The Impact of Sino-US Trade War on Chinese Stock Market
Based on Even-study Analysis

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ABSTRACT
Based on event analysis, this paper studies the impacts of the trade war between China and the United States on the six major sectors of stock market in China and analyzes the overall influences of different key events on China's stock market by combining events and stock index changes from a diversified perspective. And TSAR model is used to investigate the volatility of yield rate in different sectors. From the perspective of statistical significance, it can be concluded that the impact of the trade war on Chinese stock market is multi-faceted. Moreover, some measures about China's response to the trade war are put forward.

Keywords: *Sino-US trade war, Event study, Stock market.*

1. INTRODUCTION

The great differences between China and USA in the workforce structure and products are the source of trade imbalance and conflicts between the two countries, which led to a trade war ultimately. The anti-dumping and countervailing duty investigation against China launched into by United States marked the warm-up of the trade frictions in November 2017. And at the beginning of 2018, the Sino-US trade friction had escalated gradually, it was titled with "Trade War" firstly. Then the trade war officially kicked off when President Trump announced the extra 25% and 10% tariffs would be levied on steel and aluminium products imported from China respectively.

Not only the bilateral trade suffered heavy losses but also the stock market was affected in the trade war. With the escalation of the trade conflicts, the US raised taxes further on a large number of manufacturing industry stocks since 8th. March 2018, which directly led to the decline of stock indexes of relative sectors of market while the market panic was brewing. The volatility index (VIX) which reflected the degree of market panic was doubled from 10 on 30th. November 2017 to 20 on 31st. March 2018. At the same time, Shanghai and Shenzhen 300 index fall sharply. In stock pledge market, the risk of Liquidation triggered the agglomeration effect, and the adverse impact spread to credit market. Many enterprises were up against winding-up under the backdrop of a sharp decline in the stock market. That, in turn, would generate the stock market fell. The Liquidity of companies reduced significantly in financing predicament with frequently defaults. It becomes the end of the first stage of the war when both sides decided to conduct a 90-day trade negotiation until 2nd. December 2018. But there were still repercussions on the market. On 3rd. January 2019, the Shanghai and Shenzhen 300 index reached its freezing point since the war began declining for 23%. And the S&P 500 fell 16% to 2351.1 points from 9th. March 2018 to 24th. December 2018. The second stage of the war began from the trade negotiation on 2nd. December 2018 and ended with the rising of tariffs on $200 billion of Chinese imports from 10% to 25% on 9th. May 2019. Shortly afterward, the government of China also levy additional tariff to fire back. The third round of stalemate started after both sides implemented a series of retaliatory measures. Meanwhile, Shanghai and the Shenzhen 300 index experienced a high frequency fluctuation. The detailed events are as following. ("Table 1")

Table 1. The Four Events

Date	Events
23rd March 2018	President Trump proposed an extra 25% tariff on $50 billion Chinese imports.
19th June 2018	Making public a list of the $50 billion Chinese imports and starting collet tariffs.
5th May 2019	Planed to rise the tariff on another $200 billion Chinese imports from 10% to 25%.
1st August 2019	Levied an extra 10% tariff on another $300 billion Chinese imports and decreased tariff of $250 billion Chinese imports on the previous list by 7.5%.

2. LITERATURE REVIEW: EXISTING EMPIRICAL RESULTS

For the moment, Chinese academics haven't reached a consensus on the empirical result of the effects of Sino-US trade war on Chinese economy. Some scholars think the Sino-US trade friction will have a more striking negative impact on Chinese financial market than on the U.S. [1]. There are also scholars emphasized the trade war will hurt both sides with different industries [2] [3]. Besides, there are also some empirical findings hold the another view and show that the Sino-US trade competition is a zero-sum game in the short run, but it will facilitate the opening up of Chinese financial market and have a profound influence on the future reform of financial system, which will generally lead to a win-win consequence in in the long run [4].

In terms of research methods, the empirical approaches are various. The main research methods include effective transfer entropy [1], event-study analysis [3] [5], quantile point regression model [6], Bayesian-VAR [7], computable general equilibrium (CGE) model [8] [9], etc.

On the whole, the most existing studies analyze the influence of trade friction on different relative interested parties, which is quite complicated and changeable required for concrete analysis of specific situations. And in some certain conditions, the stock shock caused by trade friction could be weakened in long term. Trade conflict could not only lessen the economic exchanges between some regions or some countries but also tighten the economic connection between a part of nations. Since event analysis can explore the impact of one event on stock market intuitively, yet the even study is chosen as the main research method.

3. DATA AND RESEARCH METHODS

3.1 Sample and Variables Selection

Focusing on the research of different impact on various sections of Chinese stock market index under several important event of Sino-US trade war, this research takes the Shanghai and Shenzhen 300 index as market index, which is a typical reflection of variation tendency of Chinese stock market. In addition, the Shanghai and Shenzhen 300 index well covers six-attributes stock plates influenced by the trade war, such as pharmaceutical business, national defense, banking industry, real estate, chip concept and communication services plats. The data of the Shanghai and Shenzhen 300 index and each subsection plates are from March 2017 to December 2019. The data source is CSMAR and Bloomberg.

Reviewing the process of the trade war, this paper selects four significant events within several rounds of negotiations between the two sides and takes the date when the market first learned them. The details of four events are shown in table 1 below.

After determining the key dates of the events, this study sets 10 days before and after the events respectively as the event window and defines the value of the event date as 0 and a t-value of event window from -10 to 10. The paper takes the period before the event as the estimation period to predict the expected return of certain industries without the event. To ensure the effectiveness and unbiasedness, and avoid the event window overlapping, the sample is set to be 1 year with a corresponding t value from -261 to -11. ("Table 1")

3.2 Empirical Models

This research employs single index market model (risk adjusted return method) to estimate the expected return within the event window and calculate the sum of abnormal return (AR) and

abnormal return (CAR) and with effective rate of return. Then AR and CAR are standardized respectively and tested the significances. The equations are as following.

The calculation of rate of return on individual shares follows continuous compounding, satisfying the basic assumption of normal distribution and the fundamental regression analysis proposed by Fama (1991) which is shown in Equation (1).

$$R = \ln(P_i / P_{i-1}) \quad (1)$$

where P_i, and P_{i-1} respectively represent the closing price of stocks the day and the day before with right offering in order to eliminate the effect of ex-dividend. And the parameters β and α are calculated by the covariance of market index and each industry plate. The expected return is estimated by Equation (2).

$$R_{jt(est,window)} = \alpha_{j(est,period)} + \beta_{j(est,period)} \times R_{mt(event,window)} \quad (2)$$

where $R_{jt(est,window)}$ and $R_{mt(event,window)}$ denote the daily return of industry j and the market on the event window respectively, while $\alpha_{j(est,period)}$ and $\beta_{j(est,period)}$ denote estimated intercept and slope of industry j on the sample period.

The Equation (3), Equation (4) and Equation (5) below are used to calculate the abnormal rate of return (AR), standardized abnormal rate of return (SAR) and the standard deviation of rate of return independently. he standard deviation of rate of return independently.

$$AR_{jt(event,window)} = R_{jt(event,window)} - \alpha_{j(est,period)} - \beta_{j(est,period)} \times R_{mt(event,window)} \quad (3)$$

$$SAR_{jt} = \frac{AR_{jt}}{\sqrt{V_{AR_{jt}}}} \quad (4)$$

$$\sqrt{V_{AR_{jt}}} = \left[\frac{\sum_{t=-(D_j+10)}^{-10} \left(AR_{jt(est,period)} - \overline{AR}_{jt(est,period)} \right)^2}{D_j - 2} \right] \times \left[1 + \frac{1}{D_j} + \frac{\left(R_{mt(event,window)} - \overline{R}_{m(est,window)} \right)^2}{\sum_{t=-(D_j+10)}^{-10} \left(R_{mt(est,period)} - \overline{R}_{m(est,window)} \right)^2} \right] \quad (5)$$

where SAR_{jt}, AR_{jt} and $\sqrt{V_{AR_{jt}}}$ measure the relative *SAR*, *AR* and the standard deviation of sector j on time t, while $\overline{AR}_{jt(est,period)}$ and $R_{m(est,period)}$ are set to be the averages of AR of sector j on time t and rate of return of the market on estimated period; D_j represents the No. of trading days of sector j.

In order to ensure the statistical significance of the data, the corresponding z-value and p-value are computed with Equation (6) below.

$$Z - statistic = \frac{TSAR_t}{\sqrt{\sum_{j=1}^{N} \frac{D_j - 2}{D_j - 4}}} \quad (6)$$

in which $TSAR_t$ is the daily TSAR within sample period, and will be examined with both horizontal and vertical comparison. The horizontal comparison can discover the time-varying rules of abnormal rate of return within the sample period by accumulate daily SAR of each industry sector during the event window of Sino-US trade war from 2018 to 2019. And for surveying the total abnormal rate of return of each sector with event period, the vertical comparison is to add up the SAR of each sector under different events. Besides, this paper also adopts index standardization, set the price index of the date of event T to 100 as a benchmark to intuitively estimate the short-run impact of Sino-US trade on each industry sector index.

4. EMPIRICIAL RESULTS

4.1 The Variation in Rates of Return for Sector Index

To compare how different industry sectors were affected by the shock of Sino-US trade conflict, this paper selects six representative sectors as research sample and conduct a significant analysis on TSAR of six sectors vertically. The result is show in "Table 2".

Table 2. TSAR of the Six Sector Indexes

	Medical	Military	Banking	Real Estate	Chip	Communi-cation
t=1	-1.8	0.2	-1.21	-1.82	-1.79	-3.52
t=2	-2.3	-2.2	0.13	-3.45	-1.69	-3.97
t=3	-0.34	-1.25	4.17	-1.7	-2.01	-1.73
t=4	-0.66	-0.76	-0.8	-1.8	-1.37	-1.6
TSAR	-5.1	-4.01	2.29	-8.77	-6.86	-10.82
Z-value	-2.52	-1.98	1.13	-4.34	-3.39	-5.35
P-value	1.16%	4.72%	25.71%	0.00%	0.07%	0.00%

Note: *t* denotes the sector the No. of conflicts.

According to "Table 2", medical, military, real estate, chip and communication-services industries have negative Total SAR, which suggests that their real rate of returns (*Ri*) are less than their expected rate of returns E(*Ri*). In general, there is a significant adverse impact of the four events on the indexes of these sectors with a p-value at least less than 5%. Among them, Chip and communication-services sectors suffer more in the trade war.

At the same time, the result shows a reverse trend to the banking industry but with non-significant statistics, indicating the abnormal rate of return of banking sector is indifferent before and after the trade war. The reason why the banking industry has a positive Total SAR might be the more sensibility of banking industry leading to a more pessimistic expected rate of return.

4.2 The Volatility Analysis

4.2.1 The Analysis on Volatility of Each Sector

Based on the price trend analysis of six sectors above, this study makes a comparison of volatility, that is, comparing the combined influences of trade war on six sectors vertically. First, calculate the standard deviation of rate of return and select the period from T-10 to T+10, 21 days in all. The relative volatility is shown in "Table 3" below.

Table 3. Total Volatility of Sectors in the War

Date	2018. 3. 23	2018. 6. 19	2019. 5. 5	2019. 8. 1
Industry	Round 1	Round 2	Round 3	Round 4
Medical	7.09%	7.47%	9.19%	4.14%
Military	9.31%	12.22%	12.73%	6.10%
Banking	5.47%	4.99%	5.52%	4.14%
Real Estate	6.47%	8.39%	10.48%	5.66%
Chip	11.98%	12.00%	14.22%	7.42%
Communi-cation	9.01%	11.88%	13.22%	7.64%
Cumulative Mean	8.20%	9.50%	10.90%	5.80%

From the "Table 3" above, the volatility of chip and banking sector have the largest cumulative mean (11.4%) and the smallest mean (5.0%) respectively. In addition, this paper measures the overall rebound extent after each event date with a contrast between the sector index of T=10 and T=0. Within 10 days after events, chip sector has the highest extent of the rebound among all the six industries. While the banking industry has no obvious recovery with -0.7% rebound.

4.2.2 The Analysis of Total Rate of Return for Each Sector on Event Date

Then TSAR model is employed to accumulative for examining how each sector very on the event dates (23rd March 2018; 19th June 2018; 5th May 2019; 1st August 2019) of Sino-Us trade war. On the basis of the standardized abnormal rate of return above, the Total AR and relative Total SAR of all the sectors within the four fights could be obtained. For an easier vertical comparison of significance on key event days, the data one day before and one day

are taken after as a reference. The details can be found in "Table 4" below.

Table 4. The Significance of Cumulative TSAR

Date	Relative to Event Date	TSAR	TSAR z-value	TSAR p-value
Round 1	-1	2.56	1.03	30.09%
	0	-9.95	-4.02	0.01%
	1	9.48	3.83	0.01%
Round 2	-1	-3.04	-1.23	21.96%
	0	-13.49	-5.45	0.00%
	1	3.05	1.23	21.78%
Round 3	-1	3.04	1.24	21.59%
	0	-5.33	-2.17	3.02%
	1	2.61	1.06	28.83%
Round 4	-1	2.88	1.17	24.11%
	0	-6.99	-2.84	0.45%
	1	-0.81	-0.33	74.34%

It can be seen from the above "Table 4" that on the four event days all the six sectors experience significant negative Total SAR, which means the real rate of returns are lower than the expected. It proves that the tariff rises of the US has opposite forces on Chinese stock market on the event date while the abnormal rate of returns of Round 1 and Round 2 are greater than Round 3 and Round 4. In the meantime, it's worth noting that only the Total SAR of the day after event date of Round 1 is positive. As the very first round of trade war, its excessive shock triggers the panic of investors, and leads to a severity underestimation of market performance the following day. But with the development of trade war, this effect weakens gradually

5. CONCLUSION

This study employs TSR model to analyse the patterns of abnormal rate of return and index volatility of six Chinese industries. From a macroscopic view, the tax hike imposed by the US has a significant and durable negative impact on various industries of Chinese stock market, especially the high-tech sector related to semiconductor industries such as chip and communication suffering the greatest impact in both the short term and the long term. On the other side, the sectors pegged to exchange rates mainly based on banking industry and real estate have the lowest short-run and long-run volatility. When it comes to rebounding trend of sector index after the dates of each fight, chip and national military industrial sectors enjoy higher rebound, while the price index of banking industry is just the opposite. The four events are proved to play significant effects on the relative industry sectors of Chinese stock market with TSAR model. According to the timeline, the first fight truly triggered the unprecedented panic of investors and led to an overreaction in investors' decision-making, which dulled on round third.

There is an information effect on Chinese stock market within this Sino-US trade conflict, that is, when the friction started by the US, Chinese stock market would take it as a critical bad news, striking on both the market and industry indexes. Simultaneously, this contagion is spreading from the industries directly affected by the change of their export quotas to the industries such as banking and real estate industries which are not influenced directly by the list of trade war due to the variation of exchange rate and financial liquidity.

AUTHORS' CONTRIBUTIONS

Xinran Li is responsible for experimental design and the manuscript writing; Zhe Zhang contributed to the relative data collection and empirical results inspection.

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