The Impact of Sino-US Trade Conflict on the Volatility of American Stock Market

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ABSTRACT

Since the start of the Sino-US trade conflict in 2018, the United States has frequently imposed tariffs on Chinese imports. To investigate the impact of the Sino-US trade conflict on the volatility of the US stock market, this paper employs the ARMA-GARCH model and nine time points when the US announced the imposition of tariffs as dummy variables. According to the study, the Sino-US trade conflict has little impact on the US stock market, despite the significant increase in volatility in China's stock market and the obvious decline in the rate of return. China benefited from a trade surplus but suffered from a lack of technical knowledge. The U.S. stock market was likely to occupy the technical advantage, so the stock market had little impact on the trade conflict.

Keywords: Sino-US trade conflict, stock market, ARMA-GARCH model

1. INTRODUCTION

With the development of China's economy, China proved to be the world's second-largest economy in 2010, second only to the United States. After that, China's trade surplus with the United States was getting bigger, which came to 275.8 billion dollars in 2017, accounting for 56% of China's total trade surplus in Chinese statistics. That even reached 375.2 billion dollars, according to U.S. statistics, 46% of America's trade deficit in goods [1]. On the one hand, the United States hoped that the trade deficit could be reduced to maintain its long-term economic advantage over China and promote the return of the American manufacturing industry. On the other hand, in order to better open the Chinese market and safeguard the interests of American multinational corporations, coupled with the personal profit and individual style of Trump, who has been elected president by the business community, the United States finally imposed a 25% tariff on about $34 billion of goods imported from China on July 6, 2018, which indicated the official start of the Sino-US trade conflict. It was mainly reflected in the frequent increase of tariffs on products imported from China, which increased the cost of Chinese foreign trade enterprises exporting products to the United States and forced them to adjust product prices, so as to reduce the purchase of Chinese products by American citizens and lessen the trade deficit. However, the implementation of the policy did not achieve the expected effect but reduced the overall welfare level of the United States [2]. American consumers and importers bear the losses from increased tariffs. Only the total income level of the government had increased. At the same time, it did not help the employment growth of the manufacturing industry, but increased the burden of workers [3-6] and inhibited the growth of American exports, which triggered fluctuations in the US stock market.

During the trade conflict, the U.S. stock market basically fell when China and the United States increased taxes. On March 22, 2018, former U.S. President Donald Trump announced the imposition of tariffs on about $60 billion of China's imports, then the US stock market fell to its lowest level in a month. China quickly responded to the list of US proposals on April 4, after which, US stocks fell to the bottom again. On June 15, China and the United States both announced tax increases on $34 billion of goods from July 6, which brought a small decline to the stock market. After the two sides announced on September 18 that they would impose an additional 10% on $200 billion of commodities from September 24, the US stock market ushered in a three-month downward fluctuation. On May 6, 2019, Trump suddenly said that he would impose an additional tariff of 25% on China's $200 billion imported goods that had previously imposed a tariff of 10% from May 10, and 25% on another $325 billion goods in the short term. China responded accordingly a week later. During this period, the stock market continued to fall and reached its

lowest level in four months. The United States had repeatedly declared tariff rate hikes, as well as China's countermeasures, which led to the trough of U.S. stocks throughout August. On October 10, after the United States announced the termination of the tariff increase and the start of the exclusion procedure, the US stock index showed a slow but obvious upward trend. The confrontation phase of the Sino-US trade conflict has also come to an end, for the time being.

Despite these fluctuations, the US stock market was generally more stable than the Chinese stock market was. The impact of the Sino-US trade conflict on the United States was far less than that of China. The existing literature mostly studies the impact of trade conflict on China's science and technology development [7], RMB exchange rate market [8], China's manufacturing development [9,10], industrial structure upgrading [11], international trade of agricultural products [12] and so on from the perspective of China, as well as some articles on the decline of carbon emissions [13-18] and international relations [19]. Most studies on the financial market also focus on the linkage of China's stock market [20] or the interaction between Chinese and American Stock Markets [21,22], with a little separate research on the US stock market [23]. As for the linkage, there was a weak positive correlation between the Chinese and American stock markets throughout the whole stage of the trade conflict [20]. For China's stock market, negative trade friction events have led to significant negative abnormal returns in most industries, enhanced short-term systemic risks, and significantly improved the volatility of China's stock market in the short term, but basically had no long-term impact [21]. For the US stock market, it has also brought some adverse effects, such as the decline in yield and the rise in the VIX Index [23]. However, few studies have independently studied the impact of the Sino-US trade conflict on the volatility of the US stock market. The impact of Sino-US trade tensions was not limited to China and the United States but also had an impact on the global economy and international patterns in the context of economic globalization [24]. As a world superpower, the United States is the focus of world economic development. It has the largest and most mature stock market in the world. Its every move affects the global economy and employment. At the same time, its own economic development also has a certain guiding role and reference significance for the direction of world economic development.

The following parts of the paper are organized as follows: Section 2 includes the data, variable definition, and model specification, as well as an introduction to the methods. Section 3 includes the unit root test, order determination of the mean equation AR and Ma, and the results and analysis of the GARCH model. And Section 4 is the conclusion.

2. METHODS

2.1. Data

This paper selects the NASDAQ index, the Dow Jones index, and the S & P 500 index as the research objects, which are derived from the DataYes, and uses Stata software to analyse the data. The selection range of stock samples is from December 22, 2017, to January 21, 2020. The trade friction started on March 22, 2018, the period of three months before which was regarded as the reference and comparison period. The novel coronavirus pneumonia was diagnosed on January 21, 2020, for the first time in the United States, which was the end of experimental data to exclude the impact of the US epidemic.

2.2. Variable definition

The occurrence of major events, especially bad news, often causes investors' panic. Even if the event has not really happened, the early disclosure of authoritative news will increase investors' anxiety and non-determinacy, so as to avoid possible risks. According to the process of the Sino-US trade conflict, this paper selects 9 time-nodes for the announcement of tax increase news as virtual variables.

On March 23, 2018, US President Trump officially signed a memorandum of trade with China at the White House. Trump announced on the spot that it would be possible to impose tariffs on $60 billion of goods imported from China and restrict Chinese enterprises' investment and mergers and acquisitions in the United States.

On June 15, 2018, the U.S. government issued a list of goods subject to tariff increases, which will impose a 25% tariff on about $50 billion of goods imported from China, of which about $34 billion of goods will be subject to tariff increase measures from July 6, 2018.

On July 6, 2018, the U.S. Customs and Border Protection announced that the United States would impose 25% import tariffs on 818 categories of Chinese goods with a value of $34 billion on the first batch of lists from July 6 local time.

On August 7, 2018, the office of the U.S. trade representative announced that it would impose a 25% tariff on about $16 billion of goods imported from China from August 23.

On September 18, 2018, despite the overwhelming majority of international objections, the United States announced that it would impose an additional 10% tariff on $200 billion of Chinese products exported to the United States from September 24 and then take other tariff-upgrading measures.

On May 6, 2019, Trump suddenly said that he would impose an additional tariff of 25% on China's $200 billion imported goods that had previously imposed a tariff of 10% from May 10, and 25% on another $325 billion goods in the short term.

On August 2, 2019, US President Trump said that the United States would impose an additional 10% tariff on $300 billion worth of Chinese goods from September 1.

On August 15, 2019, the United States announced that it would impose a 10% tariff on Chinese goods worth $300 billion, which would be implemented in two batches on September 1 and December 15, respectively.

On August 28, 2019, USTR announced that the tariff rate on Chinese goods worth $300 billion would be increased from 10% to 15%, which would be implemented in two batches on September 1 and December 15, respectively.

At these nine time-nodes, the United States announced the tax increase decision in an official form to some extent, including all the events of a unilateral tax increase by the United States in the selected time period. The stock market, as the first risk area when the financial market is subjected to external shocks, is likely to make a fluctuating response to this.

2.3. model specification

The ARMA-GARCH model is selected in this paper. The above nine time points are set as dummy variables. The log price $ln\, p_t$ is obtained by taking the logarithm of the daily closing price of U.S. stocks, and then the difference is processed, calculating the logarithmic return series r_t as follow:

$$r_t = ln\, p_t - ln\, p_{t-1} \qquad (1)$$

Then substitute it into the mean equation of ARMA-GARCH:

$$x_t = \phi_0 + \sum_{i=1}^{p} \phi_i x_{t-i} + a_t - \sum_{i=1}^{q} \theta_i a_{t-i} \qquad (2)$$

In the formula, x_t and x_{t-i} is the logarithmic rate of return r_t, ϕ_0 is a constant, $\sum_{i=1}^{p} \phi_i x_{t-i}$ is the AR term, $\sum_{i=1}^{q} \theta_i a_{t-i}$ is the MA term, a_t and a_{t-i} are perturbation terms, ϕ_i and θ_i are coefficients. The variance equation is as follows:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \gamma D_t \qquad (3)$$

σ_t^2 is the variance, α_0 is a constant, ε_{t-1}^2 is the ARCH item, σ_{t-1}^2 is the GARCH item, D_t is a dummy

variable. In this paper, there are 9 dummy variables in variance equation, which are as follows:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \gamma_1 D_1 + \cdots + \gamma_9 D_9 \quad (4)$$

α_1, β_1 and γ are coefficients. Observe the significance of 9 dummy variables through ARMA-GARCH model to explore the impact of U.S. tax increase on U.S. financial market.

3. RESULTS AND DISCUSSION

3.1. Unit root test

In order to determine whether there is a random trend or to determine the trend, the ADF unit root test is used to test the stationarity of the log price and log return series of the closing prices of the three indexes. The inspection results are as follows:

Table 1. The ADF unit root test of American stock index

	Test Statistic	1% Critical Value	5% Critical Value	p-value
Nasdaq	-2.13	-3.96	-3.41	0.53
	-18.19	-3.96	-3.41	0.00
Dow Jones	-2.93	-3.96	-3.41	0.15
	-17.25	-3.96	-3.41	0.00
S& P 500	-2.15	-3.96	-3.41	0.52
	-17.22	-3.96	-3.41	0.00

It can be seen from Table 1 that the P values of the three logarithmic yield series are all equal to 0, indicating that the three series are all stable.

3.2. Order determination of mean equation AR and Ma

After the unit root test, it is found that the return series is stable, then the time series can be modelled. First, use the ARMA model, which is the most widely used, to construct the mean equation. Therefore, it is necessary to identify P and Q of ARMA, which means identifying the AR and Ma orders of the NASDAQ index, the Dow Jones index, and the S & P 500 index, respectively. AR uses information criteria to determine the order, and MA uses ACF. The results are as follows:

Table 2 Information criterion order determination of the NASDAQ index

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	1508.09				0.00	-5.93	-5.93*	-5.92*
1	1509.15	2.12	1	0.14	0.00	-5.93	-5.92	-5.91
2	1511.47	4.62	1	0.03	0.00	-5.93	-5.92	-5.91

3	1512.49	2.04	1	0.15	0.00	-5.93	-5.92	-5.90
4	1512.5	0.02	1	0.87	0.00	-5.93	-5.91	-5.89
5	1513.19	1.37	1	0.24	0.00	-5.93	-5.91	-5.88
6	1513.19	0.00	1	0.98	0.00	-5.92	-5.90	-5.87
7	1514.62	2.85	1	0.09	0.00	-5.93	-5.90	-5.86
8	1518.64	8.02*	1	0.00	0.00*	-5.94*	-5.91	-5.86
9	1518.66	0.04	1	0.83	0.00	-5.93	-5.90	-5.85
10	1518.88	0.43	1	0.50	0.00	-5.93	-5.90	-5.84
11	1519.14	0.53	1	0.46	0.00	-5.93	-5.89	-5.83
12	1519.14	0.00	1	0.97	0.00	-5.92	-5.88	-5.82

Since the p-value of the second order in Table 2 is less than 5%, and comparing the size of other data in the table, it can be seen that the AR of the NASDAQ index is determined as the second order. Generally, the smallest order of the appropriate order is taken for convenience.
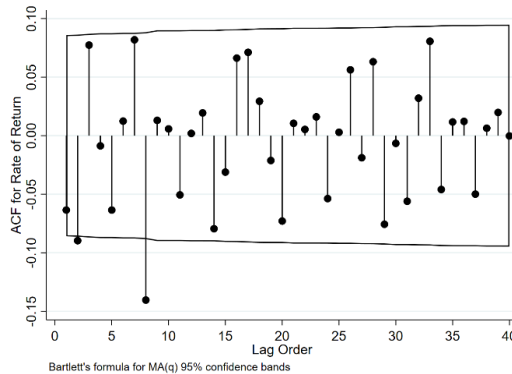

Bartlett's formula for MA(q) 95% confidence bands

Figure 1 The ACF order determination of NASDAQ index return series.

In Figure 1, the second order is greater than 0, so it is significant. Ma is determined as the second order, and the mean equation of the NASDAQ index is finally determined as ARMA (2,2).

Table 3 Information criterion order determination of the Dow Jones index

lag	LL	LR	df	P	FPE	AIC	HQIC	SBIC
0	1613.09				0.00*	-6.42*	-6.41*	-6.41*
1	1613.24	0.29	1	0.58	0.00	-6.41	-6.41	-6.40
2	1614.31	2.13	1	0.14	0.00	-6.41	-6.40	-6.39
3	1614.83	1.03	1	0.31	0.00	-6.41	-6.40	-6.38
4	1615.03	0.41	1	0.51	0.00	-6.41	-6.39	-6.37
5	1615.62	1.16	1	0.28	0.00	-6.41	-6.39	-6.36
6	1615.74	0.24	1	0.62	0.00	-6.40	-6.38	-6.35
7	1616.72	1.97	1	0.16	0.00	-6.40	-6.38	-6.34
8	1617.81	2.16	1	0.14	0.00	-6.40	-6.37	-6.33
9	1617.93	0.25	1	0.61	0.00	-6.40	-6.37	-6.32
10	1618.24	0.61	1	0.43	0.00	-6.40	-6.36	-6.31
11	1618.33	0.17	1	0.67	0.00	-6.39	-6.36	-6.29
12	1618.33	0.00	1	0.97	0.00	-6.39	-6.35	-6.28
13	1618.95	1.24	1	0.26	0.00	-6.39	-6.34	-6.27
14	1621.99	6.06*	1	0.01	0.00	-6.40	-6.35	-6.27

15	1622.17	0.36	1	0.54	0.00	-6.39	-6.34	-6.26
16	1622.28	0.22	1	0.63	0.00	-6.39	-6.33	-6.25
17	1623.45	2.34	1	0.12	0.00	-6.39	-6.33	-6.24
18	1623.46	0.00	1	0.95	0.00	-6.39	-6.32	-6.23

As shown in Table 3, it is obvious that the data meeting the conditions are the data of the 14th order.
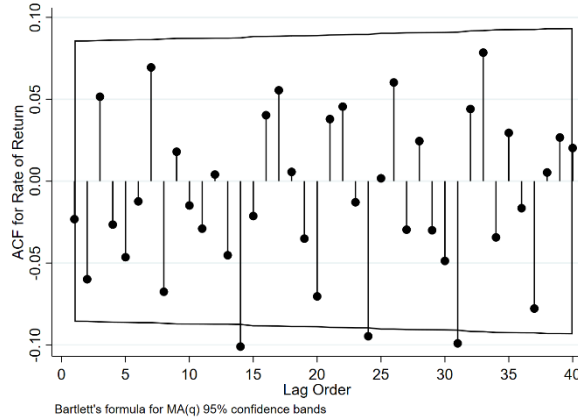

Figure 2 The ACF order determination of Dow Jones index return series.

Similarly, after observing Figure 2, the Dow Jones index is ARMA (14,14).

Table 4 Information criterion order determination of the S & P 500 index

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	1650.04				0.00*	-6.49*	-6.48*	-6.48*
1	1650.27	0.46	1	0.49	0.00	-6.48	-6.48	-6.47
2	1651.08	1.62	1	0.20	0.00	-6.48	-6.47	-6.46
3	1652.28	2.39	1	0.12	0.00	-6.48	-6.47	-6.45
4	1652.43	0.29	1	0.58	0.00	-6.48	-6.46	-6.44
5	1653.04	1.22	1	0.26	0.00	-6.48	-6.46	-6.43
6	1653.06	0.03	1	0.84	0.00	-6.48	-6.45	-6.42
7	1654.21	2.30	1	0.12	0.00	-6.48	-6.45	-6.41
8	1656.69	4.95	1	0.02	0.00	-6.48	-6.45	-6.41
9	1657.02	0.65	1	0.41	0.00	-6.48	-6.45	-6.40
10	1657.28	0.51	1	0.47	0.00	-6.48	-6.44	-6.38
11	1657.32	0.08	1	0.76	0.00	-6.47	-6.43	-6.37
12	1657.32	0.00	1	0.98	0.00	-6.47	-6.43	-6.36

It can be seen from Table 4 that the AR of the S & P 500 index is determined as the eighth order.
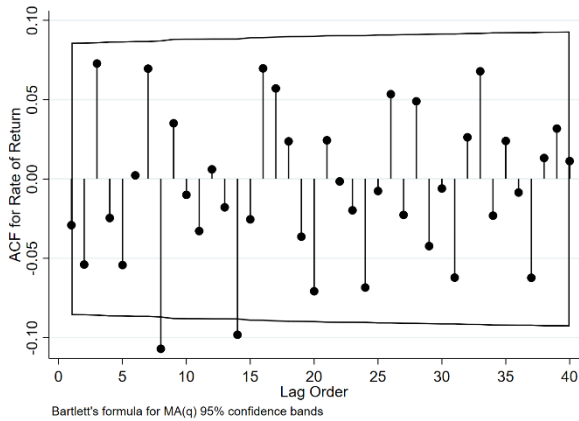
Figure 3 The ACF order determination of S & P 500 index return series.

Combined with Figure 3, the S & P 500 index is ARMA (8,8).

3.3. Results and analysis of GARCH model

Table 5 The ARMA-GARCH model estimation results

	Nasdaq	Dow Jones	S& P 500
D1	-1.23	-0.82*	-1.17*
	(0.80)	(0.48)	(0.60)
D2	1.48	0.08	0.71
	(0.94)	(0.97)	(0.80)
D3	-1.31	-1.55	-1.45
	(1.23)	(1.79)	(1.30)
D4	0.15	0.48	0.05
	(1.27)	(1.65)	(1.45)
D5	0.64	1.45**	1.64**
	(0.69)	(0.62)	(0.79)
D6	-0.17	-0.76**	-0.52
	(0.45)	(0.35)	(0.40)
D7	2.46***	2.64***	2.57***
	(0.89)	(0.71)	(0.81)
D8	-5.31	-1.75	-2.42
	(59.11)	(1.87)	(3.05)
D9	1.83	-1.34	-1.02
	(58.62)	(1.57)	(2.69)
ARCH	0.16***	0.15***	0.17***
	(0.04)	(0.03)	(0.04)
GARCH	0.78***	0.74***	0.73***
	(0.04)	(0.06)	(0.06)
Constant	-11.18***	-10.91***	-11.17***
	(0.41)	(0.35)	(0.36)

Note: Robust standard errors are reported in parentheses, and the estimated results are rounded-up to 2 digits after the decimal point. ***, **, and * indicate the level of significance of 1%, 5%, and 10%, respectively

This paper examines the impact of trade conflicts on the volatility of the American stock market. It can be seen from the variance equation of the GARCH model in Table 5 that only a few events cause the increase in volatility in the U.S. stock market, such as D5 and D7, which occurred at the latter stages of the trade conflict. In the early stage, D2, D3 and D4 did not bring significant fluctuations to the stock market except D1. This may be because of the technological advantage occupied by the United States and its dominant position as the initiator of the trade conflict. The beginning of the trade conflict did not bring negative panic to the U.S. stock market. On the contrary, in terms of fundamentals, since the United States first announced the imposition of tariffs on China, the whole Chinese stock market appeared very weak in 2018, and the Shanghai stock index fell to more than 2400 points. However, the U.S. stock market did not fluctuate violently, and the S & P 500 showed some volatility only in the first half of the year, which occurred before the trade conflict.

The reason why the latter events can frequently increase the volatility of the U.S. stock market may be that the tax increase policy of the trade conflict did not achieve the originally expected effect of the United States. At the same time, the negative effects brought by the rise of enterprise production costs, the decrease of sales revenue, the damage to farmers' interests and the increase of consumers' living costs are projected onto the stock market. As a result, D5, D6, D7, D8 and D9 in 2019 have a certain impact on the US stock market, especially D5 and D7.

However, overall, the impact of Sino-US trade friction on the U.S. stock market is not large. China's advantage lies in exports. China's US trade is a surplus for China and a deficit for the United States, but China has no advantage in the field of technical knowledge. From the perspective of global trade, product export is a competitive market behaviour, but the technical advantage makes the market not fully functional, so the impact on the stock markets of the two countries is different. U.S. stocks are likely to occupy technical advantages and have little impact on the stock market in the trade conflict.

4. CONCLUSION

This paper uses the ARMA-GARCH model to study the impact of the US announcement of tariffs on Chinese imports on the volatility of the US stock market during the China-US trade conflict. The study found that the US announcement of the tariff increases had little impact on the US stock market. Only a few events brought a small increase in the stock market volatility in the latter stages, but had a significant impact on the volatility of China's

stock market, which was largely related to the technical advantages occupied by the United States. Even though China has the export advantage of trade surplus, its technological advantage makes it impossible to give full play to this advantage.

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