2023

Global Trade Implications of a Russia and Ukraine-like Conflict Between China and Taiwan

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Submitted to

Professor Fernholz

By

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For

Senior Thesis

Spring 2023

April 24, 2023

Abstract

This paper examines the effects of global trade in general from a Russia-Ukraine-like conflict between China and Taiwan as well as the consequences to the worldwide semiconductor industry. A main component of these effects comes from two assumptions: trade between Taiwan and the rest of the world will cease when the conflict occurs and a group of geopolitically aligned and developed countries called the “Allies” will sanction China across a range of product categories. The main effect of the sanctions is the reduction in imports to China in key strategic goods that help in winning military battles and or promote economic development in technology-driven sectors. These analyses conclude that while the “Allies” will lose significantly in the realm of cheaper manufactured technology, vehicle-related goods, and advanced semiconductors from Taiwan, China will endure hardship in all of the same areas but at a much greater cost.

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Background

The Russia-Ukraine conflict in 2022 was a worldwide shock that ended the once-lasting peace between great powers since WW2. The reason for the conflict according to Russian President Vladimir Putin is to “demilitarize and de-nazify Ukraine” and propaganda networks in Russia support this statement like broadcaster Ria Novosti "denazification is inevitably also de-Ukrainisation", effectively meaning the erasure of the Ukrainian State (Kirby 2022). The origins of the buildup and then full-scale invasion go back to 2014 when Russian-backed separatists fought the Ukrainian government forces over control of the Donetsk and Luhansk regions. Even before any conflict started over Ukraine, Putin and Putin’s former main ideologist Vladislav Surkov claimed Ukraine and its Kievan Rus roots are regarded as the ancestral homeland of Russia. Thus Ukraine is not a state but a part of Russia (Düben 2020). These claims were further promoted when President Putin described the war in Ukraine as a ‘sacred duty to ancestors and descendants’ in his New Year's Eve address in 2023. (Kramer and Troianovski 2022).

Since the start of the conflict, Russia has suffered immense economic consequences. A year out of the conflict, Russia has seen its previously strategic export commodity and political influence wane as gas imports from partners like Europe and other Western are dropping and instead are redirecting their energy focus to alternative forms like nuclear, coal, and renewable energies. Russia is entering back into a state reflective of the Cold War as exports from the West decline, especially in advanced technologies and investment. Russia will also be more reliant on China for any resources it cannot import because of sanctions (Jenkins 2023; Ivanov 2023).

The war is still ongoing in Ukraine, but fears of a larger-scale conflict between China and Taiwan have governments and intelligence agencies speculating about economic and military

scenarios. Recent announcements by Chairman Xi Jinping about military readiness, decreased dependency on strategic international resource imports, increases in the defense budget, and evidence of recent military exercises near Taiwan air space presage a major conflict and economic disaster for the world (Pomfret and Pottinger 2023). US President Joe Biden has responded that the US military will come to Taiwan's aid in the event of an attack, leaders in Europe, Japan, Korea, and Australia have communicated some sort of military or economic repercussions to China in the event of an attack
(Brunnstrom and Hunnicutt 2022; Benner 2021; Atkinson 2023; Kosuke 2022; Brands 2022).

"Reuniting" mainland China with what Xi Jinping views as the "lost province" of Taiwan would help cement Xi Jinping's place in history. Much like Putin highlights blood ties with Ukraine, Xi views Taiwan and mainland China as part of a familial bond (Sacks 2022). More than likely, an event such as a conflict with Taiwan would most likely come within Xi's administration as he has consolidated power to the point where he has ousted any opposition to him in the politburo, making him the most powerful Chinese leader in modern Chinese history outside of Mao Zedong (Graham-Harrison and Davidson 2022)

One of the most crucial elements of a China-Taiwan conflict is its effect on the global semiconductor industry. Taiwan produces over 60% of semiconductors globally and 90% of the world's global advanced semiconductors (*The Economist* 2023). Semiconductors are crucial for advancing technology. With smaller semiconductors possessing faster processing, reduced power consumption, and less heat, it leaves a path for more advanced electronic products, military equipment, and industrial machines, among other computationally driven devices (Markoff 2015). The loss of Taiwan and its advanced semiconductor technology is a significant concern

for governments and has caused countries to start investing heavily in their own semiconductor development (Ravi 2021).

The questions this paper addresses: if there is a China-Taiwan conflict, what would global trade between China, China's adversaries, and the rest of the world look like? What will be the consequences of the disruption of the global semiconductor industry? Using publicly available trade data across a myriad of product categories on the UN's Comtrade website, the analysis will examine the reasons why certain goods are exported/imported more or less from Russia and China after sanctions and which product areas will be a cause of concern for countries reliant on imports of those products.

Literature Review

Because of the nature of this topic being time-sensitive, finding up-to-date information regarding trade between Taiwan, China, Russia, and countries that trade with them can be challenging. Especially on the topic of a Taiwan-China conflict, where studying the question of a possible invasion disrupting global trade (although increasingly relevant) is not studied as there are multiple factors affecting trade that are difficult to predict. Much of the recent literature analyzes the trade and economic consequences for individual countries, industries, and geopolitical relationships. However, *Rhodium Group*'s December 2022 research paper titled "The Global Economic Disruptions from a Taiwan Conflict" delves exactly into this question. Other research analyzes themes to this question but delves into topics outside of global trade.

Taiwan will face heavy consequences whether through a blockade or a full-scale invasion. The major industry affected is semiconductors and especially TSMC, which produces 35% of the world's automotive microcontrollers and 70% of the world's smartphone chipsets. A rough estimate of $1.6 trillion of revenue annually is the total amount to possibly be foregone in the event of a blockade for the semiconductor industry. Regional partners who rely on Taiwanese chip inputs for downstream semiconductor assembly and testing operations would also be harmed, with the Philippines, Vietnam, Malaysia, and Singapore experiencing major disruptions. Related manufacturing components in semiconductor-related value chains would also be disrupted, with major global producers of auto components and vehicles such as China, the US, Japan, and Germany where auto production makes up an important share of GDP would be affected. In fact, during the 2021 semiconductor shortage, average European passenger vehicle production fell by around 13% with German production tumbling by nearly 20% and Italian production by over 25%. Direct investment to and from Taiwan would plummet, with Taiwan

investing $18 billion per year overseas and foreign multinationals repatriating $22 billion from Taiwan in 2021, putting $127 billion in direct investment at risk (Vest, Kratz, and Goujon 2022).

While Taiwan and Taiwan's allies would be severely affected, China would also feel the full brunt of the consequences as well. China's food security would immediately become a problem with China possibly seeing the US cutting some of the 30% of its soybean exports to China that is used to feed China's hog herd, of which makes up 60% of China's total meat consumption (*Nikkei* 2022). Other threats such as the threat of sanctions and a global liquidity crunch, trade finance with China would become at least as scarce as it was in the global financial crisis with the potential to disrupt more than $270 billion in trade between China and the rest of the world (even before sanctions in place). Global and domestic investors would seek to move money out of China, straining China's exchange rate to the degree that even China's strong capital controls and intervention by the PBOC would be unable to fully contain. With a faltering domestic economy, a weaker RMB would reduce China's imports from the rest of the world thereby disrupting technical industries in China that rely on foreign manufacturing parts. Foreign investors are likely to dump their holdings of Chinese securities. As of June 2022, foreign investors held over one trillion dollars in onshore Chinese bonds and equities, and as of September 2022, more than $775 billion in offshore Chinese equities were listed in the United States. In the event of a conflict, investors would shed Chinese securities to reduce their exposure to possible financial sanctions and broader economic risks" (Vest, Kratz, and Goujon 2022).

Other effects studied from the start of a conflict deal with fiber-optic cables. Today there are over 450 cables across the ocean floor and over 1,300 unique coastal landing stations. These sophisticated fiber-optic cables transmit nearly all transoceanic data and digital communications

such as phone calls, emails, and web pages. One report estimates that the daily effect of a temporary shutdown of the internet and all of its services for a highly connected country is approximately $23.6 million per 10 million people. Given Taiwan's population of 23.57 million, the average cost would work out to $55.63 million per day or $1.69 billion per month. The economic effects over time would not be linear and the costs of disruption would quickly escalate if companies were compelled to make larger production adjustments during a sustained conflict. In addition, the South China Sea is one of the world's busiest sea routes. Estimates are that $3.4 trillion in trade passed through the South China Sea in 2016, or 21 percent of the global trade in that year, a significant risk to global supply chains if a conflict were to break out (McDaniel and Zhong 2022).

Looking into the Russia-Ukraine War, there are several events that could be applied to a potential Taiwan-China conflict. For example, while food price forecasts went up by 11 percent on average, the revision in wheat prices was 25 percent, in barley prices it was 38 percent and in sunflower oil prices it was 30 percent – three products in which Russia and Ukraine had a combined global export market share above 20 percent in 2021. The correlation between the combined market share of the two countries and price forecast revisions is 0.47, suggesting that prices increased more for foods for which the two countries have larger market shares. We can see this being the case with China and Taiwan holding a large market share in semiconductors of course, but also electronics and other hardware-related items. Another risk for China that has happened to Russia is the risk of being shut off from high-tech products or parts manufactured in other developed countries. An example such as when the US acted promptly by announcing on February 24th stringent export controls that aimed to severely restrict Russia's access to technologies and other items needed to sustain its military capabilities, primarily targeting

Russia's defense, aerospace, and maritime sectors. The export controls not only restrict trade in US-produced items but also foreign items produced using US technology (for instance, equipment, software, and blueprints). Some of the items under export control are semiconductors, computers, telecommunications, information security equipment, lasers, and sensors. The EU, the UK, Japan, and South Korea have also announced export bans on various strategic goods for Russia, which included high-tech goods and components for use in sectors including electronics, telecommunications, aerospace, and oil refining. Another observation is that Russia's trade has been reoriented from advanced countries imposing sanctions on China, India, and Turkey, three countries that did not impose sanctions. Nevertheless, Russian imports of product categories that include sanctioned products suffered a hit, even from those countries that did not impose sanctions, which suggests that sanctions have had an impact on trade (Darvas and Martins 2022). China would need to reorient its trade to other trading partners (possibly similar partners like Turkey and India), but could not rely on a more advanced economic superpower for trade like Russia has with China.

In my paper, I make use of the analyses provided by recent literature and contribute to this topic further by utilizing statistics from the trade decline with Russia and applying those statistics to a theoretical conflict between China and Taiwan. In addition, I examine the volume of trade commodities between China and other countries to identify the commodities that experience the most significant drop or gain after sanctions are put in place. Finally, I investigate how these sanctions will impact the global trade of semiconductors.

Research Introduction

The purpose of this analysis is to determine the trade and economic consequences of a China-Taiwan conflict assuming similar effects from the Ukraine-Russia conflict can be applied to China. There have been articles examining just some of the economic consequences of a war between Taiwan and China or a blockade of Taiwan, but current literature highlights only certain key industries such as semiconductors and other lower-level consumer electronics and parts. I want to do a broader analysis looking into two parts of the scenario: the global trade consequences in general and a deeper analysis of the semiconductor industry.

The global trade consequences section utilizes evidence from sanctions applied to Russia from geopolitically aligned countries against Russia called the "Allies". I take the percentage drop in "Allies" imports and exports of trade goods categories to and from Russia and apply the same percentages to China in the event of a conflict between China and Taiwan. I base the sanctions on the Russia-Ukraine War as Russia and China are strategic allies with a "no limits partnership" (*Foreign Affairs Committee* 2023), China and China's adversaries are technologically decoupling (*Business Today* 2022; Tominaga 2022; Bateman 2022; Fabry 2022) and recent military exercises around Taiwan by the PLA have influenced support for Taiwan militarily in the case of a conflict (Cheung 2023; *Euronews* 2023).

The analysis into the semiconductor industry utilizes Comtrade data and specifically looks at HS code 8542: "Electronic integrated circuits". While this HS code encompasses semiconductors in general and not necessarily advanced ones, it provides a picture of the reliance of the world on Taiwan for semiconductors and the drastic consequences for China if they are not only sanctioned by the "Allies", but also lose the imports of strategic advanced semiconductor technology from Taiwan.

Data Methodology

For the global trade consequences analysis data, I utilized the UN's Comtrade database and downloaded spreadsheets of exports and imports of product categories in 2019 and 2022 between China, Russia, "Allies" and "Neutral". The "Allies" include the USA, Canada, EU, Japan, Korea, Australia, and Taiwan. The rationale for these countries/areas chosen is based on evidence of positive relations between them economically, militarily, and or their involvement in enacting sanctions against Russia. Neutral countries are all countries not in the Allies group. They are called neutral because they will not assist China or the Allies militarily or employ sanctions in a Taiwan conflict and will maintain a course that keeps them from entangling themselves too much on either side.

Some assumptions and adjustments about the global trade consequences section + semiconductors:

1: China includes Hong Kong SAR, Macau SAR, and trade between Hong Kong and China or Macau and China is not accounted for

2: In event of invasion or blockade by China, Taiwan's global trade goes to 0 for both imports and exports

3: As mentioned earlier, % change in total exports and imports between Russia and Allies applies to China and Allies

4: When finding the % change in total exports and imports between Russia and Allies, the difference between trade in 2022 is subtracted from 2019 in order to avoid effects Covid may have had in 2020 and 2021

5: Because Taiwan and Korea had no 2022 trade data, I adjusted the 2019 Russia-Allies trade data to subtract Taiwan and Korea 2019 data and found the % difference in % of exports and imports between Russia and Allies (Australia, Canada, EU, USA, Japan)

6: All trade to and from Russia in 2022 assumes sanctions were in place the entire year, versus starting on February 24, 2022, or days later when Russia officially invaded Ukraine

7: UK is included in the EU trade data for 2022

8: China will not be able to take advantage of Taiwan's advanced semiconductor technology in the event of an invasion

9: Advanced Semiconductors come primarily from Taiwan and any other form of advanced semiconductor technology comes from the other Allies

The reason for Assumption 1 in China including Hong Kong SAR and Macau SAR is that there are certain products and countries that export more to Hong Kong than China. Trade between China and its special administrative regions is not accounted for as the assumption is that in the event of an invasion, the same sanctions on products will be applied to Hong Kong and Macau. Assumption 2 of Taiwan's trade going to 0 would not be the most likely scenario in reality as we have seen grain imports for example being exported to Ukraine as well as weapons and other military-grade equipment being imported to Ukraine from its western border (*Al Jazeera* 2023). However, Taiwan's trade would fall drastically with possibly only minor exports and imports allowed to leave and exit as China would be able to use its navy and air force to patrol the ocean and stop any ships from entering or leaving Taiwan (Buckley et al. 2022). Assumption 3 is a realistic scenario considering the Allies have halted all exports of advanced technology and military-grade equipment to Russia. Assumption 4 seeks to eliminate noise in the trade data associated with Covid. Adjustment 5 did not affect the data drastically when

calculating the percent change in imports and exports with Russia in 2022 because of Taiwan and Korea's distance geographically in trade to Russia and the small trade balance between them. Assumption 6's reasoning is that because I was not able to get trade data for certain months of the conflict and could only collect data representative for the entire year, the model will assume all 12 months of 2022 were as if the Allies sanctioned Russia. The significance of this is that the trade data used for 2022 would possibly be smaller if the first two months of the year were not included, meaning sanctions would have been harsher. Adjustment 7 is used for any calculation between the Allies and Russia or China in 2022 as it simplifies reading the data. Assumption 8 is based on information from Taiwan's National Security Bureau that China in the event of an invasion would not be able to take over TSMC's operation (Zheng and Wang 2022). Assumption 9 is used because nearly all advanced semiconductors come from the Allied countries (Lee 2021) and will be used as a proxy to see how much China relies on imports of technologically advanced goods from the Allies.

To see how calculations were made for each figure, follow this link to this paper's Appendix: (https://docs.google.com/spreadsheets/d/1R1LwnzsJ95yVfrgfwbS59S2B9eVOTYghXJ0bHXM1H2I/edit#gid=0).

All tables and figures in this paper are explained in the appendix as well as raw data used to make calculations. Calculation examples are also done below every set or single bar chart figure in order to provide clarity on how the calculations were done.

Note: Exports in this paper will be defined as trade from "Allies" and "Neutral" to Russia, China, or Taiwan as specified. In other words, we are taking the frame of reference of the

countries who are trading with China or Russia. Imports by this definition are products from China or Russia traded to “Allies”, and “Neutral”.

Data & Analysis

Global Trade Consequences (Russia)

From Comtrade, I downloaded data surrounding the imports and exports of all countries to and from China split into three categories: “Allies” and “Neutral”. I chose the HS Commodity code system and used the AG2 coding method which is a 2-digit code stretching from 1-99 for every product category (https://www.allianceexperts.com/hs-code/). I then simplified the 99 product codes into 12 commodity groups, each of which corresponds to a distinct commodity category.

Codes 1-24, for example, label products like fish, meat, vegetable, and other foodstuffs under “Agricultural, Animal, beverage, prepared foods products”. This section refers to all products that are consumed for nourishment purposes and no products such as edible items are included in the other 11 categories. Another example may be codes 84-86: “Electric Machinery and mechanical equipment, Nuclear, Boilers”. These 3 codes are more technology-driven goods ranging from use for energy purposes to computational power. While they are not as clear cut as codes 1-24 as some products may differ in function, they are put together as they share the identity of technically advanced products that are crucial to the further development of an advanced economy (see Table 1 in Appendix).

To determine the percentage of total exports and imports that dropped due to the imposition of sanctions by the Allies, the initial step is to ascertain the percentage share of each commodity group's total exports from all countries to Russia that the Allies possess, as well as the percentage share of each commodity group’s total imports from Russia to all countries that the Allies possess. Using data from Comtrade for 2019 exported products from the Allies to

Russia and 2019 imported products from Russia to the Allies, we can understand which side relies on which commodity groups. Figures 1+2 were calculated by taking the total imports and exports between Russia and the Allies and dividing it by the total imports and exports between Russia and all countries in the world.

Figure 1: 2019 % Exported Products to Russia from Neutral, Allies by Commodity Group

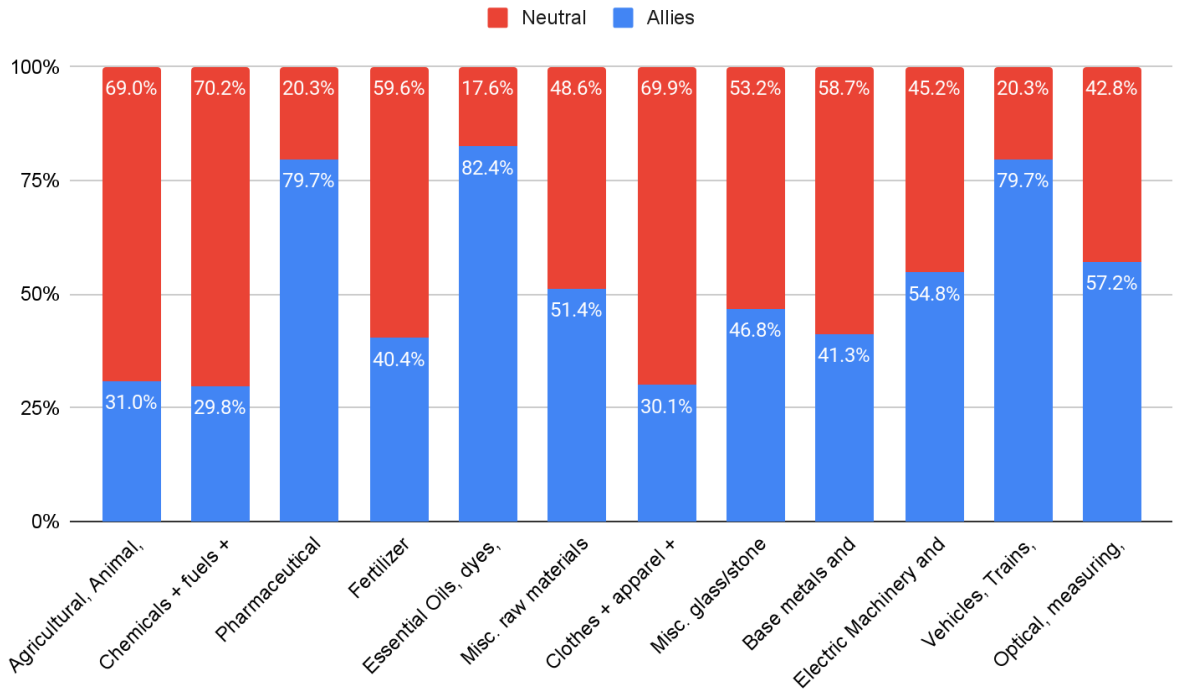
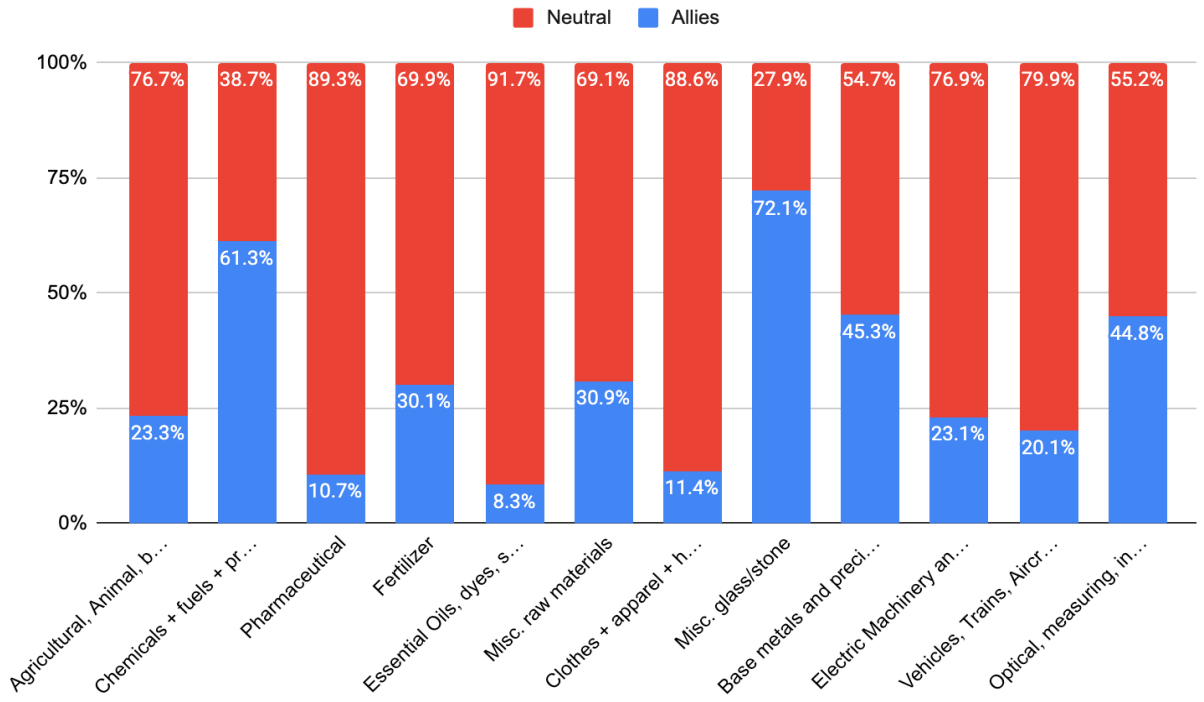


Figure 2: 2019 % Exported Products to Russia from Neutral, Allies by Commodity Group



Sources: UN Comtrade (2023); Appendix Table 2

Calculation example (Figure 1): in Figure 1 the total export value of “Misc. raw materials” worldwide from all countries to Russia is $26,663,545,718 and the Allies to Russia total value is $13,696,528,242. Dividing the Allies figure by the worldwide figure, we get:

$13,696,528,242 / $26,663,545,718 = 51.4%

There are several commodity groups Russia is reliant on the Allies for, but specifically, “Vehicles, Trains, Aircraft, Boats” and “Electric Machinery and mechanical equipment, Nuclear, Boilers” are key categories to investigate as they are crucial for military success. This is because winning a war requires having the advantage technologically and greater technological sophistication means more powerful weapons (Schneider 2023). Looking at the % change in Allies exports and imports, which is calculated by taking the % difference found in Table 3 of the appendix and dividing it by the 2019 totals, we see which commodity groups saw a drop or increase in trade value from 2019 to 2022.

Figure 3: % Change in Exports to Russia from Allies After Sanctions by Allies

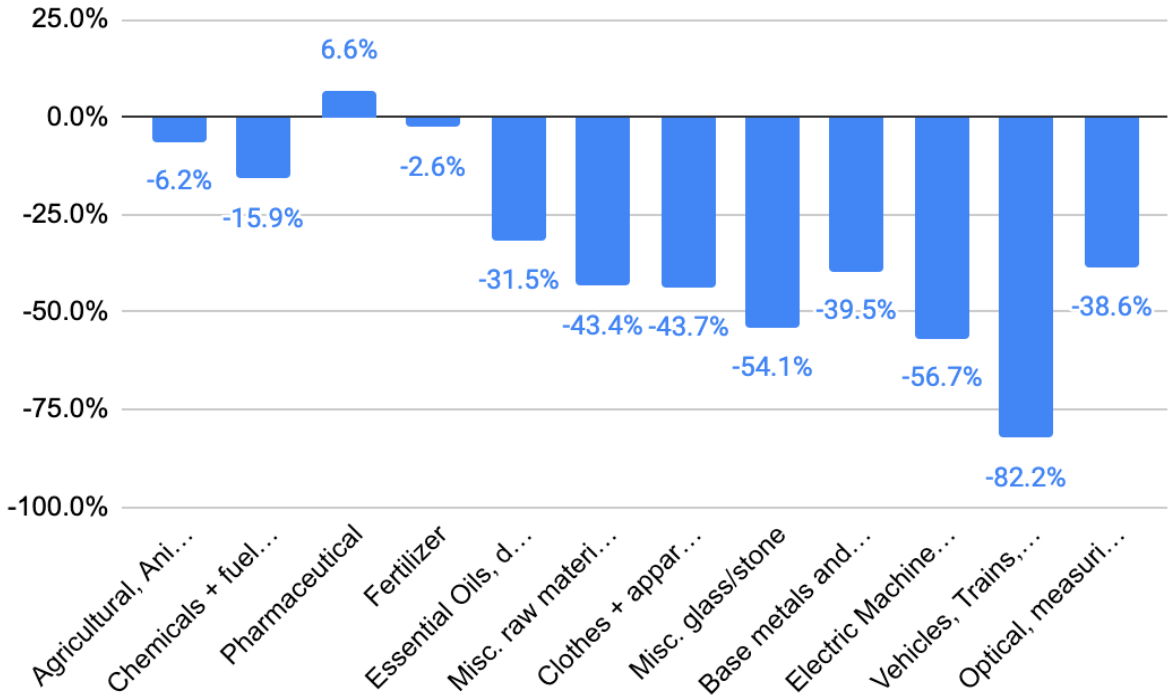
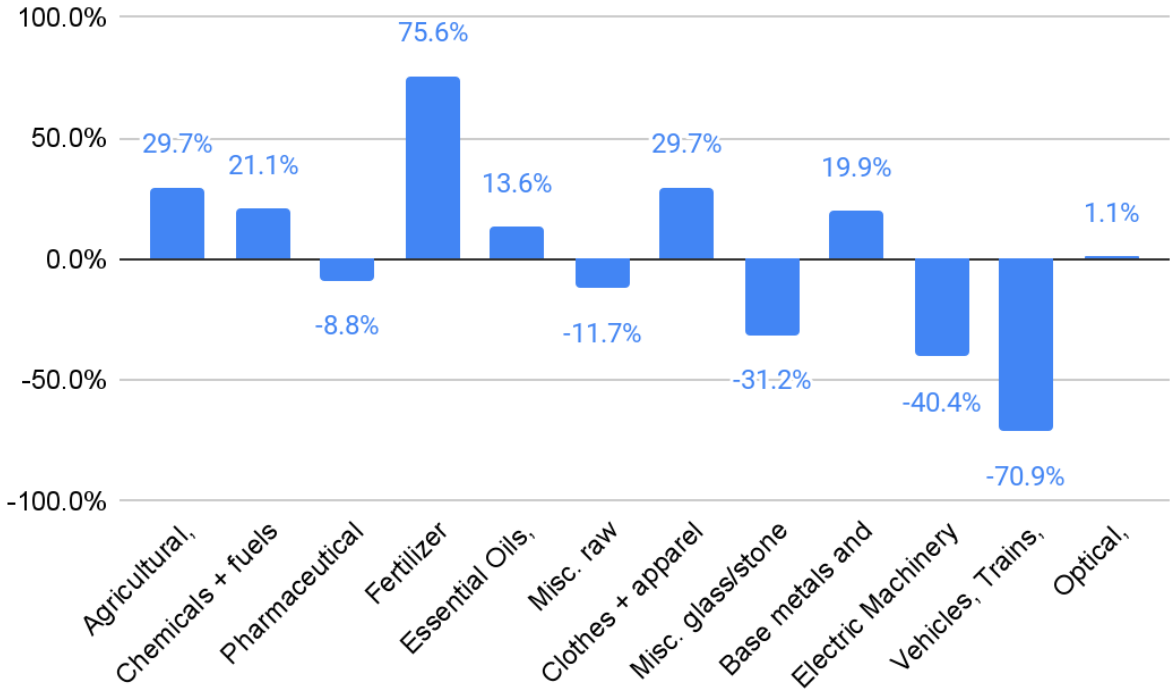


Figure 4: % Change in Imports from Russia to Allies After Sanctions by Allies



Sources: UN Comtrade (2023); Appendix Table 3

Note: Taiwan and Korea did not have 2022 trade data released so I used the other Allied countries for 2019 and 2022 with trade to Russia to find the % change.

Calculation example (Figure 3): Note above implies we subtract the trade from Russia to Taiwan + Korea and vice versa as there is no 2022 data yet for both Taiwan and Korea. Thus, using the "Misc. raw materials" example from the previous figures, we take the exports from Allies to Russia's total value of $13,696,528,242 and subtract Taiwan and Korea's total ($1,069,105,396):

$13,696,528,242-$1,069,105,396 = $12,627,422,846 (new 2019 value). 2022 value is $7,147,360,343. Thus subtracting 2022 from 2019, we have:

$7,147,360,343 - $12,627,422,846 = $-5,480,062,503. Now to find the percent decrease in exports from Allies to Russia in "Misc. raw materials" we take the difference between the 2019 and 2022 value and divide it by the 2019 total value sans Taiwan and Korea:

$-5,480,062,503 / $12,627,422,846 = -43.4% (decrease in exports to Russia of raw materials from Allies after sanctions in place).

Save for Pharmaceuticals, which in 2022 were not sanctioned leading to a large import of pharmaceuticals (Martuscelli and Tamma 2022), every allied country had some form of sanctions for every resource Russia imported in the past. While there was a drop in raw materials imports for Russia, the main consequence of the sanctions was the loss of imports of technical goods. The 2 strategic commodity groups sanctioned the most were "Electric Machinery and mechanical

equipment, Nuclear, Boilers", "Vehicles, Trains, Aircraft, Boats", as well as other important commodity groups for war, like "Optical, measuring, instrument devices, manufactured goods, misc", and "Metals and precious metals". Russia is reliant on the Allies for all of these technical materials and because of the lack of modern military weapons is now relying on its own arsenal of outdated military equipment (Lendon 2023).

In imports, the top 5 imports in order for the Allied countries are chemicals + fuels, misc. Glass and stone, metals, raw materials, and agriculture. Especially in fuels, Russia has been able to support itself financially by selling key resources to different countries and has been a boon for countries able to buy Russian gas at a discount such as India (*Energy and Clean Air*; Verma 2022).

Surprisingly, fertilizer and agricultural products have grown tremendously from the period 2019 to 2022. Investigating this trend further, net imports have increased from 2019 to 2022 on average by 25% each year since 2019 which would make the 75% lower in reality (Table 4).

Global Trade Consequences (China)

China, like Russia, is reliant on the Allies for key technological goods within “Electric machinery and mechanical equipment”, “Vehicles, Trains, Aircraft, Boats”, and “Metals and Precious Metals” (Figures 6+7). Imports to Allies from China are relatively level as a percent of world share, with imports being roughly 50% of the share of trade from China compared to everywhere else.

Figure 6: 2019 % Exported Products to China from Neutral, Allies Before Sanctions

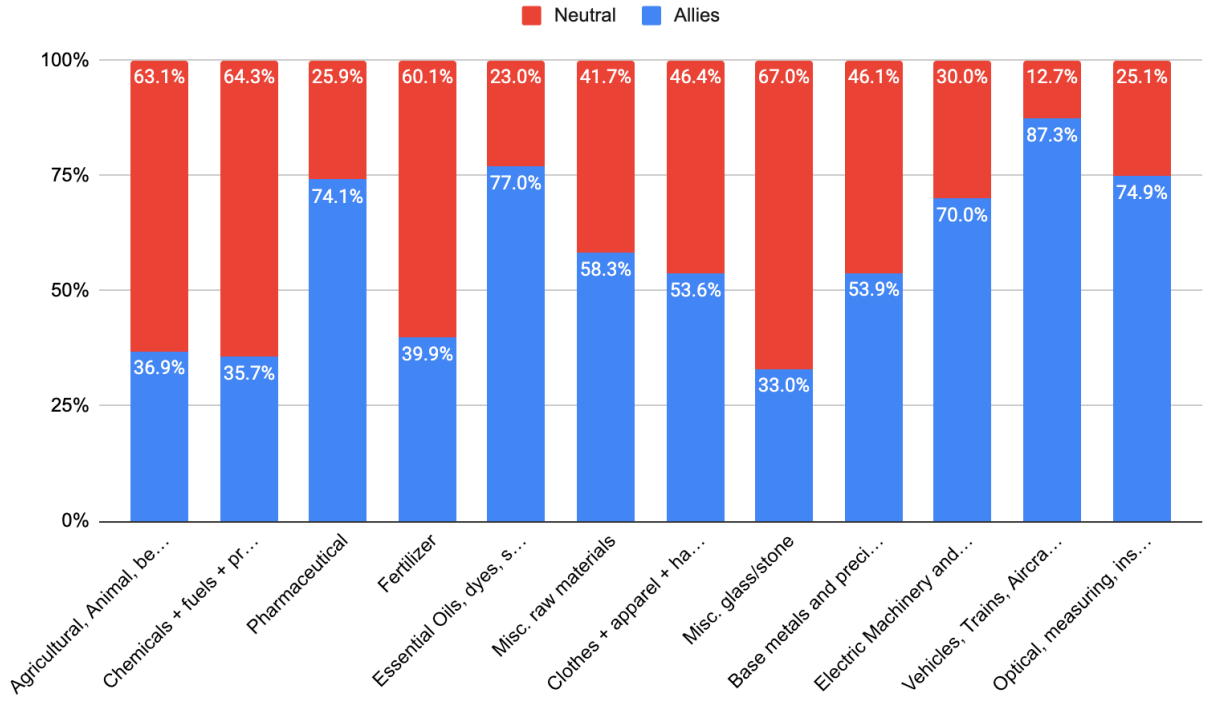
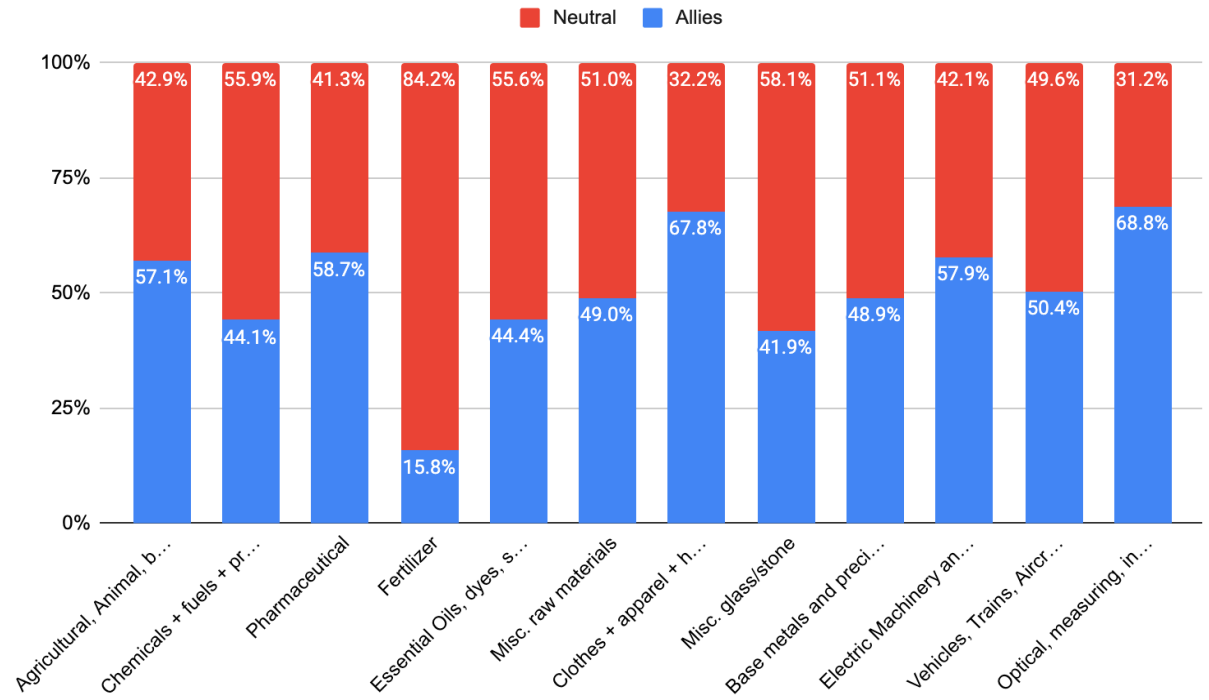


Figure 7: 2019 % Imported Products from China to Neutral, Allies Before Sanctions



Sources: UN Comtrade (2023); Appendix Table 5

Calculation Example (Figure 6): “Base metals and precious metals” Exports from Allies to China in 2019 is valued at $43,847,431,324 and the value for “Base metals and precious metals” from all countries to China is $81,303,006,358. Finding the % China relies on the Allies for the imports of these metals is found by dividing $43,847,431,324 by $81,303,006,358:

$43,847,431,324 / $81,303,006,358 = 53.9%

There are only four product categories China imports from the Allies that are not 50+% coming from the Allies. Meaning, China in 8/12 of the commodity group categories rely on 50% of its imports from the Allies with a significant percentage coming in the form of strategic and technologically advanced goods such as “Electric Machinery and mechanical equipment, Nuclear, Boilers” and “Vehicles, Trains, Aircraft, Boats” (Figure 6).

Applying the % drop in trade for imports and exports from sanctions by the Allies in Table 3, we can see what percent of the original exports and imports to and from China change (Table 6). Figures 8 + 9 are calculated by taking the value of the sanctions put on China across all 12 commodity groups, subtracting those from the before-sanctions total, and dividing that number by total trade in exports and imports between China and the world.

Figure 8: % Change in Exports from All Countries to China After Sanctions by Allies

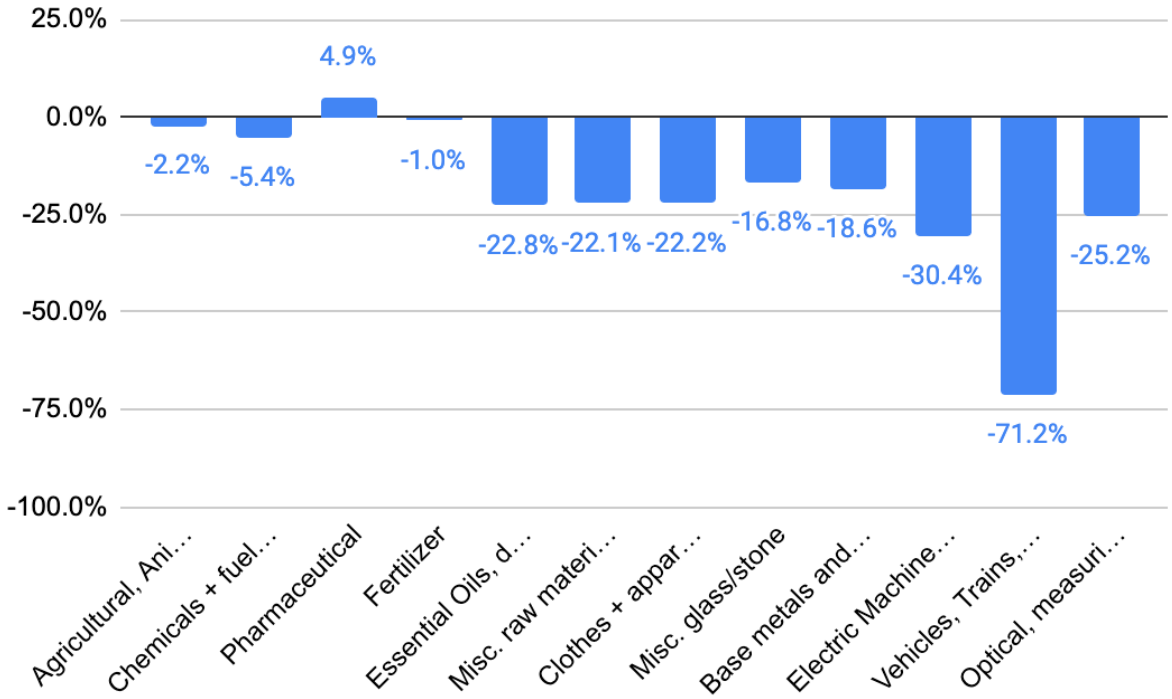
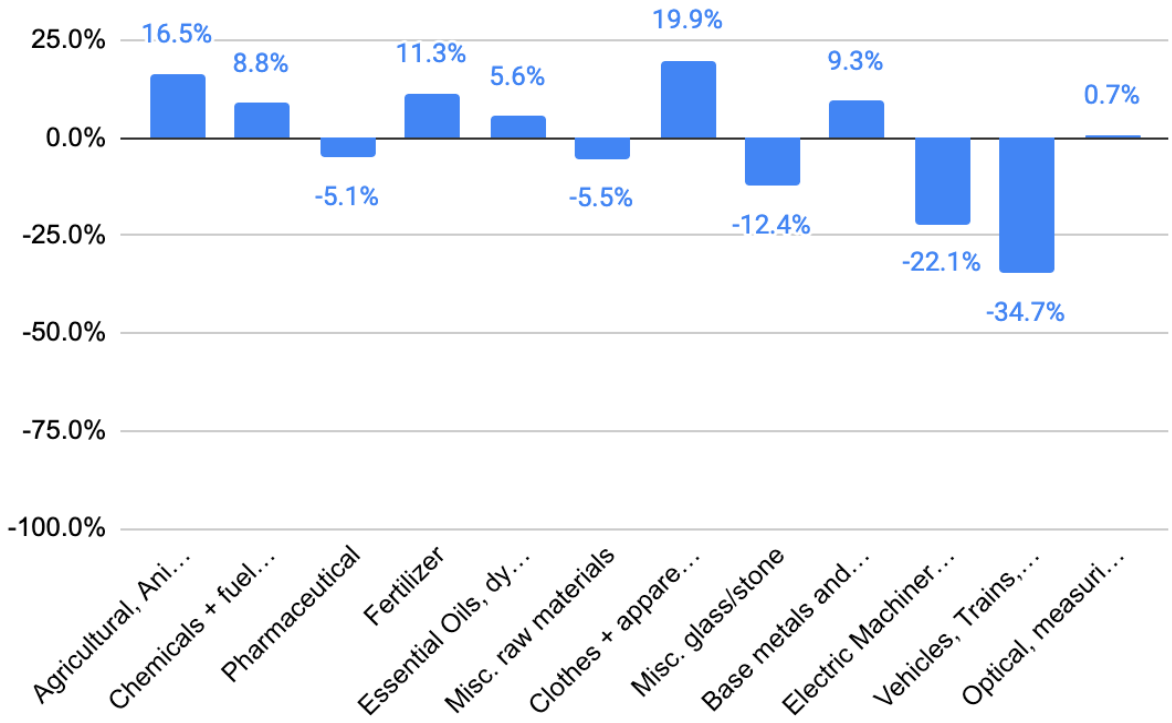


Figure 9: % Change in Imports to All Countries from China After Sanctions



Sources: UN Comtrade (2023); Appendix Table 6

Calculation Example (Figure 8): “Base metals and precious metals” exports from Allies to China in 2019 is $43,847,431,324. We need to subtract the exports of these metals from Taiwan to China because of assumption 2, which calculates as:

$43,847,431,324 - $5,601,243,598 = $38,246,187,726

We then apply the % change in export value of -39.5% from Table 3 cell I13, giving:

$38,246,187,726*(-39.5%) = $-15,103,111,720 (lost trade value from loss of Taiwan and sanctions).

We now take the total exports of these metals from all countries to China and then subtract the lost trade value just calculated to get:

$81,303,006,358 - $15,103,111,720 = $66,199,894,638

Taking the figure just calculated as a % of the Total trade value of metals before sanctions and the loss of Taiwan, we get:

$66,199,894,638 / $81,303,006,358 = 81.4%

Or 81.4% - 100% = -18.6% change in metals exports to China.

Total exports to China worldwide would fall 21.6% and imports worldwide from China would fall 9.4% if the sanctions were to go through (Table 6). The largest loss of exports to China would be vehicles of all sorts at a 71.2% drop followed by electric machinery, and mechanical equipment at a 30% drop, and technical instrument devices falling 25%. Most of this equipment would also come in the form of advanced technological equipment, especially advanced semiconductor chips of which 90% are manufactured in Taiwan (Dasgupta 2022). In terms of total imports, more than likely Figure 9 would be different in that China exports more electronics equipment, apparel, and other manufactured goods.

China would more than likely retaliate with their own sanctions on the Allies and begin to rely on imports from the Neutral countries. As we have seen in the Russia-Ukraine conflict, countries like India, Brazil, Turkey, and China have seen significant gains in trade volume. Looking at the % China would rely on Neutral countries for imports and exports, we see a minuscule shift towards these economically powerful and politically neutral countries.

Figure 10: % Exports from Allies and Neutral to China After Sanctions

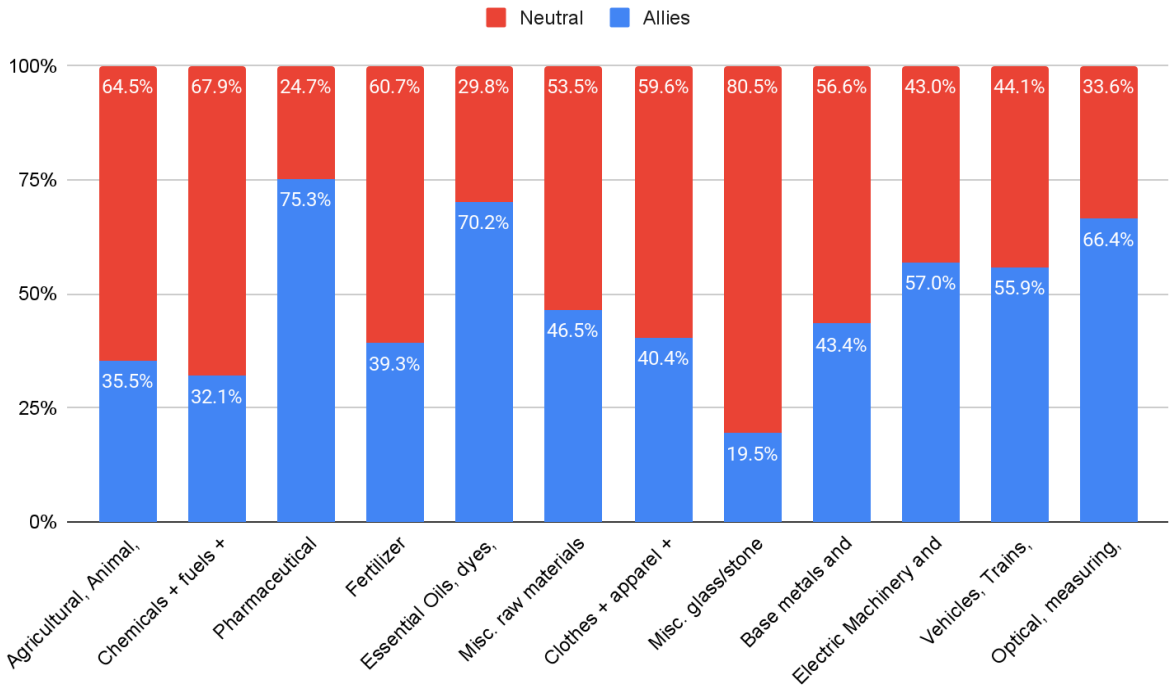
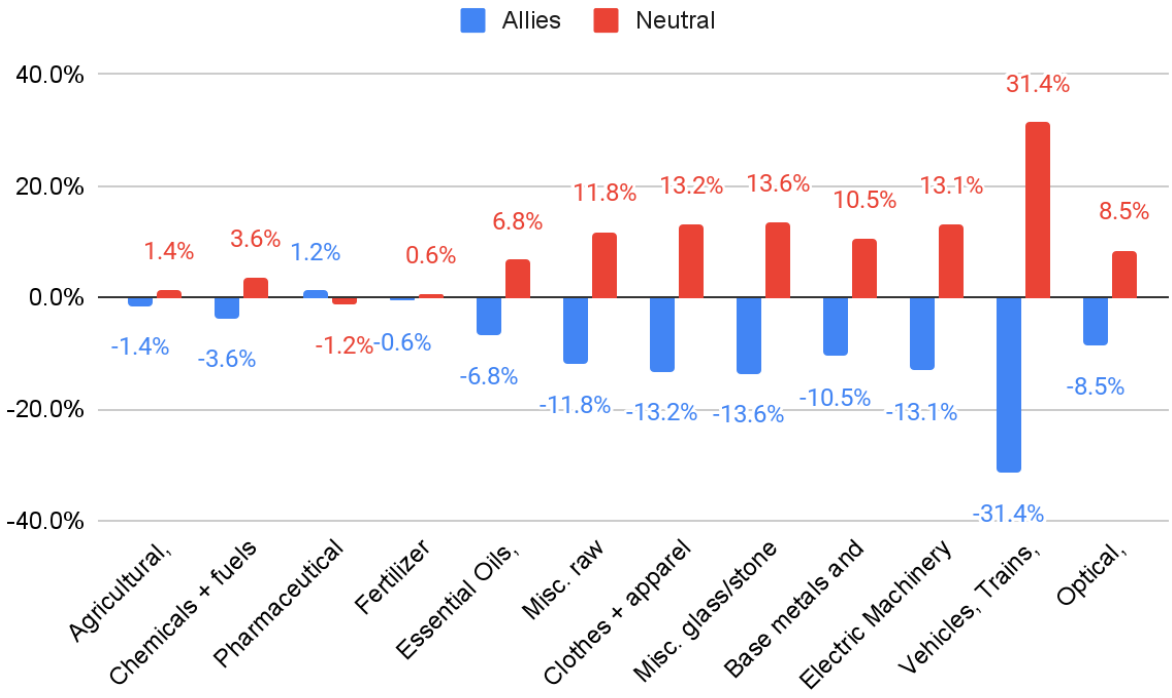


Figure 11: % Change in Export Trade Share to China From Allies, Neutral After Sanctions



Sources: UN Comtrade (2023); Appendix Table 7

Calculation example (Figure 10 + 11): “Base metals and precious metals” exports from all countries to China before sanctions is $81,303,006,358 and after sanctions is $66,199,894,638.

“Base metals and precious metals” exports from Allies to China before sanctions is $43,847,431,324 and after sanctions is $28,744,319,604

Calculating the fraction of exports from Allies to China before sanctions over metal exports from all countries to China before sanctions gives the percent of metal exports from all countries to China that are from the Allies:

$43,847,431,324 / $81,303,006,358 = 53.9% (all metal exports before sanctions to China that are from the Allies)

Taking after sanctions metal exports of Allies to China in over metal exports from Allies to China before sanctions:

$28,744,319,604 / $66,199,894,638 = 43.4% (all metal exports after sanctions to China that are from the Allies)

The percent difference between the after and before sanctions percentages just calculated gives:

43.4% - 53.9% = -10.5% (% drop in the share of Allies metal exports to China after sanctions instituted).

Looking at the difference in percentage between pre-sanctions and post-sanctions makeup of exports to China, we see the neutral countries only gain a small % in certain areas. Take "Vehicles, Trains, Aircraft, Boats" for example, a -71.2% change in exports from the Allies to China in this commodity group is only an overall -31.4% change in Allies share of exports of this commodity group (Figure 11). This means even with sanctions that decrease exports from allies to China by 71.2%, the Allies are still the majority exporters of vehicles, trains, aircraft, and boats by over 50% (Figure 10). This same relationship is true for "Electric Machinery and mechanical equipment, Nuclear, Boilers" and "Metals and precious metals", both of which are necessary for winning a war. The reason why this is significant is that if the Allies choose, they can lower the exports even more which could possibly shut down the automotive, locomotive, and aerospace industries entirely in China as they will not have the technical components necessary.

Looking at the new percentage of "Neutral Countries" it is clear China's trade policy with the Neutral countries in case of a conflict with China will be paramount for success as they seek to find countries to replace the lost trade volume from the Allies. This can already be seen with several of the neutral countries, with China developing closer ties to countries in Southeast Asia, Brazil, Saudi Arabia, and Iran, among other politically neutral states. (Rising 2022; Frantzman 2023; Afterman 2023).

Global Semiconductor Trade Consequences

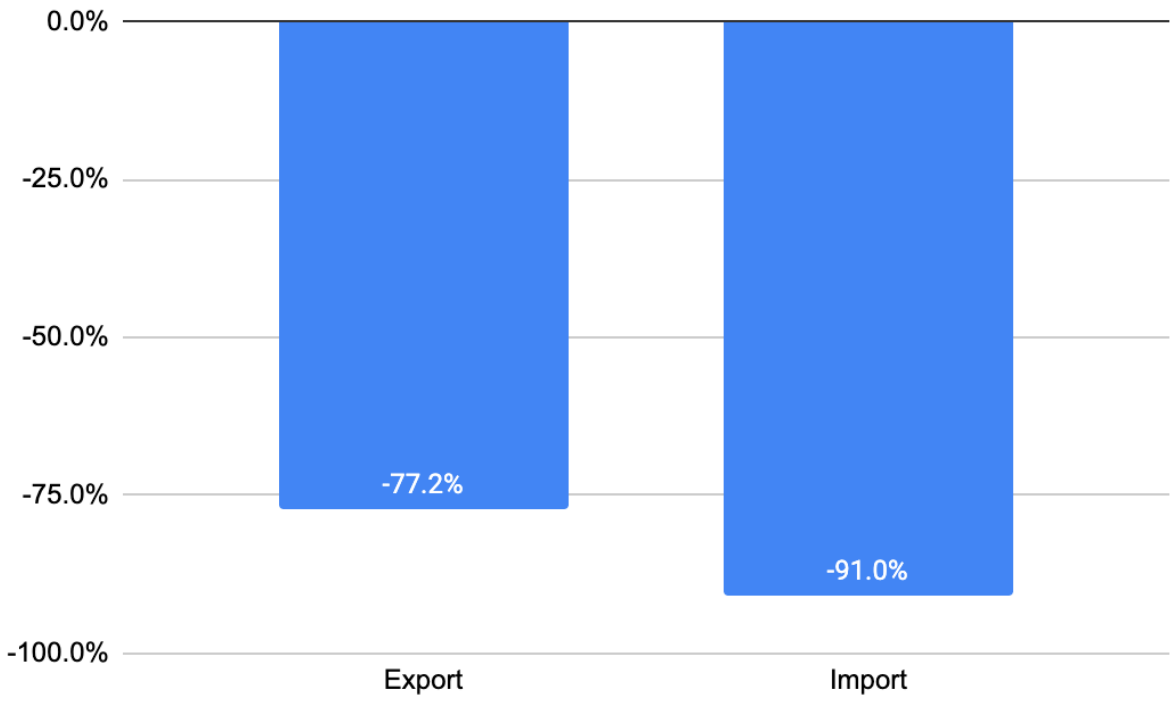
The reason why the topic of Taiwan and Semiconductors is so crucial is that they are what enable modern technology and enhance computational power. They are key components of computers, smartphones, sophisticated gaming graphics, aircraft avionics, computer-controlled industrial machinery, motor vehicles, medical devices, and household appliances (Cronin 2022). A country with a higher degree of computational power and, in effect, advanced technology will have an advantage financially, industrially, and militarily, among many other critically important facets for a nation (*Semiconductor Industry Association*). China can only manufacture 6% of its semiconductor chip needs and imports the majority of the rest from Taiwan (with TSMC making up 70% of the deficit). China does not have the equipment or foundries needed to catch up with Taiwan and because of restrictions on shipping advanced chip-making equipment such as extreme ultraviolet photolithography (EUV) machines, China will need to invest in its own industry to catch up (Cronin 2022).

Semiconductors, especially advanced ones, are the key risk for the Allies in the case of a conflict as the source of those semiconductor chips primarily comes from Taiwan. While allied countries can import cheap electronic goods in Southeast Asia and possibly more advanced types of electronic goods as there is increasing economic development in these countries, there are few replacements for advanced microchips like those from TSMC or other Taiwanese chip companies (*ASEAN Briefing*; Miller 2022).

Looking at HS code 8542: Electronic integrated circuits, which is included in the chapters 84-86 codes “Electric Machinery and mechanical equipment, Nuclear, Boilers” showcase where the most important technological components in semiconductors are coming from.

Looking specifically at the Allies, who are major suppliers of advanced microchips, I took the same procedure from Table 3 and applied it to HS code 8542. I took the difference in the year 2019 and the year 2022 of the total exports and imports between 5 of the Allied countries (USA, Canada, EU, Japan, and Australia) and Russia. I then took that number and divided it by the total trade in exports and imports between the 5 Allies and Russia in 2019 and found the % drop in trade because of sanctions (Table 8).

Figure 12: % Decrease by Sanctions in Exports to Russia by Allies and Decrease Imports to Allies from Russia



Sources: UN Comtrade (2023); Appendix Table 8

Note: Taiwan and Korea are not included because they have not released their 2022 trade data yet. Also, I incorporated the UK into the 2022 EU data as the 2019 totals include the UK (Assumption 6).

Calculation example (Figure 12): To calculate the % change in exports, I took the 2019 total exports from Allies to Russia in HS code 8542 (semiconductors) which was $606,870,560, and subtracted it by the 2022 value ($138,401,906) to get:

$138,401,906 - $606,870,560 = $-468,468,653

Finding the % change from 2019 to 2022 is:

$-468,468,653 / $606,870,560 = -77.2% (total drop in semiconductor exports from Allies to Russia because of sanctions).

Before applying these percentages (77.2% for exports and 91% for imports) to see what would happen in a Taiwan-China conflict, we need to subtract Taiwan from the trade between the Allies and China as the key assumption for a conflict with China is that the semiconductor industry in Taiwan terminates completely (Assumption 2). Looking at Figure 13 + 14, we see how lucrative Taiwan is to the global trade of semiconductors to the largest economies and how much of a % change would occur to China and the allies if all trade were to cease in Taiwan.

Figure 13: 2019 % of Global Semiconductor Exports from Allies and China to Taiwan

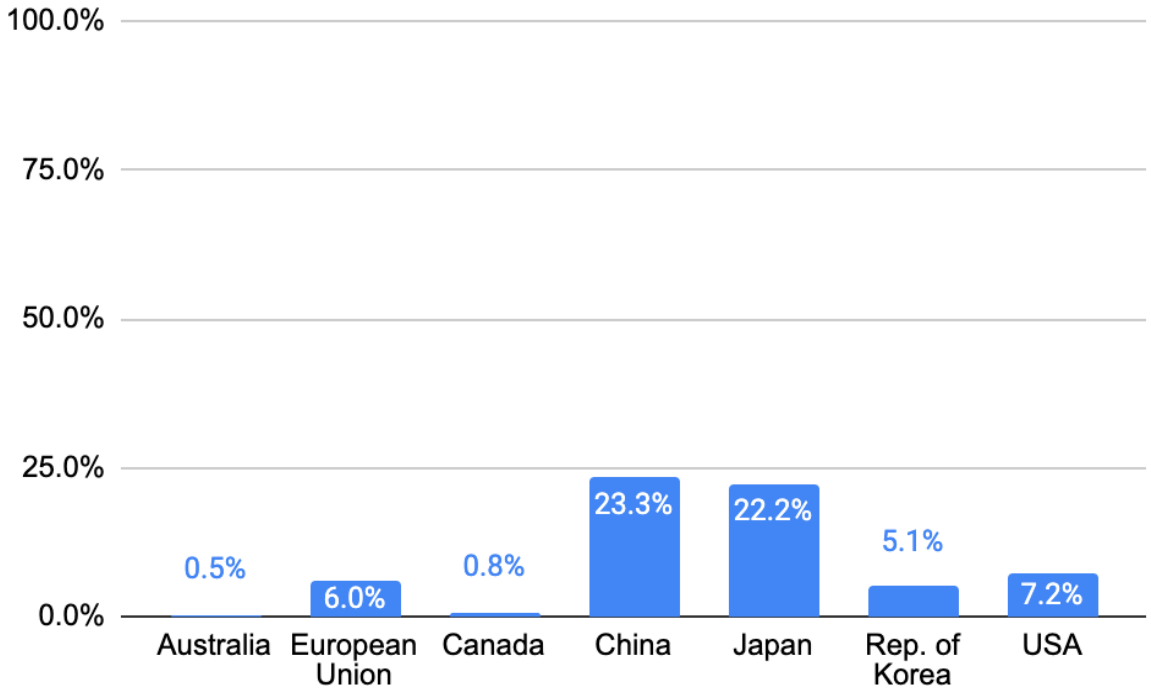
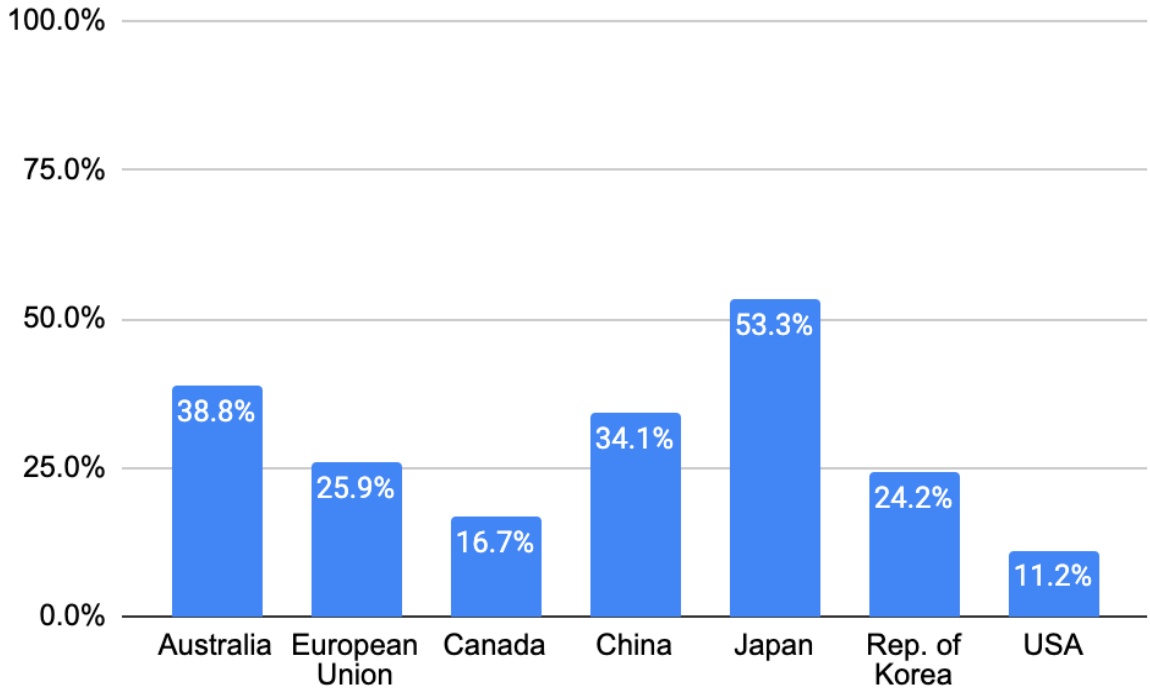


Figure 14: 2019 % of Global Semiconductor Imports to Allies and China from Taiwan



Sources: UN Comtrade (2023); Appendix Table 9

Note: China includes its Special Administrative Regions (Hong Kong, Macau). In addition, Exports and imports between China, Hong Kong, and Macau are not accounted for and only trade from or to China is accounted for (Assumption 1).

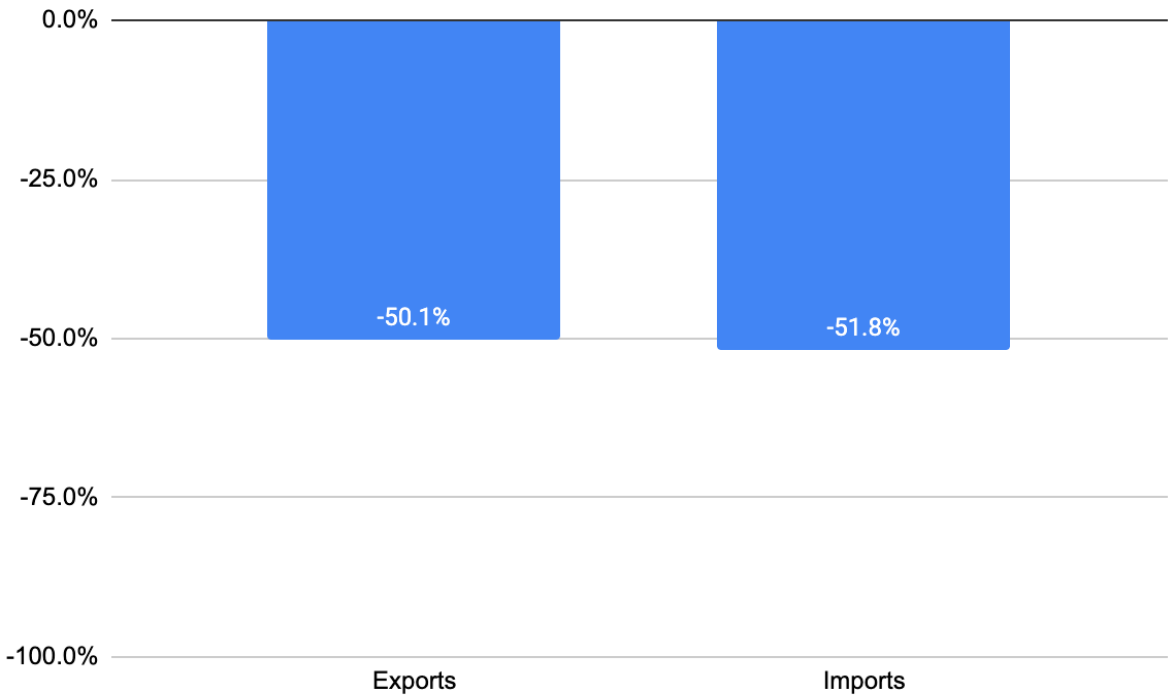
Calculation Example (Figure 14): Finding what percent of the USA's global importations of semiconductors comes from Taiwan is as follows:

Total US imports of semiconductors globally are $33,085,045,987 and imports specifically from Taiwan are $3,701,644,149. The percent of US imports that are coming from Taiwan are:

$3,701,644,149 / $33,085,045,987 = 11.2%

Figure 14 showcases how much Taiwan's neighbors and even geopolitical allies across the world all import a significant share of all semiconductors from Taiwan, which in times of a conflict will disrupt all industries requiring advanced semiconductor technology. However, despite China losing 34.1% of semiconductor trade with Taiwan to instigating a conflict, this does not take into account the sanctions China will encounter from the Allies. Using the -77.2% drop in exports and -91% drop in imports from Allies to China from Figure 12, we can calculate the total drop in exports and imports to and from China worldwide in semiconductors.

Figure 15: % Change in Exports from China to World and Imports from World to China After a Taiwan Conflict



Source: UN Comtrade (2023); Appendix Table 10.B

Calculation example (Figure 15): exports to China from the USA for semiconductors in 2019 were $11,516,389,511. Applying the -77.2% change in exports to China calculated in Figure 12 for Russia, we calculate:

$11,516,389,511 * -77.2% = $-8,837,621

Applying this same process to Australia, European Union, Canada, Japan, and Korea, and then summing the total loss in value gives $-66,664,876,106 (Table 10.B).

Taking China's global imports of semiconductors from the world ($377,578,199,113), subtracting global imports of semiconductors from Taiwan (assumption 2; Table 9), and then subtracting the loss of imports because of sanctions from Allies calculates as:

$377,578,199,113 - $128,805,554,782 - $66,664,876,106 = $182,107,768,225

Dividing this number by the total imports to China from the world before the conflict gives:

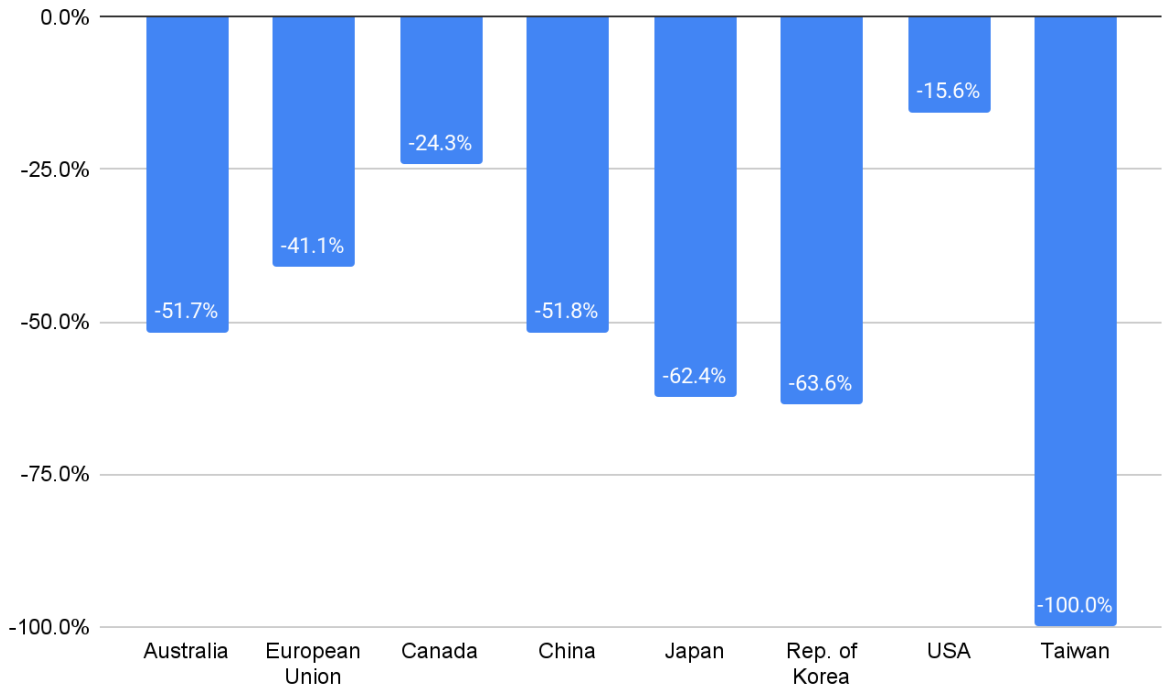
$182,107,768,225 / $377,578,199,113 = 48.2% (% of the total trade value of China's original imports of semiconductors from all countries after sanctions).

Subtracting this percent by 100% gives the total drop in global imports from the world to China:

48.2% - 100% = -51.8%

The effect of a conflict between China and Taiwan would now cost China half of its semiconductor imports versus 34.1% from before. But now China can sanction the rest of the allies by 91% (Figure 12). We can find this by using the total imports and exports between the Allies (sans Taiwan) to and from the world.

Figure 16: % Change in Semiconductor Imports from All Countries to Allies + China After the Start of the China-Taiwan Conflict



Source: UN Comtrade (2023); Appendix Table 10.C

Calculation Example (Figure 16): Japan's imports in semiconductors worldwide totaled $18,511,107,876. Subtracting the loss of Taiwan trade ($9,860,791,946; Table 9.B) and trade value from sanctions ($1,681,210,261; Table 10.A), we get:

$18,511,107,876 - $9,860,791,946 - $1,681,210,261 = $6,969,105,669

Subtracting the loss of trade from Taiwan and the sanctions from China figure from the original, we get:

$6,969,105,669 - $18,511,107,876 = $-11,542,002,207

Represented as a percent of the original calculates as:

$-11,542,002,207/$18,511,107,876 = -62.4%

From the table, we see China would lose roughly 52% of its semiconductor imports with the conflict. However, what the graph does not show is that the majority of all advanced semiconductors are produced in the "Allies" countries. Using assumption 7, we find the percent change in imports of advanced semiconductors falls 86.48% of its original value to 13.5% (Table 11).

Calculation example (Table 11): Exports in advanced semiconductors from the USA to China before the China-Taiwan conflict were $11,516,389,511. After sanctions to China of -77.2% (Figure 12), we calculate the new total exports to China:

$11,516,389,511(-77.2%) = $-8,890,652,702

Doing this same process for Australia, European Union, Canada, Japan, and Korea, and totaling we get $-66,664,876,106. We then subtract Taiwan's exports to China as exports go to 0 from an invasion:

$-66,664,876,106 - $-59,299,505,527 = $-125,964,381,633

Adding this amount to the original total exports of semiconductors to China by the Allies, we get:

$-125,964,381,633 / $145,652,971,986 = -86.48%

An 86.48% loss of the crucial component for powering high-tech technology and machinery will set back the Chinese economy considerably if preparations are not made in advance. Building up China's semiconductor industry will be a massive undertaking, and it could be the major factor in China's decision to use force to reunite Taiwan with the mainland.

Conclusion

This paper attempts to summarize the global trade implications of a conflict between China and Taiwan using data from the Russia-Ukraine War as a model. The findings show that a conflict between China and Taiwan would have drastic global trade consequences, but especially for China. China is reliant on imports from the Allies by over 50% on 8/12 commodity groups (Figure 6). Most of those exports to China would drop primarily in areas crucial for advancing China's economy or winning a military conflict such as "Electric Machinery and mechanical equipment, Nuclear, Boilers", "Vehicles, Trains, Aircraft, Boats", and "Base metals and precious metals" (Figure 8). And with imports of semiconductors and semiconductor technology falling 51.8% from all countries to China (Figure 15) as well as advanced semiconductor technology falling 86.4% (Table 11) by the Allies sanctions, China will need to accomplish advancement of its "top industrial priority" (Ravi 2021) in advancing its semiconductor technology to obtain self-sufficiency. This will be a daunting challenge that will take years if not decades at accelerated research and development, time that Xi's administration may not have time to achieve if reunification with Taiwan happens under his leadership.

For the Allies, the loss of trade with Taiwan and the sanctions on China will be lesser than China's but will still experience more of an impact compared to the Russia-Ukraine war. Electronic goods, vehicles of all sorts, and base and precious metals used for industrial purposes will see a decline (Figure 11) and in effect, the supply of cheap electronic and manufactured goods originally from China will only be scarcer. However, with a growing electronics manufacturing industry in Southeast Asia and India, as well as countries and regions like the EU, Japan, USA, and other Allied countries developing the infrastructure to create more sophisticated

semiconductors, the Allies have the ability to rebound from a China-Taiwan shock (Allen, Benson, and Putnam 2023; Liu and Mozur 2023; *Micron* 2022).

Neutral countries will need to make the decision of balancing their economic and trade objectives through trade with China and possibly face consequences like sanctions from the Allies or enact sanctions against China and face possible reciprocated sanctions by China. With the lack of sanctions happening against other countries in the Ukraine-Russia conflict even when countries like India and Brazil are seeing growing trade volume that supports Russia's war, choosing the status quo will be likely. If this were to happen, the share of imports from Russia to the Neutral countries would grow only a little bit with the Russia-Ukraine sanctions (Figure 11) but prices for items like manufactured goods and electronics may be at a discount as Russia has done with gas (Menon 2022).

For further studies, the economic consequences of brain drain from skilled workers should be examined considering the number of overseas Chinese studying and working in "Allies" countries. This would complement this paper as it would examine whether the consequence of sanctions on technologically sophisticated goods and the loss of skilled laborers who understand those goods will stall the Chinese economy from developing their own technological capabilities.

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