



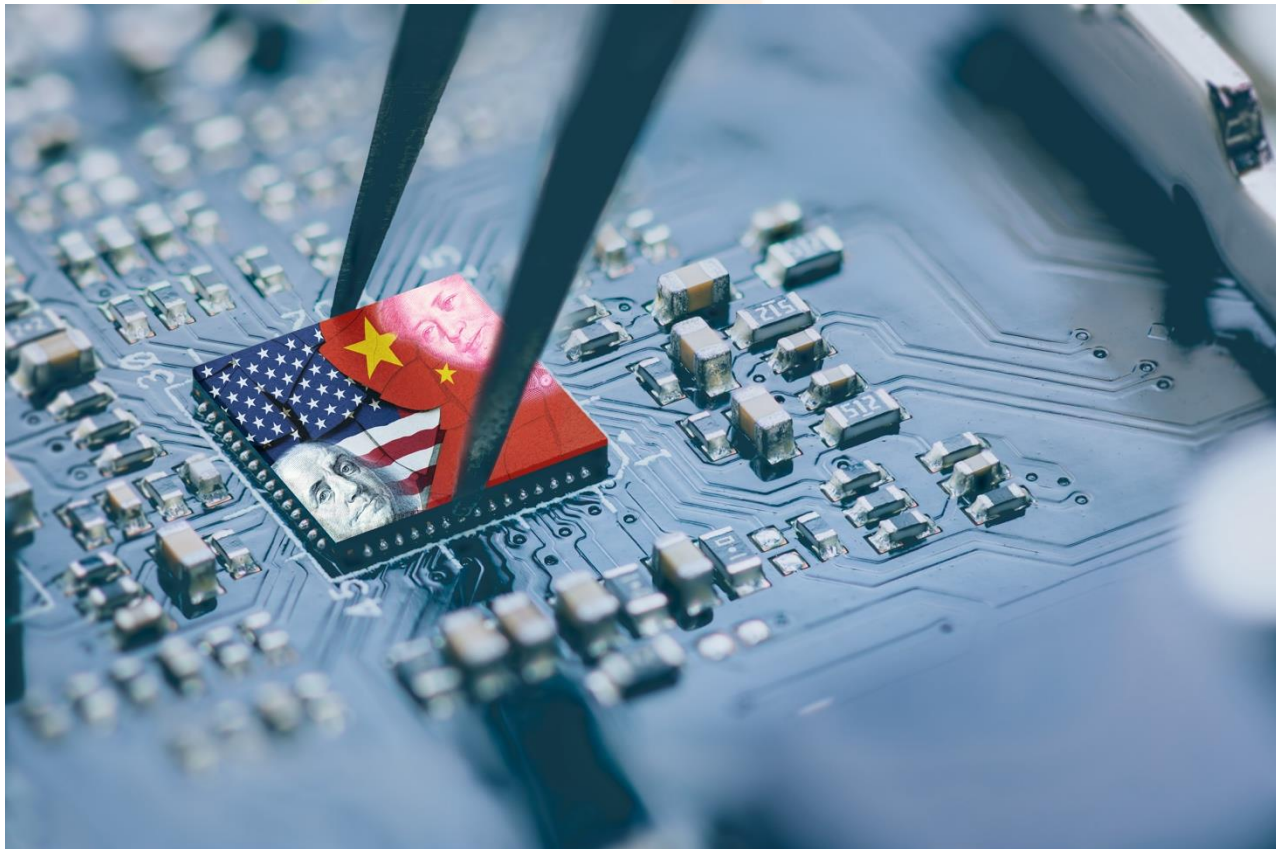
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Who Controls the Chips? The Geopolitical Scramble for Semiconductor Supremacy

Ukraine today, Taiwan tomorrow.

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Abstract

The world's reliance on semiconductors is growing, serving as the cornerstone of modern technology, but it faces significant geopolitical challenges. This study delves into the intricate interplay among government policies influenced by national interests and the complex semiconductor supply chain, with a focus on the United States, China, and Taiwan. The research examines how the strategies of these major actors influence the industry landscape, highlighting potential conflicts and disruptions in supply chains.

Government policies play a dual role in fostering innovation and growth within domestic semiconductor industries. Initiatives like China's "Made in China 2025 plan" and the United States Chips and Science Act exemplify this, aiming to drive self-sufficiency and technological leadership. However, for Taiwan, the central hub of silicon production, balancing technological advancement with geopolitical pressures poses a unique challenge. Despite the complexities, these policy dynamics yield tangible benefits such as technological progress, job opportunities, and economic expansion.

However, this intricate dance also lays the groundwork for potential conflicts. The pursuit of self-sufficiency can breed protectionism and trade barriers, fragmenting the supply chain and exposing vulnerabilities. The strategic rivalry between the US and China, intensified by the Taiwanese issue, adds another layer of uncertainty, potentially leading to disruptions and even military escalation. Such disruptions could affect everything from everyday consumer electronics to critical national security infrastructure. Thus, the issue transcends mere technological progress; it becomes one of managing geopolitical tensions to ensure the smooth flow of semiconductors, crucial for the global economy and security. The research presented here explores various conflict management strategies, including multilateral trade agreements and industry collaboration through diplomatic channels, emphasising the need for a cooperative approach to address vulnerabilities and build resilience, mitigating risks by recognising the interdependence of all actors within the semiconductor ecosystem.

By untangling the intricate web of government policies and diverse geopolitical landscapes affecting the future of semiconductors, this article provides a profound comprehension of the factors influencing this pivotal industry. It offers insights for collective action among stakeholders to prioritise collaboration, ensuring the uninterrupted flow of semiconductors and preventing them from becoming pawns in geopolitical tensions, particularly in the Indo-Pacific region.

INTRODUCTION

With the phrase "Ukraine today, Taiwan tomorrow," the significance of semiconductors emerges as foundational to modern electronics. Neither purely conductive nor fully insulating,

these materials serve as the cornerstone of electronic devices, controlling electricity flow to execute intricate functions. From smartphones to satellites, semiconductors power a vast array of technologies, driving innovation and economic growth across industries. Their ubiquity spans everyday gadgets to advanced military systems, underscoring their critical role in contemporary society. Beyond economic impact, semiconductors hold strategic importance for national security, empowering countries with domestic production capabilities to safeguard critical infrastructure and sensitive technologies. In the realm of defence, advanced chips form the backbone of modern weaponry and communication systems, emphasising the imperative of securing the semiconductor supply chain to maintain military readiness.

Indeed, this dependence on semiconductors exposes vulnerabilities during supply chain disruptions, as seen during the pandemic, resulting in shortages that can significantly impact industries and the global economy. Geopolitical tensions stemming from competition for semiconductor industry dominance may escalate into trade wars, technological espionage, and political instability. Semiconductors represent more than mere chips; they are the bedrock of our modern world, shaping economies, fueling innovation, and influencing national security. A comprehensive understanding of their pivotal role is essential for navigating the intricacies of today's landscape.

There was a prevailing belief in the inevitability of globalisation and the necessity to offshore jobs. This decision contributed to Donald Trump's election, and it also fuels Joe Biden's emphasis on industrial strategy. Consequently, we are witnessing a pendulum shift in the economy, not only in the USA but also in many developing countries.

The USA has implemented protectionist policies to revitalise its domestic semiconductor industry, which declined after the Cold War. Intel CEO Pat Gelsinger emphasises the critical role of the semiconductor industry in industrial policy. The bipartisan Chips and Science Act, a cornerstone of the Biden administration, prioritises domestic supply chains, starting from Arizona. This act allocates \$52.7 billion, with \$39 billion dedicated to grants. Its key objective is to ensure US production of chips vital for national security while maintaining regional hegemony by safeguarding Taiwan, a move that could escalate tensions and volatility with China.

China is actively advancing its semiconductor industry to meet high standards outlined in its Made in China 2025 plan, despite facing international criticism and trade restrictions. Despite opposition from manufacturing equipment companies allied with the USA, China has sought alternative resources for constructing semiconductor fabrication plants domestically. This development has raised concerns among the USA and its allies, particularly with Taiwan caught in the strategic rivalry between the USA and China, posing an existential threat to the island.

The Taiwan Semiconductor Manufacturing Company (TSMC) stands as the unrivalled leader in advanced chip production, holding a remarkable dominance with over 50% of the global

foundry market share. This means that TSMC controls more than half of the world's cutting-edge chip production, surpassing competitors such as Samsung and Intel. Consequently, a significant portion of the world's most powerful processors, powering devices ranging from iPhones to supercomputers, originate from TSMC's facilities. TSMC continually pioneers leading chipmaking technologies, exemplified by its recent achievement of mass-producing 3-nanometer chips, placing it years ahead of competitors and establishing a monopoly on the most advanced chips. Tech giants like Apple, Qualcomm, and Nvidia heavily rely on TSMC for their high-performance chips, further consolidating TSMC's influence. However, this concentration of demand also creates a single point of failure in the global supply chain.

why is TSMC's dominance a pivotal chokepoint?

Investment and expertise, making it challenging for new competitors to emerge and alleviate the reliance on TSMC. Therefore, any disruption at TSMC, whether from natural disasters, political tensions, or internal issues, has the potential to trigger a global chip shortage, plunging industries into turmoil. The pandemic underscored this vulnerability, with carmakers and electronics manufacturers forced to scale back production due to chip scarcity. Taiwan's geopolitically sensitive position further heightens risk; tensions between Taiwan and China could disrupt production or lead to a complete shutdown of TSMC, with far-reaching consequences for the global economy. Establishing advanced chip production requires significant investment and expertise, presenting barriers for new competitors to enter the market and mitigate dependence on TSMC.

The expertise barrier presents significant hurdles for other companies aiming to catch up with TSMC's business model and diversify their supply chain, perpetuating dependence on TSMC. Meanwhile, China's ambition to achieve self-sufficiency in semiconductors plays a central role in the current geopolitics of the technology landscape. Fuelled by aggressive investments and domestic chip production initiatives, China seeks to challenge the dominance of Taiwan and South Korea while reducing reliance on foreign technology. Through initiatives like the Made in China 2025 plan and the National Integrated Circuit Industry Fund, China has injected billions of dollars into the semiconductor industry, supporting the development and manufacturing of domestically produced chips. This suggests a high likelihood that China is exploring alternative strategies, laying groundwork for the possibility of Taiwan annexation to maintain economic hegemony in the region. China's assertive foreign policy contributes to volatility in the Taiwan Strait region, a critical chokepoint for global semiconductor supply chains.

The Race for Semiconductor Supremacy

Chris Miller describes semiconductors as the new oil, emphasising their central role in geopolitics and geostrategy. The disruptions caused by Covid-19 have prompted states to

reconsider supply chains, focusing on building resilience while balancing competition and cooperation. Semiconductors serve as data accumulators, providing the digits for storage, and have evolved significantly from the vacuum-sealed conductors of the Cold War era to contemporary advanced lithographic semiconductors. Miller also explores the transformation of Silicon Valley into "The Silicon Valley," shedding light on its development and significance in the semiconductor industry.

The US military was at the forefront of the demand for enhanced capabilities and space programs, leading to the development of advanced rockets and missiles filled with semiconductors manufactured by companies like Texas Instruments. By the late 1950s, Silicon Valley began to take shape as companies invested in research and development to explore cutting-edge technologies that could potentially change the dynamics of military warfare. During this period, the military was the primary purchaser of chips, driving innovation in the semiconductor industry.

In contemporary times, the complexity created by semiconductor technology in military warfare has significantly impacted security dilemmas across power blocs. The distinction between capability and capacity has become more pronounced, as chip manufacturing now requires advanced technology production capabilities. This necessitates ensuring that production capacity aligns with the sophistication of the technology being produced, underscoring the importance of balancing production capacity and technological advancement in semiconductor manufacturing.

Moore's Law, a principle in computing chips productivity, suggests that the production of chips doubles approximately every two years. This rapid development is evident in historical events, such as when Russian talent was educated at prestigious universities in the USA to gain contacts and information necessary for setting up semiconductor fabrications. Asia, in turn, provided a platform for implementing these advancements.

During the early Cold War period, the devastated Japanese economy found revival opportunities in Asia's cheap labor pool, reducing the risk of Japan becoming a liability. Southeast Asia, with its vast workforce, became attractive to US firms seeking affordable labor. The chip industry, requiring substantial manpower, further solidified ties among East Asian countries. Additionally, many Southeast Asian governments sought protection from the USA against Communist China, ensuring their security. In line with maintaining the principles of the liberal international world order, the USA began offshoring most manufacturing units by the 1990s, leading to the emergence of potential supply chains in Southeast Asia.

The challenge in semiconductor supply chains begins with acquiring chip designs, followed by producing chips that function according to those designs. Certain chips, especially those for military use, must meet stringent US regulations and contain unique intellectual properties. Once the design is obtained, chip production can be scaled up. Extreme ultraviolet

photolithographic machines are crucial for laying down silicon patterns on semiconductors according to the design. However, these machines are highly regulated by Western allies, and acquiring them has become difficult for China, leading to tensions between the USA and China.

TSMC stands out as a key player in the semiconductor industry, as it is the only company capable of producing chips using extreme ultraviolet lithography. Founder Morris Chang recognised the potential of the semiconductor industry and pioneered a business model where chip design and manufacturing were integrated. TSMC's unique expertise and capabilities have established its value chain, allowing it to manufacture advanced processor chips for a wide range of companies. In fact, TSMC manufactures around 90% of the world's chips.

The rise of PCs and technology has underscored the critical importance of semiconductors, with every device containing hundreds of them, from simple gadgets to complex systems. China has recognised the significance of the semiconductor industry, investing heavily in it, even surpassing its investment in oil. However, China faces a dilemma as most semiconductor production occurs outside its borders, and many of the countries that possess this technology are geopolitical adversaries.

A decade ago, there was significant progress in China's private sector, which could have thrived with more investment. However, Chinese companies have increased their interdependence, resulting in supply chains around the USA and Taiwan. Despite pouring substantial funds into the domestic chip industry, Chinese firms tend to operate as private enterprises, aiming to avoid government control. They prioritise market-driven approaches in technology development, seeking autonomy from government influence.

Telling the story of USA

Huawei's deep integration into both the USA and Chinese political economies has led to turbulence for the company, particularly due to its reliance on TSMC for chip manufacturing. Tensions escalated when it was revealed that TSMC produced Huawei chips after those for Apple, sparking concerns in the USA about potential security risks associated with Huawei's products. Given the historical precedence of Chinese spying activities, the USA was wary of Huawei's global ambitions and its potential to leverage technology for espionage purposes.

The USA's response to Huawei's rise as a global tech player was to impose bans and restrictions, pressuring TSMC to halt production for the Chinese firm. These moves exacerbated political tensions between the two countries, as Huawei found itself solely dependent on existing supply chains without any viable alternatives. The USA's relatively late realisation of the strategic importance of TSMC reflects the incredible significance of the company in the semiconductor industry and its pivotal role in global technology supply chains.

The semiconductor supply chain is indeed highly concentrated and fragile, with the USA and Japan playing significant roles in the industry. If these countries do not comply with USA regulations, they risk being blacklisted from receiving essential chemicals for chip manufacturing in Taiwan. The COVID-19 pandemic highlighted the fragility of these supply chains, as chip production increased globally in 2020 compared to 2019, yet certain chips experienced shortages. Chipmakers had to reallocate production due to reduced demand from car companies, which significantly impacted the automotive industry.

Cars rely heavily on semiconductors for various functions, from automated systems for opening and closing doors to fuel injection systems. The performance of a car hinges on the accuracy and functionality of these semiconductors, and their designs cannot be easily replicated at other facilities. This dependency on semiconductors has caused volatility in the automotive industry during the pandemic, illustrating how the global economy has become unconsciously reliant on semiconductor technology.

During the Trump administration, there were numerous actions taken against individual companies, while the Biden administration has pursued a strategy of incentivising cooperation among countries like Japan and the Netherlands to limit their semiconductor supply to China, effectively hindering China's advancement in advanced manufacturing capabilities. Export controls have been imposed on China, with the USA banning the export of the most advanced chips for AI training, citing the critical importance of AI in defence and strategy.

The USA, with its significant talent pool compared to China, sees AI dominance as a leverage against China. The supply chain for AI-related technologies is largely dominated by firms outside of China, granting them exclusive access. Japan's access to crucial chemicals further restricts China's ability to produce cutting-edge technologies. These measures reflect a concerted effort to maintain technological superiority and strategic advantage in critical sectors.

In ways not as evident in 2021, the long-term capacity of Chinese companies to acquire advanced semiconductors is now increasingly dependent on the progress of China's domestic toolmaking and manufacturing capabilities. This is due to the growing number of Chinese design firms facing restrictions from foreign foundries. Additionally, while U.S. restrictions have primarily targeted advanced manufacturing capabilities, Beijing and Chinese firms are also concerned about potential future constraints. Therefore, they are prioritising the development of tool and material production lines independent of Western inputs to mitigate long-term risks.

Beijing officials are exploring new methods of collaboration between the public and private sectors to drive innovation in critical technologies like advanced lithography. Working closely with private entities, Beijing aims to address bottlenecks by facilitating the transfer of

advanced state-supported research to designated private sector firms, fostering cooperation among companies on vital technologies, and adopting successful strategies from other sectors.

Efforts to establish domestic Chinese alternatives extend beyond semiconductor manufacturing, encompassing areas such as design tools, advanced materials, advanced packaging techniques, and systems engineering approaches. These endeavours, particularly in packaging technologies like chipset design and 2.5 and 3-D back-end packaging, emphasise system-led approaches to enhance performance and transition to new, domestically controlled production processes.

Despite these measures, the challenges posed by U.S. controls remain formidable. Chinese semiconductor firms would prefer to maintain their global industry participation and engage in beneficial arrangements with peers. However, there is widespread skepticism within Chinese semiconductor circles regarding the intent of expanding U.S. controls, with doubts about whether they are truly focused on national security objectives. Consequently, China seeks to maintain global linkages while investing more resources in key technologies susceptible to technology control or future restrictions.

As China progresses across various technology domains, the timing of technology maturity and scaled commercial production for specific manufacturing supply chain elements remains uncertain.

What does the USA want?

1. The USA aims to diversify the manufacturing base for semiconductors, reducing dependence on a few key players, particularly in light of the China-Taiwan issue. While much of the assembly occurs in Taiwan and packaging in South Korea and other East Asian countries, the USA seeks less concentration in these regions.

2. The USA desires a more level playing field in the semiconductor industry, recognising that many governments, as indicated by OECD studies, subsidise their chip industries, putting the USA at a disadvantage. The offshoring of chip manufacturing has been detrimental to the USA's interests. The US Chips Act has spurred other countries to invest in their chip programs, seeing it as both an opportunity and a threat. China's announcement in 2014 regarding the importance of chips prompted other countries to follow suit with subsidies. Additionally, Silicon Valley's creation was facilitated by USA military support.

If TSMC were to be annexed, it would trigger a global financial crisis due to its pivotal role in the semiconductor industry. The geo-economic impact would be severe, as almost all of the most advanced AI chips are manufactured in Taiwan, along with cutting-edge processor chips and components for smartphones and PCs. The loss of TSMC would be devastating, particularly given its leadership in mature chip-making technology.

Taiwan has more manufacturing capacity than any other entity in the industry, but the effects of COVID-19 have demonstrated the vulnerability of this mature chip-making capacity. There is no spare capacity available to compensate for the loss of TSMC, and the impact could be comparable to events like the Great Depression. Additionally, constructing new fabs would take multiple years, further exacerbating the crisis.

The author also highlights how Morris Chang, the founder of TSMC, provided a "silicon shield," presumably referring to his leadership in advancing semiconductor manufacturing technology and establishing TSMC as a cornerstone of the global semiconductor industry.

Indeed, the potential scenario of a large-scale war breaking out, particularly over Taiwan, would have severe economic consequences, and the risk is widely recognised. History has shown that conflicts are often driven by factors beyond maximising GDP, such as territorial expansion, national interests, or glory. The rise of authoritarian leaders in 2022, for example, underscores this point.

In such a situation, China might attempt a temporary blockade of Taiwan to test US resolve, leading to uncertainty about whether the USA would defend Taiwan. This uncertainty could escalate tensions, with potential outcomes ranging from the USA maintaining its position to China taking control, leading to a significant shift in military balance and geopolitical dynamics.

Moreover, shortages of certain components like GPUs have been observed, particularly with the emergence of AI applications, which require high-performance computing. Nvidia's dominance in GPU production has created supply constraints for other companies, resulting in adverse consequences for various industries. This highlights the interconnectedness and vulnerabilities of global supply chains.

USA as a potential defender

Your research argument regarding the potential deterrent effect of the USA-backed AUKUS agreement in the China-Taiwan equation is compelling. The AUKUS agreement, a security pact between Australia, the United Kingdom, and the United States, has garnered attention with US officials suggesting its potential role in deterring Chinese military action against Taiwan. This development introduces a new dimension to the intricate relationship between the AUKUS countries, China, and Taiwan. The existence of AUKUS could serve as a counterbalance to China's expanding influence in the Indo-Pacific region, potentially influencing the dynamics of

regional security and stability. Further exploration of this topic could shed light on the evolving geopolitical landscape and the implications for regional security strategies.

The formation of AUKUS in 2021 was driven by the shared goal of countering China's expanding influence in the Indo-Pacific region. A pivotal aspect of the pact is Australia's acquisition of nuclear-powered submarines, representing a substantial enhancement to its existing naval capabilities. While the initial emphasis was on bolstering regional security, recent comments by U.S. Deputy Secretary of State Kurt Campbell shed light on additional objectives.

Campbell's remarks suggest that the capabilities provided by AUKUS could potentially contribute to stability in the Taiwan Strait. This acknowledgment indicates a broader strategic vision for AUKUS, extending beyond immediate regional concerns to address broader geopolitical challenges. By strengthening maritime capabilities in the Indo-Pacific, AUKUS may play a pivotal role in shaping regional dynamics and ensuring stability in critical maritime areas such as the Taiwan Strait.

The USA's "Balancing Act" may indicate a shift toward its commitment to Taiwan's defence. Despite Campbell's statements, the AUKUS nations have been cautious in explicitly tying the pact to Taiwan. For example, Australia has clarified that AUKUS doesn't equate to a commitment to back the U.S. militarily in a possible Taiwan conflict. This caution probably stems from a desire to prevent escalating tensions with China while retaining strategic ambiguity.

According to China, the AUKUS concept is perceived as a trigger for an arms race. China consistently opposes the AUKUS agreement, seeing it as a threat and a potential driver for increased militarisation in the area. The idea of an enhanced Australian navy with nuclear submarines has especially worried China, especially regarding the Taiwan matter. This is evident in how the USA engages with other Southeast Asian nations like Japan and the Philippines amidst China's assertive actions in the region.

The emergence of AUKUS coincides with broader initiatives by the United States to bolster alliances with Asian allies in light of China's expanding military capabilities and assertive territorial assertions. President Joe Biden has convened summits with leaders from Japan and the Philippines, emphasising the significance of regional collaboration.

The Future of AUKUS:

The long-term implications of Campbell's remarks regarding AUKUS and Taiwan remain to be examined to understand the power relations among all the variables. Whether the advanced submarines truly act as a deterrent to potential Chinese action depends on a complex web of factors including China's own military capabilities, regional dynamics and diplomatic efforts. The situation surrounding AUKUS, China and Taiwan is likely to evolve

further. China has always been peculiar about their concerns about AUKUS and all of them are well documented.

China perceives the establishment of this military alliance as a deliberate provocation of conflict in the region. Conversely, the USA views AUKUS as a beneficial development for regional security, emphasising its role in fostering cooperation and information sharing among key allies to maintain stability in the Indo-Pacific. China argues that this collaboration is precarious and aims to contain its rise, citing continued support for Taiwan through arms sales, which only heightens tensions. In response, the USA asserts that Taiwan, as a vibrant democracy, has the right to self-defence and emphasises occasional mentions of their commitment to the One China policy. However, this does not negate Taiwan's right to exist and receive support. The USA aims to mitigate tensions across the Taiwan Strait, advocating for peaceful resolution through dialogue. Additionally, the USA continues to urge China to engage in meaningful discussions with Taiwan.

There exists a significant lack of trust between the two superpowers, as the US continues to bolster Taiwan with military support and engage in unofficial diplomatic engagements, causing concern in Beijing. The USA attempts to reassure its adversaries by portraying its actions as purely defensive, aimed at achieving a peaceful resolution to the complex issue. However, China questions the sincerity of the AUKUS alliance, perceiving it as sending conflicting messages. On one hand, there is a military buildup and the potential for confrontation, prompting the USA to emphasise that AUKUS is not about conflict with China but rather about maintaining a free and open Indo-Pacific region for the prosperity of all nations, including China.

In the current volatile climate, any effort to leverage AUKUS to intervene in the Taiwan issue would undoubtedly trigger a strong response from China, which cannot be overlooked. The US maintains its commitment to seeking a peaceful resolution that considers the interests of all stakeholders. Perhaps future discussions can facilitate a more constructive approach to navigating this complex issue.

Chinese President Xi Jinping has a distinct objective: to reshape the global order.

His aim is to diminish the influence of the USA by undermining its alliances and advocating for alternative international norms rooted in Chinese principles. This envisioned system would prioritise state control and economic development, with China positioned at the forefront. Xi expresses confidence in his vision, asserting that China has established a global cooperation platform and is spearheading international reform. However, beyond China's borders, these assertions often face skepticism. Many perceive China's ambitions as faltering, evidenced by neighbouring countries distancing themselves and economic challenges. Furthermore, China's assertive diplomacy has not garnered widespread support. Despite these obstacles, Xi's vision

holds significance. China's propositions resonate with nations dissatisfied with the current system, while still presenting advantages to US allies.

Moreover, China employs a well-funded and strategic approach, actively involving itself with governments and populations globally. This tactic is yielding support for China, especially within certain international organisations and non-democratic states. China effectively positions itself as a catalyst for positive transformation, contrasting with the perception of the US as defensive in upholding the current status quo.

Rather than disregarding China's strategy, the US should take lessons from it. The US should articulate its own vision for a revamped international system, one that embraces inclusivity and flexibility to accommodate diverse nations. Like China, the US must prioritise investments in technology, military capabilities, and diplomacy to uphold security and global influence. However, it's equally essential to pursue short-term stabilisation of the US-China relationship. Through strengthening existing dialogues and easing tensions, the US can allocate resources toward winning the long-term competition.

China envisions a world order characterised by multiple powerful nations, each exercising full sovereignty over its affairs. Security arrangements should be founded on international agreements and the United Nations, while human rights standards ought to be determined by individual countries according to their unique circumstances. Development is regarded as crucial for addressing global challenges, with China seeking to diminish the hegemony of the US dollar and promote broader participation in the global system.

China contends that its vision surpasses the current US-led system. They critique the US for clinging to a Cold War mindset, forming alliances to bolster its influence, and meddling in the internal affairs of other nations. Additionally, China accuses the US of leveraging its economic and cultural sway to exert control over other countries.

China's strategy to realise this new world order comprises four components.

- ***The Belt and Road Initiative (BRI)***: This extensive infrastructure project seeks to link China with other nations across Asia, Africa, and Europe. It aids developing countries in constructing infrastructure while concurrently expanding China's economic and political sway.
- ***The Global Development Initiative (GDI)***: This initiative concentrates on assisting developing nations in combating poverty, enhancing access to technology, and tackling climate change. It promotes China's development approach, prioritising economic growth above other considerations.

- ***The Global Security Initiative (GSI)***: This initiative aims to establish a new security framework devoid of alliances or interference in other countries' internal affairs. China and Russia have employed this concept to rationalise Russia's incursion into Ukraine.
- ***The Global Civilisation Initiative (GCI)***: This initiative asserts that nations can adopt distinct political and human rights systems. It critiques the notion of universal human rights standards.

China is actively striving to persuade other nations and international bodies to embrace its vision. This effort involves striking deals with individual countries, integrating its programs into existing organisations, and exerting influence over UN policies. The Belt and Road Initiative (BRI) stands out as the most successful instance of this strategy, with numerous countries participating and the UN expressing endorsement. While the newer initiatives Global Development Initiative (GDI), Global Security Initiative (GSI), and Global Civilisation Initiative (GCI) are beginning to gain some traction, their support primarily comes from countries already closely aligned with China.

The ambitions and objectives pursued by China in the semiconductor industry have given rise to several geopolitical dynamics impacting both the USA and China. This strategic rivalry has intensified competition while also fostering cooperation between the two nations. However, the enduring prospect of peaceful coexistence is still uncertain, especially in the event of a potential escalation in the Taiwan Strait, which could ultimately disrupt global supply chains.

What USA has done to China on semiconductors?

The timing of the regulations was somewhat unexpected, leading to further division. There was considerable uproar during the Trump administration, which expressed apprehensions about chips potentially strengthening China's military capabilities. ASML, for instance, faced restrictions on exporting its technology, including limitations on lithography.

The regulation of semiconductors in US foreign policy traces back to the Cold War era, where limitations were imposed due to concerns about national security, primarily focusing on Russia at that time. However, the dynamics have evolved significantly, particularly with the rise of China. Unlike the past, where semiconductors were predominantly associated with military applications, today, the vast majority (98%) of semiconductor usage is for civilian purposes.

The military balance between China and the USA has shifted in recent years, with China playing a larger role in global supply chains, especially in the semiconductor industry. This shift underscores the increasing importance of relative economic power. China's strategic subsidies to its chip industry have enabled it to advance rapidly in acquiring cutting-edge technologies.

While chips and oil share similarities in terms of economic importance, there are notable differences between them. Unlike oil, which is a finite resource extracted from specific geographical locations, chips require the construction of semiconductor fabrication plants (fabs). Additionally, the semiconductor supply chain exhibits more volatility compared to oil due to factors such as technological advancements and geopolitical tensions.

Research indicates that the COVID-19 pandemic significantly affected semiconductor production lines. The pandemic disrupted global supply chains, leading to shortages and delays in chip manufacturing. This disruption, in turn, impacted various industries, including the automobile sector. While there wasn't a shortage of chips per se, there was confusion within the industry regarding which chips to prioritise for maximum efficiency given the available resources during the pandemic.

Moreover, the pandemic underscored the importance of political stability, as it necessitated swift and effective leadership to navigate the crisis. Leaders who demonstrated political stability and adept crisis management skills were crucial in addressing the challenges posed by the pandemic.

The introduction of restrictions on certain technology transfers to China by the background administration has marked a significant shift in global trade dynamics, especially in the context of national security concerns amidst the rise of China and the escalating tensions surrounding the Russia conflict. These restrictions have profound implications for the global supply chain, potentially leading to shortages in critical components and disrupting various industries.

One pivotal development was the imposition of restrictions on the export of EUV lithography machines to China. EUV lithography machines are crucial for advanced semiconductor manufacturing, particularly for producing cutting-edge chips used in various electronic devices. The decision to restrict their export underscores the strategic importance of semiconductor technology and its role in national security considerations.

Furthermore, the limited investment by US firms in tools necessary for the production of logic and memory chips in China has hindered the country's efforts to bolster its semiconductor capabilities. This lack of investment has not only affected China's domestic semiconductor industry but also contributed to its reliance on imports for key components, thereby amplifying concerns about technological dependence and security vulnerabilities.

The restrictions imposed on specific Chinese firms stem from the US government's belief that these companies are linked to activities contrary to national security interests. These concerns are supported by evidence and statements issued by US authorities, including press releases detailing the rationale behind these measures. The focus on preventing Chinese firms from accessing sensitive technologies and resources, such as those related to semiconductor manufacturing and supply chain infrastructure, reflects a broader strategy aimed at

safeguarding critical technologies and maintaining competitive advantages in strategic industries.

Moreover, efforts to counter Chinese attempts to acquire technology through illicit means, such as intellectual property theft and forced technology transfer, have become integral to US policy. The US government has emphasised the importance of protecting intellectual property rights and preventing unauthorised transfers of sensitive technologies to mitigate the risk of exploitation by adversaries and the imposition of restrictions on technology transfers to China and the broader efforts to safeguard critical technologies reflect a complex interplay of national security concerns, economic interests, and geopolitical considerations. By providing supporting facts and constructing a well-based narrative, the US seeks to justify its actions and defend its policies in the face of evolving challenges in the global landscape.

The second restriction imposed on China pertains to advanced computer chips, including those essential for AI applications such as GB chips. By limiting the availability of these chips, the US aimed to curtail China's progress in developing its technological capabilities, particularly in the field of artificial intelligence. This restriction has indeed hindered China's efforts to build its AI infrastructure and has effectively served the strategic interests of the US.

These restrictions were not only directed at Chinese entities but also extended to US citizens involved in facilitating technology transfers or holding dual citizenship with China. This broader scope underscores the comprehensive approach adopted by the US government to prevent unauthorised access to sensitive technologies and safeguard national security interests.

It's important to note that while certain restrictions have been imposed, other cutting-edge technologies remain unaffected. This selective approach reflects a nuanced strategy aimed at balancing the need to protect critical technologies with the imperative to maintain competitiveness and innovation in key sectors.

The US government has emphasised that while restrictions are in place, they are targeted and focused, with a particular emphasis on preventing the transfer of sensitive technologies that could be detrimental to national security. This distinction underscores the complexity of managing technological advancements in an increasingly interconnected and competitive global landscape.

The Global Chip Gamble: How Taiwan's Semiconductor Industry Impacts Geopolitics and Geoeconomics?

In today's interconnected world, achieving a delicate equilibrium is crucial, especially within the semiconductor industry. Delving into the delicate state of affairs concerning Taiwan, a

pivotal player in chip production, unveils the potential repercussions of any disruption to its manufacturing capacity. The volatility within semiconductor fabrication capabilities presents not just an economic challenge but also harbours potential military ramifications, given the military's reliance on economic prowess and its influence on global geopolitical dynamics. The intricate web of interdependence among national economies, particularly within the framework of deeply integrated global supply chains, underscores both mutual benefits and vulnerabilities. The concentration of semiconductor fabrication facilities in Taiwan, coupled with the indispensable role of semiconductors across various sectors, underscores an economic fragility that could potentially be exploited by China. Seizing control over Taiwan's semiconductor facilities, notably those belonging to giants like TSMC, would grant China significant leverage in advanced semiconductor manufacturing, thereby exerting a profound impact on global politics and economics. This highlights the need for diversified supply chain strategies and heightened diplomatic efforts to mitigate such risks and maintain a stable global semiconductor ecosystem.

In the scenario of Peaceful Unification, China stands to gain a substantial portion of the global semiconductor capacity at minimal cost. This would confront the United States and its allies with a challenging decision in the short term: either accept Chinese dominance and collaborate with Taiwanese companies now under Chinese ownership or impose sanctions and grapple with the loss of crucial high-end production capabilities. Despite industry players being cognisant that engaging with an authoritarian regime would entail different and potentially more restrictive rules compared to dealing with democratic Taiwan, they find themselves with limited options. They would essentially have no choice but to maintain relationships with companies now under the control of the Chinese Communist Party (CCP). In this context, U.S. government intervention that restricts access to Taiwanese supplies could be perceived as more detrimental than Chinese control over the supply chain. This dilemma underscores the complex and nuanced dynamics at play, where geopolitical considerations intersect with economic imperatives, necessitating careful diplomatic navigation to safeguard both national interests and global stability.

On the other hand, the government might opt to bear the risks linked with directly trading with CCP-dominated companies, viewing this as justification for immediate action. Nevertheless, if the United States endeavours to enforce counter-sanctions across various sectors, it is probable to encounter resistance domestically and from allied nations. Accepting economic repercussions presents another geopolitical reality that policymakers must contend with. This underscores the intricate balance between asserting national interests and navigating the complex web of international alliances and economic dependencies.

As a result, the United States and its allies would likely find themselves compelled to accept the altered relationship, unable to substantially diminish their vulnerability for several years. Meanwhile, the People's Republic of China (PRC) would stand to augment its global influence by effectively monopolising the fabrication of the world's most advanced semiconductors.

Should the PRC succeed in subjugating Taiwan through economic coercion, it could potentially challenge established geopolitical boundaries across Asia. Demonstrating resilience against trade disruptions, particularly in comparison to the West, could formally enable President Xi Jinping's vision of establishing a Chinese-dominated, unipolar international system. Beijing might then escalate its island reclamation efforts in the South China Sea and defy Western demands for demilitarisation in the region. In each of these scenarios, China would showcase its capacity to wield leverage while thwarting attempts to counterbalance its influence.

This expanded sphere of influence would undoubtedly reshape the global balance of power, ushering in a new era characterised by China's ascendancy and challenging the traditional dominance of Western nations.

In the scenario of Contested Unification, the situation would swiftly deteriorate as access to Taiwan's semiconductor manufacturing capabilities becomes increasingly uncertain. The United States and its allies would find themselves devoid of viable non-military solutions to address the ensuing disruption, ultimately reducing conflict resolution to a matter of which side could better withstand the economic repercussions.

Consequently, industry and government perspectives may align, with industry stakeholders asserting that government intervention would be imperative to adjudicate the prioritisation of limited semiconductor supply. This convergence of industry and government viewpoints underscores the gravity of the situation and the imperative for coordinated action to mitigate the impact on global supply chains and economic stability. In the contested scenario, maintaining the status quo relationship with semiconductor manufacturers while initiating efforts to relocate production capability would no longer be a feasible option. The available choices become more limited.

One option entail ceasing support for Taiwan's resistance against coercive measures, thereby allowing semiconductor production capacity to be restored under Chinese control. Alternatively, countries could choose to support Taiwan's efforts and accept the loss of access to semiconductors and trade with the PRC, potentially leading to an economic downturn. Another option involves considering military action to directly challenge and coerce the PRC, which could escalate tensions significantly. The escalation of conflict could ultimately lead to military intervention. In the contested scenario, the choices boil down to either capitulating and relinquishing significant geopolitical influence on the PRC, thereby overriding the wishes of the Taiwanese people, or supporting Taiwan at the expense of triggering a global economic depression and initiating a lengthy process of reshoring production capabilities. These decisions carry profound implications for international relations, global security, and economic stability.

Furthermore, the escalation could indeed lead to a military option. In the contested scenario, the choices essentially boil down to either capitulating and surrendering significant geopolitical influence on the PRC, thereby disregarding the wishes of the Taiwanese people, or supporting Taiwan at the expense of triggering a global economic depression and initiating a protracted process of reshoring production capabilities.

The PRC's relatively unconstrained freedom of action and the United States' and its allies' inability to effectively respond to PRC actions could emerge as the outcome of a contested annexation. This would significantly alter the calculations of allies regarding the reliability and effectiveness of U.S. diplomatic and political assurances. The United States' inability to counter aggressive moves by the PRC is largely attributed to its lack of economic flexibility to respond, underscoring the intricate interplay between economic strength and geopolitical influence in shaping global power dynamics.

Indeed, the concentration of fabrication capacity poses a potential risk for Taiwan rather than solely serving as a benefit. If the loss of Taiwanese semiconductor capacity were to result in a global economic downturn, it could significantly weaken the United States and its allies. This scenario becomes particularly pronounced if Taiwan fails to take action to mitigate these outcomes or if its actions are perceived to exacerbate the threat to the global economy.

Requesting the United States and its allies to not only risk their military forces to defend Taiwan but also endure a severe economic depression could place a substantial strain on the alliance. The expectation of such sacrifices, both in terms of military engagement and economic hardship, underscores the complexities and challenges inherent in maintaining strategic partnerships amidst evolving geopolitical dynamics. This highlights the delicate balance between safeguarding national interests, supporting allies, and preserving global economic stability.

The economic impacts stemming from such geopolitical factors could range from concerning to devastating. Interconnected economies inherently create vulnerability, especially if disruptions occur within the supply chain. Denial of access to semiconductors for tech industries would impede their ability to rely on continuous technological advancements to sustain growth and market share. Similarly, if semiconductors become unavailable to other industries, production would suffer, leading to shortages and supply chain disruptions.

This disruption would reverberate across both the PRC and Western economies. Even if the PRC were to completely secure the chip supply, economic disruptions elsewhere in the world would dampen demand for Chinese goods. Consequently, fewer consumers globally would have the financial means to purchase goods produced by PRC companies. This highlights the intricate interdependencies within the global economy and underscores the far-reaching consequences of disruptions in critical supply chains.

The disruption would indeed impact both the PRC and Western economies, with implications for global consumption patterns. However, the degree and immediacy of the impact, as well as the ability to adapt and overcome the disruption, raise important questions for further investigation.

Areas for Further Research

1. Who would suffer more and most immediately?

- Analysing factors such as existing economic dependencies, diversification strategies, and resilience to supply chain disruptions could shed light on which economies would bear the brunt of the immediate fallout. This assessment would likely involve examining the intricacies of trade relationships, market dynamics, and the extent of reliance on semiconductor-dependent industries.

2. Who would best be able to adjust and overcome the disruption?

- Addressing this question requires a comprehensive understanding of each economy's capacity for adaptation. Beyond relocating production, it entails fundamental changes to supply chain structures and market mechanisms. Factors such as access to capital, availability of skilled labor, technological advancements, and government capabilities play pivotal roles in determining an economy's ability to navigate and recover from such disruptions.

The adjustment process would necessitate significant time, resources, and strategic planning. For instance, estimations suggest that it would take two to five years for the United States and its allies to establish sufficient fabrication capacity to compensate for the loss of Taiwan's production, assuming optimistic conditions. In contrast, China's autocratic governance structure could potentially expedite infrastructure development, but the timeline for replicating Western tooling and building the necessary labor force remains uncertain.

Ultimately, the issue extends beyond the speed of capacity expansion to encompass the resilience of economies amidst a global economic downturn. Evaluating how swiftly the PRC could generate new capacity is crucial, but equally important is assessing its ability to withstand the broader decline in global economic activity stemming from the disruption. This multidimensional analysis would offer insights into the complex interplay between economic dynamics, governance structures, and geopolitical considerations in shaping the response to supply chain disruptions in the semiconductor industry.

Conclusion:

Summary of Findings

- a. Due to limitations on purchasing advanced tools from the West, China is anticipated to persist in investing in mature process nodes, especially those at 28 nm and older technologies. By the conclusion of 2024, the capacity for mature chip production is slated to grow across 32 Chinese fabs, resulting in a substantial rise in China's global share of mature capacity. TrendForce forecasts China's global share of mature capacity to reach 39% by 2027, prompting concerns in the USA.
- b. To tackle these challenges, the US Department of Commerce has launched a Semiconductor Supply Chain Review, aimed at addressing national security worries associated with chips sourced from China. The review seeks to understand how U.S. companies acquire older-generation chips and forms part of a larger strategy to allocate almost \$40 billion in subsidies for semiconductor chip manufacturing.

Recommendations for USA's foreign Policy:

1. Engage in a comprehensive dialogue and try to negotiate good terms with its southeast Asian allies by trying to be available for them before China shakes their hand which would stir inefficiency towards USA's foreign policy.
2. To foster transparency and good governance for economic development and local job creation, it's imperative to adjust, engage economically, and invest in the semiconductor industries of India, Vietnam, and domestically.
3. Strive to strike a balance by maintaining military presence and security cooperation initiatives in the region, with a focus on countering escalated threats. Additionally, aim to act as a stabilising force and support local capacity-building initiatives, while being cautious to avoid excessive intervention.

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