Journal of Innovation and Development
ISSN: 2958-4752 | Vol. 5, No. 3, 2023

Research on China's Chip Industry Policies in the Context of the China-US Trade War

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Abstract: China and the US have always been important trading partners, but the huge unilateral trade deficit of the US has led the Trump administration to launch a "trade war" against China in an attempt to reverse the trade deficit through tariffs. In the Sino-US trade war, the US has launched a "301" investigation against Chinese companies, targeting China's high-tech sector. The United States has added Huawei, SMIC and other leading domestic chip companies to its list of entities, which has seriously hindered the development of China's chip industry. Before the Sino-US trade war broke out, China could import high-end chips from the US, but after the trade war, the US cut off the supply of high-end chips to China. Chip is the foundation of semiconductor technology enterprises and the strategic basis of national development. But China is not deeply involved in this strategic industry and faces a bottleneck in key technologies.

Keywords: Sino-US Trade War; Industrial Policy; High-tech Industry; Chip Industry.

1. Introduction

(1) Research Background

China's implementation of reforms and its accession to the World Trade Organization have propelled its foreign trade to grow rapidly. China and the United States have been significant trade partners, maintaining a substantial trade volume. However, the trade relationship between China and the US has experienced fluctuations and constant changes. After President Trump took office, his administration implemented a series of trade policies targeting China, prompted by the significant trade deficit between the two countries. In March 2018, the US government announced tariffs on $600 billion worth of imported goods from China, based on its "Section 301" investigation, in an effort to address the substantial trade deficit. This announcement officially triggered the China-US trade war. Subsequently, China responded by imposing tariffs on approximately $3 billion worth of products imported from the US. Thereafter, both countries engaged in multiple rounds of negotiations and tariff escalations, intensifying the trade war.

The outbreak of the China-US trade war undoubtedly had a significant impact on China. While China's development momentum and technological advancements are strong, there is a significant gap in certain areas, particularly the chip industry, especially in the high-end chip sector, where China heavily relies on imports. China is currently in a crucial strategic opportunity period for development, and as a crucial jewel in the history of industrialization, chips have tremendous strategic significance for national development. However, the core technology of chips faces a bottleneck issue, which must be addressed in the process of building a socialist modernized country. Therefore, this paper focuses on the perspective of industrial policies to analyze the differences between China's chip industry and the international chip industry. It reflects on the weaknesses of China's current chip industry policies in light of the current development status of the chip industry. In the context of the China-US trade war, facing sanctions from the US, how China can leverage its institutional advantages to formulate industry policies favoring chip industry development and gain control over key core technologies is a significant challenge for our country.

(2)Research Significance

Before the outbreak of the China-US trade war, China could fulfill its industrial development needs by importing chips, including high-end ones, from abroad. However, after the trade war, the US banned the export of high-end chips to China. This decision highlighted the bottleneck issue of China's critical technology. Currently, China's chip development is facing a bottleneck period, where chip design is aligning with international advanced levels, but the key core technologies of chip manufacturing are significantly lagging behind international standards. The world is currently undergoing major changes not seen in a century, and China is also in a crucial strategic opportunity period for development. The breakthrough of key core technologies is crucial for national development. China's current chip industry policies play a significant role in chip industry development. However, in the context of the China-US trade war, adjustments must be made to these policies. Therefore, this paper analyzes the differences between China's chip industry and the international chip industry from the perspective of industrial policies. It reflects on the weaknesses of China's current chip industry policies in the context of the current development status. Based on these analyses, objective suggestions will be proposed.

2. Literature Review

(1)Domestic Literature

Many domestic scholars have conducted research and analysis on China's high-tech industry and chip industry from different perspectives. Li Yan long (2018) found that industrial tax incentives have a positive impact on the innovation efficiency of high-tech enterprises. Huang Zhiwen (2019) argued that industrial policies, with tax policies being one of the most effective ones, are needed to support the implementation of national strategies. Gao Yue (2020) suggested that China's high-tech industry policies exhibit dynamic changes, with the efficiency of industrial policies varying at different stages. Fan Xu and Liu Wei (2020) believed that China's industrial policies have gradually

transitioned from a focus on supply-side and environmental policies to a development pattern with increasing use of demand-side policies, and the government is increasingly inclined to a combination of multiple policy tools. Zhang Zhenhua (2020) found that fiscal subsidies and tax incentives have heterogeneity in their impact on the total factor productivity of the semiconductor display industry, where fiscal subsidies inhibit the improvement of total factor productivity, while tax incentives promote its improvement. Zhang Xiaojing (2020) suggested policy support for the chip industry from aspects such as finance and taxation, investment and financing, research and development, imports and exports, talent, intellectual property rights, market applications, and international cooperation.

(2)Foreign Literature

There is relatively less research by foreign scholars on high-tech industry policies and chip industry policies. Fukuhara Ryo (2013) conducted an empirical analysis, demonstrating that the intellectual property rights system is related to a company's research and development activities; companies with more robust intellectual property rights systems have higher levels of research and development. Suzuki Takaaki (2015) portrayed the impact of intellectual property protection activities on corporate innovation from the perspective of patent system policies. Isabel et al. (2017) studied the differences in the effects of tax incentives for research and development activities across different industries. Hulya (2017) argued that governments of various countries provide different fiscal measures to attract companies to engage in research and development, with tax incentives being one of the important measures. Inmaculada et al. (2018) believed that research and development investment is a key factor for long-term economic growth.

3. Impact of the US-China Trade War on the Chip Industry

(1)Key technologies are being restricted

Since the outbreak of the US-China trade war, China has faced severe restrictions on key technologies. Taking the chip industry as an example, although Huawei can currently independently design high-end chips with 7nm and 5nm nodes, it heavily relies on Taiwan Semiconductor Manufacturing Company (TSMC), a US-holding company, for chip manufacturing. Since Huawei was added to the US Entity List, it has completely lost access to high-end chips, which has had a significant impact on Huawei's consumer business and 5G technology applications. Currently, all companies producing these chips are under US control. After the outbreak of the trade war, the US banned the supply of high-end chips to China, leading to a complete chip supply crisis. China cannot fully resolve this critical "restriction on key technologies" issue in a short period of time.

(2)Escalation of intellectual property disputes

As a core industry in the industrial sector, the chip industry is connected to many aspects of industry. Since the outbreak of the US-China trade war, the US has launched a "301" investigation against China on intellectual property issues. Chinese technology companies are still in the learning and exploring stage in many fields of core scientific technology. As a result, the Chinese government, in order to promote production and economic development, has not taken comprehensive measures to protect many related technologies, allowing for vicious cycles of imitation, reference, and plagiarism, which significantly prolong the research and development cycle of independent innovation and hinder the development of key technologies in related industries. Intellectual property disputes have severely affected technology-intensive industries. The tariffs include industries such as aviation, high-speed rail, alternative green energy vehicles, and other high-tech products. In recent years, China has been in an advantageous position in high-tech fields such as high-voltage power transmission technology, high-speed rail technology, new energy green vehicles, and supercomputers.

(3)Significant increase in production costs

According to the latest data from the National Bureau of Statistics, China has approximately 50,000 chip companies, including more than a dozen leading technology companies and other R&D and manufacturing companies such as Huawei and SMIC. Among them, leading companies require chips that China imports from the US, accounting for over 70% of the total, including major core components, parts, and materials. Before finding alternative products, the production costs of Chinese products may increase by 20%-25%. US-imposed tariffs not only cover a wide range of Chinese companies, but also involve blocking key technologies and suppressing the market. If the technological blockade in chip manufacturing by Western countries cannot be resolved, the increased cost of importing technology will lead to price increases in commodities, and consumers will bear the entire cost increase. This will cause IC (integrated circuit) companies that rely on technology imports, especially technology companies importing chips from the US, to lose price advantages. The competitiveness of their products in the market will gradually decline, leading to a loss of market share.

4. Analysis of China's Chip Industry Policies

In order to achieve national economic development, it is necessary to rely on high-tech industries, especially in the current era of unprecedented changes where a new round of industrial and technological revolution is flourishing. To build a socialist modernized country, we must firmly grasp the strategic development focus of high-tech industries, with the chip industry becoming an important driving force for industrial progress.

(1)Impact of the quantity of chip industry policies:

China's industrial policies for the chip industry have shown a spiraling upward trend, with four main stages. From the early days of the founding of the country until before the reform and opening-up, China's economy was relatively backward and had low technological levels. There was insufficient demand for new products such as semiconductors, resulting in inadequate attention given to the semiconductor industry and relatively limited policy support. From the reform and opening-up until the early 21st century, China opened its doors to the world, and at that time the domestic semiconductor industry suffered from foreign product impact. The prevalent mindset was one of "importation". Consequently, the development of the domestic semiconductor industry stagnated and government support was weak. In the 21st century, there was a significant increase in policy support for the integrated circuit industry, marking the first warm spring for the domestic semiconductor industry. In 2012 alone, China introduced 12 industrial policies to

support the development of the chip industry. From 2014 onwards, China made innovation-driven development a national strategic plan, placing the chip industry in a more prominent position. The country has also increased its support for the industry and emphasized the role of marketization, industrialization, and core enterprises. Up to now, China has seen the emergence of a large number of excellent companies in the chip industry, such as Huawei HiSilicon and SMIC.

The government's increasing attention and support for the chip industry through policies have played a crucial role in its development. These policies have provided guidance and direction, promoting the growth and innovation of domestic chip companies. However, challenges still exist, such as the dependence on international supply chains and the need to catch up with advanced countries in terms of key technologies and patents. It is necessary for China to continue improving its policies, fostering an innovation-driven and self-sufficient chip industry, and actively participating in global competition and cooperation to enhance its overall competitiveness.

Since 2014, the policies introduced by the Chinese government for the chip industry have shown an overall increase. At the same time, the national integrated circuit production has also shown an increasing trend during this period. It can be observed that the growth rate of production aligns with the changes in policy implementation.

(2)Effects of Policies on Different Types of Industries

1) Tax incentives

Tax incentives have a significant impact on technology research and development. Since entering the 21st century, China has focused on supporting the chip industry and has provided policy support to semiconductor and software design companies in terms of taxation. Tax exemptions and benefits have been given to domestic integrated circuit industries that meet certain conditions. In the first and second years, no corporate income tax is levied, and in the following three years, a certain percentage of corporate income tax is collected. The tax incentive policies released in 2008, 2012, 2016, 2018, and 2020 all conform to the mentioned features. The implementation of these tax incentives has had a clear impact on the national chip industry.

In the past decade, the size of China's integrated circuit industry has been continuously increasing under the influence of favorable tax policies. In recent years, the growth rate has become stable, entering a golden period of development.

2) Technological Support Policies

Since the beginning of the 21st century, China has been focusing on the development of the integrated circuit industry and continuously increasing support for the chip industry. The chip industry has become a "star industry" in the "Made in China 2025" plan and has been listed as the top among the ten major industrial sectors. The Ministry of Science and Technology of China has approved two national key research projects specifically targeting the fields of chips, software, and electronic components, namely "core electronic devices, high-end general-purpose chips, and basic software products" and "large-scale integrated circuit manufacturing equipment and complete processes". Starting from these policy documents, China has concentrated human, financial, and resource efforts on continuous technological breakthroughs. Leveraging the existing advantages of our country, the aim is to maximize the national innovation capacity and achieve a series of breakthroughs in key core technologies.

3) Investment and financing policies

The profitability of the integrated circuit industry is mainly in the hands of technologically advanced companies, which poses a disadvantage for domestically lagging enterprises. To help companies increase their R&D investment, the government has implemented favorable investment and financing policies. The state strongly supports the R&D of high-end chips and provides financial support to eligible companies. Additionally, the government aims to broaden the financing environment for enterprises and encourages financial institutions to provide funding support.

The National Integrated Circuit Industry Investment Fund has invested a total of 138.7 billion yuan in various stages of IC design, manufacturing, and packaging. Currently, the fund is raising funds for the coming year, with a total of approximately 340 billion yuan secured. The fund initially focuses on equity investment in chip design companies, gradually moving into lower-level industries such as chip manufacturing and equipment. The establishment of regional government industry funds has played a catalytic role in the chip industry. These investments have yielded significant results, as China's self-sufficiency rate for domestic chips has continuously increased. The self-sufficiency rate has grown from 8% in 2013 to the current 40%, demonstrating the significant role of industrial policies in promoting the development of the chip industry.

(3)Shortcomings of chip industry policies

1) Insufficient investment in basic research

Science and technology are the primary productive forces and a long-term driving force for a country's development. The development of technology relies on the support of basic theories, and basic research plays a crucial role in a country's strategic development. Currently, global investment in basic research is continuously increasing. While China is also increasing its investment in this area, its proportion is still lagging behind compared to scientifically advanced countries.

The basic investment in both China and the United States has remained relatively stable with minor fluctuations. However, there is a significant disparity in the proportion of basic research investment between the two countries. In 2018, China's proportion of basic research investment was 5.5%, which exceeded 6% for the first time in 2019. In contrast, the United States had a basic research investment proportion of 24% in 2018, which is four times higher than that of China. This ratio is remarkably high and highlights the difference between the two countries.

2) Mismatch between Industrial Policies and National Innovation System

Firstly, there is not a perfect coordination between the national innovation system and the policies implemented in the chip industry. In the current development process of China's chip industry, although there is some interaction between industrial policies and the national innovation system to a certain extent, they have not established a mutually reinforcing and symbiotic relationship. Although the Chinese government has introduced some industrial policies to support the development of the domestic chip industry, the effective coordination between these policies and the promotion of innovation, utilization of the advantages of China's socialist market economy system, and integration of various innovation entities to serve the chip industry has not been fully achieved.

3) Imperfect Intellectual Property Rights System

After the outbreak of the US-China trade war, the United States has used intellectual property rights as a weapon to sanction Chinese companies. The significant flaws in China's

intellectual property rights system put the country at a disadvantage in terms of technological research and development. The chip industry is a technology-intensive industry that requires innovation. Patents are an important indicator of the chip industry's innovation capabilities. Due to the late start and previous stagnation period of China's chip industry, many R&D patents are held by foreign researchers. As a result, China faces technological bottlenecks in areas like IC design, chip manufacturing, and packaging testing. For China's chip industry to achieve surpassing development, it must enhance its independent innovation capabilities and address key technological bottlenecks through continuous innovation by domestic researchers. The problem lies in China's low self-innovation capabilities in the chip industry, resulting in fewer invention patents compared to developed countries. This leads to an unhealthy development of China's chip industry, unable to meet the needs of industrial development. If China fails to establish a healthy, self-sustaining ecosystem for independent innovation, it will struggle in terms of patent conversion.

4) Incomplete Incentive Mechanisms for Researchers

A scientific and reasonable incentive mechanism for researchers plays a vital role in China's scientific research. Currently, China is in a critical catch-up period for technological development and urgently needs to break technological barriers and master core technologies in multiple key areas. However, there are some shortcomings in China's incentive mechanisms for research and innovation. For instance, the role of market incentives and government incentives has not been fully utilized. The incentive methods are relatively singular, and the reward system is insufficient, which cannot effectively guide high-level scientific research talents to engage in scientific research. Additionally, the existence of market-driven factors leads to utilitarianism among researchers. Basic research requires the continuous efforts of researchers, and the transformation of scientific and technological achievements can be a lengthy process. The presence of market-driven factors makes researchers more interested in material rewards rather than intrinsic motivation. The imperfect incentive mechanism may lead researchers to excessively pursue quick application-oriented research for technological transformation, while neglecting basic research, which may weaken the foundation of scientific research.

5. Recommendations to Promote the Development of Technological Innovation in China's Science and Technology Industries

(1) Increase investment in basic research

Our country needs to strengthen basic and frontier research to fundamentally enhance our scientific and technological strength. Firstly, increase the level of national financial investment. Encourage long-term persistence and bold exploration, and give more priority to key areas of basic research to solidify the foundation for building a strong technological country. Secondly, expand channels for social investment. We should guide all sectors of society to pay more attention to basic research and encourage social participation through various channels. Establish funds to support basic research, continuously regulate fund operations, expand funding sources, and provide financial support for basic research. Thirdly, establish a unique financial product system to actively support enterprise research and development (R&D). Currently, domestic banks mainly support R&D expenses through working capital loans, with 1-2 year terms, which cannot meet the high R&D investment and long return cycles of integrated circuit companies. It is recommended to establish R&D loans for high-tech enterprises, with terms set based on industry characteristics, and appropriately extend the loan period according to the R&D cycle. In addition, relevant policies can be implemented to provide interest-free loans for a certain period of time for critical core technologies that the country urgently needs to break through, promoting technological advancements. Meanwhile, it is necessary to further expand the scale of the "National Integrated Circuit Industry Investment Fund" and introduce risk investment funds to increase investment in the field of integrated circuit R&D.

(2) Balance and coordinate industrial policies with the national innovation system

Firstly, use industrial policies to create a sustainable institutional environment for innovation. General Secretary Xi Jinping emphasized, "To promote independent innovation in our country, the key lies in removing institutional barriers and fully unleashing the infinite potential of science and technology." Strengthen top-level design, make integrated circuit innovation and development the focal point, and gradually remove institutional barriers that hinder integrated circuit industry development by employing national medium and long-term strategic planning and major scientific and technological projects to guide development directions, as well as utilizing policies for the development of the chip industry.

Secondly, develop industrial policies towards the establishment of a global, proactive, open innovation direction. Fully leverage the advantages of China's chip industry, integrate and utilize innovative resources available worldwide, build a harmonious and healthy innovation environment, absorb international advanced chip industries and technologies domestically. Additionally, maximize the innovative capabilities of China's researchers, and promote the orderly and harmonious integration of independent creation and cooperative innovation.

(3) Improve the intellectual property rights system

Firstly, strengthen the top-level design of intellectual property rights protection. Urgently formulate a strategy to build a strong intellectual property nation, study and formulate the national plan for intellectual property protection and utilization during the 14th Five-Year Plan period, clearly defining goals, tasks, measures, and implementation blueprints. Strengthen the creation and reserve of independent intellectual property rights in key areas, and deploy major reform initiatives, important policies, and key projects.

Secondly, raise the level of legal governance in intellectual property rights protection. While strictly implementing the relevant provisions of the Civil Code, accelerate the improvement of related laws and regulations, and coordinate the revision of patent law, trademark law, copyright law, anti-monopoly law, scientific and technological progress law, enhancing the correlation and consistency among laws.

Thirdly, further strengthen the comprehensive protection of intellectual property rights throughout the entire value chain. Coordinate the protection of intellectual property rights, anti-monopoly, and fair competition review, promote the autonomous and orderly flow and efficient allocation of innovation elements. Enhance the construction of intellectual property information and intelligent infrastructure, strengthen

the application of information technology such as artificial intelligence and big data in intellectual property examination and protection, and promote the integration of online and offline development in intellectual property rights protection.

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