Industrial Policy and Geoeconomics of US-China Tech Rivalry

(Draft)

Kevin H. Zhang
Department of Economics
Illinois State University
Normal, IL 61790-4200

khzhang@ilstu.edu

Abstract

The focus of the current US–China rivalry is mainly on technology and the race to dominate strategic emerging sectors. Industrial policy, as a return of key instrument, is playing an increasingly important role in both countries for competition. This paper aims to study several issues about US-China geoeconomic rivalry of technology and industrial policy adopted in the two countries. We first explore the evolution of China's technology advancement since 1978, focusing on industrial policy used to help China emerge as a global tech power. A theoretical framework is developed to explain how and why US-China geoeconomic tech rivalry arise. We argue that industrial policy plays a critical role in both the US and China to compete each other. We conclude that the intensifying US-Chinese rivalry has the potential to foster a new era of public policies characterized by global statism and techno-nationalism.

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1. Introduction

China has unexpectedly emerged in mere a few decades as the 2nd largest economy in the world (global largest in terms of purchase-power parity since 2016). Although still a middle-income country, China now has the world's second most important high-tech sector, as well as the world's largest manufacturing and internet sectors (Baldwin, 2024; Atkinson, 2024; Naughton, 2021). Figure 1 shows growth of the Chinese economy relative to the US over 1979-2023. In mere 44 years, China's GDP rose by almost 44-fold, while the US, the best performer in G-7, raised its economy only by 3-fold. The fast growth of China's GDP shrinks its gap with the US, China/the US ratio rose from 5.5% to 79% in the period (World Bank, 2024).

Figure 1 may be here.

What is the global position of China's technology and innovation? How large is China's gap from the US in high-tech? According to the recent study (Atkinson, 2024)[1], China appears ahead in nuclear power; on par in electric vehicles and batteries; near the lead in robotics, displays, artificial intelligence, and quantum; and lagging in chemicals, machine tools, semiconductors, and biotechnology. Apart from semiconductors, where progress has been somewhat frustrated by the US export controls on equipment, and quantum, China's rate of progress is striking, as shown in Table 1.

Table 1 may be here.

China is at the leading edge of global innovation in two sectors and is not far behind the global leaders in four others. China has not yet taken the overall lead, but its firms are making rapid progress in developing their innovation capabilities and will likely equal or surpass the U.S. and other Western leaders within a decade or so, according to the ITIF report investigation. "The prevailing view of China's economy has long been that it is a production powerhouse, but a mere copier that lacks the scientific and technological ability to develop groundbreaking innovations," said ITIF President Robert D. Atkinson, who led the research. "But, if China can develop new-to-the-world innovations ahead or on par with the United States and its allies in the West, its potential to displace them and gain a decisive global advantage becomes much more likely." (Atkinson, 2024). As outlined in the report, if China succeeds in becoming the world's innovation leader, the center of global techno-economic power will shift. Among the potential consequences, China would be less vulnerable to Western sanctions and other trade tools, and its military capabilities and influence over developing nations would grow.[2] Meanwhile, the US technology production base would continue to erode.

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[1] Information Technology and Innovation Foundation (ITIF), the most famous tech-innovation thinktank in the US, conducted a 20-month investigation of China's technology and innovation capabilities in 10 advanced-technology industries: robotics, chemicals, nuclear power, semiconductors, display technologies, electric vehicles & batteries, artificial intelligence, quantum computing, biopharmaceuticals, and machine tools. ITIF President Robert D. Atkinson led the research.

[2] Several striking factoids about China's innovation include (a) China installed more industrial robots than did rest of the world in 2023. (b) In 2013, the U.S. share of chemical industry R&D spending was 30%, while China's was 1%. By 2022, China's was 16.8% and America's 18.6 %. (c) China has more nuclear power plants under construction than does the rest of the world combined. (d) China will add more chip-making capacity than will the rest of the world combined in 2024. (e) China accounts for 62 percent of global EV production. (f) From 2017 to 2021, Chinese new drug clinical trials grew faster than any nation's. (g) China has the world's first long-distance quantum-secured communications route (Atkinson, 2024).

The US is engaged in a competition for technology and innovation leadership with China, with both nations making significant investments in their domestic innovation systems while seeking to undermine the other's innovation system. The US, for instance, has implemented export controls and investment restrictions to slow China's rate of technological innovation, while launching innovation initiatives covering emerging energy technologies, quantum computing, and wireless communications, among other industries (Starrs & Germann, 20212; Cory, 2023; Jin, 2024).

The rest of the paper is organized into six parts. Section 2 outlines the evolution of China's technology advancement since 1978, focusing on the strategies and policies that help China rise as a global tech power. In Section 3, we develop a theoretical framework of techno-geoeconomics and industrial policy with the background of globalization in the past four decades. Section 4 discuss key issues of US-China geoeconomic technology rivalry. In the following two sections, we analyze industrial policy adopted by the US and China, respectively. The last section offers a summary and concluding remarks.

2. China Emerges as US Tech Competitor

China's technology has advanced dramatically over the past few decades, from being a technology importer to becoming a global leader in certain areas of innovation. This progress has been driven by a combination of state-led industrial policy, strategic investments, and geoeconomic maneuvering (Studwell, 2013; Baughton, 2021; Zhang, 2020 and 2023). The evolution of China's geoeconomics of technology reflects a strategic shift toward technological self-reliance, global influence, and control over critical technology supply chains. An outline of the key stages and driving factors may be identified as follows.

Early Industrialization and Technology Imports (1978-2000) In 1978, China embarked on its policy of "reform and opening up," which sought to modernize the economy through market-oriented reforms and integration into the global economy. Initially, China relied heavily on foreign technology to drive its modernization. During this period, China focused on importing technology from advanced economies, particularly through foreign trade and foreign direct investment (FDI) with technology transfers. Multinational corporations (MNCs), especially from the US, Japan, and Europe, were encouraged to invest in China in exchange for market access. China aimed to learn from these investments and gradually build its own technological capabilities. At this stage, China was not a significant player in the global technology space but sought to build technological capacity by leveraging its vast labor force and offering itself as a manufacturing hub for global firms.

Building Domestic Capabilities and Strategic Industries (2001-2012) China's accession to the World Trade Organization (WTO) in 2001 marked a turning point. It allowed China to become more deeply integrated into the global economy, boosting its exports, and facilitating access to global technology and innovation. The mid-2000s saw the launch of China's "indigenous innovation" strategy, which aimed to reduce reliance on foreign technology and foster domestic innovation. The Chinese government began to support local firms through subsidies, state funding, and favorable policies. China identified key strategic sectors for technological development, including telecommunications, aerospace, semiconductors, renewable energy, and biotechnology. Companies like Huawei, ZTE, and Lenovo began to emerge as significant players during this period. While still largely dependent on foreign technology, China began to establish its own global technology firms. Its position in the global supply chain was moving

from low-end manufacturing toward higher-value segments, such as electronics and telecommunications equipment.

China as a Global Technology Competitor (2012-2019) By the 2010s, Chinese companies like Huawei, Tencent, Alibaba, and Baidu had become global competitors in sectors like telecommunications, e-commerce, and AI. These companies benefited from China's large domestic market, supportive government policies, and access to foreign technologies and markets. In 2015, China launched its "Made in China 2025" initiative, a comprehensive industrial strategy aimed at achieving global leadership in high-tech sectors. The policy focused on sectors such as advanced manufacturing, AI, robotics, quantum computing, and semiconductors. The plan also aimed to reduce dependency on foreign technologies, especially from the US, Europe, and Japan. The strategy included goals for import substitution, particularly in critical areas like semiconductors, where China sought to reduce its reliance on US and other foreign suppliers. This marked a more aggressive approach to building domestic capacity in critical technology sectors. China's geoeconomic strategy during this period relied heavily on *state-led capitalism*. The government played a central role in directing investments, subsidizing R&D, and guiding the development of national champions in technology. Tech companies that aligned with national strategic goals received significant support. Launched in 2013, Belt and Road Initiative (BRI) has both geoeconomic and geopolitical dimensions. Through the BRI, China exported its technology, particularly in telecommunications, infrastructure, and digital networks, to developing countries. Huawei and ZTE, for instance, became key players in building telecom infrastructure along BRI countries, enhancing China's influence in these regions.

US-China Tech Rivalry and Decoupling (Late 2020-Present) The late 2010s saw the intensification of the US-China tech rivalry. The US imposed tariffs, export controls, and sanctions on Chinese companies like Huawei and ZTE, citing national security concerns. This led to an increasing push toward technological decoupling, where both countries sought to reduce dependence on each other's technology.[3] In response to US actions, China has placed increasing emphasis on achieving technological sovereignty. This includes expanding domestic R&D, securing supply chains, and developing indigenous technologies to reduce dependence on foreign suppliers, particularly in areas critical to national security. Alongside technological sovereignty, China has also pushed for data sovereignty, asserting more control over the flow of data across its borders. China's Cybersecurity Law in 2017) and its Data Security Law in 2021 are aimed at regulating data flows, protecting domestic tech infrastructure, and ensuring that foreign tech companies operating in China comply with national security requirements.

Current Trends and Future Direction (2024 and beyond) (a) As part of its broader economic strategy, China has adopted a "dual circulation" model, which emphasizes domestic innovation and consumption while maintaining international trade ties. This is aimed at reducing vulnerabilities exposed by the US-China trade war and ensuring China's technological

[3] For example, semiconductors are a battleground in the US-China tech rivalry. The US imposed restrictions on China's access to advanced semiconductor technologies, including chips and manufacturing equipment. In response, China ramped up efforts to develop its own semiconductor industry, though it still lags global leaders in chip design and manufacturing. Another important case is AI and 5G. AI and 5G have become central battlegrounds in the tech rivalry. China's advances in AI, driven by companies like Baidu, Alibaba, and Tencent, have positioned it as a leading AI innovator. In the 5G space, Huawei emerged as a global leader, prompting concerns in the West about Chinese influence over critical digital infrastructure.

independence. (b) China is positioning itself as a global leader in green technologies such as solar power, electric vehicles, and renewable energy. In parallel, it is advancing digital transformation, promoting the use of AI, cloud computing, and blockchain in industries ranging from finance to manufacturing. (c) The Chinese government continues to invest heavily in emerging technologies like quantum computing, AI, biotechnology, and new energy technologies. China's leadership sees these sectors as critical to securing future economic growth and geopolitical influence. (d) China's global influence through technology continues to grow, especially in the Global South. Chinese firms, backed by state investment, are increasingly present in Africa, Latin America, and Southeast Asia, providing affordable technologies like smartphones, telecom infrastructure, and digital payment systems. (e) China is increasingly active in international organizations that set global technology standards. It aims to shape global norms for emerging technologies such as 5G, AI, and cybersecurity. For example, China's participation in the International Telecommunication Union (ITU) has allowed it to influence global telecom standards in ways that align with its strategic interests.

For about four decades, China's tech strategy in the geoeconomic context has evolved from a focus on importing foreign technologies to becoming a global technological power. It has leveraged its vast domestic market, state-led policies, and participation in global supply chains to build national champions and push for technological self-sufficiency (Atkinson, 2020 and 2024). The evolution of China's geoeconomics of technology is now characterized by an increasingly assertive stance in global tech competition, especially with the US, and a drive toward technological leadership in key sectors like AI, 5G, and semiconductors. As technology becomes more intertwined with national security and global influence, China's approach will continue to shape the global geoeconomic.

Several features of China's geoeconomics of technology may be summarized as follows. (a) *State-led capitalism*: China's model of development has relied on a combination of market mechanisms and strong state intervention. The government plays an active role in directing technological development, providing subsidies, and protecting domestic industries from foreign competition. (b) *Strategic use of global supply chains*: China has become a critical player in global technology supply chains, particularly in manufacturing electronics, telecommunications equipment, and rare earth minerals. It uses this position both as a source of economic strength and as leverage in geopolitical disputes. (c) *Tech nationalism*: China's emphasis on technological self-reliance has grown, especially in response to pressures from the US and its allies. The pursuit of technological nationalism is central to China's geoeconomic strategy, with domestic innovation being a priority to ensure long-term security and economic growth. (d) *Innovation and export of technology*: China has transitioned from being a consumer of foreign technology to an exporter of technology, especially to developing countries. Through initiatives like the BRI, China is exporting telecommunications networks, and digital technology, extending its geoeconomic influence globally (Moschella & Atkinson, 2020; Cory, 2023; Atkinson, 2020 and 2024).

3. A Theoretical Framework

The geoeconomics of technology explores how technological advancements and policies influence global economic power dynamics and international relations. Theories in this field are based on both geopolitics and economics, emphasizing the strategic use of technology to achieve economic and geopolitical goals. While there isn't a single unified theory of the geoeconomics of technology, several theoretical frameworks from international relations,

political economy, and strategic studies help analyze the issue. Three approaches may be identified: techno-nationalism vs. techno-globalization, techno-hegemony vs. power transition, and strategic techno-autonomy vs. strategic techno-competition (Erlbacher & Schmalz, 2023; Moschella & Atkinson, 2020; Zhang, 2020 and 2023). Together, these perspectives offer a multi-dimensional view of how technology influences global economic competition, security, and governance in an increasingly interconnected and technologically driven world.

Techno-nationalism vs. techno-globalization Rooted in realist thinking[4], techno-nationalism theories suggest that states should develop and control key technologies to ensure national security, economic competitiveness, and strategic autonomy. Great powers like the US and China prioritize technology development to secure national interests, leading to competition in sectors such as artificial intellectual (AI), the 5th generation (5G), and semiconductors. The techno-nationalism theory also emphasizes the link between technological innovation and military power. States that dominate strategic technologies (e.g., cyber capabilities, AI-powered autonomous weapons, quantum computing) can project power more effectively on the global stage.

Techno-globalization theories highlight the importance of international technology cooperation, free markets, and institutions in fostering economic prosperity through globalization. Open access to technological innovation and global markets are viewed to benefits all states and leads to mutual gains. The rationale behind the theories are cross-global interdependence and technology as a public good. The global economy, especially in the technology sector, is characterized by interdependence. Countries rely on each other for innovation, supply chains, and markets, which makes decoupling (i.e., severing technological ties between major powers like the US and China) costly and potentially destabilizing. Technology (especially digital technologies like the internet) is viewed as a global public good that can improve governance, transparency, and cooperation among states. However, this view is challenged by the rise of digital authoritarianism and state efforts to control technological standards.

Techno-hegemony vs. power transition Derived from the hegemonic stability theory (HST)[5] and geoeconomic power theory, the techno-hegemony theory suggests that countries use technology as tools of statecraft to achieve geopolitical and geoeconomic objectives. Specifically, countries use technological capabilities to gain influence over others by controlling access to key technologies, standards, and markets. Global tech stability and innovation are best supported when a leading nation or block (such as the US in the 20th century) sets the rules, standards, and norms.[6]

Power transition theory suggests that periods of shifting dominance, especially in areas like technology, can lead to geopolitical and geoeconomic tensions, trade wars, and even conflict.

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[4] In international relations, realism posits that states act primarily in their self-interest, seeking power and security in an anarchic international system. This view applies to technology, where technological superiority is seen as a tool for enhancing national power.

[5] HST argues that the international system is more stable when a single hegemonic power dominates.

[6] In the 21st century, the US and China are competing for technological hegemony, particularly in critical sectors like AI, 5G, and semiconductors. The hegemon sets standards for intellectual property rights, technological regulation, and internet governance, influencing the entire global tech ecosystem.

As China challenges US dominance in technology, the global system faces instability. Technological sanctions and export controls (e.g., the US restricting China's access to advanced semiconductors or telecommunications equipment) are key tools of the US as hegemon. These measures are designed to deny rivals access to technologies that can bolster their economic and military capabilities.[7]

Strategic techno-autonomy vs. strategic techno-competition Based on the game theory, both approaches of strategic techno-autonomy and competition use analyses of strategic interactions and the decision-making of rational actors in competitive environments. Strategic techno-autonomy refers to a country's ability to independently make decisions and pursue policies without being overly dependent on external actors. Techno-autonomy tends to lead to techno-decoupling, the process of disentangling the two nations' economies like the US and China. In the theory of strategic techno-competition, countries may face a prisoner's dilemma in areas like cyber warfare, where mutual cooperation (avoiding cyber-attacks or theft) could benefit both parties. However, the incentive to defect (launching preemptive cyber-attacks or espionage) can create a cycle of mistrust and escalation. The theory also helps explain whether countries view technology competition as a zero-sum game **(**one country's gain is another's loss, as in military AI) or a positive-sum game (where technological cooperation can lead to mutual benefits, as in global climate tech).

In the context of the geoeconomics of technology, industrial policy is a strategic tool for countries to secure economic and technological power, influence global standards, and protect national interests in critical technology sectors. Geoeconomics combines economic and geopolitical considerations, especially in technology, as competition increasingly centers around digital infrastructure, AI, semiconductors, and telecommunications. The role of industrial policy in the geoeconomics of technology includes securing technological sovereignty; driving innovation and tech competitiveness; and setting global tech standards and norms.

Securing Technological Sovereignty Industrial policies support domestic technology development, reducing the risk of exposure to foreign control or trade restrictions. By investing in domestic or allied technology supply chains, countries aim to secure access to essential components, such as rare earth minerals or semiconductor chips, ensuring resilience against disruptions due to geopolitical tensions or sanctions.

Driving Innovation and tech Competitiveness Industrial policies encourage innovation through funding for R&D, technology parks, and collaborative research institutions. By fostering an innovation ecosystem, countries can establish themselves as global technology hubs in areas like AI, quantum computing, or biotechnology. Countries use industrial policies to support domestic firms in acquiring patents and IP in strategic technologies, bolstering their global competitiveness. Patenting activity not only strengthens a country's influence over standards but also provides leverage in trade negotiations.

Setting Global Standards and Norms

[7] Digital Currencies and Economic Control: The rise of central bank digital currencies (CBDCs) is another example of how technology is becoming a tool of geoeconomic influence. China's digital yuan is part of its strategy to reduce dependence on the US-dominated global financial system and increase its influence in the global economy.

Industrial policy helps nations establish first-mover advantage: becoming early adopters or creators of new technologies and positioning them to shape global standards, as seen in 5G technology and artificial intelligence ethics frameworks. By setting standards, countries influence how technology evolves and ensure that it aligns with their strategic interests. Industrial policies also aim to influence the rules governing digital trade, data governance, and cybersecurity. Countries that establish leadership in technology can set rules that protect their companies and data privacy norms, potentially pushing other countries to adopt similar standards.

In sum, industrial policy in the geoeconomics of technology enables countries to navigate the intersection of economics and security by building a domestic technology base, safeguarding critical assets, and influencing global technology standards.

4. Key Issues in US-China Geoeconomic Tech Rivalry

The US-China geoeconomic relations of technology is one of the most critical dimensions of their broader geopolitical rivalry, involving competition for dominance in key technological sectors, economic strategies to achieve self-sufficiency, and efforts to secure strategic advantages in emerging technologies. This competition impacts global supply chains, trade relations, security concerns, and the broader international order. Several key issues that define the US-China geoeconomic conflict over technology may be identified as follows.

Technology Sovereignty and Decoupling The US and China are moving toward a degree of technological decoupling, where both countries are trying to reduce dependency on each other for critical technologies. This is particularly pronounced in sectors such as semiconductors, telecommunications (5G), artificial intelligence (AI), and advanced manufacturing.[8] Both countries are pursuing strategies to develop technological sovereignty. The US has passed legislation such as the CHIPS Act, providing billions in funding to boost domestic semiconductor production. China's Made in China 2025 initiative aims to reduce reliance on foreign technology and build domestic capabilities in sectors like robotics, aerospace, and semiconductors.

Semiconductor Supply Chain Disruptions Semiconductors are at the heart of the US-China tech rivalry. The US controls the high end of the supply chain, with leading firms like Intel, NVIDIA, and Qualcomm, while China is heavily reliant on imports for advanced chips. Taiwan's TSMC (Taiwan Semiconductor Manufacturing Company) plays a pivotal role, as it produces the most advanced chips globally, serving both US and Chinese companies. The US has imposed export controls on advanced chips to China, aiming to prevent China from developing advanced AI and military capabilities. Both countries recognize the vulnerabilities in the global semiconductor supply chain and are taking steps to secure it. The US is encouraging chip production domestically, while China is working to close the gap in chip manufacturing technology through massive state investment.

[8] The US has imposed restrictions on Chinese tech companies like Huawei, and China has responded by accelerating efforts to develop its own technologies to reduce reliance on the US. Semiconductors are a key flashpoint, as the US leads in chip design, while China is working to develop its own capabilities in this critical industry. US sanctions on China's access to advanced semiconductor technologies have intensified China's push for self-reliance.

Competition in Emerging Technologies China and the US are in fierce competition to lead in AI development. AI is seen as a transformative technology with implications for economic growth, military applications, and global dominance. While US companies like Google, Microsoft, and OpenAI lead in AI research, China is rapidly catching up, with companies like Baidu, Tencent, and Alibaba making significant strides.[9] Huawei, China's leading telecom company, has become a focal point of US-China tensions. The US has banned Huawei from its 5G networks and urged its allies to do the same, citing national security concerns. The US fears that China's dominance in 5G infrastructure could allow it to control global communications and engage in espionage.[10] Both countries are heavily investing in quantum computing, which has the potential to revolutionize sectors like cryptography, cybersecurity, and communications. The US and China are each racing to achieve breakthroughs in this technology, which could provide a significant strategic advantage.

Cybersecurity and Data Governance Both countries are locked in a competition over cybersecurity, particularly related to espionage and intellectual property theft. The US has accused China of conducting cyberattacks to steal sensitive government and corporate data, while China sees US dominance in global internet infrastructure as a threat to its national security. Another key issue is the governance of data and cyber infrastructure. The US has expressed concerns that Chinese tech companies, particularly Huawei and TikTok, could be used by the Chinese government to access sensitive data.[11]

Global Supply Chain Disruptions The US-China trade war, initiated in 2018, has had significant impacts on global tech supply chains. The imposition of tariffs on Chinese goods, including electronics and tech products, disrupted global manufacturing networks, and forced companies to reassess their supply chain strategies. US companies have started to diversify their supply chains away from China, seeking alternatives in countries like Vietnam, India, and Mexico. At the same time, the US government is encouraging the reshoring of critical manufacturing capabilities, particularly in high-tech sectors like semiconductors.[12]

Technology Standards and Global Influence Both countries are engaged in a quiet but intense battle to shape international standards for emerging technologies. Controlling the standards for technologies like 5G, AI, and quantum computing can provide significant advantages in the global market. China has been actively increasing its influence in international standard-setting bodies, particularly in telecommunications. These raise concerns in the US and its allies that China could shape global technology in ways that benefit Chinese companies and the Chinese government's strategic goals. The US is leading efforts to

[9] There is also competition over the global governance of AI technologies, with both the US and China seeking to shape global norms and standards.

[10] The US and China are also competing to shape global standards for 5G and future telecommunications technologies. This battle is playing out in international bodies such as the International Telecommunication Union (ITU).

[11] The US seeks to protect its control over the global internet infrastructure, while China promotes its vision of cyber sovereignty, where nations have the right to control and regulate internet access and data flows within their borders.

[12] The COVID-19 pandemic underscored the fragility of global supply chains. Both the US and China are now prioritizing supply chain resilience in critical technologies like semiconductors, medical equipment, and rare earth minerals.

ensure that Western companies and technologies remain dominant in global standards bodies, particularly in AI ethics, telecommunications, and internet governance.

Intellectual Property (IP) and Innovation A long-standing issue in the US-China tech rivalry is China's alleged theft of US intellectual property (IP). The US has accused China of engaging in state-sponsored hacking to steal trade secrets and sensitive technology from American companies. Both countries are in a race to lead global innovation, particularly in patents related to cutting-edge technologies. China has rapidly increased its global patent filings, particularly in areas like AI, 5G, and biotech, and has positioned itself as a leader in certain fields. The US continues to dominate in research and development (R&D) spending and innovation in areas like semiconductors and pharmaceuticals.

The US-China geoeconomics of technology is a multi-faceted and intensifying competition with significant implications for global economic, political, and security dynamics. Both countries are seeking to secure dominance in critical technologies, control supply chains, shape global standards, and protect their national interests through technology-related policies. The stakes are high, as the outcomes of this competition will shape the future of the global technology landscape, influencing innovation, trade, security, and global governance.

5. US Industrial Policy for Tech Competition with China

The US industrial policy in the geoeconomic rivalry with China represents a significant shift from its traditional, market-driven approach to one where the government plays a more active role. US industrial policy aims to address dependencies on China, support technological leadership, and secure national and economic security. The key components of the US industrial policy in the context of its technology rivalry with China are as follows.

Strategic Investments in Critical Sectors (a) CHIPS and Science Act (2022): This landmark act allocates over $52 billion in federal subsidies for semiconductor manufacturing and R&D within the US. With semiconductors being critical for nearly all advanced technologies, the US is focused on building a secure, domestic semiconductor supply chain. This policy seeks to reduce dependency on foreign sources, especially China and Taiwan. (b) Inflation Reduction Act (IRA): Though primarily an economic and environmental measure, the IRA includes incentives for green technology, electric vehicles (EVs), and clean energy manufacturing. By funding US-based manufacturing of EV batteries, solar panels, and other clean technologies, it aims to counter China's dominance in these areas and create a US-based green technology supply chain.

Reshoring and "Friend-Shoring" Supply Chains (a) Reducing Dependence on China: The US is encouraging companies to reshore production and is promoting "friend-shoring" by working with allies to develop alternative supply chains. For instance, the US has been strengthening partnerships with countries like Japan, South Korea, and the European Union to source critical materials and components. (b) Critical Minerals and Rare Earths: China dominates the supply of rare earth elements (REEs) and other critical minerals essential for electronics, EVs, and defense systems. To address this dependency, the US has invested in domestic mining, recycling, and refining, along with partnerships with Australia and Canada to diversify these supplies.

National Security and Export Controls (a) Export Restrictions on Key Technologies: The US has imposed export controls on technologies that China could use to gain strategic advantages, particularly in areas with potential military applications. For example, the US has restricted exports of advanced semiconductors and AI software to Chinese companies, as well as the sale of semiconductor manufacturing equipment. (b) Investment Screening: Through the Committee on Foreign Investment in the US (CFIUS), the US scrutinizes Chinese investments in US companies, particularly in tech sectors like semiconductors, AI, and cybersecurity. There are also new controls on outbound US investments in certain Chinese tech sectors, as these investments could indirectly advance China's tech capabilities.

R&D Funding and Technological Innovation (a) National Science Foundation (NSF) and Department of Energy (DOE): The CHIPS and Science Act increased funding for scientific research at agencies like the NSF and DOE to maintain US leadership in foundational and emerging technologies. AI, quantum computing, biotechnology, and energy innovation are major focus areas. (b) ARPA-H and Quantum Research: Modeled after the successful DARPA (Defense Advanced Research Projects Agency), the US has launched new initiatives like ARPA-H (Advanced Research Projects Agency for Health) to push the frontiers of health tech. Significant investments are also being directed toward quantum computing, a field with implications for both national security and economic competitiveness.

Strengthening Alliances for Technological Standards and Supply Chains
(a) EU-US Trade & Technology Council (TTC): The US is working with allies through multilateral organizations to establish standards and protocols for emerging technologies like AI, cybersecurity, and telecommunications. Collaborating with EU aims to prevent China from setting global technology standards. (b) Cooperation with Allies on Semiconductor Supply Chains: Recognizing that semiconductor manufacturing is global, the US collaborates with allies like Japan, Taiwan, South Korea, and the Netherlands to limit China's access to semiconductor technology and prevent China from building an independent semiconductor industry.

Building Domestic Champions (a) Support for Private Sector Leaders: Although the US lacks the state-owned enterprises of China, it supports domestic technology champions through incentives and research grants. Major American tech companies, particularly in AI and semiconductor manufacturing (e.g., Intel, NVIDIA, and Qualcomm), benefit from federal support and are encouraged to develop cutting-edge technology. (b) Talent Development and Education: To sustain its innovation lead, the US is investing in STEM education and workforce development. The CHIPS Act, for example, includes funding to train workers for advanced manufacturing, especially in semiconductor fabrication. There is also increased investment in programs to attract global talent, with a renewed focus on visas and pathways for skilled immigrants in tech fields.

Selective Decoupling and Counteracting China's Belt and Road Initiative (BRI) (a) Decoupling in Strategic Sectors: The US has moved toward selective decoupling in areas considered critical to national security. This includes restrictions on Chinese telecommunications equipment in 5G networks, US government data storage, and limits on certain Chinese tech imports. (b) Countering China's Influence: Through initiatives like the "Build Back Better World" (B3W) partnership and cooperation with G7 nations, the US aims to provide an alternative to China's BRI, especially in digital infrastructure.

Several challenges and risks have emerged with the US industrial policy. (a) Cost and Capacity Constraints: Rebuilding supply chains domestically and among allies is costly and requires significant investment in infrastructure and training. Some sectors, like rare earths and advanced manufacturing, remain difficult to localize due to cost, environmental issues, or talent shortages. (b) Global Market Fragmentation: If US-China technology standards diverge, it could lead to a fragmented global technology landscape, raising costs for companies and complicating global tech ecosystems. Furthermore, allies may find it challenging to fully align with US policies, given their own economic interests in China. (c) Innovation Competition: As the US prioritizes certain sectors, maintaining the pace of innovation will be critical. Federal funding and incentives are helpful but may not fully compensate for the advantages Chinese companies gain from close government alignment and significant subsidies.

Table 2 may be here.

The US industrial policy in the technology rivalry with China is characterized by proactive investments, export controls, and alliances designed to secure its technological edge and reduce dependence on Chinese supply chains. This strategy marks a departure from a purely market-driven approach, aiming to build resilience and independence in critical areas like semiconductors, green energy, and advanced research. In doing so, the US seeks not only to protect its economic interests but also to shape global technology standards in alignment with democratic values, data privacy, and fair competition. This intensified industrial policy could define US-China relations and the global economy for decades to come.

6. China's Industrial Policy for Tech Competition with the US

China's industrial policy has become central to its strategy in the ongoing geoeconomic tech rivalry with the US. By leveraging government-led planning, subsidies, and targeted investment, China aims to attain technological self-sufficiency and global leadership in key high-tech sectors.

Strategic Plans and Vision (a) Made in China 2025: Launched in 2015, this initiative was China's blueprint to dominate high-tech manufacturing and innovation by 2025. Focusing on ten priority sectors—such as robotics, aerospace, and biopharmaceuticals—the plan aims to decrease China's reliance on foreign technology and build its own capacity to produce world-class technology products. (b) Dual Circulation Strategy: the strategy seeks to boost domestic consumption (internal circulation) and selectively engage with the global economy (external circulation). This approach reflects a desire to decouple, where possible, from dependencies on the US and other advanced economies for critical technologies.

Heavy Investment in R&D and Subsidies China has massively increased its R&D spending, targeting 7% annual growth, which is among the highest globally. The government offers substantial subsidies to companies in critical sectors like semiconductors, AI, and clean energy, and provides low-interest loans, land grants, and tax incentives. State-led venture capital funds, such as the China Integrated Circuit Industry Investment Fund, inject billions into semiconductor companies to build a robust domestic industry. Local governments also support companies that align with national goals, creating an ecosystem geared toward prioritized technological advancement.

Figure 2 may be here.

Domestic Champions and State-Owned Enterprises (SOEs) China nurtures domestic tech champions, such as Huawei, Tencent, and Baidu, which receive favorable regulatory conditions, subsidies, and support in overseas expansion. The government also directs SOEs to focus on technology areas considered critical to national security and economic sovereignty. SOEs and tech companies often work closely with government institutions in R&D, particularly in sectors like AI and telecommunications, creating a synergy between state policy and corporate activity. This support structure allows China to build competitive companies that can rival US firms on the global stage.

Focus on Semiconductor Independence Semiconductors are a core vulnerability for China, as it remains heavily dependent on foreign suppliers for advanced chips. To reduce this reliance, China has increased investment in domestic semiconductor design, manufacturing, and materials. Key areas of focus include advanced lithography machines and other semiconductor manufacturing equipment. China has committed tens of billions of dollars to chip manufacturing hubs, such as those in Shenzhen and Shanghai, and actively works to develop homegrown talent and R&D capabilities in this area.

Technology Transfer and Intellectual Property (IP) Acquisition China has historically used technology transfer as part of its industrial policy, requiring foreign companies to share technology or partner with local firms to access the Chinese market. While global pressure has prompted reforms, these policies have allowed China to accelerate its tech development and acquire foreign expertise. Acquiring IP through partnerships, acquisitions, and, in some cases, cyber-espionage has played a role in China's tech rise. This approach, though controversial, has been effective in supporting its goal of technological self-sufficiency.

Global Outreach through the Belt and Road Initiative (BRI) The BRI serves as an industrial and technological policy tool by expanding Chinese tech infrastructure and standards to developing regions. Chinese telecom firms like Huawei and ZTE have played significant roles in BRI countries by providing affordable technology infrastructure, including 5G networks. Through this initiative, China is embedding its technology standards in global markets, securing access to resources, and potentially creating dependency in emerging economies. This helps China expand its technology influence and provides a counterweight to US restrictions on Chinese technology.

Shaping Global Technology Standards and Rules China has become increasingly active in international bodies that set tech standards, such as the International Telecommunication Union (ITU) and the International Organization for Standardization (ISO). By influencing these standards, China can create a favorable regulatory environment for its firms and products abroad. China's influence in these standards-setting bodies could lead to global rules that align with its tech and data governance models, presenting a potential counter-narrative to US-backed open standards and data privacy regulations.

Military-Civil Fusion (MCF) Through MCF, China integrates technological advancements made in the civilian sector into its military, facilitating innovation and security. By sharing resources between public research institutions and private enterprises, China accelerates development in dual-use technologies, including AI, drones, and cyber capabilities. This integration amplifies the security concerns for the US, particularly in areas like AI, quantum computing, and space technology, where breakthroughs have direct military applications.

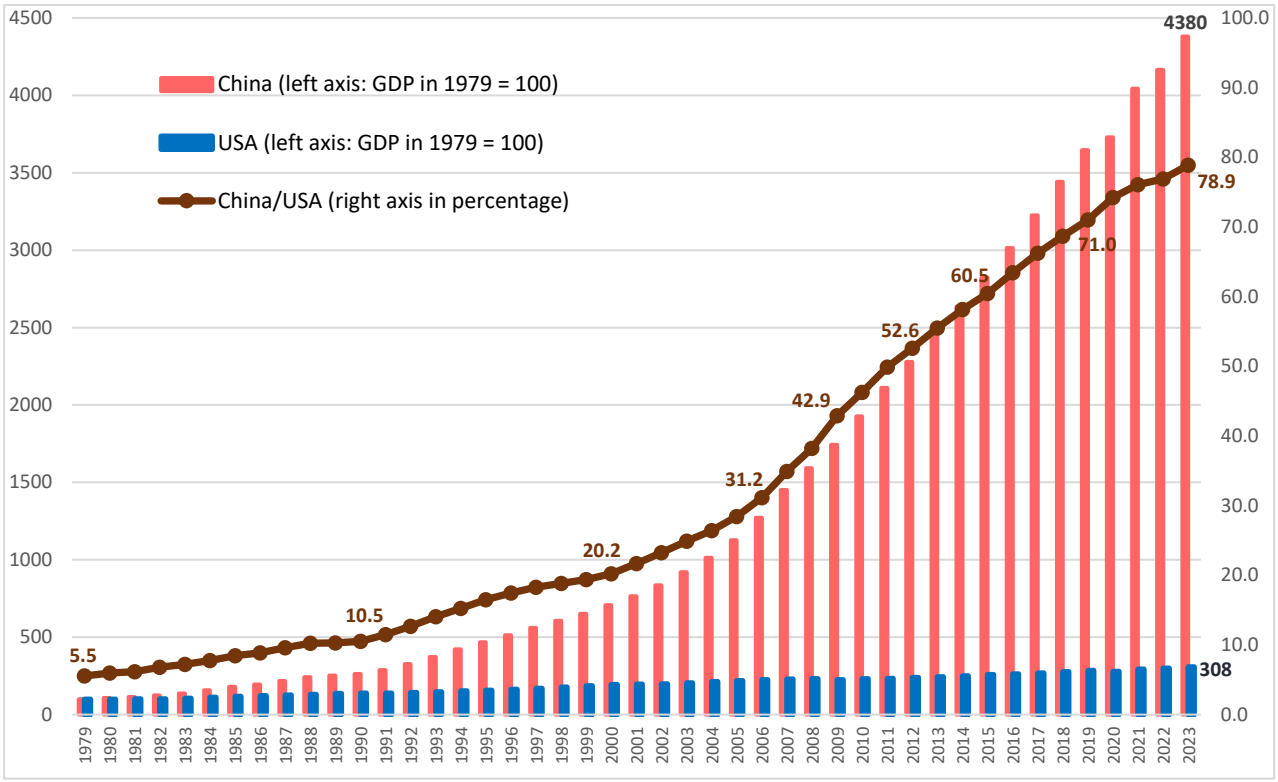
While China has achieved significant progress, challenges remain. The country still depends on foreign suppliers for critical semiconductor inputs and high-end chips, while US restrictions and export controls have strained these dependencies. Additionally, attempts to restrict foreign investments in key technology areas have limited Chinese firms' access to advanced technology and capital.

China's industrial policy in the US-China technology rivalry is built on a combination of state intervention, market incentives, and strategic planning aimed at achieving technological autonomy and global leadership. By investing heavily in R&D, supporting domestic champions, and prioritizing self-reliance in critical areas, China's approach contrasts sharply with the more market-oriented policies of the US, setting the stage for a prolonged competition that will shape global technology standards and economic power structures in the coming years.

7. Conclusions

To be completed.

Figure 1 GDP of China and US: 1979-2023 (GDP in 1979 = 100)



Sources: Computed from *World Bank Databank* (World Bank, 2024).

Table 1 China's Position in the World and Progress Pace: 10 Advanced Industries in 2024

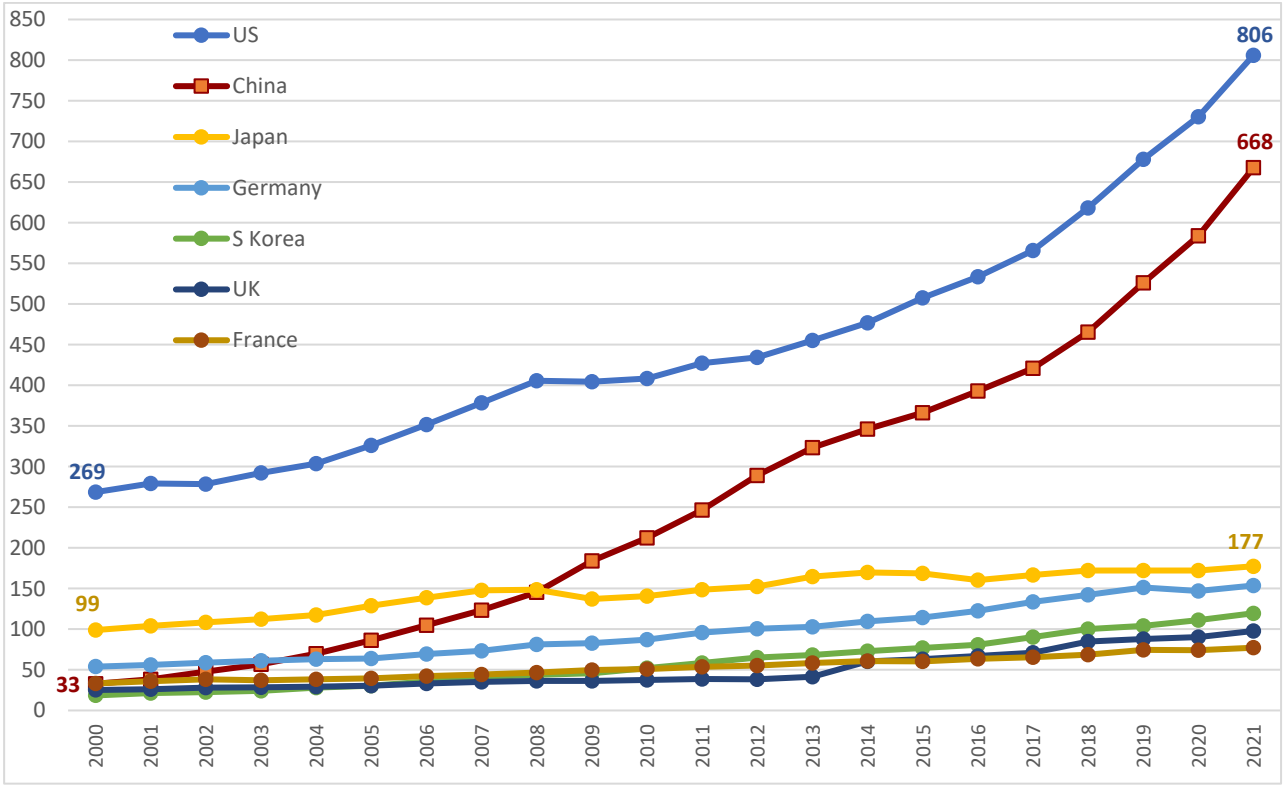
Industry	Position vs. World Leaders	Pace of Progress
Nuclear Power	Ahead	Rapid
Electric Vehicles/Batteries	At Par	Rapid
Robotics	Near	Rapid
Artificial Intelligence	Near	Rapid
Display Technology	Near	Rapid
Quantum	Near	Modest
Chemicals	Lagging	Rapid
Machine Tools	Lagging	Rapid
Biopharmaceuticals	Lagging	Rapid
Semiconductors	Lagging	Modest

Source: based on Atkinson (2024).

Table 2 US and Chinese Economic Systems

	US System	Chinese System
Overarching goal	Enable comparative advantage based on market forces	Win the global war for advanced technology leadership
Immediate goal	Consumer welfare (or worker welfare for the Left)	National power
Process	Allocation efficiency	Dynamic and productive efficiency
Types of trade	Free trade (or protectionism for the Left and new Republicans)	Power trade
Tool for tech progress	Fund basic science	Fund indigenous technology advancement
Rationale for investment	Invest for rate of return	Invest for market share
Means	Consumption (to keep full employment)	Investment
Technology	No direction	To lead in advanced technology
Focus on industry	Sectoral indifference	Strategic interests
Politics	Aggregation of competing private interests	National interests

Figure 2 Gross Domestic Expenditures on R&D of Global Top 7: 2000-2021



Notes: Figures are in billions of current PPP US dollars.
Sources: OECD, *Main Science and Technology Indicators*, September 2023.

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