Master's Thesis of SNU GSIS

Impacts of the U.S.-China Trade War on Taiwan's Semiconductor Industry

- Fate of TSMC -

미중 무역전쟁이 대만 반도체 산업에 미치는 영향

- TSMC 의 운명 -

August 2023

Graduate School of International Studies

Seoul National University

International Commerce Major

Chih-Chia Liu

Impacts of the U.S.-China Trade War on Taiwan's Semiconductor Industry

- Fate of TSMC -

Cheong, Young-Rok

Submitting a master's thesis of
International Studies

August 2023

Graduate School of International Studies
Seoul National University
International Commerce Major

Chih-Chia Liu

Confirming the master's thesis written by
Chih-Chia Liu
August 2023

Chair Rhee, Yeongseop (Seal)
Vice Chair Song, Jiyeoun (Seal)
Examiner Cheong, Young-Rok (Seal)

Abstract

The U.S.-China trade war, which began in 2018, has a profound impact on the global semiconductor industry, particularly on Taiwan's semiconductor industry and the leader of the industry—Taiwan Semiconductor Manufacturing Company (TSMC). This thesis aims to explore Taiwan's position in the trade war, and how TSMC, a key player in Taiwan's economy and the semiconductor industry, navigates the new trade climate. The trade war was initiated by the former U.S. President Donald Trump, driven by concerns about China's unfair trade practices and U.S. increasing trade deficits. In response, the United States implemented tariffs on Chinese imports and imposed export controls and restrictions on Chinese firms in the semiconductor industry. China retaliated with tariffs on U.S. imports, escalating the tensions between the two superpowers. Heavily relying on trade with both the United States and China, Taiwan is essentially stuck in the middle of the trade war between its two largest trade partners. Taiwan faces challenges of the implications caused by the trade war. Being the "silicon shield" of Taiwan, TSMC manages to navigate through the storm of the trade war.

This thesis analyzes the impacts of the U.S.-China trade war on Taiwan's semiconductor industry by focusing on the case study of TSMC. Furthermore, this research aims to understand Taiwan's challenges and opportunities in the trade war and sheds light on the underlying concerns of the new dynamics in Taiwan's semiconductor industry. Overall, as both the beneficiary and victim of the trade war, Taiwan's semiconductor industry remains resilient in the new trade environment.

Keywords: Trade War, Semiconductor Industry, TSMC, Taiwan, Tariff, U.S., China

Student Number: 2020-26763

Table of Contents

I. Introduction

1.1 Research Background

Since the beginning of the trade war between the United States and China, which began in July 2018 under the Trump administration, the global economy, for better or worse, has drastically changed. In 2017, the United States government, under former president Donald Trump's command, self-initiated an investigation into China's unfair trade practices under Section 301.[1] The U.S. trade representative alleged that China required foreign firms to engage in joint venture with local companies, which resulted in involuntary transfer of technology from U.S. intellectual property-holders as a quid pro quo for allowed access to the Chinese market; furthermore, the U.S. accused the Chinese government of state-sponsored industrial espionage and theft of intellectual property.[2] The United States implemented legal measures against China, such as a 25 percent levy of tariffs on semiconductors imported from China[3] and a series of U.S. export controls and restrictions on semiconductor-related sales to Chinese firms.[4]

Many believe the conflict between the two largest economies in the world had long been brewing; moreover, the outbreak simply manifested in the rising power of China in the global economy as former President Donald Trump wished to impose punitive tariffs on China in order to reverse trade deficits, followed by a series of regulations such as restricting China's access to high-tech U.S. products and foreign investments involving security concerns and banning sale and import from blacklisted Chinese companies. These U.S. trade measures

[1] Office of the United States Trade Representative, "Section 301 Investigation Fact Sheet." Section 301 is a provision in the Trade Act of 1974 that allows the United States Trade Representative (USTR) to investigate foreign countries that engage in unfair trade practices that harm America. During the Trump administration, USTR initiated an investigation under Section 301 into China's discriminatory trade practices, such as state-led, market-distorting policies and practices, forced technology transfers and cyber intrusions of U.S. commercial networks.
[2] Bown, "How the United States Marched the Semiconductor Industry into Its Trade War with China."
[3] Ibid. In July 2018, the United States imposed 25 percent tariffs on semiconductors imported from China, as the United States claimed to find evidence of unfair trade practices by China that hurt various U.S.-headquartered companies, including those in the semiconductor industry.
[4] Ibid. In 2019, driven by national security concerns regarding China's alleged theft of intellectual property and potential threats of Chinese government's influence on U.S. critical network infrastructure, via international Chinese conglomerates (a Fortune Global 500 company like Huawei, for example), the United States enforced export controls on the global semiconductor supply chain but had little effect on Chinese companies at the time.

against China ultimately escalated the tensions between the two superpowers even more. In response, China retaliated by imposing tariffs on goods originating from the U.S. The tit-for-tat trade war officially began.

The trade war between the United States and China inevitably affected the economic trends of many countries due to their significant economy size and global presence as a whole. Among them, Taiwan is hit especially hard as the country's economic and trade interdependence with the United States and China. Furthermore, Taiwan's unique geopolitical position for the United States, in terms of building strategic alliance against China, and Taiwan's more than ever belief of its independence from China since the end of the Chinese civil war have deepened the conflict and extended it to more than just simple economic-related matters. As a result, Taiwan has found itself trapped in the middle of the trade war between these two superpowers.

Taiwan is deemed as a global hub for semiconductor production and a location of vital suppliers for Apple Inc. and other multinational tech giants. The United States and China are two major exporting countries in Taiwan, and due to Taiwan's high dependence on exports, Taiwan's economy is undoubtedly susceptible to the influence of the United States-China trade war. Taiwan is essentially "stuck in the middle" as it may eventually end up becoming a bargaining chip between the two, in the case that the United States backs away from the One-China policy, which prevents Washington from recognizing Taiwan as an independent country from China.[5] Furthermore, the trade war between the United States and China inadvertently hurt Taiwan, in terms of its supply chain of goods manufactured and assembled in China and other overseas Taiwanese companies based in China. In essence, Taiwan's position between the two superpowers is delicate, and the implications of the trade war have immediate and serious impacts on the island's political status and economy.

[5] Pandey, "The stakes for Taiwan in a U.S.-China trade war."

1.2 Research Significance

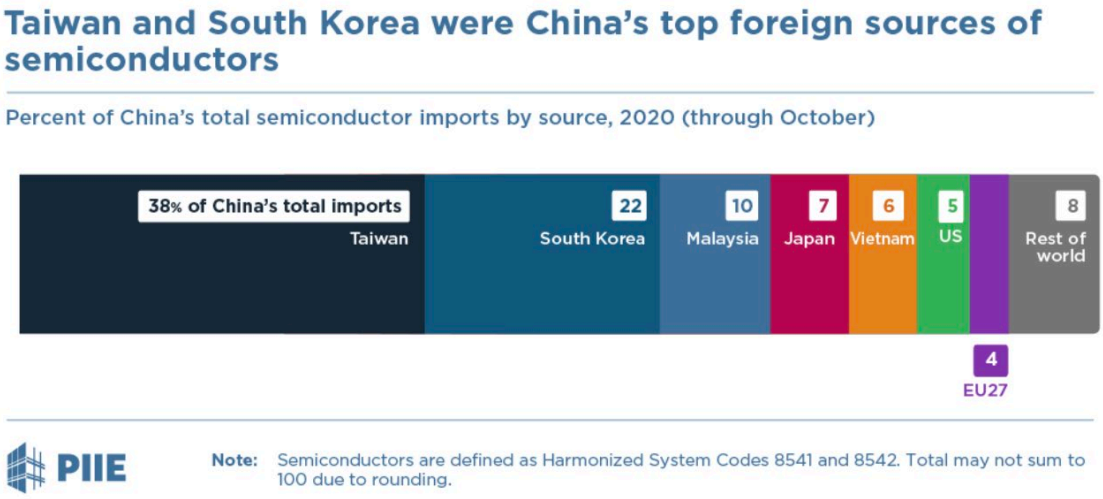
As China rises as a major power in the world, the United States feels the threat to guard its national security as well as the country's global presence and ultimate power. With the United States' increasing trade deficits and interdependency in terms of its relationship with China, former President Donald Trump, with the façade of concerning the United States' national security, started the trade war by mobilizing political and public strength as well as using different legal rules and restrictive economic measures against China. The initial purpose of such measures is to decouple from China by minimizing the interdependent relationship between the two and, more importantly, reducing the U.S. trade deficit with China. However, as of the Trump administration, the U.S. trade deficit with China rose to 419.2 billion dollars as exports to China fell.[6]

Now, the ongoing trade war between the United States and China affects the global economy as a whole and many countries' trade activities and economic growths, but among them, Taiwan is certainly impacted the most as its economy, trade patterns and even national security are highly interconnected with the United States and China, whether as rivals or partners. Caught in the crossfire of this trade war, Taiwan needs to decide whether to pick a side or possibly find a way to avoid direct conflict while doing business with both the United States and China amid the situation. Trump administration's actions of putting restrictions on Chinese companies—for instance, Huawei—and imposing sanctions and punitive tariffs on Chinese goods have affected Taiwan, which is home to Taiwan Semiconductor Manufacturing Company (TSMC), the world's largest semiconductor chip manufacturer.

Although TSMC is not the only semiconductor company in Taiwan, among other smaller segments of the island's semiconductor chain, TSMC holds an overwhelming presence in the global semiconductor industry and makes over half of the world's semiconductors. Despite TSMC's effort to walk the fine line of doing business with the United States and China

[6] Wu, "The U.S.-China Trade War and Options for Taiwan."

in the beginning, as more and more restrictions and trade measures put on both countries as tit-for-tat, it has become more difficult for TSMC not to play a part in it anymore. TSMC's dilemma in the trade war mirrors Taiwan's larger problem with China: a constant tension between reliance and threat;[7] Taiwan's trade relationship and economic gains with China yet Taiwan's independence against threats from China, which claims Taiwan as a breakaway province that will eventually be under Beijing's control under "reunification".[8] In fact, China is Taiwan's largest trading partner, accounting for almost 28 percent of its exports and over 20 percent of its imports in 2019.[9]



Source: *Peterson Institute for International Economics*

On the other hand, the United States is the biggest ally and protector of Taiwan's sovereignty from China. Moreover, the United States is a vital trading partner of Taiwan, accounting for more than 14 percent of exports and over 12 percent of imports in 2019.[10] The U.S. market is also a main export destination for the end products of Taiwanese companies in

[7] Shattuck, "Stuck in the Middle: Taiwan's Semiconductor Industry, the U.S.-China Tech Fight, and Cross-Strait Stability," 102.
[8] Brown, "China and Taiwan: A really simple guide."
[9] Shattuck, "Stuck in the Middle: Taiwan's Semiconductor Industry, the U.S.-China Tech Fight, and Cross-Strait Stability," 103.
[10] Ibid.

China, and among all the companies, TSMC is key to Taiwan's economic vitality as it is the largest global supplier for chips.

As the U.S.-China trade war continues even in the Biden era, partner to its two largest semiconductor consumers—China and the United States, Taiwan could possibly become a bargaining chip as the conflict escalates. Furthermore, TSMC business relationship with both sides is dragged into the battle of picking a side or remaining neutral while navigating the new trade climate and maintaining its strong momentum amidst trade war. There is existing research about the challenges and damages the trade war has inflicted on Taiwan's semiconductor industry. However, there is a limited scope of research resources on the opportunity the trade war has created for Taiwan. Thus, with the case study of TSMC, the thesis explores Taiwan's place in the U.S.-China trade war and how the chip industry performs under new circumstances, in hopes to find the silver lining for Taiwan's semiconductor industry. Finally, the thesis aims to address some concerns associated with maintaining Taiwan's "silicon shield" and continuing the semiconductor momentum within the island.

II. Taiwan's Semiconductor Industry

2.1 Background

The semiconductor industry is one of the key drivers of Taiwan's economy and has played a significant role in the development of the island over the past decades. Taiwan's semiconductor industry began when the Industrial Technology Research Institute (ITRI) was established in 1973, followed by the establishment of the Electronics Research and Service Organization (ERSO) in 1974. The establishment of such organizations marked government efforts to re-engineer the Taiwan's economic structure by transforming Taiwan's manufacturing from low to high value-added activities, as well as upgrading Taiwan's semiconductor industry. The very first project the ITRI worked on was an integrated circuit development project for the Radio Corporation of America. The United Microelectronics Corporation (UMC), spun out of the ITRI following the project became the very first semiconductor company in Taiwan.[11] In 1978, the Taiwanese government built a high technology infrastructure at the Hsinchu Science Industrial Park (HSIP), mirroring the success of California's Silicon Valley. HSIP was opened in 1980, and most firms in the area attracted overseas Taiwanese from top companies in the United States and encouraged "reverse brain drain" with improved incentives, such as tariff exemptions, educational centers, investment allowances, medical services, R&D matching funds tax benefits, low interest loans offered by the government.[12]

Within the decade of 1980s, many companies were established in the HSIP, including IC design houses like Taiwan Semiconductor Manufacturing Company (TSMC), Syntek and Weltrend, which stimulated the emergence of a cluster of designing, masking, fabrication and assembly firms.[13] Among all, TSMC was certainly the most significant one as it truly reinvented

[11] Bown, "How the United States Marched the Semiconductor Industry into Its Trade War with China," 361.
[12] Rasiah, Shahivar, and Yap, "Institutional support, innovation capabilities and exports: Evidence from the semiconductor industry in Taiwan."
[13] Ibid.

the semiconductor industry in Taiwan and revolutionized the global semiconductor supply chain. Details of the company's history and development are provided in the next chapter.

Taiwan's semiconductor industry, crowned as the island's "silicon shield", which is the idea that "global reliance on Taiwan's chipmakers keeps the island safe from a Chinese military invasion",[14] acts as Taiwan's deterrent to war and is considered as one of the most vital, if not the most, industries in the island. Taiwan's semiconductor industry has become one of the world's leading manufacturers of semiconductor chips, and many Taiwanese chipmaking companies, such as TSMC and UMC, hold a crucial position in the global semiconductor industry, as they produce chips some of the biggest tech companies in the world. There are a number of factors in the following that contributed to the unique position and success of Taiwan's semiconductor industry:

1. Supply meets demand. The market for semiconductors had been expanding, and there was a high demand for chips all over the world. With an inadequate amount of chip factories around the world to meet the demand, Taiwan's growing chipmaking industry was able to jump on the semiconductor bandwagon;
2. Government support. The Taiwanese government provided funding, incentives, subsidies, tax breaks, and other forms of support to attract companies to invest in the R&D and export high-tech products like chipmaking machines and raw materials used to make chips, as well as to incentivize companies to cultivate and develop local expertise;
3. Strong research and development capacity due to the cluster effect. With companies, universities and research institutes working together in the HSIP, Taiwan was able to quickly develop new technologies and products for the semiconductor industry;
4. Skilled workforce and talent pool. Taiwan invested heavily in training and education in science, technology, engineering and mathematics (STEM), cultivated local workforce

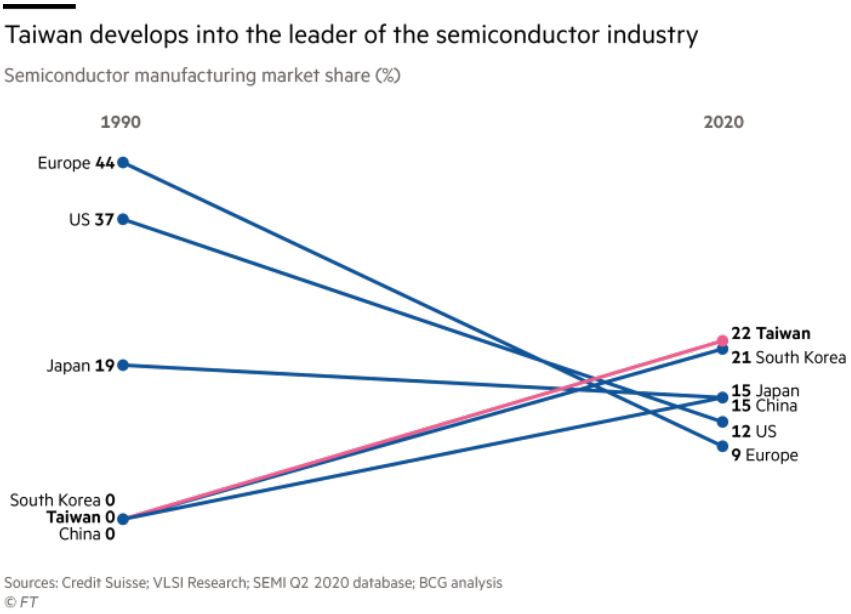
[14] Powers-Riggs, "Taipei Fears Washington Is Weakening Its Silicon Shield."

and recruited technical talents from abroad. A large pool of highly skilled workers contributed to the rapid development of Taiwan's semiconductor industry;

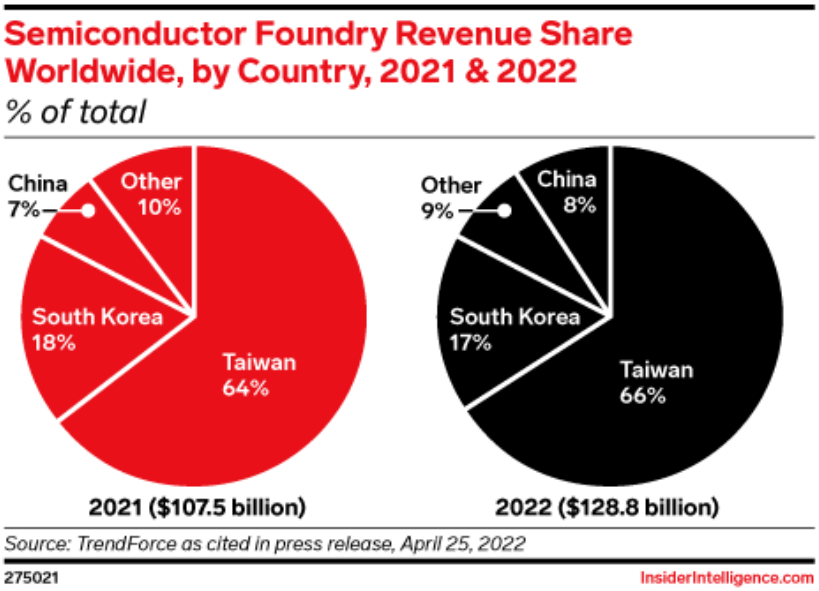
5. Strategic partnerships with global technology giants. Alliances and partnerships with other global companies allowed Taiwanese companies to gain access to new technologies and foreign markets, helping them drive innovation and expand business internationally. For instance, TSMC's foundation as a joint venture between the Taiwan government (21%), Philips (28%), and other private investors[15];
6. Competitive manufacturing sector. Pouring investments in advanced manufacturing capabilities, such as cutting-edge technologies and equipment, helped promote Taiwanese companies on the global platform and maintain a competitive position in the global market.[16]

Taiwan's rise to the prominence in the semiconductor industry was made possible thanks to both government efforts and private investments and partnerships. The significance of Taiwan's semiconductor industry manifests in most of the high-tech products and cutting-edge tools and weapons in the world. According to *The Economist*, "[semiconductor chips] make up 15% of Taiwan's GDP. Taiwan produces over 60% of the world's semiconductors and over 90% of the most advanced ones."[17]

[15] Nenni, "A Brief History of TSMC."
[16] Milne, "Taiwan's Chip Industry Explained: Why It Matters So Much Today."
[17] *The Economist*, "Taiwan's dominance of the chip industry makes it more important."



Source: *Financial Times*



Source: Insider Intelligence Inc.

2.2 Taiwan Trapped in the Middle of the Trade War

Taiwan's semiconductor industry found itself deeply involved and implicated in the middle of the U.S.-China trade war, which is essentially a battle for technology hegemony and geo-

strategic dominance. According to a 2021 Boston Consulting Group Study, Taiwan possesses 90% of the manufacturing capacity for the world's most advanced chips.[18] Granting that high-tech industry is Taiwan's strong suit and lifeline, world's dependency and reliance on Taiwan's semiconductor industry have made Taiwan important yet vulnerable amid the trade war between the two superpowers. Impacts of the trade war on Taiwan are not limited to only economic and financial aspects; in fact, the conflict between the United States and China have complicated the longstanding, deep-rooted political sovereignty status of the island as the Chinese government continues to pursue a policy of "One Country, Two Systems" with Taiwan. As the trade war persists, through policies, tariffs and sanctions, the United States essentially builds alliances against China and weaponizes Taiwan's chipmaking for its own agenda, hence many scholars have growing concerns over Taiwan's democracy, in fears of Beijing's economic blockade of Taiwan or, possibly, military invasion of the island.

The relations between the United States and China have tensed up since the trade war broke out during the Trump administration, and President Joe Biden has somewhat carried on Trump's legacy in terms of curtailing China's economic growth and revising down China's rise as a major tech power. In response, China shows no inclination to back down, imposing retaliatory tariffs and sanctions on the United States. Furthermore, China continues to grow its economic power by partnering with and investing in the United States' allies. As Taiwan is highly dependent on both the United States and China for its economy and trade, the island's semiconductor industry, which is a key driver of Taiwan's economy and an important factor of Taiwan's national security, has been affected by the trade war in many ways, including economic impacts and political instability.

Economic Impacts

Reduced Demand

[18] Graham, "U.S.-China Trade War Over Technology Heats Up; What It Means For Apple, Micron, Tesla."

As both the United States and China imposed tariffs on each other's imports, the trade war has caused a decline in demand for Taiwanese semiconductor products due to added costs on suppliers, thereby increasing purchasing costs for consumers in importing countries like the United States and China.[19]

Increased Costs Less Profits

China imposed tariffs on U.S. imports in response to tariffs levied on Chinese imports by the U.S. government. The back-and-forth tariff battle has impacted Taiwanese industries, including the semiconductor industry, as many Taiwanese companies manufacture and export semiconductors to the United States and China, two of Taiwan's biggest trade partners. Taiwan's manufacturing of intermediate products was mostly based in China, from where products are exported to other countries, such as the United States. The United States' additional tariffs levied on imports from China means Taiwanese factories now need to either increase prices to secure profit margins or accept less profits given the situation.

Given that the U.S. market is the main export destination for the end products of Taiwanese factories in China, the imposition of punitive tariffs heavily impacts the industry. Enterprises are faced with two options: return to Taiwan or migrate to Southeast Asia. The other option for these Taiwanese companies based in China is to reshore. The Taiwanese government under President Tsai provides incentive, including tax breaks and low-interest-rate loans to attract companies to reshore.

Uncertainty

The U.S.-China trade war has increased overall global economic uncertainty, and Taiwan is no exception. With so much uncertainty due to the ongoing trade war and all the muscle flexing of their economic power between the United States and China, Taiwan has

[19] Chang, "The U.S. China Trade War and Its Implications or Taiwan's Economic Structure."

suffered from the result of shifts in investment patterns since companies are now hesitant to invest or expand in uncertain economic conditions, in which Taiwan has experienced since the trade war began. Furthermore, as Taiwanese companies relocated to other locations, there are increasing concerns about unintentional and mandatory technology transfers required by local governments, consequently diminishing competitiveness of Taiwanese leading industries, such as the semiconductor industry.

Supply Chain Disruptions

One of the biggest impacts of the U.S.-China trade war is supply chain disruptions. As tariffs are levied on imports from China, companies are forced to find alternative suppliers or adjust their manufacturing processes to avoid tariffs. Furthermore, export controls and entity lists implemented by the United States and China have further disrupted Taiwan's trade patterns. Supply chain of the semiconductor industry has become more complex than ever as companies navigate the trade war while finding alternative sources of inputs for their production chains as well as shifting production away from China in order to minimize their vulnerability to geopolitical and economic risks.

Political Instability

Rising Geopolitical Tensions Weaken Taiwan's Silicon Shield

Tensions between China and Taiwan have been rising ever since President Tsai Ing-wen, whose political party favors Taiwan's independence, took office in 2016. President Tsai did not carry over her predecessor's effort to increase cross-strait ties; instead, she has been firm on Taiwan's democracy and has rejected China's policy of "one country, two systems" and Beijing's plan for "reunification". China has ramped up political and military pressure on Taiwan, leading the U.S. to step into Taiwan's defense. With increasing tensions seen in the trade war, Taiwan is undoubtedly caught in the middle as the island's economy and, more

importantly, national security are entangled in the U.S.-China relations. Furthermore, some scholars believe the United States will weaponize Taiwan to exert pressure on China in terms of political and economic support and military cooperation.

Due to cross-strait tensions and the U.S.-China trade war, Taiwan's semiconductor supply chains and Taiwanese production structure and operation of international trade have been affected significantly. Besides, the trade war has prompted restructuring of global supply chains, including production relocation, investment diversion, elevated uncertainty, international trade restructure, and etc. It is vital for Taiwan to assimilate to the new trade system quickly, prompt foreign investments and Taiwanese businesses reshoring, and reshape strategies to keep its semiconductor industry competitive and maintain its leadership position in the semiconductor industry.

III. The U.S.-China Trade War

3.1 Trump Administration

In 2018, the U.S.-China trade war officially began under the Trump administration. The trade war started from countless back-and-forth negotiations and soon escalated to a tit-for-tat tariff fight. Both countries first became embroiled in an ongoing trade dispute soon after Donald Trump took office. Then, in July 2018, the negotiations broke down, and the U.S.-China trade war officially began when the United States placed 25 percent duties on around US$34 billion of imports from China, including cars, hard disks and aircraft parts. Inevitably, China retaliated by imposing a 25 percent tariffs on 545 goods originating from the United States worth US$34 billion, including agricultural products, automobiles and aquatic products.[20] A series of back-and-forth tariff levy, customs and duties imposition and blacklisting soon followed.[21]

Table 1. U.S.-China trade war timeline since July 2018 under the Trump administration

Date	Event
06/07/2018	US-China trade war begins as US imposes 25 per cent tariffs on US$34 billion worth of Chinese imports
	China retaliates by imposing 25 per cent tariffs on 545 goods originating from the US worth US$34 billion
14/08/2018	China files WTO claim against US
23/08/2018	Washington imposes 25 per cent tariffs on a further US$16 billion worth of Chinese goods; China responds by applying 25 per cent tariffs on US$16 billion worth of US goods
	China files a new WTO complaint against US's Section 301 tariffs on Chinese goods
24/09/2018	US places 10 per cent tariffs on US$200 billion worth of Chinese imports
	China responds by placing customs duties on US$60 billion worth of US goods

[20] Mullen, "US-China trade war timeline: key dates and events since July 2018."
[21] See Table 1

01/12/2018	Xi Jinping and US counterpart Donald Trump call a truce in the trade war at the G20 summit in Argentina
14/12/2018	China temporarily lowers tariffs on US autos and resumes buying US soybean export
07/01/2019-09/01/2019	US and China engage in 3-day trade talks in Beijing
11/02/2019-15/02/2019	US and China hold trade talks in Beijing
31/03/2019	China extends the suspension of additional tariffs on US autos and auto parts
10/05/2019	After trade negotiations break down, US increases tariffs on US$200 billion worth of Chinese goods, from 10 to 25 percent
16/05/2019	US Department of Commerce announces the addition of Huawei to its "entity list", banning it from purchasing from US companies
31/05/2019	China announces plans to establish its own "unreliable entity list"
01/06/2019	China increases tariffs on US$60 billion worth of US products
21/06/2019	US adds another five Chinese entities to its "entity list"
29/06/2019	Xi Jinping and Donald Trump again agree to a trade war truce, this time at the G20 summit in Japan
09/07/2019	US exempts 110 Chinese products from 25 percent tariffs, issues licenses to American Huawei suppliers
06/08/2019	US designates China as a "currency manipulator"
13/08/2019	US announces that various planned levies on US$455 billion worth of Chinese products have either been delayed or removed
23/08/2019	China announces planned tariffs of 5 and 10 per cent on US$75 billion worth of US goods
01/09/2019	US tariffs on more than US$125 billion worth of Chinese imports begin as expected
11/09/2019	US agrees to briefly delay new tariffs on US$250 billion worth of Chinese goods
13/09/2019	China exempts various agricultural products from additional tariffs

20/09/2019	US releases new tariff exemption lists, which exempt over 400 Chinese goods from tariffs
11/10/2019	US announces that it will delay a planned tariff increase of 25 to 30 per cent on US$250 billion worth of Chinese goods
01/11/2019	China wins WTO case, able to sanction US$3.6 billion worth US imports
15/01/2020	China and the US sign the phase-one trade deal
14/02/2020	China halves additional tariffs on US$75 billion worth of American products imposed in 2019
12/05/2020	China announces a second batch of trade-war-tariff exemptions covering 79 American products
14/05/2020	China allows imports of barley and blueberries from the US
01/09/2020	Dozens of US imports from China are granted short extensions to previous tariff exemptions
14/09/2020	US customs agency issues "withhold release orders" banning cotton, apparel, hair products and computer parts from four Xinjiang companies
15/09/2020	China decides to exempt additional tariffs on a batch of 16 US products for another year
02/12/2020	US government says it will begin to block the import of all cotton products made by the Xinjiang Production and Construction Corps (XPCC)
	US president-elect Joe Biden tells The New York Times he will not make any "immediate moves" to lift trade war tariffs

Sources: Mullen, "US-China trade war timeline: key dates and events since July 2018"; Wong and Koty, "The US-Chna Trade War: A Timeline."

An initial exchange of tariff imposition between the two countries since the beginning of the trade war can be observed in Figure 1. Furthermore, an increasing trend of tariff levy on one another by the United States and China can also be observed in Figure 2.

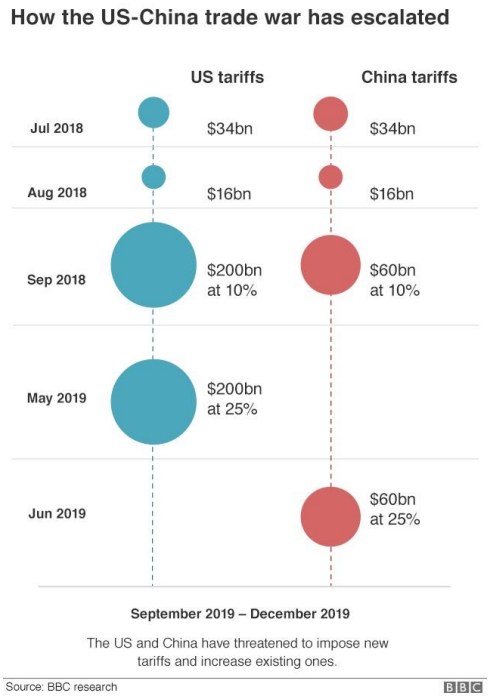


Figure 1. *How the US-China trade war has escalated*. Figure from BBC News, "A Quick Guide to the US-China Trade War," January 16, 2020. https://www.bbc.com/news/business-45899310.

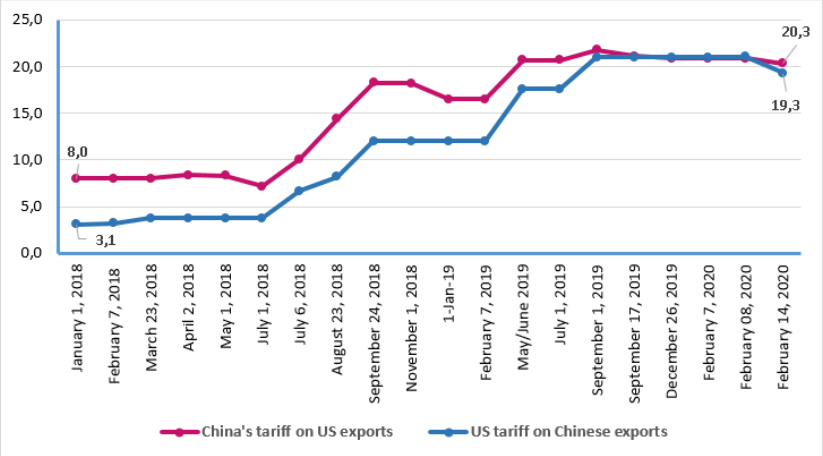


Figure 2. *US-China Trade Tariffs, %.* Figure from Azimzhan Khitakhunov, "US-China Trade War: Economic Causes and Consequences," *Eurasian Research Institute*, February 27, 2020. https://www.eurasian-research.org/publication/us-china-trade-war-economic-causes-and-consequences/.

The U.S.-China trade war, which continued throughout the Trump administration, had significant impacts on beyond just the two countries, but it affected the global economy in various ways. Among all, global trade was hit hardest as tariffs and other trade sanctions disrupted global supply chains, resulting in increased costs for multinational companies across a range of industries. One of the industries most impacted immediately by the trade war was the semiconductor industry. Semiconductors are critical to many products commonly used, such as smartphones, automobiles and computers. As the United States became concerned about China's rapid development and increasing self-sufficiency in its semiconductor production, the U.S. government placed restrictions on the export of semiconductor-related technologies to China, as well as tariff levy on semiconductor-related goods. Many restrictions targeted at preventing China from prospering the country's own domestic semiconductor industry. These actions by the U.S. government not only disrupted the global semiconductor supply chain but also backfired on the United States as many U.S. semiconductor companies relied on exports to China for a large portion of their revenue.

Besides the tariff increase on both sides, leading to lower profit margins and slower pace of innovation for the companies, the trade war also introduced new restrictions on technology imports and exports, such as the case of Huawei. Over the years, congressional committees, the FBI, the National Security Agency, and others had flagged close ties between the Chinese Communist Party and Huawei.[22] And in 2018, top U.S. intelligent chiefs accused Huawei and another Chinese tech company (ZTE) of posing potential national security risks, such as espionage and attacks by the Chinese government, to the United States and warned U.S. companies about doing business with them.[23] Former Secretary of State Michael Pompeo told Fox News on May 28, 2018:

[22] Stewart, "The US government's battle with Chinese telecom giant Huawei, explained."
[23] Ibid.

> Huawei is an instrument of the Chinese Government. They are deeply connected. It's something that's hard for Americans to understand. We would—our companies cooperate with the United States Government; that is, they comply with our laws; but no president directs an American private company. That's very different in China. They just simply operate under a different set of rules. That's the most fundamental thing I think people need to try and get their head around. If it's the case that the Chinese Communist Party wanted to get information from technology that was in the possession of Huawei, it is almost certainly the case that Huawei would provide that to them. That deep connectivity exists inside the way their political economy operates. That's very different than the United States. That's the threat that President Trump sees from Huawei.[24]

Huawei was added to the U.S. "Entity List" under the Trump administration in 2019.[25] The logic behind it was to restrict U.S. companies and partners of U.S. companies from doing business with Huawei. The consequences of such action were significant due to Huawei's major role in the global semiconductor business. Moreover, it had a serious impact on the United States as Huawei is one of the biggest customers of U.S. chipmakers like Qualcomm and Intel.[26]

On January 15, 2020, the U.S.-China Phase One trade agreement was signed by former U.S. president Donald Trump and former Chinese Vice Premier Liu He in the White House. Under the Phase One agreement, pledges are made by the two countries to address the trade imbalances and issues that had risen between them.

United States

1. The U.S. will cut by half the tariff rate it imposed on September 1 on a US$120 billion worth of Chinese goods to 7.5%;
2. U.S. tariffs of 25% on US$250 billion worth of Chinese goods will remain unchanged, though they could be rolled back on future trade talks with China;

[24] Goldman, *You Will Be Assimilated: China's Plan to Sino-form the World.*
[25] Stewart, "The US government's battle with Chinese telecom giant Huawei, explained." "Entity List" is a trade blacklist that bars anyone on it from buying parts and components from U.S. companies without the U.S. government's approval. The addition of Huawei on the "Entity List" drove a number of U.S. firms to back away from their business with Huawei.
[26] Ibid.

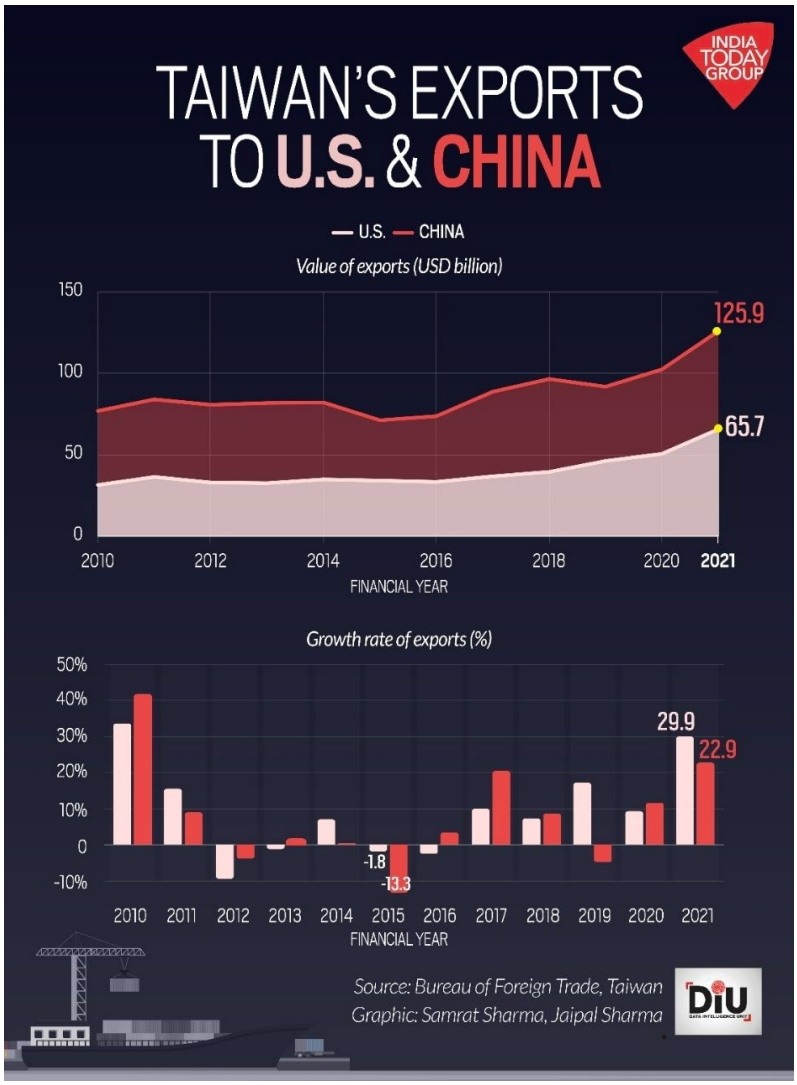
3. Tariffs scheduled to go into effect on December 15 on about US$160 billion worth of Chinese goods, such as cellphones, computers, toys and clothing will be suspended indefinitely.[27]

China

1. China agreed to expand purchases of American products and services, including manufacturing, agricultural and energy goods, by at least US$200 billion for the two-year period from January 1, 2020 through December 31, 2021;
2. China's retaliatory tariffs on December 15, including a 25% tariff on U.S.-made automobiles, will be suspended;
3. China pledged to include stronger Chinese legal protection for patents, trademarks, copyrights, including improved criminal and civil procedures to combat online infringement, pirated and counterfeit goods;
4. China pledged to eliminate any pressure for foreign companies to transfer technology to Chinese firms as a condition of market access, licensing or administrative approval and agreed to eliminate government abetting such technology transfers;
5. China agreed not to support outbound investment aimed at acquiring foreign technology to meet its industrial plans;
6. China pledged to make "enforceable commitments to refrain from competitive devaluation" and agreed to publish relevant data on exchange rates and external balances;
7. China agreed to improve U.S. companies' access to China's financial services, including banking, insurance, securities and credit rating services, as an effort to open up its financial services to more foreign competition. [28]

[27] Reuters Staff, "What's in the U.S.-China Phase 1 trade deal."
[28] Ibid.

The climate of the semiconductor industry was unstable and unpredictable throughout the Trump administration. The increased uncertainty in the industry led to reduced investment as companies became reluctant to invest in new projects and partnerships, given the risk of sudden policy or regulatory changes. However, the trade war does not seem to affect much of Taiwan's export volumes to the United States and China, albeit the growth rate of exports to the United States exceeds that to China. Furthermore, the United States and China remain to be Taiwan's two largest semiconductor consumers.[29]



Source: *India Today*

[29] Sharma and Mishra, "Taiwan is a big part of global trade: Here's what US-China tension can affect."

3.2 Biden Administration

The United States continued to be in a trade war with China during the Biden administration, despite both sides of the Pacific expected that he would back away from the trade war with China. Since taking office, President Joe Biden has intensified the trade conflict by imposing sweeping restraints designed to curtail China's access to technology critical to the country's growing military muscle.[30] In dealing with China, the Biden administration has taken a more multilateral strategy by building alliances with other countries in order to maximize Washington's leverage on Beijing. According to the *Interim National Security Strategic Guidance* published in March 2021, the document states that "our democratic alliances enable us to present a common front, produce a unified vision, and pool our strength to promote high standards, establish effective international rules, and hold countries like China to account."[31] Some significant measures taken by the Biden administration since his inauguration include:

1. A sweeping set of export controls, banning Chinese companies from buying advanced chips and chip-making equipment without a license. The rule further restricts American citizens and green card holders from providing support for the "development or production" of chips at certain manufacturing companies in China;[32]
2. A ban on all goods produced in Xinjiang, a western region in China. The ban is a further action following previous restrictions, under the Uyghur Forced Labor Prevention Act that was passed at the end of 2021, for some imports from the Xinjiang region. This is due to the accusation by rights group that Uyghurs and other ethnic and religious minorities had faced human rights abuses and forced labor practices. The new ban will not only block all imports made in the Xinjiang region but also bar goods made

[30] Liu, "What's at stake for the world's top two economies at Biden and Xi meet."
[31] Piesse, "The US-China trade relationship during the Biden Administration."
[32] He, "US curbs on microchips could throttle China's ambitions and escalate the tech war."

by firms outside the region but have links with Xinjiang companies or the Xinjiang government;[33]

3. More Chinese companies on the blacklist, based on the claim that the added companies could potentially undermine U.S. national security. According to a *CNN Business* article, "U.S. officials called the move part of an effort to prevent emerging U.S. technologies from being used for quantum computing efforts that would support China's military, such as 'counter-stealth and counter-submarine applications'";[34]
4. Sanctions on 24 Chinese and Hong Kong officials over Beijing's ongoing crackdown on political freedoms in Hong Kong.[35]

Key events and developments between the United States and China under the Biden administration[36] are further provided in Table 2.

Table 2. U.S.-China trade war timeline between President Joe Biden's inauguration day (January 20, 2021) and the end of 2022.

Date	Event
18/02/2021	US Treasury Secretary Janet Yellen says that tariffs on China will be "kept in place"
10/03/2021	The US extends tariff exclusion on Chinese medical products
12/03/2021	Five Chinese companies including Huawei are blacklisted by US telecom regulator
17/03/2021	US sanctions 24 Mainland China and Hong Kong officials ahead of Alaska talks
18/03/2021-20/03/2021	US and China hold the first high-level meeting in Alaska
22/03/2021	EU, US, UK and Canada sanction China over alleged Xinjiang human rights issue
08/04/2021	US blacklists seven Chinese supercomputing entities
16/04/2021	US and China announce joint statement addressing the climate crisis

[33] Yeung, "US bans imports from China's Xinjiang region over forced labor concerns"; Liang, "美國禁止從新疆進口產品 對品牌來說意味著什麼 [What the U.S. ban on Xinjiang goods means to companies]."
[34] Disis and Atwood, "US adds a dozen Chinese companies to its trade blacklist."
[35] Soo, "US Sanctions 24 China and Hong Kong Officials Ahead of Talks."
[36] For the purposes of this paper, data collection of the Biden era is from Joe Biden's inauguration day until the end of 2022.

26/05/2021	Chinese Vice-Premier Liu He and US Trade Representative Katherine Tai speak in the first trade talks since August 2020
01/06/2021	Chinese Vice-Premier Liu He holds a "candid" exchange on issues of concern with US Treasury Secretary Janet Yellen
03/06/2021	Biden expands Trump-era ban on American investment into Chinese firms
09/06/2021	Biden drops Trump attempt to ban TikTok and WeChat, but the scrutiny will continue
10/06/2021	Chinese Commerce Minister Wang Wentao speaks with his American counterpart Gina Raimondo
	China passes a new law to counter US and EU sanctions
23/06/2021	US bans imports of solar panel material from Xinjiang
08/07/2021	US adds 23 Chinese companies to economic blacklist
14/07/2021	US senate passes bill to ban all products from Xinjiang
15/07/2021	US says it has no intention to resume highest-level bilateral forum
19/07/2021	Trade deal didn't address 'fundamental problems', Yellen says
23/07/2021	China imposes sanctions on seven US citizens and entities
25/08/2021	US reportedly approves licenses for Huawei to buy auto chips
16/09/2021	China extends tariff exemptions on 81 products from US
24/09/2021	Huawei CFO Meng Wanzhou returns to China
26/10/2021	US Treasury Secretary Janet Yellen, Chinese Vice President Liu He hold virtual meeting
15/11/2021	Biden and Xi kick off their first virtual summit
24/11/2021	US blacklists Chinese quantum computing companies
08/12/2021	US bans all imports from China's Xinjiang
16/12/2021	US treasury department blacklists eight Chinese companies
16/12/2021 **20/12/2021**	US commerce department adds 34 more Chinese entities on its entity list

	US sanctions five more Hong Kong-based Chinese officials
05/02/2022	US House of Representatives passes America Competes Act
07/02/2022	US adds 33 Chinese entities to its "unverified list"
23/03/2022	The Office of the United States Trade Representative (USTR) reinstates tariff exemptions on some Chinese goods
25/03/2022	The US Securities and Exchange Commission (SEC) adds Weibo to list of Chinese companies for possible delisting from US stock exchanges
11/05/2022	Joe Biden says US may lift tariffs on Chinese goods to combat inflation
11/05/2022	US removes key language on its stance on Taiwan
24/05/2022	US President Biden indicates a willingness to defend Taiwan militarily
21/06/2022	US ban on Xinjiang imports takes effect
02/08/2022	Speaker Pelosi arrives in Taiwan prompting military drills
05/08/2022	China sanctions Pelosi
23/08/2022	US adds seven China entities to its export control list
07/10/2022-13/10/2022	US Department of Commerce implements new export controls on advanced computing and semiconductors to China
15/11/2022	Biden and Xi hold first face-to-face meeting as leaders
25/11/2022	China extends tariff exemption on 95 US goods for six months
16/12/2022	US extends tariff exemption on 352 Chinese goods, following a previous extension in March 2022

Sources: Mullen, "US-China trade war timeline: key dates and events since July 2018"; China Briefing, "The US-China Trade War: A Timeline."

One of the key events and actions taken by the Biden administration was to review the Phase One trade deal, which was signed by former President Donald Trump with China in January 2020. The core of the Phase One trade agreement was a purchase commitment from China to increase specific imports from the United States totaling US$200 billion of extra purchases

during 2020 and 2021.[37] However, the review found that China fell short of the Phase One agreement's targets by the end of the term. According to the *Peterson Institute for International Economics (PIIE)*, China purchased only 58 percent of the total U.S. goods and services over the course of 2020-2021 that it had committed to buy under the agreement.[38] In other words, China did not purchase any of the additional US$200 billion of U.S. exports committed under the deal.[39]

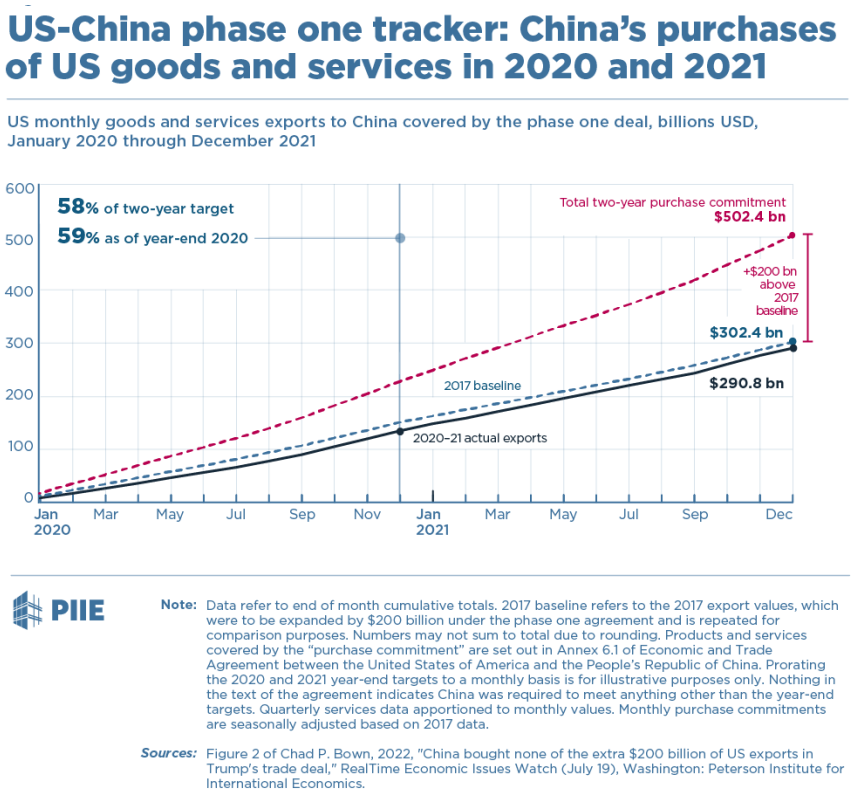


Figure 3. *U.S. Monthly Goods and Services Exports to China Covered by the Phase One Deal from January 2020 to December 2021.* Figure from Chad P. Bown, "US-China phase one tracker: China's purchases of US goods," *Peterson Institute for International Economics*, July 19, 2022. https://www.piie.com/research/piie-charts/us-china-phase-one-tracker-chinas-purchases-us-goods.

[37] The China Business Review, "Reflections on the Phase One Agreement."
[38] See Figure 3
[39] Bown, "US-China phase one tracker: China's purchases of US goods."

Furthermore, the *Peterson Institute for International Economics* indicates that during the period between January 1, 2020, and December 31, 2021, China committed to purchase no less than an additional US$162.1 billion of covered goods from the United States relative to the 2017 baselines.[40] In additional to China's failed commitment to purchase more of U.S. goods and services, the Chinese government did not deliver other commitments, such as regulatory changes and a more open financial system. The U.S.-China Business Council accused the Chinese government of "drag[ging] its feet in improving the transparency and predictability of regulatory approval or importing genetically modified U.S. agricultural products produced by Monsanto, Syngenta and other firms. And that the benefits to U.S. pharmaceutical firms by improvements in China's patent approval process has been offset by an apparently deliberate rapid increase in patent approvals for generic competitors of braded U.S. products. The council president further explained the accusation by saying '[t]here is definitely an argument to be made that Chinese industrial policy might be undercutting some of the improvements in intellectual property rights that we had anticipated.'"[41] In the end, the Phase One trade agreement is a failure, though, some believed, a projected one. According to the *POLITICO*, "…trade experts say that China was saddled with impossibly high import targets that made under-delivery inevitable."[42] In China's perspective, the government insists that it has honored its Phase One commitments in good faith despite challenges posed by the supply chain disruptions and economic impacts caused by the COVID19 pandemic.[43]

[40] See Figure 4. In this figure from the *Peterson Institute for International Economics,* defining the 2017 baseline using the U.S. export statistics implied a two-year purchase commitment, which is a total of US$352.2 billion; defining the 2017 baseline using the Chinese import statistics implied a two-year commitment, which is a total of US$380.5 billion.
[41] Kine, "From 'momentous' to 'meh'—Trump 's China trade deal letdown."
[42] Ibid.
[43] Ibid.

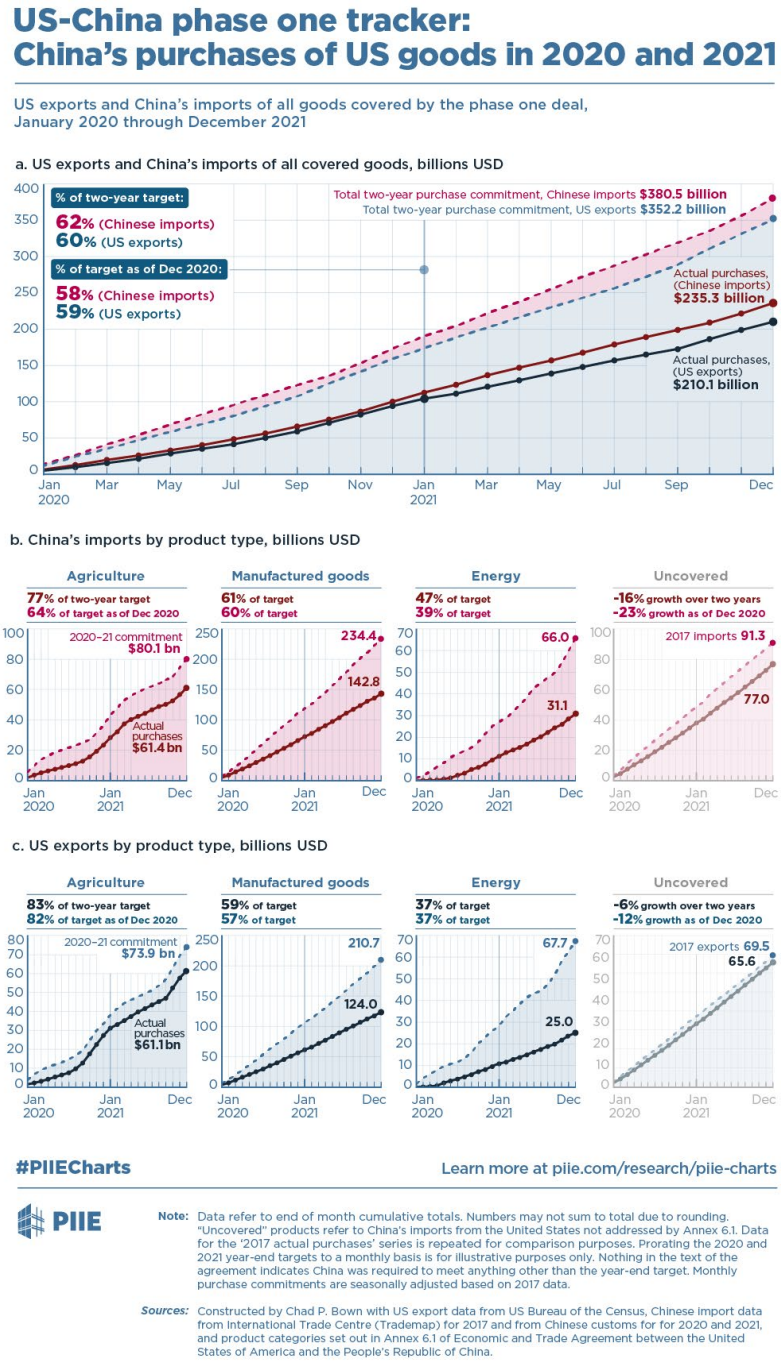


Figure 4. *U.S. Exports and China's Imports of All Goods Covered by the Phase One Deal.* Figure from Chad P. Bown, "US-China phase one tracker: China's purchases of US goods," *Peterson Institute for International Economics*, July 19, 2022. https://www.piie.com/research/piie-charts/us-china-phase-one-tracker-chinas-purchases-us-goods.

IV. Taiwan Semiconductor Manufacturing Company (TSMC)

4.1 Background

Taiwan Semiconductor Manufacturing Company (Chinese: 台灣積體電路製造, 台積電), short for TSMC, was founded by the Taiwanese government (21%) as a joint venture with Phillips Electronics (28%) and other private investors in 1987 under the leadership of Morris Chang, who had previously worked at Texas Instruments and General Instrument. The establishment of TSMC was the Taiwanese government's effort to move up the island's manufacturing value chain and promote the development of the island's semiconductor industry. The company has become one of the most influential chipmaking manufacturers in the world and led the world's largest semiconductor foundry.

Unlike most business models that seek from an early stage to develop brand recognition for the product in question with the aim of charging a premium price once the brand's reputation is established, TSMC, in contrast, elected to act as contract manufacturers to others, making products and components of products for other companies. The profit per unit produced is smaller than at other firms, but TSMC offset this against its much larger output by supplying several companies with rival products, without being a competitor itself.[44]

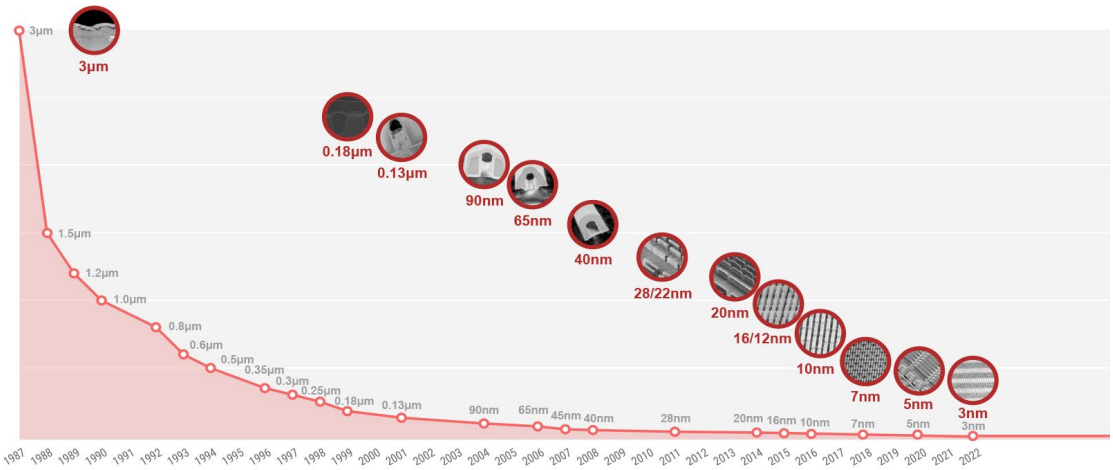
In TSMC's early years, the company primarily manufactured and supplied microprocessors and memory chips for companies like AMD, NVDIA, IBM and Intel. Although the company first started two-node processes behind its competitors at the time, TSMC quickly broke the 1-micron wafer-processing barrier in 1991, replacing its 6-inch, 2-micron wafer-processing fabrication facility. By 1992, TSMC was rated as the world's top silicon foundry and accounted for 80 percent of Taiwan's production of SRAM and other semiconductor chips.[45] In September 1994, TSMC went public on the Taiwan Stock Exchange, followed by the company's

[44] Reilly, "How Taiwan won the semiconductor race."
[45] "Taiwan Semiconductor Manufacturing Company Ltd. History," Funding Universe.

establishment of their own 8-inch wafer fabrication facility in 1995. In April 1996, TSMC was listed on the New York Stock Exchange as the first Taiwanese company. By the year 1997, TSMC had reached 1 million wafer capacity though the year of sales declined with a 50 percent drop in profits due to its excess supply of wafers for microchips and rising competition in the semiconductor industry. TSMC chairman Morris Chang took the position of TSMC's President and, in the face of fierce competition for market share, further grew the company, in terms of stock value, product strength and professional reputation, by keeping the advancement of the company's process at the forefront.[46]

In early 2000s, TSMC attained many business milestones, including its acquisition of TSMC-Acer and its merger with WSMC, Taiwan's third-largest foundry, and TI-Acer. During the 2000s and 2010s, TSMC continued to launch new innovations of its chipmaking and increase and upbring its manufacturing capacity. TSMC produces the smallest chips in the world and leads the semiconductor manufacturing industry in an unprecedented way, as it revolutionized the semiconductor industry by being a sole chipmaking company that provides for fabless companies in the world. The company has consistently invested in its foundries and equipment not only to stay competitive amid rising competitions from Intel and Samsung but also to cement its leadership position in the industry by having the most advanced chipmaking technology in the world. TSMC has always insisted on building a strong in-house R&D capability. The graph below provides a timeline of TSMC's foundry process technologies.

[46] History Computer Staff, "Taiwan Semiconductor: Everything You Need To Know."



Source: TSMC Website

Taiwan indubitably dominates the foundry market. Contract manufacturers of Taiwan made up 60% of global foundry revenue in 2020, and 90% of them was pocketed by one firm—TSMC. In a *Time* article written by Chris Miller:

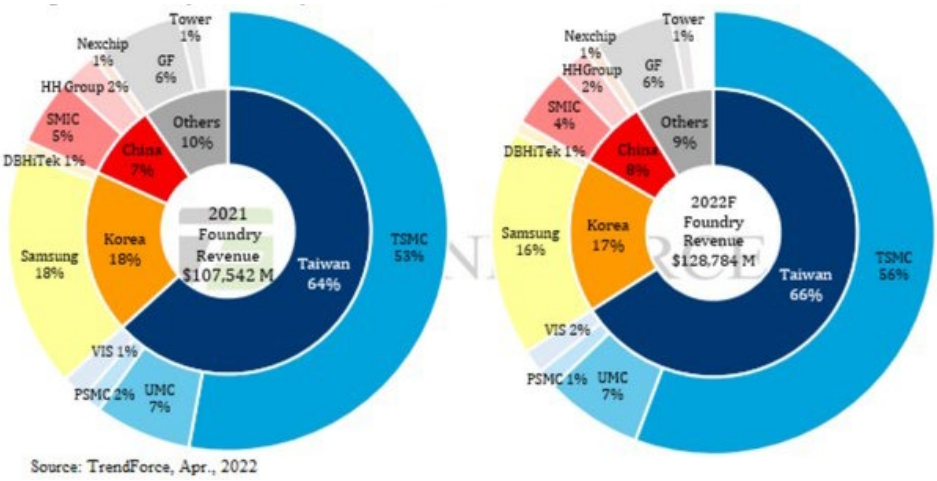
> Making advanced chips requires using complex software, explosive chemicals, ultra-pure silicon, and machines costing hundreds of millions of dollars to pattern billions and billions of nanometer-sized transistors onto silicon wafers. For the past half-decade, TSMC has been the world's leader, its engineers pioneering secret methods to pattern chips with unprecedented accuracy at unparalleled scale. TSMC has around 55% of the global market for contract chip fabrication, for above OPEC's 40% market share for oil. And unlike the oil market, where each barrel is more or less the same, there are vast differences between types of chip. Taiwan produces almost all the most advanced processors, a market position that makes Saudi Arabia's 12% share of global oil production look unimpressive."[47]

TSMC has paved the way for industrial revolution in the semiconductor manufacturing world. Amid the pandemic, there was a global shortage of chips that inevitably affected the production of computers, processors, smartphones, laptops and everything else related to technology and internet. TSMC and its competitor Samsung have become more valuable than ever as the world demands advanced chips from them. TSMC put together a plan to build a fabrication plant in Arizona to fix the chip shortage and prevent it from happening again.[48] As semiconductors

47

[48] Campbell, "Inside the Taiwan Firm That Makes the World's Tech Run."

become all the more important, competitors like Samsung and Intel also seek to gain more market share through investments and partnerships. Nonetheless, as of now, TSMC leads the semiconductor manufacturing industry and supplies the most advanced chips to its big-name customers.[49]



Source: *TrendForce*

4.2 TSMC Stuck Between the United States and China

Taiwan Semiconductor Manufacturing Company (TSMC) has secured a technology that is crucial to advanced digital devices and cutting-edge weapons. According to a *Reuters* article, TSMC accounts for a majority of global output of advanced chips.[50] As conflict between Taiwan's two largest trade partners, China and the United States, intensifies, TSMC, the "silicon shield" of the island and an important role in the global semiconductor supply chain, also finds itself stuck in the middle of this rivalry.

Stuck in the middle of the trade war, which is essentially a technology war between the United States and China, TSMC has encountered hurdles due to sanctions, tariffs and other political and economic measures the two superpowers implemented as a way to limit technology innovation against each other. Many scholars have published findings of the

[49] Some well-known customers of TSMC include Apple, Qualcomm, Nvidia, Mediatek, AMD, Broadcom and etc.
[50] Lee, Shirouzu, and Lague, "Taiwan chip industry emerges as battlefront in U.S.-China showdown."

damages and impacts the trade war has brought on TSMC; among all, some of them stood out as they are not only the events that hit the company hardest, but, more importantly, they also highlight the significant long-term challenges the U.S-China trade war pose on the company's economic well-being.

Halt of new Huawei orders

TSMC was severely hurt by the U.S. ban on companies selling Huawei-designed chips back to Huawei, one of the company's largest clients. Following the previous control of placing Huawei on the entity list and restricting sale of American-made technologies to Huawei, the new ban by the Department of Commerce bars companies without a license from supplying Huawei if they are selling a product designed using U.S. software, technology or intellectual property, or manufactured to Huawei's specifications using U.S. machines.[51] For TSMC, Huawei accounted for a 23% revenue share for the company in 2019. In other words, Huawei is one of TSMC's biggest customers; halting supply to Huawei in compliance with U.S. sanctions meant a great revenue loss for TSMC: "TSMC's move might please the Trump administration and Taiwan's independence-leaning ruling party. However, TSMC's decisions to cut off Huawei and open a U.S. plant could hurt the chipmaker over the long run."[52] Nonetheless, TSMC Chairman Mark Liu said to an investors conference that TSMC would only take a short-term hit from the sanctions imposed on Huawei, and the company would be working with other clients to make full use of its capacity.[53]

Restriction on American citizens working in Chinese firms

Due to the U.S. technology export rules, U.S. citizens working in Chinese firms are faced with a tough choice—whether to continue working in Chinese firms at the risk of losing

[51] Hille and Stacey, "TSMC falls into line with US export controls on Huawei."
[52] Sun, "Is TSMC Becoming a Pawn in the Trade War Between the U.S. and China?"
[53] Hui and Wei, "TSMC Cuts Off Computer Chip Sales to Huawei Under U.S. Sanctions."

U.S. citizenship or to quit their jobs to comply with the U.S. policy. U.S. Commerce Secretary Gina Raimondo stated in an interview with CNBC's Jim Cramer, "we have to protect the American people against China. Period. Full stop."[54] Four days after the announcement of the ban, TSMC's stock fell 8% and its market capitalization dropped more than NT$1tn.[55] TSMC is hit by the new restriction in many ways more than just the personnel sector, as now the company can no longer help its Chinese customers put advanced graphics and AI processors into production; moreover, TSMC's key clients, including Nvdia and Advanced Micro Devices, can no longer ship high-end graphic processors for use in the Chinese market.

Shift of supply chain geography

The U.S.-China trade war restructured semiconductor supply chains and somewhat shortened global supply chains as companies realized that they need to become more proactive in the global production activities in terms of supplying products in a timely manner despite outside factors, such as pandemics and geopolitical risks caused by the trade war. Furthermore, governments around the world have all learned a lesson from the trade war between the United States and China when the disruption of supply chains led to severe chip shortages. High dependency on one single company, TSMC in this case, makes all companies in the technology-intensive industries vulnerable considering TSMC chips are key components of their products. As a result, many countries now consider the semiconductor industry as an essential part of national strategy; building their own semiconductor industry is important in strengthening supply chain resilience and increasing their national power.[56]

Implicated by the U.S.-China trade war, TSMC has made a deal with the U.S. government and has been building its new Arizona plant that will come online in 2024.

[54] Cox, "U.S. Commerce Secretary Raimondo doubles down on Biden plan to restrict American companies, and citizens, from helping China make semiconductor chips."
[55] 錢玉紘, "童子賢: 美中貿易戰升級! 一道禁令讓台積電蒸發兆元市值, 台灣該擔憂嗎?"
[56] Chen, Lin, and Lien, "Taiwan's Shifting Role in the Global Supply Chain in the U.S.-China Trade War," 322.

Concerns about Taiwan's semiconductor industry being hollowed out at the expense of strengthening its ties with the United States are boiling as the U.S. policies may possibly reshape Taiwan's semiconductor industry and weaken Taiwan's "silicon shield." Moreover, if TSMC shifts its production of older chips to the United States, higher labor costs will also throttle the company's margins. The right-wing party Kuomintang (KMT) accused the government of "gifting" TSMC to the United States. "TSMC will surely become USMC in the future," said Tseng Ming-Chung, a KMT legislator.[57] With the new TSMC plant being built in Arizona, there are growing fears that Washington is pushing to diversify chip manufacturing away from Taiwan, and therefore TSMC will become less of a protective shield over the island and eventually lose its competitive edge to the United States.

Geopolitical tensions and uncertainty

"Taiwan risk" has become a phenomenon as companies now worry that rising tensions between the United States and China can possibly stir up a military confrontation between the two superpowers, where Taiwan would be affected the most as it highly depends on the two countries, which are also TSMC's biggest partners. Embroiled in the battle between world's two superpowers, TSMC faces increasing geopolitical risks. Manufacturing factories of TSMC's most advanced chips are based in Taiwan, which is an opportunity and also a risk. TSMC's tight concentration of fabs in Taiwan makes the company utterly susceptible to the geopolitical tensions between the island and China as well as the conflict between the United States and China.[58] The trade war and other geopolitical tensions (for example, Taiwan's status of independence from China) have created significant uncertainty in the global business environment. The uncertainty can affect investment decisions, FDI flows, supply chains, customer demand, talent retention, and many more. TSMC, as a global chip manufacturing

[57] Cheng, "Taiwan's dominance of the chip industry makes it more important."
[58] See Figure 5

leader, relies heavily on international markets, which makes the company vulnerable to fluctuations in demand and pricing and trade policies as companies and governments adjust their strategies and supply chains to mitigate risks associated with the trade war.

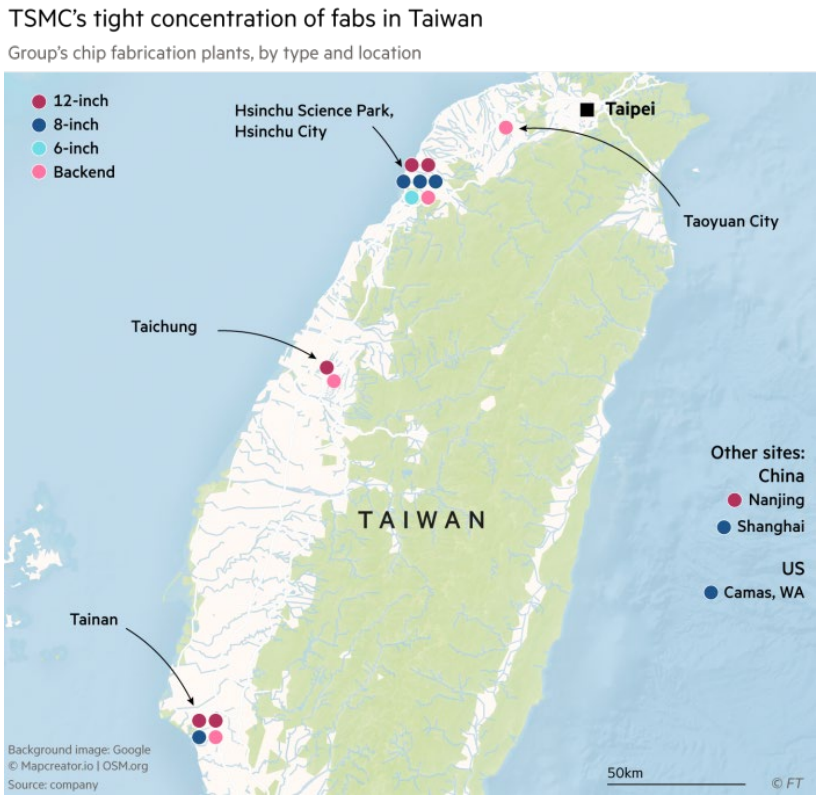


Figure 5. *TSMC's tight concentrations of fabs in Taiwan*. Figure from Kathrin Hille and Demetri Sevatopulo, "TSMC: the Taiwanese chipmaker caught up in the tech cold war," *Financial Times*, October 24, 2022. https://www.ft.com/content/bae9756a-3bce-4595-b6c9-8082fd735aa0.

4.3 TSMC Remains Resilient

Semiconductors have become indispensable in our daily life. They are vital to everyday domestic electronic products, but, more importantly, they are an essential material of national security products, such as fighter jets.[59] TSMC, the most important company in the

[59] Chang, "A Taiwanese perspective on the Semiconductor Industry: Maintaining the Competitive Edge."

semiconductor manufacturing industry, holds a near monopoly in chipmaking. Despite damages done by the U.S.-China trade war and the chip shortages triggered by the COVID-19 pandemic, TSMC continues to grow and prosper in terms of its financial position and financial performance. A think tank op-ed published by the European Institute for Asian Studies (EIAS) in 2021 noted:

> Taiwan holds a near monopoly in this security-related product. Responsible for 63% of global semiconductor market share, Taiwan lies at the heart of the semiconductor industry, reaching an output value of 3 trillion NTD in 2020 (107.53 billion USD). As a world leader in semiconductor manufacturing, the Taiwan Semiconductor Manufacturing Company (台灣積體電路製造公司, TSMC) accounts for 54% of the global semiconductor market share. The demand for the chips below 10nm…is towering and is estimated to become the largest portion of monthly installed capacity share in 2024. Currently, in the global market of chips below 10 nanometers, TSMC is the major supplier (accounting for 84% of the pure foundry revenue in 2020). The only competitor producing chips below 10nm is Samsung of South Korea with a 14% of pure foundry revenue in 2020. So far, the major clients of TSMC, such as China and the U.S., do not have the capacity to produce their own advanced semiconductors. As a result, Taiwan has become an indispensable link in the global production of semiconductors.[60]

Although there are many existing studies on the negative impacts and damages caused by the trade war on Taiwan's biggest chipmaking company, TSMC has been seeing resilient chip sales and continued to perform well in recent years. TSMC's consistent strong performance can be observed in its annual reports, as shown below.

[60] Ibid.

Condensed Statement of Comprehensive Income from 2018 to 2022 (Consolidated)

Unit: NT$ thousands (Except EPS: NT$)

Item \ Year	2018	2019	2020	2021	2022
Net Revenue	1,031,473,557	1,069,985,448	1,339,254,811	1,587,415,037	2,263,891,292
Gross Profit	497,874,253	492,701,896	711,130,120	819,537,266	1,348,354,806
Income from Operations	383,623,524	372,701,090	566,783,698	649,980,897	1,121,278,851
Non-operating Income and Expenses	13,886,739	17,144,246	17,993,482	13,145,417	22,911,867
Income before Income Tax	397,510,263	389,845,336	584,777,180	663,126,314	1,144,190,718
Net Income	351,184,406	345,343,809	518,158,082	597,073,134	1,016,900,515
Other Comprehensive Income (Loss) for the Year, Net of Income Tax	9,836,976	(11,823,562)	(30,321,802)	(7,619,456)	42,430,165
Total Comprehensive Income for the Year	361,021,382	333,520,247	487,836,280	589,453,678	1,059,330,680
Net Income Attributable to:					
Shareholders of the Parent	351,130,884	345,263,668	517,885,387	596,540,013	1,016,530,249
Noncontrolling Interests	53,522	80,141	272,695	533,121	370,266
Total Comprehensive Income Attributable to:					
Shareholders of the Parent	360,965,015	333,440,460	487,563,478	588,918,059	1,059,124,890
Noncontrolling Interests	56,367	79,787	272,802	535,619	205,790
Basic/Diluted Earnings Per Share (Note)	13.54	13.32	19.97	23.01	39.20

Note: Based on weighted average shares and diluted weighted average shares outstanding in each year.

Source: TSMC annual report

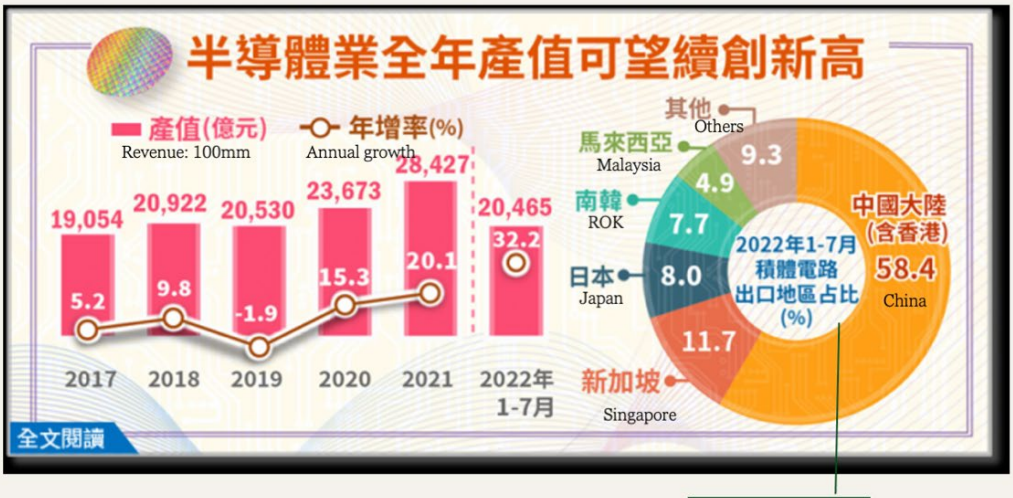
Despite uncertainty and challenges posed by the U.S.-China trade war and even the COVID19 pandemic, TSMC remains competitive in global semiconductor supply chains. To stay at the top of the industry, TSMC focuses on improving its technology by investing heavily in R&D so that the company will be able to accommodate emerging opportunities in 5G, high-performance computing, etc. In addition, TSMC's investment in the chipmaking plant in Arizona will be beneficial to supply chain cooperation between Taiwan and the United States. There are also potential plans to build plants in Singapore and Japan, helping the company expand its alliance and supply chain cooperation further. For now, Taiwan is "irreplaceable in the near-term in the semiconductor industry," said Bum Ki Son, economist at Barclays Plc, in an email to *Bloomberg News*.[61]

[61] Bloomberg News, "'Irreplaceable' – Taiwan Still Dominates Chip Industry, Despite Geopolitical Turmoil."

V. Opportunity for Taiwan's Semiconductor Industry

As the demand for chips rose around the world, Taiwan's semiconductor industry reaped strong earnings and surfaced as the top of the global semiconductor supply chains. Although the U.S.-China trade war has brought negative impacts on Taiwan due to the uncertainty and disruptions, Taiwanese semiconductor exports and revenues continue to grow. Furthermore, despite challenges risen in the new trade environment, Taiwan has experienced some opportunities amid the changing dynamics.

Semiconductor Export and Annual Revenue



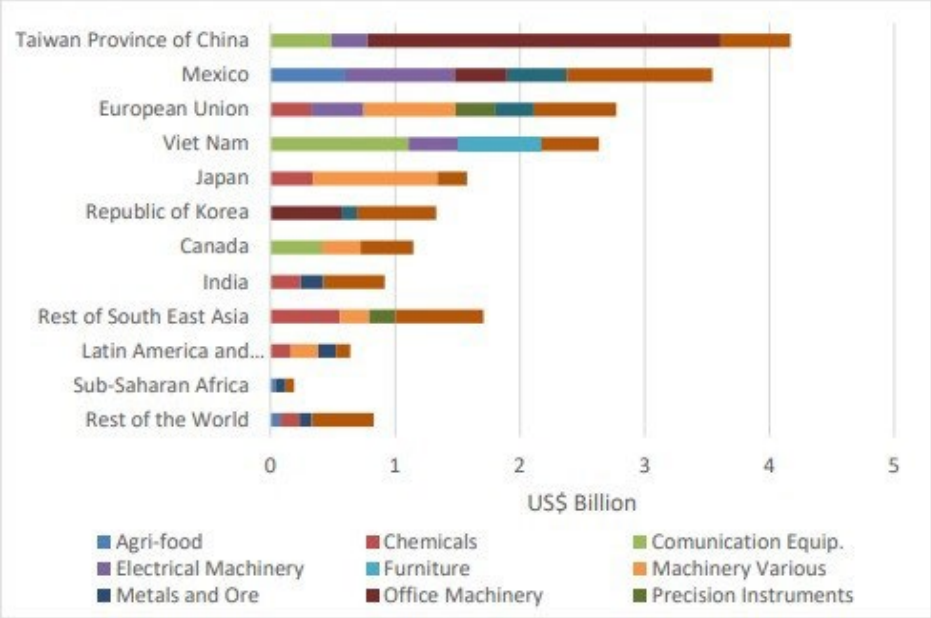
Source: Ministry of Economic Affairs, ROC

Trade diversification

Trade war between the United States and China has not only created a surge in exports of Taiwan's semiconductors to the United States but also induced a growth in trade activity and an increase in investment in the island. According to a report released by UNCTAD, "Taiwan was singled out as the top beneficiary of the trade diversion effects of U.S. tariffs leveled

against China. In the first half of 2019, Taiwan saw an increase of US$4.2 billion (NT$127.8 billion) in exports to the U.S."[62]

Figure 3. Trade diversion effects, by economies and regional groups (first half of 2019)



Source: UNCTAD

	OFFICE MACHINERY	MACHINERY VARIOUS	ELECTRICAL MACHINERY	CHEMICALS	COM. EQUIPMENT	METALS AND ORE	PRECISION INSTRUMENTS	AGRI-FOOD	TRANSPORT EQUIPMENT	FURNITURE	TEXTILES AND APPAREL	OTHERS	TOTAL
Taiwan (Province of China)	2830	122	287	5	491	205	183	6	14	55	8	11	4217
Mexico	420	407	876	127	0	373	166	599	456	99	47	0	3570
European Union	108	739	422	324	0	96	371	215	285	0	66	55	2681
Vietnam	60	8	400	134	1106	130	18	14	52	665	4	10	2601
Japan	63	997	0	342	10	62	0	21	1	0	12	32	1540
Canada	39	307	110	0	416	83	62	21	76	0	0	83	1197
Korea (Rep. of)	568	99	68	95	13	52	2	19	117	5	48	29	1115
India	18	68	83	243	0	181	23	23	6	27	41	42	755
Thailand	0	124	25	243	0	58	0	0	4	22	4	1	481
Brazil	0	191	27	129	9	71	7	4	11	0	4	0	451
Russian Federation	0	0	19	143	0	54	0	56	1	0	0	74	347
Malaysia	12	0	12	40	0	50	76	0	1	58	2	1	251
Turkey	0	23	12	17	31	89	9	13	5	11	14	1	226
Indonesia	0	29	27	0	42	25	4	0	1	0	2	0	129
Australia	0	5	0	23	13	0	4	16	2	26	3	3	95
Argentina	0	22	1	8	0	27	0	9	0	3	1	3	75
South Africa	0	3	3	30	0	0	4	13	0	5	2	0	60
Pakistan	0	0	0	5	0	0	1	3	0	2	25	0	37
Rest of the World	179	82	89	272	10	78	261	33	0	3	583	25	1616
Total Trade Diversion	4297	3226	2461	2179	2142	1635	1190	1065	1031	981	866	371	21443

Source: Trade diversion effects in the US market by economy and sector, first semester 2019 (millions US dollars) by UNCTAD

[62] Everington, "UN recognizes Taiwan as biggest winner from US-China trade war."

Furthermore, as the United States imposed tariffs on Chinese imports, including semiconductors, multinational companies relocated production away from China to Taiwan and sought new sources of related manufacturing components in Taiwanese semiconductor companies, thereby increasing demand for Taiwanese semiconductors and leading to increased production and revenue.

Technological advancement

The trade diversion effect driven by the trade war has prompted Taiwan's semiconductor industry to enhance its technological developments and drive innovation in the sector. Moreover, as companies aim to reduce dependence on China and strengthen supply chain resilience, many Taiwanese companies push for developing more mature and self-sufficient manufacturing processes. With Taiwanese government's effort to reengineer the local chip industry and increasing incentives for Taiwanese semiconductor companies to invest in research and development of cutting-edge technologies, Taiwan's semiconductor industry has remained competitive in the global market and attract foreign investments and partnerships.

New collaborations

The U.S.-China trade war has fostered partnerships and forged collaborations between Taiwanese semiconductor companies and foreign firms and countries. One of the most significant examples that has emerged amid the trade war is TSMC's work-in-progress plant in Arizona, USA. As the Biden administration emphasizes building a more self-sufficient and resilient semiconductor supply chain, the U.S. government prioritizes domestic semiconductor production and invites TSMC to work closely with American technology firms to develop customized solutions to different industry needs. Furthermore, aligning with Biden administration's agenda to lure manufacturers to produce chips domestically, the U.S. government provides tax credits and other incentives for TSMC to build its fabs in Arizona. The

fabs will make a lot more advanced and lucrative chips while focusing on the fabs' sustainability.[63] Building new plant in Arizona will do more than just helping the U.S. domestic semiconductor sector; additionally, it will help TSMC gain an edge in developing its technology, recruiting top talents, avoiding unnecessary risks associated with the trade war and securing customers in the United States.

[63] Wiles, "When will it open? How can you find jobs? 5 things to know about Phoenix's TSMC semiconductor plant."

VI. Conclusion

The U.S.-China trade war has restructured global supply chains and impacted a wide range of industries in the world. Taiwan's semiconductor industry is no exception; in fact, the trade war has brought significant challenges and opportunities for Taiwan's semiconductor industry, including Taiwan's largest and most crucial company—Taiwan Semiconductor Manufacturing Company (TSMC). Some major challenges brought by the trade war include the imposition of U.S. export controls on Chinese imports, addition of Chinese companies on the entity list, work restrictions of U.S. citizens in Chinese companies, bans on doing business and providing American-made technology products to Chinese firms. As a result, as a key player of the semiconductor manufacturing industry and a major supplier of Chinese tech firms, TSMC experienced a decline in demand, affecting the company's sales performance and further disrupting global supply chains. The trade war has also created geopolitical tensions and uncertainty in Taiwan's market. However, some scholars believe, the U.S.-China trade war has indeed brought new opportunities and benefits to the semiconductor industry in Taiwan, particularly its "silicon shield"—TSMC.

With the case study of TSMC, this thesis was able to explore both positive and negative impacts, some of which are particular to Taiwan's unique circumstances, the U.S.-China trade war has brought to Taiwan's semiconductor industry. Taiwan's semiconductor industry has demonstrated great resilience despite uncertainties and challenges persisted throughout the trade war. Through adaptability and flexibility, the industry quickly and successfully adjusted to changing market dynamics and modified to suit client demands in the new ecosystem bombarded by sanctions and economic restrictions. Disruptions of semiconductor supply chains, growing global uncertainties and rising geopolitical tensions within the island have impacted TSMC significantly, yet the company continued to outperform through market diversification, technological advancements, and strategic partnerships. TSMC has continued to stay

competitive through R&D. As a result, the company continues its strong semiconductor momentum and maintains its leadership in the global semiconductor manufacturing industry.

While Taiwan's semiconductor industry has weathered the storm of the U.S.-China trade war, ongoing research is imperative to observe the long-term consequences of the trade war. Trajectory of the impacts and opportunities the trade war has on Taiwan need further study as some Taiwanese politicians and scholars have raised doubts about the long-term consequences of some major business decisions made by the Taiwanese government and other semiconductor companies, including TSMC. For instance, Chinese National Party (KMT) has accused the government of "gifting" TSMC to the United States due to pressure from Washington.[64] "DDP government is not only pressuring it [TSMC] to set up plants abroad, it is also giving away gifts, such as Taiwanese experience and talent in chip production, to other countries," and "[i]n doing so, the DDP has ruined TSMC as well as Taiwan's economy," KMT caucus deputy secretary Wu I-ding (吳怡玎) said.[65]

One of the biggest concerns proposed by KMT is TSMC's weakening silicon shield due to potential technology transfer. TSMC's Arizona plant may possibly lead to technology transfer due to the fabs' close proximity to Intel's Arizona plant. KMT caucus convener Tseng Ming-chung (曾銘宗) told the news conference:

> TSMC is now building a plant in Arizona with initial investment of US$12 billion. The 4-nanometer chip facility is due to start production in 2024. It is also planning a 3-nanometer plant with US$40 billion investment[.] Meanwhile, its main competitor, Intel, also has a plant in Arizona for 4-nanometer and 3-nanometer chip only an hour's drive away from TSMC's plant … Industry executives and experts have said Intel would be the winner by taking new technology from TSMC and improving its production yield rate … Intel offers salaries three to five times higher those offered by TSMC … It is tantamount to TSMC training engineers and technicians for Intel.[66]

[64] Pan, "KMT accuses government of 'gifting' TSMC to US, warns of economic doom."
[65] Ibid.
[66] Ibid.

Furthermore, TSMC's new plant in Arizona will require top talents from Taiwan to station in the fabs, eventually hollowing out Taiwan's semiconductor talent pool. In Tseng's words, "TSMC has already sent 1,000 engineers to Arizona and the number is expected to reach 2,000 by the end of next year … when 3-nanometer chip production begins in 2026, it [TSMC] will have to poach engineers from Taiwan's other semiconductor firms … The brain drain of Taiwan's semiconductor professionals to the US would escalate in the coming years."[67] On the other hand, U.S. sanctions and tariffs against Chinese companies may result in the emergence of China's self-sufficient semiconductor sector as the Chinese government pursues an independent semiconductor supply chain. This most likely will hurt the competitiveness of Taiwan's semiconductor industry even further.

All in all, the implications of the U.S.-China trade war are complicated as they are not solely harmful or beneficial to Taiwan's semiconductor industry. This thesis delves into the multifaceted impacts of the trade war and the role of Taiwan's semiconductor industry in it. The damages and opportunities proposed by the thesis will need to be further monitored and studied due to the volatile, constantly-changing global landscape of semiconductor supply chains.

[67] Ibid.

VII. Bibliography

BBC News. “A Quick Guide to the US-China Trade War.” BBC News. BBC, January 16, 2020. https://www.bbc.com/news/business-45899310.

Bloomberg News. “‘irreplaceable’ - Taiwan Still Dominates Chip Industry, despite Geopolitical Turmoil.” Data Center Knowledge, January 18, 2023. https://www.datacenterknowledge.com/hardware/irreplaceable-taiwan-still-dominates-chip-industry-despite-geopolitical-turmoil.

Bown, Chad P. “US-China Phase One Tracker: China's Purchases of Us Goods.” Peterson Institute for International Economics. PETERSON INSTITUTE FOR INTERNATIONAL ECONOMICS, July 19, 2022. https://www.piie.com/research/piie-charts/us-china-phase-one-tracker-chinas-purchases-us-goods.

Bown, Chad P., and Melina Kolb. “Trump’s Trade War Timeline: An Up-to-Date Guide.” Peterson Institute For International Economics, March 24, 2023. https://www.piie.com/blogs/trade-and-investment-policy-watch/trumps-trade-war-timeline-date-guide.

Brown, David. “China and Taiwan: A Really Simple Guide.” BBC News. BBC, April 6, 2023. https://www.bbc.com/news/world-asia-china-59900139.

Cheng, Ting-Fang. “TSMC Gets 1-Year US Licence for China Chip Expansion.” Financial Times, October 18, 2022. https://www.ft.com/content/2e38805c-d446-45ec-94eb-40b229d4cc97.

China Briefing Team. “US-China Relations in the Biden-Era: A Timeline.” China Briefing News. Dezan Shira & Associates, April 27, 2023. https://www.china-briefing.com/news/us-china-relations-in-the-biden-era-a-timeline/.

The China Business Review. “Reflections on the Phase One Agreement.” China Business Review. China Business Review, January 20, 2022. https://www.chinabusinessreview.com/reflections-on-the-phase-one-agreement/.

Colby, Elbridge A., and The Strategy of Denial: American Defense in an Age of Great Power Conflict. “Why Protecting Taiwan Really Matters to the U.S.” Time. Time USA, October 11, 2022. https://time.com/6221072/why-protecting-taiwan-really-matters-to-the-u-s/.

Cox, Chelsey. “U.S. Commerce Secretary Raimondo Doubles down on Biden Plan to Restrict American Companies, and Citizens, from Helping China Make Semiconductor Chips.” CNBC, November 3, 2022. https://www.cnbc.com/2022/11/03/us-commerce-secretary-raimondo-doubles-down-on-biden-plan-to-restrict-us-companies-and-citizens-from-helping-china-make-semiconductor-chips-.html.

Disis, Jill, and Kylie Atwood. “US Adds a Dozen Chinese Companies to Its Trade Blacklist.” CNN. Cable News Network, November 25, 2021. https://edition.cnn.com/2021/11/25/tech/us-chinese-companies-trade-blacklist-intl-hnk/index.html.

Everington, Keoni. “Un Recognizes Taiwan as Biggest Winner from US-China Trade War.” Taiwan News, November 7, 2019. https://www.taiwannews.com.tw/en/news/3812154.

Goldman, David P. *You Will Be Assimilated: China's Plan to Sino-Form the World*. New York: Post Hill Press, 2020.

He, Laura. “US Curbs on Microchips Could Throttle China’s Ambitions and Escalate the Tech War.” CNN Business. Cable News Network, October 31, 2022. https://edition.cnn.com/2022/10/31/tech/us-sanctions-chips-china-xi-tech-ambitions-intl-hnk/index.html.

History Computer Staff. “Taiwan Semiconductor: Everything You Need To Know.” History Computer, November 29, 2022. https://history-computer.com/taiwan-semiconductor-history/.

Hui, Qu, and Han Wei. “TSMC Cuts Off Computer Chip Sales to Huawei Under U.S. Sanctions.” Caixin Global, July 17, 2020. https://www.caixinglobal.com/2020-07-17/tsmc-cuts-off-computer-chip-sales-to-huawei-under-us-sanctions-101580989.html.

Lee, Yimou, Norihiko Shirouzu, and David Lague. “Taiwan Chip Industry Emerges as Battlefront in u.s.-China Showdown.” Reuters, December 27, 2021. https://www.reuters.com/investigates/special-report/taiwan-china-chips/.

Liang, Annabelle. “美國禁止從新疆進口 品 對品牌來說意味著什 .” BBC News . BBC, June 21, 2022. https://www.bbc.com/zhongwen/trad/world-61876374.

Liu, Juliana. “What’s at Stake for the World’s Top Two Economies as Biden and Xi Meet.” CNN Business. Cable News Network, November 14, 2022. https://edition.cnn.com/2022/11/14/business/china-us-trade-issues-g20-meeting-intl-hnk/index.html.

“Logic Technology.” TSMC. Accessed May 11, 2023. https://www.tsmc.com/english/dedicatedFoundry/technology/logic.

Milne, Elizabeth. “Taiwan's Chip Industry Explained: Why It Matters so Much Today.” History Computer, December 8, 2022. https://history-computer.com/taiwans-chip-industry/.

Mullen, Andrew. “US-China Trade War Timeline: Key Dates and Events since July 2018.” South China Morning Post, August 29, 2021. https://www.scmp.com/economy/china-economy/article/3146489/us-china-trade-war-timeline-key-dates-and-events-july-2018.

Nenni, Daniel. “A Brief History of TSMC.” Semiwiki. Semiwiki.com, February 8, 2012. https://semiwiki.com/semiconductor-manufacturers/tsmc/1539-a-brief-history-of-tsmc/.

Pan , Jason. “KMT Accuses Government of ‘gifting’ TSMC to Us, Warns of Economic Doom.” Taipei Times, December 27, 2022. https://www.taipeitimes.com/News/taiwan/archives/2022/12/28/2003791557.

Pandey, Erica. “The Stakes for Taiwan in a U.s.–China Trade War.” Axios. Axios, April 10, 2018. https://www.axios.com/2018/04/09/taiwan-us-china-tsai-xi-trump-trade-war.

Powers-Riggs, Aidan. “Taipei Fears Washington Is Weakening Its Silicon Shield.” Foreign Policy. Foreign Policy, February 17, 2023. https://foreignpolicy.com/2023/02/17/united-states-taiwan-china-semiconductors-silicon-shield-chips-act-biden/#:~:text=Taiwan's%20chip%20industry%20has%20come,a%20dual%20layer%20of%20protection.

Reuters Staff. “What's in the U.s.-China Phase 1 Trade Deal.” Reuters. Thomson Reuters, January 16, 2020. https://www.reuters.com/article/us-usa-trade-china-details-factbox-idUSKBN1ZE2IF.

Reuters. “Factbox: Chinese Companies Added to U.S. Entity List.” Reuters. Reuters, December 16, 2022. https://www.reuters.com/business/chinese-companies-added-us-entity-list-2022-12-15/.

Reuters. “Taiwan Blames China-U.S. Trade War, Pandemic for U.S. Trade Imbalance.” Reuters. Thomas Reuters, December 4, 2021. https://www.reuters.com/markets/us/taiwan-blames-china-us-trade-war-pandemic-us-trade-imbalance-2021-12-03/.

Reilly, Michael. “How Taiwan Won the Semiconductor Race.” Engelsberg ideas, November 3, 2022. https://engelsbergideas.com/notebook/how-taiwan-won-the-semiconductor-race/.

“Section 301 Investigation Fact Sheet.” Office of the United States Trade Representative. Accessed May 3, 2023. https://ustr.gov/about-us/policy-offices/press-office/fact-sheets/2018/june/section-301-investigation-fact-sheet.

Sevastopulo, Demetri, and Kathrin Hille. “TSMC: The Taiwanese Chipmaker Caught up in the Tech Cold War.” Financial Times, October 24, 2022. https://www.ft.com/content/bae9756a-3bce-4595-b6c9-8082fd735aa0.

Sharma, Samrat, and Mayank Mishra. “Taiwan Is a Big Part of Global Trade: Here’s What US-China Tension Can Affect.” India Today, August 3, 2022. https://www.indiatoday.in/diu/story/taiwan-big-part-global-trade-here-what-us-china-tension-can-affect-1983402-2022-08-03.

Shattuck, Thomas J. “Stuck in the Middle: Taiwan's Semiconductor Industry, the U.s.-China Tech Fight, and Cross-Strait Stability.” *Orbis* 65, no. 1 (2021): 101–17. https://doi.org/10.1016/j.orbis.2020.11.005.

Soo, Zen. “US Sanctions 24 China and Hong Kong Officials Ahead of Talks.” The Diplomat. Diplomat Media Inc., March 18, 2021. https://thediplomat.com/2021/03/us-sanctions-24-china-and-hong-kong-officials-ahead-of-talks/.

Stacey, Kiran, and Kathrin Hille. “TSMC Falls into Line with US Export Controls on Huawei.” Financial Times, June 9, 2020. https://www.ft.com/content/bad129d1-4543-4fe3-9ecb-15b3c917aca4.

Stewart, Emily. “The US Government's Battle with Chinese Telecom Giant Huawei, Explained.” Vox. Vox, August 19, 2019. https://www.vox.com/technology/2018/12/11/18134440/huawei-executive-order-entity-list-china-trump.

"Taiwan's Dominance of the Chip Industry Makes It More Important." The Economist. The Economist Newspaper, March 6, 2023. https://www.economist.com/special-report/2023/03/06/taiwans-dominance-of-the-chip-industry-makes-it-more-important.

"Trade and Trade Diversion Effects of United States Tariffs on China." UNCTAD, November 5, 2019. https://unctad.org/publication/trade-and-trade-diversion-effects-united-states-tariffs-china.

Trendforce. "Trendforce: Taiwan to Control 48% of Global Foundry Capacity in 2022." EE Times Asia. AspenCore, April 26, 2022. https://www.eetasia.com/trendforce-taiwan-to-control-48-of-global-foundry-capacity-in-2022/.

Wong, Dorcas, and Alexander Chipman Koty. "The US-China Trade War: A Timeline." China Briefing News. Dezan Shira & Associates, August 25, 2020. https://www.china-briefing.com/news/the-us-china-trade-war-a-timeline/.

Wu, Chien-Huei. "The U.S.-China Trade War and Options for Taiwan," October 2019. https://www.wilsoncenter.org/publication/the-us-china-trade-war-and-options-for-taiwan.

Yang,Chih-hai & Hayakawa,Kazunobu, 2022. "The substitution effect of U.S.-China trade war on taiwanese trade," IDE Discussion Papers 864, Institute of Developing Economies, Japan External Trade Organization(JETRO).

Yeung, Jessie. "US Bans Imports from China's Xinjiang Region over Forced Labor Concerns." CNN. Cable News Network, June 21, 2022. https://edition.cnn.com/2022/06/21/us/us-import-ban-xinjiang-goods-forced-labor-china-intl-hnk/index.html.

Zeng, Ka. "Gauging the Impact of the China-US Trade War ." The Diplomat. Diplomat Media Inc., February 17, 2023. https://thediplomat.com/2023/02/gauging-the-impact-of-the-china-us-trade-war/#:~:text=As%20the%20largest%20commercial%20conflict,United%20States%20from%20China's%20economy.

Zhao, Junfu. "The Political Economy of the U.S.-China Technology War." *Monthly Review* 73, no. 3 (2021): 112–26. https://doi.org/10.14452/mr-073-03-2021-07_7.

陳 永健. "中美第一□ 段□ 易□ □ 到期." HKTDC research. 香港□ 易□ 展局, January 19, 2022. https://research.hktdc.com/sc/article/OTYxODYxOTAy.

涂志豪. "觀點》中美貿易戰 台積電地緣政治風險增." 工商時報, April 12, 2021. https://ctee.com.tw/news/tech/443649.html.

今週刊. "童子賢：美中貿易戰升級！一道禁令讓台積電蒸發兆元市□， 台灣該擔憂□ ？." 數位時代 BusinessNext, October 24, 2022. https://www.bnext.com.tw/article/72224/semiconductor-us-ban.

"半導體業全年□ □ 可望續創新高." 中華民國經濟部(Ministry of Economic Affairs,R.O.C.), October 5, 2022.

https://www.moea.gov.tw/MNS/populace/news/News.aspx?kind=1&menu_id=40&news_id=102994.

VIII. Abstract in Korean

2018 년부터 시작된 미중 무역전쟁은 전 세계 반도체 산업, 특히 대만의 반도체 산업과 업계의 선두주자인 TSMC(Taiwan Semiconductor Manufacturing Company)에 지대한 영향을 미치고 있습니다. 이 논문은 무역 전쟁에서 대만의 입장과 대만 경제 및 반도체 산업의 핵심 주체인 TSMC 가 새로운 무역 환경을 탐색하는 방법을 탐구하는 것을 목표로 합니다. 무역 전쟁은 도널드 트럼프 전 미국 대통령이 중국의 불공정 무역 관행과 미국의 무역 적자 증가에 대한 우려로 시작되었습니다. 이에 대해 미국은 중국 수입품에 관세를 부과하고 반도체 산업에서 중국 기업에 대한 수출 통제 및 제한을 하였고, 중국이 미국산 수입품에 관세를 부과하면서 양국 간 긴장이 고조되었습니다. 미국과 중국과의 무역에 크게 의존하는 대만은 본질적으로 두 개의 가장 큰 무역 파트너 간의 무역 전쟁의 한가운데에 갇혀 있습니다. 대만은 양국과 사업을 유지하면서 편을 선택해야 하는 어려움에 직면해 있습니다. 대만의 "실리콘 방패"인 TSMC 는 무역 전쟁으로 인한 갈등과 변화를 간신히 헤쳐 나가고 있습니다.

본 논문은 TSMC 사례를 중심으로 미중 무역전쟁이 대만 반도체 산업에 미치는 영향을 분석합니다. 또한 이 연구는 대만이 무역전쟁에서 직면한 도전과 기회를 이해하고, 대만 반도체 산업의 새로운 역학에서의 근본적인 문제에 대해 빛을 비추고자 합니다. 전반적으로, 대만의 반도체 산업은 무역환경이 변화함에 따라 이익과 피해를 함께 받으며, 여전히 강인함을 유지하고 있습니다.