The Impact of the US-China Trade War on China's Semiconductor Industry

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Abstract. On 4 April 2018, the US government released a list of goods subject to tariff increases, which will impose a 25% tariff on 1,333 items of US$50 billion of goods exported from China to the US, and the trade war between China and the US officially started and lasted for more than a year, during which the two sides experienced a total of six mutual tariff increase initiatives, which had a great impact on many fields, including the semiconductor industry. The impact has been significant in many areas, including the semiconductor industry. This paper selects two well-known Chinese electronic chip companies and intercepts their stock data from three months after the US-China trade war and uses ARMA-GARCH model to model and analyses the data, to study how the Chinese semiconductor industry has been affected by the US-China trade war, and to predict the future development of the Chinese semiconductor industry, and then make suggestions for the future development of the Chinese semiconductor industry.

Keywords: China · US · trade war · semiconductor industry · ARMA-GARCH model · cooperation

1 Introduction

Already in the 1980s, Trump advocated the implementation of tariffs to reduce the US trade deficit and boost domestic manufacturing, saying that the US was being "exploited" by its trading partners, making the implementation of tariffs the mainstay of his subsequent presidential campaign platform. The US-China trade frictions as part of the US-China economic and trade relations changed with the development of the US-China political relationship and the changing international situation. 2018 saw the Trump administration defy the Chinese side and insist on launching a trade war, setting off yet another round of US-China trade disputes, a trade dispute that has seen several mutual tariffs increases and related trade negotiations between the two countries, and culminated in a basic agreement at the end of 2019. The trade dispute has occurred in two main areas: firstly, in areas where China has a comparative advantage in exports, such as medical and light industry; and secondly, in areas where China has no advantage in imports and technological know-how, such as for chips and semiconductors. The former is essentially competitive, while the latter is where the market does not fully

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play a role, and they have different implications for the economic welfare and long-term development of the two countries.

Why has the Trump-dominated US administration focused its sanctions against China primarily on the semiconductor sector? This is because the US, as the country with the highest share of the world's semiconductor market and China's largest exporter of semiconductor chips, has an obvious advantage in comparison with Chinese-related companies. Many Chinese high-tech companies need to import chips and other high-tech products from the US to maintain the normal operation of their companies as well as technological innovation, so it can be said that China is more dependent on the US for semiconductor chips and other technological products, and in cooperation, China is in a weak position in the cooperation. And once the US imposes technology export restrictions on China, such as those on semiconductors, it will be a powerful sanction against China and will provide important leverage for the US to win the US-China trade war.

While the US technology barriers to China will have some impact on the Chinese semiconductor industry and the technology market, they may not be sustainable. Through a survey of the existing literature and related data, this article expects that the trade dispute between the US and China will have some impact on the Chinese semiconductor industry in a short period, but due to the adjustment and response of the relevant Chinese semiconductor industry, the barriers brought about by the trade war will still not cause long-term fluctuations to the Chinese semiconductor industry.

The rest of this paper is organized as follows: Part 2 is the literature review, which includes relevant research on the causes and impacts of the US-China trade war and how the US-China trade war has brought about changes in the semiconductor industry in each of the two countries, concluding with a summary of the literature review. Then it is followed by Part 3, which uses certain data and images as an aid and focuses on the impact of the US-China trade war on the semiconductor industry and illustrates the impact of the US-China trade dispute on the semiconductor industry in China and the world at large from various perspectives. After that, the fourth section will then conduct an ARMA-GARCH model analysis using the relevant data obtained. The results of empirical analysis used to demonstrate results of the empirical analysis are used to demonstrate the impact of the US tariff increase and a series of trade restrictions on Chinese semiconductor companies, and finally to draw conclusions and make predictions and give feasible and innovative suggestions for the future development of the Chinese semiconductor industry.

2 Literature Review

2.1 Studies Related to the US-China Trade War

With the rapid development of China's economy after the reform and opening in 1978, and the increasingly close cooperation and competition between the two countries after the establishment of diplomatic relations in the 1980s, it can be said that the trade relations between China and the US are developing in a game. As for the reasons for the trade war, Chen points out that the US-China trade war is a deliberate attempt by the US to disrupt the world trade environment for its selfish interests on the pretext of a huge trade deficit with China and to take a series of restrictive measures against China in the areas of trade and investment [1]. However, the main cause of the US-China trade deficit is the US government's restriction on the export of high technology content products. Zbigniew Bzrezinski and John Mearsheimer argue that China's prosperous development will inevitably shake the US world hegemony and that conflict will erupt [2]. Russell Ong similarly suggests that as the gap between the US and China continues to narrow, competitive conflicts between the two countries will become more frequent, and the likelihood of a trade war between the two countries will increase significantly once China catches up with the US in certain high technology areas [3]. In addition, Xiong points out that the US trade war against China is also aimed at preventing China from developing high-tech industries and restricting the upgrading of China's industrial structure to maintain its world dominance in the field of electronics and high technology [4].

2.2 US-China Semiconductor Trade Dispute

Semiconductors, as a very important part of the US-China trade war, are also one of the key targets of US sanctions against China. The US has been imposing technology sanctions on China for a long time, and the US, as the world's leading technology power, has imposed technology barriers on China mainly due to its leading position in the relevant industries and its concern about the rapid development of China's high-tech sector. Zhang argues that due to the special status of chip production, the core element in the semiconductor industry, for national economic development and international competitiveness, the US has sought to use its industrial supply chain power and political and economic strength to hinder China's development in high technology by leveraging its dominant position in the international political and economic power structure [5]. Furthermore, from a supply and demand perspective, the semiconductor trade between the two countries remains in a relatively unequal relationship, with the US, as China's largest supplier of chips, exporting more than a third of total US chip sales to China each year, and as the technological leader in high-tech production, the US has always dominated the US-China semiconductor trade (Jimmy) [6]. Bown, Chad P also mentions that in July 2018, the US imposed a 25% tariff on imports of semiconductors from China [7], but despite semiconductors being one of the first Chinese products targeted by the US government, integrated circuits and the equipment needed to manufacture them are notably absent from China's extensive retaliation list. The fact that China continues to increase its imports of these products from the US by 2020, despite the trade war, also illustrates the dependence and irreplaceability of Chinese companies on imports of US-related semiconductor products.

Although the trade conflict between the US and China has had a serious impact on China's semiconductor industry, often the trade conflict is accompanied by a boost in the form of more aggressive technological innovation and product innovation by the relevant industries. By constructing a partial equilibrium model, Crowley shows that trade frictions between specific countries make domestic firms tend to apply new technologies earlier to improve their competitiveness [8]. Ma analyses the impact of trade frictions on global value chains and concludes that Chinese enterprises should pay more attention to independent innovation and basic research capabilities [9]. Renkai

Zhang also points out that to be able to address the short-term impact and possible long-term effects of the US-China trade dispute on China's semiconductor industry, relevant Chinese firms should focus more on strengthening basic research and core technologies [10]. A long-term mechanism for investment in basic research should be established to address the problem of technological dependence at its root and improve the innovative development capability of domestic enterprises themselves (Zhang) [11].

2.3 Review of the Literature

Overall, the research on the causes, processes, and impacts of the US-China trade war has been relatively well researched, but there is still relatively little research on the impact of the trade war on the semiconductor industry, especially on China's domestic semiconductor industry. It is difficult to predict the future development of China's domestic semiconductor industry. Therefore, this paper hopes to do more to fill the gaps in the research in this area and use empirical data to demonstrate the impact of the trade war on the current and long-term development of China's domestic semiconductor market.

3 Analysis of the Current Situation of the Semiconductor Industry in the US and China

3.1 Import and Export Interdependence of Semiconductors

From the point of view of the semiconductor market, there has always been a complementary trade relationship between the US and China. At this stage, the United States has a market share of nearly 50% of the semiconductor market, and from the data for 2020, Fig. 1. Shows that the United States has a market share of 46% of the semiconductor market, while China is only 5%, which also shows that the United States is in the leading position in the field of research and development of high-tech semiconductor chip-related products and has obvious advantages. Therefore, in the current situation where many Chinese companies need semiconductors to maintain their internal product production, importing relevant semiconductor products from the US is the necessary choice at present.

In addition, Fig. 2. Surveyed the percentage of China's total U.S. global semiconductor share from 2009 to 2017, before the U.S.-China trade war, and the data shows that China's share of U.S. semiconductor exports is on the rise, a figure that is still growing significantly after 2018, making China a major exporter of semiconductor products to the United States.

China has long been an important end market for US commercial semiconductors, accounting for more than a third of total US chip sales. This is because China is a leading center for assembling finished chips into circuit boards that are then embedded into finished electronics such as TVs, smartphones, and laptops. US semiconductor sales to China of $70.5 billion (36% of all US chip sales in 2019) are driving the US semiconductor industry to lead the way in a "virtuous innovation cycle" driven by scale and R&D intensity. While meeting the massive demand for semiconductors from Chinese companies, sales to China's large and growing market are also providing US companies

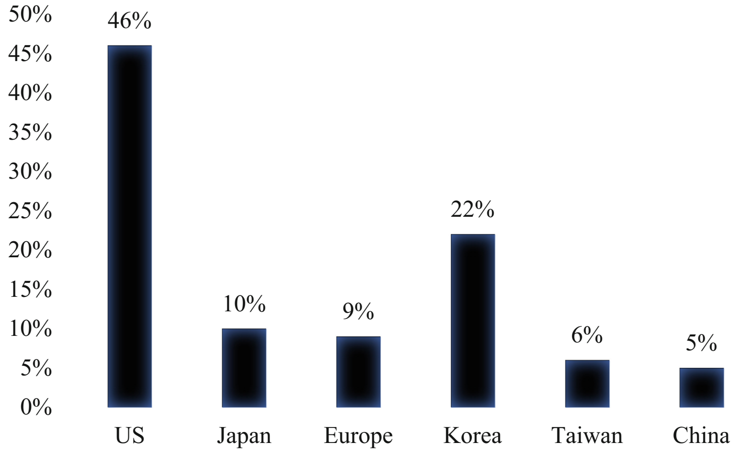

Fig. 1. World Semiconductor Market Share in 2020

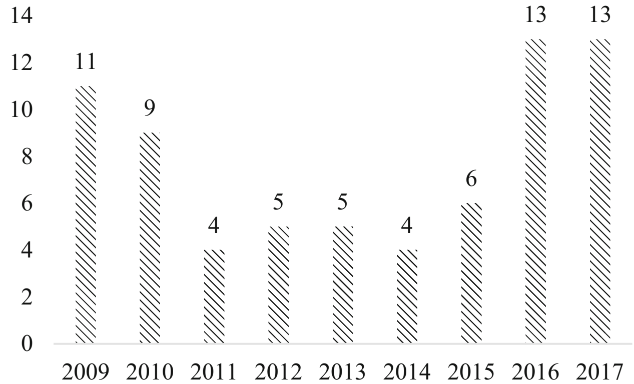

Fig. 2. China's shares of US semiconductor industry global Capex from 2009 to 2017

with the capital to support the scale of high-level R&D investment on US shores, resulting in superior technologies and products, which in turn strengthen US market leadership and profitability, so it is fair to say that at this stage the US and Chinese semiconductor industries remain stage of mutual dependence.

3.2 Trade Conflict Seriously Affects Supply and Demand in US-China Semiconductor Trade

3.2.1 Hindering Revenue Generation in the US Semiconductor Industry

In the short term, after the trade friction between China and the United States, China took countermeasures by imposing tariffs on U.S. products, leading design companies such as Qualcomm, Broadcom, and Sigma, which rely on the Chinese market by more than 50%, suffered a direct setback in revenue and profits. At the same time, the trade conflict has forced Chinese companies to accelerate the search for non-US alternatives and increase their purchases of semiconductor products from Japan, Korea, Taiwan (China), and Europe, which has indirectly led to a reduction in orders and profits for US companies.

In the long run, due to the progressive increase in the difficulty of the evolution of semiconductor technology, technology research and development is more dependent on market demand feedback, to carry out customized research and development of products in niche areas. At present, most countries with certain technical deficiencies rely on international mergers and acquisitions to quickly shorten the overall technological gap with the pioneer countries, and at the same time, with their market demand, targeting industry segments to focus on investment and establish technological leadership, global competition in the field of semiconductors will become more intense. Long-term trade barriers keep US companies away from the Chinese market, not only losing sources of R&D innovation and corporate profits, but will also undermine the confidence of Europe, Japan, and Korea to cooperate with the US. The isolated development trend will lead to a gradual reduction of the US industry's leading margin, giving rise to a major change in the global semiconductor industry.

3.2.2 Limiting the Development of China's Semiconductor Industry

The US-China trade dispute will not only bring certain profit losses and marketing hindrances to the dominant US semiconductor companies but will also bring a serious impact on China's high-tech industry, which is inevitable and irreversible in the short term. In the short term, Chinese enterprises will face rising equipment and material procurement costs, international order outflow, difficulties in international cooperation and talent introduction, and other business risks, and the semiconductor industry will bear a greater impact. However, for the domestic production of semiconductor chips and other high-tech products, benefit from the localization policy incentives, domestic design, equipment and materials, and other areas are expected to undertake domestic demand orders in the short term, to obtain direct benefits.

In addition, in the long run, the domestic semiconductor industry will face the risk of product blockade, technology monopoly, etc., and the further intensification of international competition, overseas cooperation, and mergers and acquisitions will also be hindered. However, at the same time, it will also be conducive to promoting the process of independent research and development of domestic enterprises, helping the local industry chain to work closely together, improving the industrial ecology, and promoting the benign development of the industry. The US-China trade war has had a significant push-back effect on the affected Chinese listed companies, prompting them to increase their investment in R&D to enhance their technological innovation capabilities. And further research shows that the degree of industry competition positively moderates the push-back effect of the US-China trade war on corporate R&D investment, with the push-back effect on technological innovation brought about by uncertainty being more pronounced in a more competitive market environment for companies. At the same time, this pushback effect is more pronounced in state-owned enterprises, firms with low financing constraints, and those in industries subject to direct sanctions.

Table 1. ADF test

Variables	t-statistic	p-value
Ln index		
Semiconductor 1	−1.162	0.9181
Semiconductor 2	−3.485	0.0411
Ln Yield		
Semiconductor 1	−23.813	0.0000
Semiconductor 2	−23.448	0.0000***

4 Research Design

4.1 Data Source

This paper uses the Choice financial terminal, a search engine, in conjunction with Yahoo Finance to search and obtain data on the semiconductor industry, to find out the opening and closing prices and stock returns of two of China's top ten semiconductor companies, Huawei Electronics and TCL Technology, from three months before the trade conflict between China and the United States to the present, and to highlight the stock price fluctuations of the two companies before and after the six times when China and the United States imposed tariffs on each other, as a data source and data basis for empirical analysis to study the impact of the trade war between China and the United States on China's semiconductor industry.

4.2 ADF Test

After completing the model construction, we first need to perform a unit root test (smoothness test) on the model, where the original hypothesis is that the model is not smooth. After putting the data into Stata and performing the ADF test, we can see from Table 1 that the p-value for the log-returns is 0, which is less than 0.1, so we can reject the original hypothesis that the model is stable and feasible.

4.3 ARMA-GARCH Model

4.3.1 Model Specification: ARMA

$$x_t = \varnothing_0 + \sum_{i=1}^{p} \varnothing_i x_t - i + \alpha_i - \sum_{i=1}^{q} \varnothing_i a_t - i \tag{1}$$

From Eq. (1) above, we can see that, $\varnothing_0 + \sum_{i=1}^{p} \varnothing_i x_t - i$ represents the AR(p) model, which uses the historical returns of semiconductor stocks to forecast the future; while $\alpha_i - \sum_{i=1}^{q} \varnothing_i a_t - i$ which uses past volatility to estimate the future and the last part of the model.

Specifically, in this paper, the AR model uses the historical returns of two Chinese semiconductor firms over the period from three months before the start of the US-China trade dispute to the present, while the MA model uses an error term to forecast the future.

4.3.2 Model Specification: GARCH

After that, this paper construct ARMA-GARCH models of the returns and volatilities of the stocks of two Chinese semiconductor companies simultaneously. This paper uses the time points of each of the six US tariff increases on China in the US-China trade dispute as dummy variables and add them to the model for calculation. As a result, this paper can assess the correlation between the US-China trade dispute and the returns and volatilities of the stocks of semiconductor companies.

The model GARCH (p, q) is set as follows:

$$\begin{aligned} \alpha_t^2 &= \alpha_0 + \alpha_1\varepsilon_{t-1}^2 + \ldots + \alpha_q\varepsilon_{t-q}^2 + \gamma_1\sigma_{t-1}^2 + \ldots + \gamma_p\sigma_{t-p}^2 \\ &+\beta_1 D_1 + \ldots \beta_6 D_6 \end{aligned} \tag{2}$$

In Eq. (2) above, the term $\alpha_1\varepsilon_{t-1}^2 + \cdots + \alpha_q\varepsilon_{t-q}^2$ is ARCH part, σ_t^2 is the conditional variance of the disturbance term ε_t, the subscript t indicates that variance changes over time. σ_t^2 depends on the square of the disturbance term in the previous p periods. And the last part of the model $\beta_1 D_1 + \ldots \beta_6 D_6$ represents the impact of adding six separate dummy variables, i.e., the six US tariff hikes on China in the US-China trade war, on the stock returns of the two selected Chinese semiconductor companies.

GARCH model is set up based on the ARCH model, with the addition of autoregression of σ_t^2. In (4), the term $\gamma_1\sigma_{t-1}^2 + \cdots + \gamma_p\sigma_{t-p}^2$ is GARCH part.

GARCH model is designed to reduce the number of parameters. We can simplify ARCH(p) as GARCH (1,1) by iteration.

5 Research Design

5.1 Data Source

In this section of the article, it is first necessary to order the first log-return series using the PACF and ACF pairs, the results of which re shown below.

Note: The Y-axis is the dependent variable, PACF, and ACF of the log of Logarithmic return on the two semiconductor stocks, and the X-axis is the time lag order. The area bounded by y = −0.1 and y = 0.1 refers to the 95% confidence interval for AR(p) and MA(q).

First, this paper needs to order the log returns of the first semiconductor and present the results in the figure above.

From the fixed order result of the two images in the first row in Fig. 3, the first part beyond the x-axis is 18, so AR(P) is of order 18, MA(q) is also of order 18. i.e., the value of p and q is 18.

Then this paper needs to order the log-returns of the second semiconductor and present the results in the figure above.

From the fixed order result of the two images in the second row in Fig. 1, the first part beyond the x-axis is 4, so AR(p) is of order 4, MA(P) is also of order 4, so the value of p and q are all equal to 4.

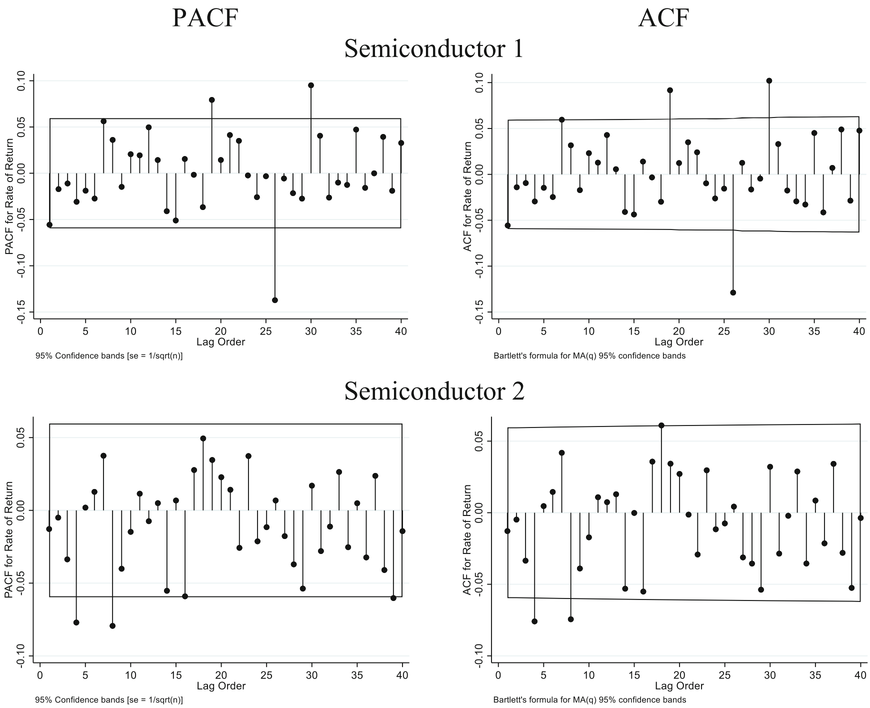

Fig. 3. PACF and ACF

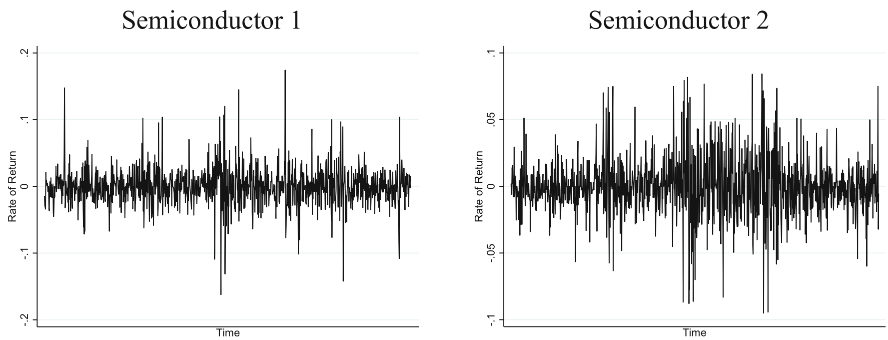

Fig. 4. Yield trend

5.2 ARMA-GARCH

To better forecast the variance of future semiconductor returns, the ARCH model is next used to look at the characteristics of semiconductor return volatility. And the consequences are shown in Fig. 4.

Looking at the images, there is a clear conditional heteroskedasticity in the two semiconductor indices, which is expressed in terms of returns fluctuating sharply at one time and less at another. In financial econometric language this means that when the volatility (variance) is greater in the current period or a few past periods, the volatility (variance) is likely to be greater in future periods, and vice versa. However, whether there is autoregressive conditional heteroskedasticity and how significant the conditional heteroskedasticity is still needed to be judged by the model estimation results.

5.3 Estimation Results

After estimating the model, this paper has the data for Table 2 and Table 3. From the estimation results of the first variance equation, both the ARCH term and GARCH of the model are significant, indicating that there is significant conditional heteroskedasticity in the first semiconductor index return and the presence of conditional heteroskedasticity indicates that the volatility of returns is aggregated and can be used for GARCH modelling. Also, from the estimation results of the exogenous variables (dummy variables), columns (2), (3), (4), (5), and (6) all have standard errors that cannot be estimated. This may be due to a covariance problem caused by the similar dates of the US tariff increase on China, and as many of the data are not machine estimable, this results in a first semiconductor return index that is less informative and difficult to estimate and forecast well. Therefore, a second semiconductor industry index is further estimated next using.

Table 2. ARMA-GARCH estimation results, variance Eq. 1

Variables	Semiconductor 1					
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy						
D1	1.6137	−1211.173***	−7.3818***	−7.4539***	−10.1021***	−109.1512
	(1.4768)	(1.0635)	(0.7351)	(0.7360)	(0.6359)	
D2		1212.477	7.6364	7.7046	10.2276	109.1137***
						(0.5591)
D3			0.7019**	0.7807	1.1229	1.1637
			(0.3447)	(1.1046)	(0.9002)	(0.8791)
D4				−0.0753*	−11.0823	−11.0439
				(1.0337)		
D5					10.7667***	10.0294***
					(0.8223)	(1.0454)
D6						0.7250
						(0.6705)
GARCH						
ARCH (−1)	0.0572***	0.0571***	0.0617***	0.0616***	0.0605***	0.0658***
	(0.0008)	(0.0087)	(0.0098)	(0.0099)	(0.0101)	(0.0113)
GARCH (−1)	0.9272***	0.9263***	0.9158***	0.9159***	0.9135***	0.9042***
	(0.0112)	(0.0114)	(0.0137)	(0.0139)	(0.0139)	(0.0156)
Constant	−13.3351***	−12.9752***	−12.3258***	−12.3281***	−12.1470***	−11.8846***
	(1.6174)	(1.1983)	(0.7579)	(0.7612)	(0.6426)	(0.5586)

Table 3. ARMA-GARCH estimation results, variance Eq. 2

Variables	Semiconductor 2					
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy						
D1	0.5498***	1.1825	1.1918	1.1973	1.2028	1.2039
	(0.1758)	(1.4051)	(1.4085)	(1.3776)	(1.3508)	(1.3395)
D2		−0.6341	−0.9169	−0.9119	−0.9098	−0.9067
		(1.3960)	(1.4272)	(1.3963)	(1.3696)	(1.3584)
D3			0.2877	1.1551*	1.1474*	1.1510**
			(0.2727)	(0.6887)	(0.6763)	(0.6739
D4				−0.8821	−1.7337**	−1.7273*
				(0.6360)	(0.7618)	(0.7595)
D5					0.8850**	−0.2332
					(0.4345)	(1.7951)
D6						1.1238
						(1.7432)
GARCH						
ARCH (−1)	0.4411***	0.4427***	0.4377***	0.4428***	0.4447***	0.4434***
	(0.0447)	(0.0448)	(0.0447)	(0.0450)	(0.0456)	(0.0459)
GARCH (−1)	0.2675***	0.2650***	0.2674***	0.2518***	0.2387***	0.2352***
	(0.0577)	(0.0574)	(0.0573)	(0.0566)	(0.0565)	(0.0570)
Constant	−8.6886***	−8.6885***	−8.6902***	−8.6687***	−8.6484***	−8.6432***
	(0.1860)	(0.1853)	(0.1852)	(0.1832)	(0.1820)	(0.1819)

Then this paper study the results of Table3. From the results of the second ARMA-GARCH estimation of the semiconductor index returns, the ARCH and GARCH terms remain significant. Furthermore, from the results of the variance equation, the dummy variable D1 is significant in column (1), indicating that the volatility of China's semiconductor returns becomes greater after the US imposes tariffs on China, with the variance mentioned at 0.5498, which is significant at the 1% level, which would indicate that the US imposes tariffs on China will bring about a significant shock to China's semiconductor industry in the short term and cause a significant impact. Continuing with the inclusion of other dummy variables it can be found that in columns (4), (5), and (6), D3 are all significantly positive and D1 is no longer significant, indicating that the fluctuations after D1 are mainly caused by the period between D3 and D4, which may be due to the large number of goods that the US imposed tariffs on China for the third time, amounting to US$50 billion, and the high percentage of tariffs imposed, amounting to 25%. Also, the timing of this tariff increase on 15 June 2018 is at a critical stage in the US-China trade negotiations and therefore has a more significant impact on China's semiconductor industry. Furthermore, D5 in column (5) is significant, D5 in column (6) is insignificant and D6 is still insignificant, as the full model identifies the interval of change in semiconductor returns due to the tariff hike after adding all dummy variables from D1 to D6, while the dummy variables are added sequentially, if the last dummy variable of the full model is insignificant, i.e., there is no long-term impact. Therefore, if D6 is not significant, the US-China trade conflict cannot have a long-run impact on the Chinese semiconductor industry. This paper can conclude that the US tariff increase on China does lead to higher volatility in the semiconductor index returns in the short run, but the development of the Chinese semiconductor industry is not affected in the long run.

6 Conclusion

The object of this thesis is to study how the semiconductor industry in China and the US, especially in China, has been affected and impacted in the short and long term respectively in the context of the US-China trade conflict, and to forecast and make recommendations on the future direction and development of the semiconductor industry in China. The article mainly uses the ARMA-GARCH model to analyze and integrate the relevant data and represents the impact on the relevant Chinese industries by examining the changes in stock returns and the volatility of two Chinese semiconductor companies after they were subjected to a series of sanctions such as the US tariff increase in the US-China trade war, and concludes that the Chinese semiconductor industry will be affected by the US-China trade dispute in the short term, while this impact is not significant enough in the long term to have a significant impact on the future development of the Chinese semiconductor industry.

In the present day, after the US-China trade conflict, companies linked to the semiconductor industry in both China and the US have been hit to a greater or lesser extent, and even if the US dominates the US-China semiconductor conflict, the Chinese market and even the global market for its related companies will be reduced to varying degrees, and the trade volume will also be reduced; whereas, from the results of the data model analysis in this paper, the Chinese semiconductor industry, although The results of this paper's data model analysis show that China's semiconductor industry, although affected by a series of sanctions such as tariff hikes and technology restrictions imposed by the US, can still maintain stability in its long-term development, so there is still great potential for the future development of China's semiconductor industry.

Looking ahead, the Biden administration in the US is now focusing its policies on multilateralism and improving the competitiveness of the US economy, indicating that the US intends to work with China on areas where their interests overlap, such as global health, nuclear weapons proliferation, and climate change, but that tensions will continue in the semiconductor sector between the US and China to contain China's rise. At a time when the world is more connected and emerging technologies are redefining society, if the US is unable to restrict companies such as Huawei, which are highly threatening to US technological leadership, despite repeated sanctions, and if more and more such highly competitive mainland semiconductor companies develop, it is more likely that the US will choose to find allies and bring together multiple parties to crack down on

China in the technology sector. Therefore, in the future, China will have to actively respond to a series of restrictive measures against China from the US and its allies, and at the same time be more proactive in improving the competitiveness of its enterprises, relying on superior technological innovation and product quality to occupy a place in the world market. It is also necessary to actively seek cooperation and seek to complement the resources and technologies of other countries in the field of semiconductors, to seek better development in the future through cooperation.

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