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RESEARCH PAPER

Analysis of Semiconductor Competition as New Dimension of Super-Power Rivalry Between US and China

Abu Bakar Janjua

MPhil Scholar, Department of Political Science and International Relations, University of Central Punjab, Lahore, Punjab, Pakistan

***Corresponding Author:** abubakkarraja656@gmail.com

ABSTRACT

The paper is focused to shed light on geo strategic importance of semiconductor that it has become cause of global economic, technological and security competition between US and China. The US has monopoly over semiconductor industry and China is trying to catch up US in semiconductor industry by importing and producing at home. A qualitative research methodology grounded in post-positivism has been employed. Data was gathered from primary & secondary sources and Document analysis was utilized for data analysis. The analysis suggests that maintaining export restrictions to China could pose significant adverse consequences for the US semiconductor industry, jeopardizing its longstanding global leadership in the field. While policy recommendations are given that how implementation of free trade principle according to its true essence can resolve the rivalry b/w both and similarly an organization of WTO's global mandate can mediate to regulate this competition from spiraling out of control between the US and China.

Key Words Semi-Conductor industry, U.S.-China Rivalry, free trade, WTO

Introduction

Throughout the 20th century, clashes and wars were overwhelmingly determined by the quest for oil in countries plentiful in normal assets. In later times, a critical shift has happened as the PRC and the US, participated in a contention revolved around electronic central processor — a crucial part in practically every cutting-edge electronic gadget. This article investigates the semiconductor business as a point of convergence for raising innovative contest between the US and China (Muzaffar, et. al. 2017). It dives into the moves made by each party against the other and examines their endeavors to moderate the subsequent repercussions. The end drawn is that the hardship in the semiconductor area fills in as a worldview of the continuous battle for monetary and mechanical matchless quality, bound to shape worldwide governmental issues in the 21st century.

Literature Review

Semiconductors

A microchip is a tiny silicon semiconductor crystal that carries out a particular function inside an integrated circuit. Silicon is widely used in microchip production because it is one of the ten most prevalent elements on Earth. Since silicon is a semiconductor, a material that lies in between insulators and conductors, its conductivity properties may be modified by the addition of impurities to permit the regulation of electric signals in a variety of electronic devices (Sadiq, 2023).

Silicon wafers are fundamental to microchip manufacturing, serving as the substrate for accommodating numerous chips on a single wafer. These wafers are

available in various sizes, spanning from 100 to 450 mm. It's important to emphasize that electrical chip dimensions are measured in nanometers. Thus, when discussing CPUs with specifications of 7 or 10 nanometers, it indicates remarkably small transistor sizes. As a result, as more transistors are packed onto a silicon wafer to improve the performance of electronic devices, the gap between transistors diminishes.

Similarly, they are being used in cloud computing and robotics, which are an integral part of the quest for acquiring state of the art technology. Semiconductors serve as the lifeblood of cutting-edge technologies, functioning as the brains of electronic devices and the core of AI systems. The strategic importance of semiconductors in context of AI is immeasurable, as advancement in semiconductor technology directly impact the speed, efficiency, and capabilities of AI applications.

The Evolution of Semiconductor Industry

The chip industry is split into two primary segments: fabless, which designs the chips, and foundries, which take designs and manufacture them in-house. With a 45 % market share, American businesses are leading the world in semiconductor design. The most well-known of them are “Qualcomm”, “Broadcom”, and “Nvidia”. In contrast, Asia is responsible for 82.5 % of all chip manufacturing activities worldwide. second place, with a share of 17.1 %. Third on the list, with 7.3 % of the world market, is the Taiwanese “UMC”. “SMIC”, a Chinese manufacturer, is in fourth position with 5 % of the market. (Sadiq, 2023)

It's crucial to underscore that manufacturing a single chip is a complex and time-intensive endeavor, often spanning up to three months and necessitating a substantial budget alongside sophisticated machinery. This occurs subsequent to the design phase, typically undertaken in the United States. ASML, a Dutch company, is responsible for producing the indispensable machinery required for chip production. The Beijing boasts the largest reserves of rare Earth minerals globally, accounting for 37% of the world's total. These minerals encompass 17 different elements, including scandium, yttrium, lanthanum, and various lanthanides, and are integral to electronic chips and other advanced technological products owing to their distinctive properties.

In recent years, securing semiconductors has become a life-and-death national security policy for countries, and governments and companies worldwide are competing to secure the semiconductors they need. In 1971, the American company Intel invented the microprocessor (central processing unit), and its sales grew rapidly thereafter Until the 1970s, the United States was the top semiconductor producing country, but in the 1980s, Japanese semiconductors became the world’s number one. Nevertheless, in the 1990s, Japan’s semiconductor industry began to decline and Korea, Taiwan, and China have been growing to replace Japan’s position. (Fujiwara, 2023)

It's worth mentioning that manufacturing a single chip can extend over three months, demanding a significant budget and sophisticated machinery. Consequently, it becomes challenging for any nation to control the entire production chain. Electronic chips, initially designed in the United States, are produced in Taiwan, South Korea, and China, using rare Earth metals sourced from Australia and China. The Dutch company "ASML" takes charge of manufacturing the necessary machinery.

The production of semiconductors involves the establishment of facilities, commonly referred to as fabs or foundries. Integrated circuits, the primary products of

the modern semiconductor industry, accounted for over 80 percent of total semiconductor sales in 2019.

The chip industry is comprised of two main sectors: fabless, responsible for chip design, and foundries, which oversee internal chip manufacturing. On a global scale, American companies dominate semiconductor design, holding a 45% market share, with notable players including "Qualcomm," "Broadcom," and "Nvidia." In contrast, Asia leads in chip manufacturing, contributing to 82.5% of global activities. For example, the Taiwanese company "TSMC" holds a significant market share of 53.1% in electronic chip production worldwide. Following closely is another company with a 17.1% share, and in third place is the Taiwanese company "UMC" with 7.3% of the global market. Holding the fourth position is the Chinese manufacturer "SMIC," with a 5% market share.

Importantly, the Beijing possesses the highest reserves of rare Earth minerals, constituting 37% of the world's total. These minerals, encompassing scandium, yttrium, lanthanum, and lanthanides (cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, and lutetium), play a crucial role in Semiconductor.

US Quest for Semiconductors

US initiated its efforts to create semiconductors at home in 1950s when discoveries and inventions were made by American scientists. Its demand arose gradually when space and defense programs started to stretch their muscles. The industry was established in California (Silicon Valley). By 1980s US started to dominate the market when its companies stared to produce semiconductors at industrial level for domestic need and some of its companies started to produce for sale and for arms. In these companies IBM, HP Intel were the most prominent. As far as globalization of semiconductors industry is concerned it stared to take shape in 1990s when us companies moved to Hong Kong for FDI to produce semiconductor at lower cost and to become market dominator. This underscores the rationale behind the enactment of the Creating Helpful Incentives to Produce Semiconductors for America Act, commonly known as the CHIPS for America Act. This legislation outlines investments and incentives designed to enhance U.S. semiconductor manufacturing, research and development, and supply chain security. Remarkably, the bill received significant bipartisan backing, merging two bills, the CHIPS Act and the Science Act. These endeavors are crafted to broaden STEM participation, reinforce research security, elevate fundamental research, and enhance research infrastructure.

The United States, has been concerned about national security implications, especially in the context of intellectual property theft, and seeks to protect its technological leadership. The U.S. government has taken measures, such as imposing tariffs, export restrictions, and sanctions, to curtail China's access to advanced semiconductor technology. This is partly driven by economic considerations to protect American industries and jobs, but also by security concerns related to the use of semiconductor technology in critical infrastructure and defense applications. (Studies, 2021)

In 2019, the Trump administration escalated tariffs on $200 billion worth of Chinese imports into the United States from 10% to 25%, igniting what later became known as a trade war. In retaliation, China imposed reciprocal 25% tariffs on roughly 50% of American imports.

In August 2022, the Chips and Science Act, passed by the U.S. Congress and signed into law by President J. Biden, aims to address China's advancements in advanced electronic chip manufacturing. This legislation earmarks approximately $280 billion in additional funding to boost domestic semiconductor research and production within the United States, with a primary focus on competing with China.

As part of its strategy to restrict China's access to electronic chips, the United States has encouraged chip manufacturers to establish facilities both domestically and internationally. For instance, in 2021, "TSMC" began constructing a $12 billion factory in Arizona, marking its second manufacturing site in the United States. Additionally, in 2022, "Intel" announced plans to invest over €33 billion (equivalent to $36 billion) to expand chip production in the European Union, aiming to decrease reliance on semiconductor imports. These investments by "Intel" are essential components of a broader initiative, with the company intending to invest up to €80 billion in Europe over the next decade.

The US–China trade war thrust the semiconductor industry back into the geopolitical spotlight. A reluctant participant this time around, US companies were no longer the provocateurs leading the charge into a foreign trade conflict, as they had with Japan in the 1980s. In the intervening decades, demand for semiconductors shifted to Asia, the business model of how to make semiconductors fragmented, and US companies came to rely heavily on global markets. This time around, US policymakers interjected the industry in a trade fight against its wishes. (Bown, 2020)

There have been two significant shifts in US policy that highlight changes from the past to the present. Firstly, in July 2018, the US levied tariffs on Chinese semiconductors, sparking a swift escalation in trade tensions. Despite this, China persisted in importing critical semiconductor-related products from the US. Secondly, starting in 2019, the US introduced export controls aimed at the global semiconductor supply chain, initially prompted by national security apprehensions concerning Huawei. Nonetheless, Huawei found ways to evade these controls by procuring from alternative sources. In retaliation, the US threatened to disrupt the supply chain for specialized equipment and software unless foreign companies ceased selling to Huawei.

The tensions between Washington and Beijing have posed significant challenges for American firms. Following the initiation of the "trade war," the top 25 U.S. semiconductor companies experienced a drastic decline in median year-on-year revenue growth, dropping from 10% in the four quarters leading up to the implementation of initial tariffs in July 2018 to approximately 1% in late 2018. Moreover, after the U.S. imposed restrictions on technology product sales to Huawei in May 2019, these companies reported median revenue declines ranging from 4% to 9% in each of the subsequent three quarters. Many attribute their performance issues to the trade conflict with China. Despite the "phase one" trade agreement signed in January 2020 addressing certain technology industry concerns, such as intellectual property protection and technology transfer practices, it does not tackle issues like direct state support for China's domestic semiconductor industry. Furthermore, restrictions on exporting U.S.-based technology products to specific Chinese entities related to U.S. national security concerns persist.

The United States' position at the forefront of semiconductor technology is of paramount importance for both economic competitiveness and national security, especially amid the evolving landscape of digital transformation and artificial

intelligence (AI). Throughout history, the U.S. has supplied 45% to 50% of the global semiconductor demand, cementing its dominance through an innovation-centric approach that hinges on access to global markets. This access is crucial for building a strong customer base, which in turn enables the necessary scale to support substantial investments in research and development (R&D). As a result, these investments empower U.S. companies to maintain a technological advantage over competitors worldwide.

Additionally, such access facilitates the intricate supply chains essential for the complex manufacturing processes within the semiconductor industry. Notably, China holds a significant share of the global semiconductor market, contributing approximately 23% of demand in 2018.

Emergence of Chinese Semiconductor Market

In response to US sanctions, China, led by Premier Li Keqiang, introduced the "Made in China – 2025" strategy in May 2015. The focus of this strategy was on achieving self-sufficiency in the microchip industry, reducing dependence on the United States, consolidating China's leadership, and concentrating both chip design and production within Chinese territory. Chinese Ministry of Foreign Affairs spokesperson Zhao Lijian denounced American ban as technical terrorism, state power abuse, coercive diplomacy, and technology hegemony abuse. He urged nations to swiftly transition to technological independence and self-reliance while cautioning against the perils of technological dependence.

On the other hand, China's semiconductor sector has undergone swift expansion, with annual growth rates reaching 12% since 2016. Currently, it commands a substantial 60% share of global semiconductor consumption and caters to 33% of final demand. However, China's global semiconductor sales only account for a modest 5%, and its involvement in the global semiconductor supply chain remains limited. This decision underscores China's commitment to bolstering the industry, facilitated by the establishment of a national semiconductor fund and the implementation of various tax support measures.

In 2016, China adopted “Made in China 2025,” a strategy of industrial advancement through manufacturing innovation, which aims to strengthen competitiveness through the convergence of existing manufacturing and information technology by 2025 and to lead the global market by 2045. In order to achieve its goal of becoming a great. Power China has followed consistent policies and investments, emphasizing the importance of technological development and the growth of innovation industries, which has significantly increased its capabilities. (Studies, 2021)

While Chinese state support for technology development can be seen across many sectors, semiconductors are key to China’s self-sufficiency goals because they are fundamental to both national security and critical high-tech growth industries identified by the Chinese Communist Party (CCP). The Made in China 2025 plan set a goal that by 2020, 40 percent of chips used in China would be domestically produced. That goal was updated in 2019 to 58 percent.4 In 2020, only 16 percent of chips used in China were domestically manufactured (Antonia, 2023)

Beijing’s motivations are primarily driven by its desire to reduce its dependence on foreign semiconductor suppliers, particularly from the United States. The Chinese

government has identified the semiconductor industry as a strategic sector crucial for national security and economic development. They have pursued an aggressive strategy of investing in domestic chip manufacturing, technology acquisition, and fostering innovation. China, recognizing the strategic value of semiconductors, has adopted neo-mercantilist policies to advance its domestic semiconductor capabilities and aims to become self-reliant in semiconductors and challenge the technological dominance of the United States in the industry. (Velasco, 2024)

Huawei being recognized as a national champion

Huawei is able to have such an outsized role in Chinese semiconductor manufacturing partly because it was added to the U.S. Entity List early and has needed to shift its business model toward domestic production as a result. Similarly, Huawei has also had to diversify its overall business. Having started out as a narrowly focused telecommunications firm, it is now branching out toward automotive, cloud, e-government, and software in response to U.S. trade restrictions. (Antonia, 2023; Center, 2022; Finnamore, 2023; Jeong, 2022; Shang, 2024; Wende, 2022)

Being chosen to join or lead a national team offers various advantages to a company. For instance, Semiconductor Manufacturing International Corporation (SMIC) obtained 1.95 billion yuan ($282.1 million) in subsidies in 2022. SMIC has significantly benefited from the Big Fund and has emerged as a major supporter of China's self-sufficiency efforts since at least 2019. However, there are also downsides to the company's participation in a national team, particularly concerning its global reputation. SMIC was added to the U.S. Entity List in 2020.

Material and Methods

The article focuses on the US-China competition on semiconductor. It will elaborate about the impacts of this rivalry on the future of AI. The paper suggests possible alternatives to address such scenario surrounding the rivalry. This research employs a qualitative research methodology grounded in post-positivism. Adopting an exploratory qualitative research approach, the study seeks to uncover insights to the examined phenomenon. Data is gathered from primary and secondary sources, with official documents, reports, and doctrines constituting primary sources, and journals, articles, newspapers, forming secondary sources. Document analysis is utilized for data analysis, involving the scrutiny of content from both primary and secondary sources to identify themes and categorize data into meaningful groups.

Theory Applied

In the rivalry between the USA and China over semiconductor technology, the theory of **offensive realism** from broader frame of realism paradigm in international relations sheds light on a strategic interaction driven by the pursuit of power and security. Both countries strive for dominance in this crucial industry, recognizing its pivotal role in enhancing economic prosperity and military strength. As they compete for technological supremacy, tensions rise, reflecting a classic security dilemma where defensive actions are seen as provocative by the other party. This rivalry extends beyond mere economic competition, involving geopolitical and strategic factors, thereby emphasizing the importance of securing leadership in semiconductor technology. Consequently, the trajectory of AI advancement becomes closely intertwined with this rivalry, leading to implications ranging from a binary technological landscape to heightened ethical and security challenges. This framework underscores the

complexities of major power competition in the digital age and stresses the necessity for sophisticated approaches to global technological governance and security.

Results and Discussion

Semiconductor industry as an emerging bone of contention b/w US-China

The realization of digital transformation (DX) and the Fourth Industrial Revolution (4IR) have led to the development of new technologies in areas such as AI, big data, metaverse, autonomous vehicles, digital currency, and block chain technology. While these sectors are expected to continue to grow, major countries including the United States and China are fiercely competing to secure a global supply chain for the semiconductor industry. (Jeong, 2022)

Founded upon the principles of free trade, the worldwide dispersion of manufacturing processes in the semiconductor sector has spurred corporate creativity and technological advancements. Nevertheless, the emerging phenomenon of technological nationalism, coupled with nations' endeavors to consolidate their value chains domestically, is anticipated to inflict damage upon the global semiconductor arena.

In 2017, the Washington initiated an investigation into Beijing's trade practices, specifically in the semiconductor sector, utilizing Section 301 legislation. The investigation revealed concerns about China's subsidies, coercion of foreign companies into joint ventures, and technology transfer at below-market rates. The US imposed a 25 percent tariff on semiconductor imports from China in 2018, leading to retaliatory tariffs by China. The Phase One agreement in February 2020 temporarily eased tensions, maintaining tariffs on $450 billion of bilateral trade, with China committing to increased purchases of US goods and services. In 2019, the Washington implemented export controls on the Chip industry, initially targeting Huawei due to national security concerns. These controls faced criticism for being both too broad and ineffective in protecting national security.

In 2017, the United States launched an investigation into China's trade practices, with a particular focus on the semiconductor sector, under Section 301 legislation. The inquiry raised concerns about China's subsidies, coercion of foreign companies into joint ventures, and technology transfer at rates below market value. As a result, the U.S. imposed a 25 percent tariff on semiconductor imports from China in 2018, leading to retaliatory tariffs from China. The Phase One agreement in February 2020 temporarily reduced tensions, maintaining tariffs on $450 billion of bilateral trade, with China committing to increasing purchases of U.S. goods and services. In 2019, the U.S. enacted export controls on the semiconductor industry, initially aimed at Huawei due to national security worries. However, these controls faced criticism for their perceived breadth and lack of effectiveness in protecting national security.

In response to perceived shortcomings in the 2019 export controls, the US introduced additional measures in May 2020, targeting semiconductor manufacturing equipment. This aimed to compel foreign companies, including major manufacturers like TSMC and Samsung, to cease selling semiconductors to Huawei. The strategy involved expanding jurisdiction through the foreign direct product rule (FDPR), presenting foreign manufacturers with a choice to either refrain from selling to Huawei to access US-made tools or find alternative equipment. Concerns were raised by US

equipment manufacturers about the emergence of foreign-made substitutes evading controls.

Furthermore, the 2018 Section 301 reports issued by the US government raised concerns about China's state-sponsored acquisition of foreign technology companies. This led to the strengthening of the legal authority for the Committee on Foreign Investment in the United States (CFIUS) under the Foreign Investment Risk Review Modernization Act (FIRRMA). Additionally, Chinese antitrust regulators have denied approval for foreign semiconductor firms seeking restructuring. The escalating semiconductor dispute between the US and China has the potential to disrupt the global supply chain, fostering protectionist tendencies and trade nationalism. This situation poses challenges for the World Trade Organization (WTO) in alleviating tensions and preventing economic stagnation similar to the global economic downturn of 1929.

Over recent years, technology and complex policy questions at the nexus of technology and security have gained increasing importance in US-China trade. The US introduced a raft of policies to slow the pace at which China acquires new technology. Policies to promote technological disengagement or "decoupling" focus on three areas: investment restrictions that make it harder for Chinese firms to acquire US assets and repatriate associated technology, export controls that limit China's access to sensitive US technology, and tariffs on intermediate goods that impede efficient production. (Wende, 2022)

As rivalry between the US and China expands beyond trade to encompass technology, China's stakes escalate. The country can no longer rely solely on abundant labor or debt-driven investments for future growth; instead, it must focus on efficiently deploying cutting-edge technology throughout its economy. This necessitates careful allocation of capital into projects with high potential returns, many of which are technology-intensive. Semiconductors, in particular, are poised to play a crucial role across a widening array of applications.

Role of Taiwan as a crucial player in this field

Taiwan not only boasts some of the world's strongest semiconductor manufacturing capabilities, but it is also host to a comprehensive semiconductor industry cluster, which includes testing and packaging, materials production, and capital equipment and machinery. As a global chip-making powerhouse, Taiwan is responsible for 20% of global wafer capacity and produces 92% of the world's most sophisticated semiconductor products, used in everything from mobile phones to automobiles. (Center, 2022)

Taiwan holds considerable significance for the United States, particularly in the realm of electronic chip manufacturing. The recent crisis involving semiconductor chips has escalated tensions between China and the U.S. regarding Taiwan. This crisis stems from several factors. Firstly, the trade war initiated by U.S. sanctions on Chinese firms during the administrations of D. Trump and J. Biden has disrupted the supply chain and the production of microchips. Secondly, the demand for microchips experienced an imbalance during the Covid-19 pandemic. The shutdown of automobile factories, coupled with the expansion of the electronic industry, resulted in a disparity. As quarantine measures were eased and lifted, the demand for automotive microchips surged unexpectedly, surpassing the production capacity of chip-manufacturing firms. Lastly, the drought in Taiwan in 2021 emerged as the fourth contributing factor. This drought adversely affected the production of high-purity water crucial for cleaning

factories and manufacturing silicon alloys essential for microelectronic chips. (Sadiq, competition in the production of electronic microchips (semiconductors) as an issue in us – china relations, 2023)

Taiwan relies heavily on imports of capital equipment and machinery from the United States to support its world-renowned foundry model, which produces chips for the United States' top fabless design firms. In 2020, Taiwan was the recipient of 45% of US exports of semiconductor equipment. In 2019, Taiwan accounted for 10% of front-end semiconductor wafer capacity of US-headquartered firms, just behind Singapore at 17% and the United States at 44%. All of the United States' top semiconductor firms have significant operations in Taiwan, and plan to invest more in Taiwan over the coming years. Total exports of electronic integrated circuits to the United States in 2020 amounted to $1.6 billion. (Center, 2022)

For very different reasons, China, and the US both severely depend on Taiwan's semiconductor manufacturing near-monopoly. The US designs most of its advanced chips at home but contracts the fabrication to Taiwan Semiconductor Manufacturing Company (TSMC). China also uses TSMC as the primary contract manufacturer for its chips, but China does not have an advanced indigenous design capability. (Finnamore, 2023)

China has utilized technology transfer to rapidly bridge the technological gap between the US military and its own forces. Advanced US designs, acquired either through legitimate sales or illicit means, now underpin Chinese technological advancements and progress in AI. This has bolstered China's confidence in its ambitions, particularly its desire to secure control over Taiwan's manufacturing technology, with aspirations for global dominance. In the event of failure, China's contingency plan involves using stolen technology to a more limited extent within its domestic manufacturing facilities. Nevertheless, China's illicit acquisitions and increasing assertiveness pose significant threats to the US, Taiwan, and the global economy. The US confronts a delicate situation, as the potential loss of TSMC fabricators would far surpass the supply disruptions caused by the COVID-19 pandemic. As a result, the US must devise a strategy to restore deterrence, stabilize its supply chain, and shield it from Chinese aggression. This requires a comprehensive policy approach that integrates military, economic, and diplomatic considerations, utilizing all available tools to establish a cohesive overarching strategy.

Conclusion

The intensifying competition between the Washington and Beijing bears critical implications for the future landscape of artificial intelligence (AI). As both nations strive for dominance in this crucial technological realm, the semiconductor market emerges as a pivotal battleground with far-reaching consequences. The outcome of this competition will undoubtedly shape the trajectory of AI development globally, influencing innovation, economic power, and strategic advantages. The inherent interdependence between advanced semiconductor technology and AI capabilities underscores the significance of this rivalry. A critical conclusion is that the winner of this contest stands to wield substantial influence over the evolution of AI, potentially dictating standards, policies, and global AI governance. The implications extend beyond economic and technological realms, delving into geopolitical considerations and the broader impact on international relations. As the Washington and Beijing vie for supremacy in microchip innovation, the world must closely monitor the developments and carefully navigate the

ensuing implications for the future of AI, ensuring that collaboration, ethical considerations, and responsible governance remain integral components of this transformative technological journey.

Recommendations

Return to free-trade principles

Following a prolonged period of relative obscurity, the semiconductor industry found itself thrust into the midst of the US-China trade and technology dispute. Unlike the circumstances of the 1980s, the industry encountered resistance to trade policy intervention owing to its extensive global integration. U.S.' National Defense Authorization Act of 2020 proposed federal subsidies for semiconductors, signaling a potential change in strategy. The legislation aimed to institute a program for funding foundational research and development, potentially involving allied countries that controlled exports to China. US companies were apprehensive that foreign customers might seek alternative suppliers if sales were manipulated by policymakers. Despite these efforts, the containment policy has only partially succeeded in restricting China's access to technology.

A parallel can be drawn with oil trade in the last century. In the 20th century, the West, spearheaded by the US, pursued control over oil using pretexts such as human rights, freedom, and democracy, often leading to conflicts. In the 21st century, a vigorous technological rivalry has emerged between the US and China over the semi-conductor as a strategic good. Such controls were not successful then in the oil industry and appear to be failing in the semi-conductor industry. Restrictions give way to unnecessary cost escalations, barriers to accessing technologies for emerging markets and promoting un-healthy policies in other fields.

The principle of free trade could play a significant role in resolving the U.S.-China competition for semiconductor dominance by promoting a more collaborative and efficient global supply chain. Free trade encourages the removal of tariffs, quotas, and other barriers, enabling countries to specialize in different stages of semiconductor production according to their comparative advantages. This specialization can lead to cost reductions, innovation through shared knowledge, and increased production efficiency. By reducing protectionist policies, both the U.S. and China can benefit from mutual access to each other's markets, fostering an environment where companies can compete fairly and focus on technological advancements rather than geopolitical tensions.

WTO's Mediating Role

Continuing from the previous point, WTO has a special position to monitor and restrict the global trade landscape. Since the U.S. tightened export control measures aiming at China, China has showed some willingness to resolve the issue within the WTO framework. China initiated a dispute against the U.S. at the WTO over sweeping semiconductor export curbs on December 12, 2022. (Shang, 2024)

Additionally, China has challenged broad export restrictions imposed by the US at the World Trade Organization (WTO), although the resolution of WTO disputes could span several years. China has progressed from being a significant assembler to a notable semiconductor manufacturer, contributing to 20 percent of global semiconductor exports as envisaged in the Made in China 2025 initiative, aiming for self-sufficiency in the domestic economy and dominance in foreign markets with Chinese products. Only an

organization of WTO's global mandate can mediate to regulate this competition from spiraling out of control.

The WTO could serve as a forum for both parties to engage in constructive dialogue aimed at finding mutually acceptable solutions. This could involve negotiations to address specific trade practices or policies perceived as unfair or discriminatory in the semiconductor industry, such as intellectual property rights enforcement, government subsidies, or market access restrictions. The WTO's dispute settlement mechanism could also be utilized to adjudicate specific grievances and provide a framework for resolving disputes in a transparent and rules-based manner.

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