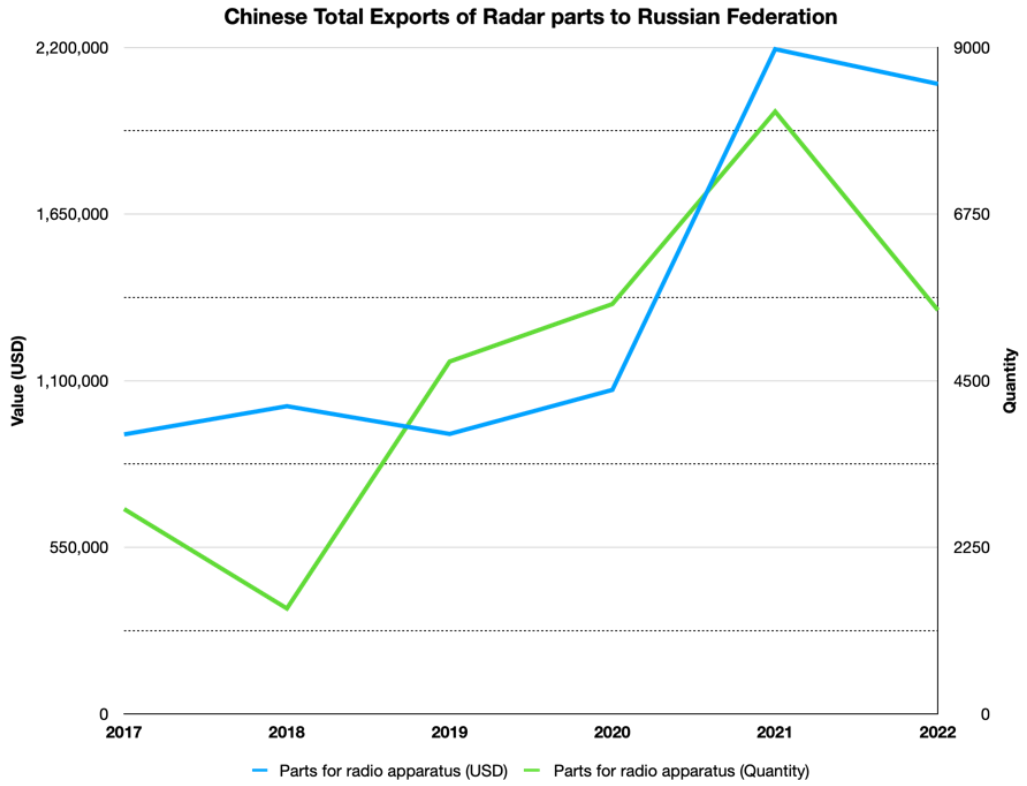
About 55% of Russian imports of electrical and mechanical goods remain unobstructed—of which China makes up the largest portion at 36.72%. The redirection of military imports through countries that have not joined the coordinated sanctions regime due to strategic partnerships or reliance on Russia is one way to bypass the blockade.

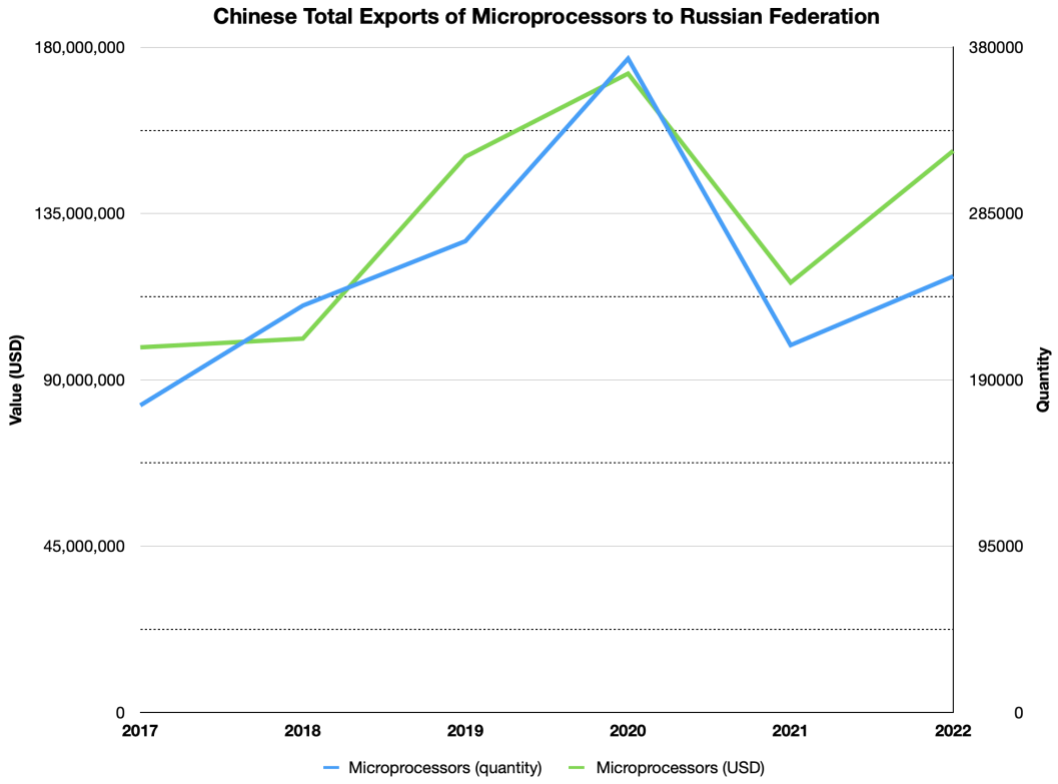
Our GEPL research supports the suspicion that Russia has also anticipated the economic consequences of their invasion for its arms industry. In the same manner that Russia amassed a substantial amount of foreign currency reserves (US $631 billion), much of which is unusually held in gold, to support their war,[4] it seems reasonable to presume some stockpiling of ammunitions, and military technology in anticipation of sanctions.

Drawing on official Chinese trade data to analyze export trends in microprocessors, lasers, and radar parts to the Russian Federation between 2017 to 2022, we find that all three show trends pointing to stockpiling. Nominal quantities increased consistently to 2022, or presumably increasingly more sophisticated technology is imported closer to 2022—taking US$/quantity as a proxy for this. See below for this general trend in the trade data.



[4] Although current sanctions means that they are not able to access about 2/3 of these amassed reserves.





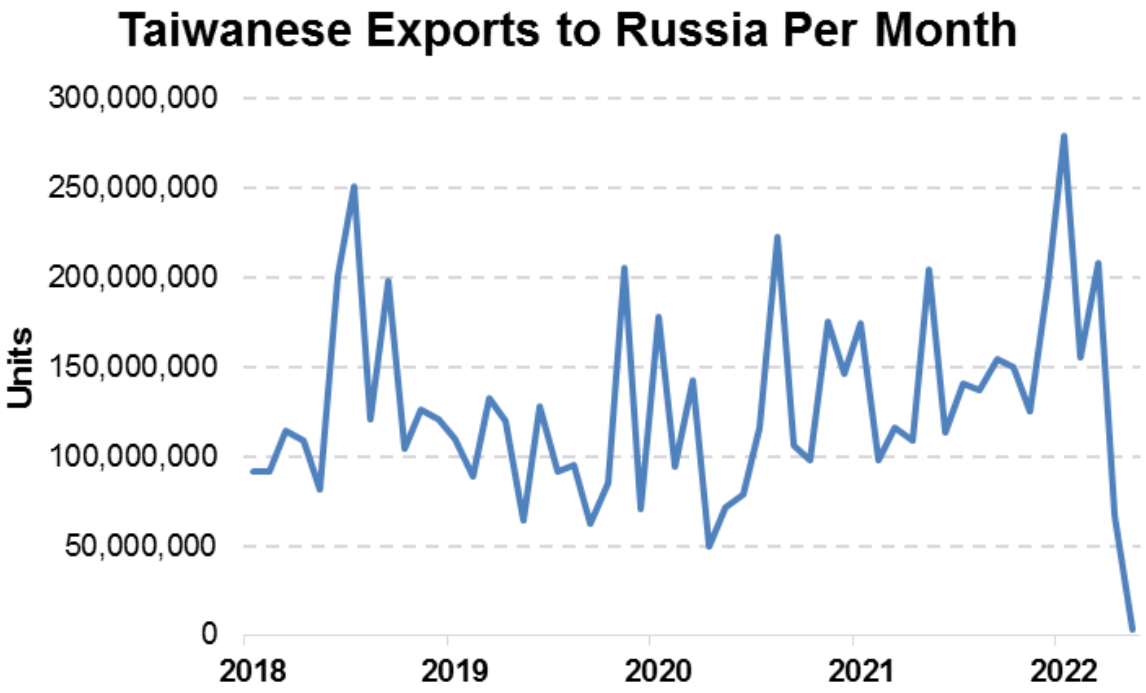
All Chinese trade data from: General Administration of Customs, People's Republic of China

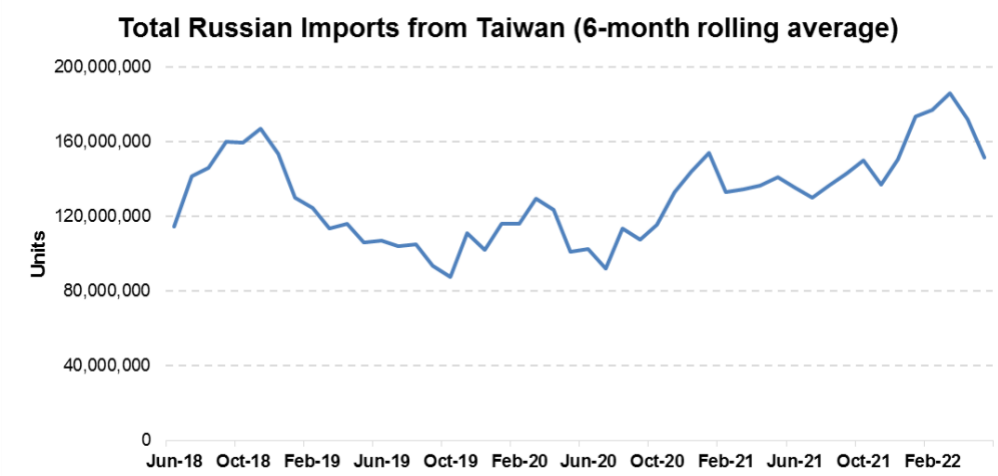
Russia-Taiwan Trade

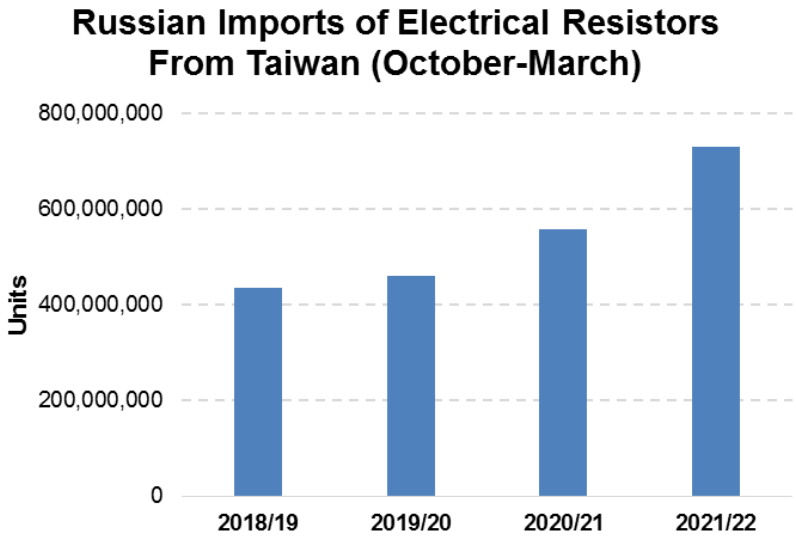
We observed a similar trend that could be construed as stockpiling in trade data from Taiwan. A leading source of electrical hardware like semiconductors, Taiwan is the primary source of high-end electrical components for Russia, including the production of the Baikal and Elbrus chips, the latter of which is a key component for the Russian military. Taiwanese trade data shows a spike in export quantities to Russia in late-2021 and early-2022 which could be due to Russian stockpiling in anticipation of their invasion.

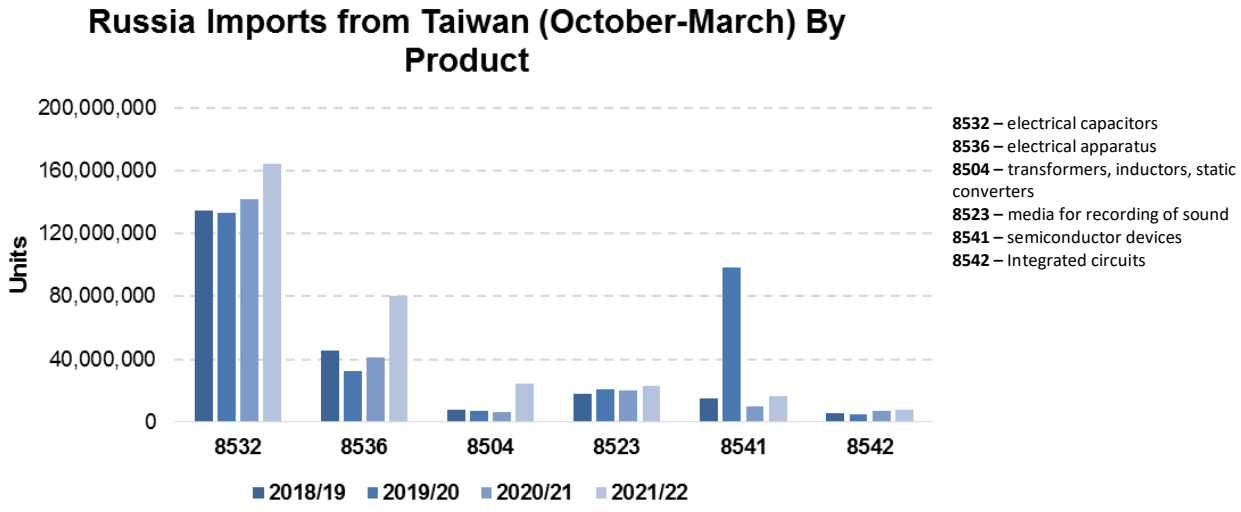
From December 2021 to March 2022, Russian imports from Taiwan increased 57% year-over-year. The level of imports in the first three months of 2022 was 50% higher than the average level of imports in every first quarter since 2018. All of this coincides with the movement of troops to the Ukrainian border from the end of 2021. This is evidence of stockpiling by Russia that, in conjunction with troop movements to an advanced position along the border with Ukraine, should in hindsight have alerted the West of Russia's intentions.

More recently though, trade data for April and May clearly indicate Taiwan's compliance with global sanctions on Russia. Trade volumes fell to just under 3.5 million units in May, a decline of 98% year-over-year. In line with Taiwan's exports to Russia, this decline is concentrated on electrical resistors, electric integrated circuits, and other dual-use goods that could support the continued production of Russian arms and military supplies.









All Taiwan trade data from: Bureau of Foreign Trade from the Directorate General of Customs, Ministry of Finance, Taiwan

Russian Military Spending

Further evidence of Russia's preparation for war and potential sanctions is the increase of military spending by 2.9% in 2021 to US $66 billion or 4.1% of (pre-invasion) GDP.

Although military spending is often compared across countries at current market prices, this fails to account for the disparities in costs that exists between nations. For example, wages in one country may be lower than those in another, meaning measurements should be made at purchasing power parity levels. While Russian military spending in current dollars is about US $66 billion, at PPP levels, estimates for Russian military spending range from US $150 to over US $200 billion, creating a substantially greater capability for research and procurement in comparable terms than a military budget of nominal US $66 billion. The "National Defense" Budget Line—equal to about 75% of Russia's military spending and accounting for operational costs and arms procurement—totaled US $48.4 billion in 2021, which was 14% higher than initially budgeted. While this can in part be explained by troop movements, it is also suggestive of increased procurement.

Conclusion

A preliminary look through the Chinese and Taiwanese export data points not only to the potential stockpiling of dual-use technology in the years prior to the invasion, but also to the immediate shifting of imports away from traditional partners (participating in the sanctions regime) to China and plausibly other countries not interested in abiding with the US's FDP.

We draw two conclusions:

1. **Current sanctions are insufficient to significantly debilitate Russia's war machine**—additional action would be needed against other third-party countries that are facilitating the bypassing of current sanctions.
2. **Early predictions of Russia's war capabilities may fall short, and Russia may have more endurance for this war than expected –** although some manufacturers, including automobile companies; are beginning to face shortages in some foreign components, evidence suggests that the Russian military industry has stockpiled these components and thus will continue to be able to produce military hardware. What is perhaps more likely is a shift in the types and quality of military hardware produced.

While current sanctions are not enough, it is highly unlikely that the west and its allies will mobilize a trade war against China, the world's second largest economy. In addition, even if the flow of dual-use goods manufactured abroad was completely shut off into Russia, the country has a significant capacity to manufacture less sophisticated military weapons. The critical question is whether Chinese-sourced components can supplant Western parts, and whether Chinese firms are willing to risk running afoul of US export controls.

All in all, it remains the that the best option for the West to support Ukraine (and international law) is to continue to equip Ukraine with high-end military technology to counterbalance its strategic disadvantages, and to be able to liberate occupied territories in the medium term.