

Sino-US trade conflict and fluctuation of American stock market

Xinyao Wang^{1, *, †}, Chengpeng Zhu^{2, †}

¹Department of economics, The University of Sheffield

²Department of Statistics, The University of Warwick

*Corresponding author. Email: Xwang275@sheffield.ac.uk

†These authors contribute equally.

Abstract. At the beginning of 2018, President Trump started the US-China trade war to protect the US companies and solve the huge trade deficit by taking tariff measures, then China also imposed tariffs to fight back. The imposed tariff on both sides increased by a significant amount and affects the stock market on both sides. This paper studies behavior of US market indices, DJI, S&P 500, and NASDAQ, in the US-China trade war. Test the stationariness of stock index and rate of return by unit root test, also, apply PACF, ACF, ARMA-GARCH model to three indices to check the effect of US-China war on the stock market. Our results show that the influence of the US-China trade war on the US stock market is insignificant in all three indices, no matter statistical significance or economic significance. Most people are concerned about the impact of the US-China trade war on the Chinese stock market, but the global stock market is more closely related, and this essay analyzes the influence of the trade war on three stock indices, DJI, S&P 500, and NASDAQ.

Keywords: US-China trade war, stock market, event study.

1. Introduction

Since 2017, the relationship between the two most momentous economies, US and China, has critically changed. In July 2017, the US government launched a Section 301 investigation on China, which determined that China's policies, acts, and practices associated with intellectual property, technology transfer, and invention are discriminatory and unreasonable. US previous President Donald Trump signed a memorandum imposing tariffs on 50 billion worth of Chinese imports to confine China's investment in key technology sectors on 22 March 2018. This movement officially triggered the US-China Trade War. The Chinese government launched anti-dumping and countervailing duty investigations of more than \$1 billion of US exports of sorghum as a strike back. It imposed anti-dumping duties of 178.6 percent on imports from the US in April 2018. At the same time, China imposed 25% tariffs on aluminum imports and soybeans US imports [6]. In 2019, China and the US continued to collide and negotiate during the period, but the trade war has never ended, and the number of tariffs was getting bigger and bigger. Until 15 January 2020, Chinese and US negotiators agreed on an undetermined Phase One deal. China committed to importing more US agriculture products and attached to new commitments on technology transfer and intellectual property; meanwhile, the US reduced tariffs on imports from China [7].

Over time, the US imposed sanctions on China's Huawei by prohibiting US high-tech companies from selling products to Huawei. Since, in the era of globalization, both upstream and downstream of the industrial chain rely on each other and coexist, US high-tech companies have suffered huge losses by stopping the supply of raw materials to Huawei according to BBC News. The escalating trade war also led to higher unemployment in the United States. At the same time, it caused global stock market shocks because of global value chains [4]. With the imposition of tariffs on up to \$60 billion in goods imported from China, the closing price of European stocks sharply declined, with the Pan-European Stock 600 index down to 1.64 percent, the Dow Jones Industrial Average falling about 2.93 percent and A share of China stock market started with a low price. Furthermore, all sectors were sharply lower at the end of trading.

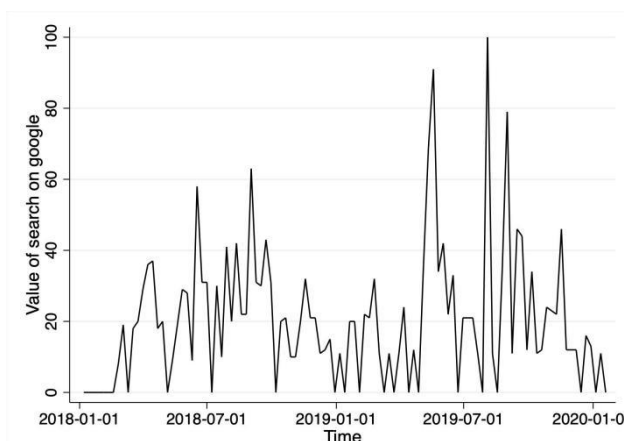


Figure 1. How many people search ‘Trade War on google’

At the same time, with the unhurriedly increased trade war, social attention in the US to the trade war was sharply boosted. In May 2019, with the imposition of tariffs on Chinese goods increased from 10 percent to 25 percent, public attention about the trade war peaked in mid-May. The public concerns that would directly impact the US stock market were associated with further economic confrontations since households are risk-averse.

The trade war had irreversible effects on the stock market. Considering that the stock market is closely conjoined to practically every prominent industry globally, such as freight, oil prices, energy, and metals, anything that happens could provoke substantial price fluctuations, not to mention the collision between the world's two largest economic and trade bodies. The essay is not only concerned with the consequence of the trade war on the economy, especially the US stock market. Whether the US monetary and political policies toward China helped the US stock market at different times in the trade war will be discussed.

The fierce trade war between the two nations also initiated a global debate. Most research investigates the effects of trade wars on China and the US economy [2]. Further research has tried to find the reaction of the US-China trade war by stock return and exported data of chosen companies and concluded there is a negative influence of trade war on firms because of tariffs directly, which is a higher proportion of export, more negative market reactions [5]. Also, the co-movements between the US and China stock markets were crucial and could show the impact of the trade war intuitively. Shi, Wang, and Ke discussed the co-movements of stock markets between two countries from two perspectives according to the time change and the news announcement effects and spillover patterns and identified structural breaks of different market co-movements during various stages. They found that the benefit of portfolio diversification decreased because of the trade war [9].

However, most research only focused on the co-movement of the Chinese and US stock markets, the time series, and the inconstancy of the Chinese financial market caused by the trade friction. Still, it failed to evaluate the US stock market changes due to different policy implementations.

From different perspectives, to analyze the influence of the US-China trade war on the fluctuation of the US stock market, this essay examines the progress of the competition and noteworthy events that might affect the US stock market. The influence of the trade war can be presently analyzed via changes in daily returns of the US stock market indices (Dow Jones Industrial Average, NASDAQ Composite, and S&P 500) from December 2017 to January 2020 (see Figure 2). NASDAQ composite was fiercely fluctuating with increased attention to the trade war news. This reflation indicates that the policies of trade conflict and the stock market trends are likely to correspond. The previous research has contributed and demonstrated the impact of macro news on stock market connection [3, 6].

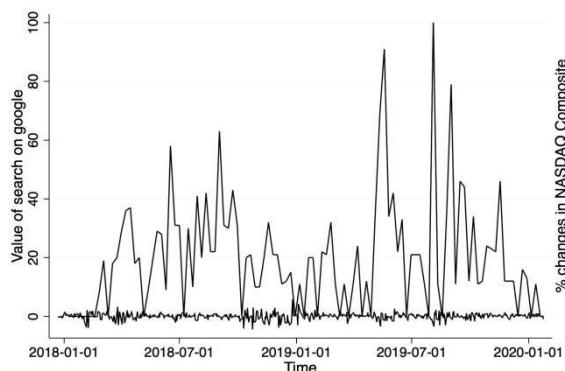


Figure 2. Value of searching on google versus fluctuation of NASDAQ

The rest of this paper is organized as follows:

part 2 is research design, which includes data sources, unit root test, and model specification. Part 3 shows empirical results and analysis, which includes AR and MA identification and ARMA-GARCH estimation results. Part 4 is discussion while Part 5 concludes with the main findings of this study.

2. Research Design

2.1 Data Sources

In this study, the daily closing prices of the Dow Jones Industrial Average Index, the NASDAQ Composite Index, and the S&P 500 Index represent pertinent stock markets. All data was acquired from the Finance.Yahoo.com database and Investing.com database. The S&P 500 Index tracks the stock performance of the top 500 US firms. The Dow Jones Industrial Average is a price-weighted measurement stock market index of 30 prominent companies. The NASDAQ Composite Index comprises all stocks on the NASDAQ Stock Exchange, which is heavily weighted by companies in the information technology sector.

This paper chooses to adopt daily indices prices for this survey to observe more information about the stock fluctuation according to the US-China trade war progress. The period is from 12th December 2017 to 24th January 2020, so most US-China trade war policies that affect the US stock market price were included, also before the global COVID-19 outbreak.

This paper collected the policies of China and the US during the US-China trade war, separately from baike.baidu.com and Wikipedia.org to get detailed fluctuations of the US stock price affected by these aspects.

2.2 Unit Root Test

As a common practice, denote the stock index using the natural logarithm of closing prices and calculate the stock market return by the first difference of the natural logarithm of closing prices over two consecutive trading days.

Using the unit root test to test whether the stock index and the rate of return are non-stationary and possess a unit root.

$$p_t = c_t + \beta p_{t-1} + \sum_{i=1}^{t-1} \Phi_i \Delta p_{t-i} + \varepsilon_t \quad (1)$$

The subscript t of the variable, p_t , refers to the period and the variable p_{t-1} means that the price of the previous period. Also, β Φ are constant coefficients and ε_t means the errors of the period t .

The null hypothesis is $H_0: \beta = 1$ which means the presence of a unit root and the alternative hypothesis is $H_1: \beta = 0$ which means p_t is stationary.

The unit root test result of the stock index and the rate of market return is shown below. The stock index is not stationary but the rate of the market return is stationary.

Table 1 ADF-Test

Variables	t-value	p-value
Stock index		
DJI	-2.9920	0.1345
S&P 500	-2.2300	0.4730
NASDAQ	-2.0940	0.5496
Rate of return		
DJI	-17.284	0.0000***
S&P 500	-17.248	0.0000***
NASDAQ	-17.761	0.0000***

2.3 ARMA-GRACH Model Specification

The augmented Dickey-Fuller (ADF) rejects the null hypothesis of unit root at the 1% significance level which means that every rate of return series is stationary. Then work on the time series directly with the Autoregressive Moving Average-Generalized Autoregressive Conditional Heteroscedastic (ARMA-GARCH) model.

For the construction of the ARMA-GARCH model, introduce 7 dummy variables according to the date China imposed tariffs on the US in the trade war to test the influence of tariffs on the US stock market. In this survey, use the AR (1), MA (1), and GARCH (1,1) models to predict the rate of market return and volatility simultaneously.

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \gamma_1 \sigma_{t-1}^2 \quad (2)$$

σ_t^2 means the variance of the time period t , ε_{t-1}^2 is the component of ARCH of time period $t - 1$ and σ_{t-1}^2 is the autoregressive part of GARCH of time period $t - 1$.

The Dickey-Fuller (ADF) statistic rejects the null hypothesis of a unit root at the 1% significance level; in other words, the series are stationary. Therefore, the time series can be processed directly without any excessive modifications. The rejection of each return series was obtained by performing Engel's ARCH test using the chi-square statistic, indicating the presence of heteroskedasticity and preference for the GARCH model.

3. Empirical Results

3.1 AR and MA Identification

The Autocorrelation Function (ACF) is a bar chart of correlation coefficients between lagged values and time series. The x-axis and y-axis represent the correlation coefficient and the number of lags, respectively. Assuming, $y_{t-1}, y_{t-2}, y_{t-3}, \dots, y_{t-n}$, then the lag-1 value is the correlation coefficient between y_t and y_{t-1} , lag 2 is the correlation between y_t and y_{t-2} and so on.

The Partial autocorrelation function (PACF) demonstrates the partial correlation between the lags themselves and the time series.

This paper uses the PACF and ACF to analyze the order of MA and AR of three US stock market indices.

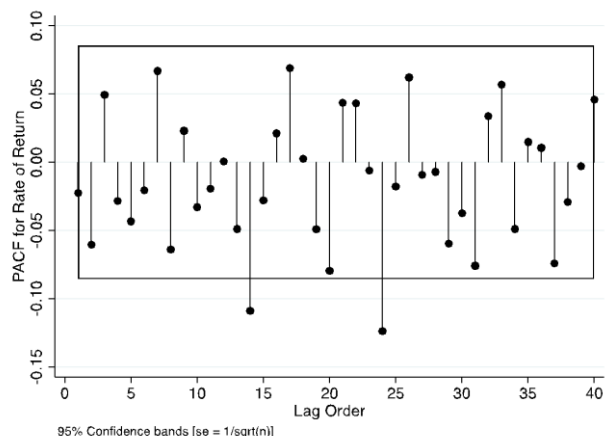


Figure 3 PACF for Rate of Return of DJI

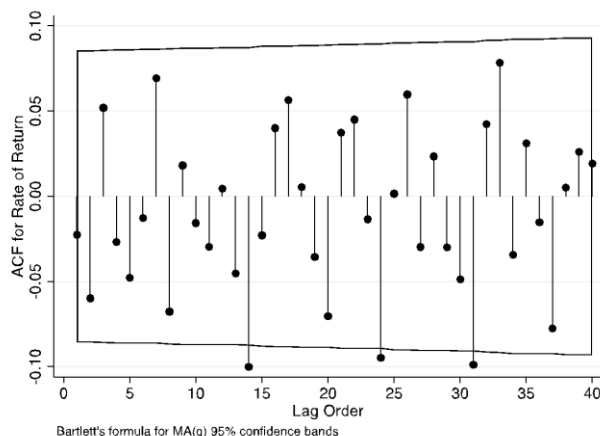


Figure 4 ACF for Rate of Return of DJI

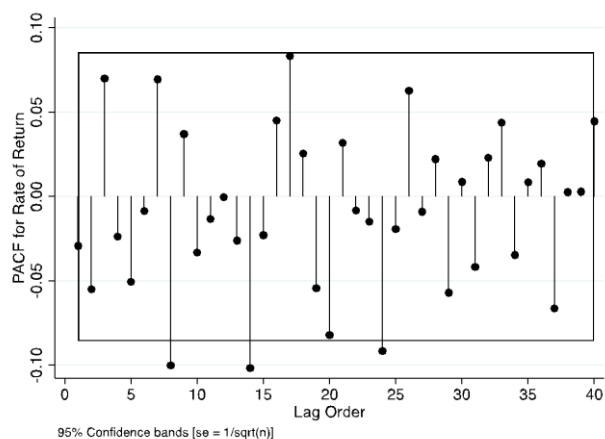


Figure 5 PACF for Rate of Return of S&P 500

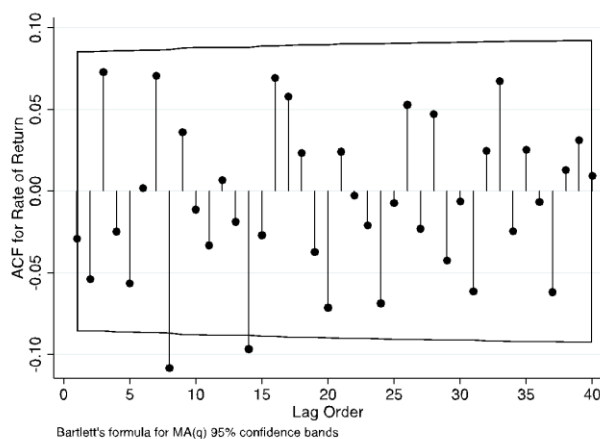


Figure 6 ACF for Rate of Return of S&P 500

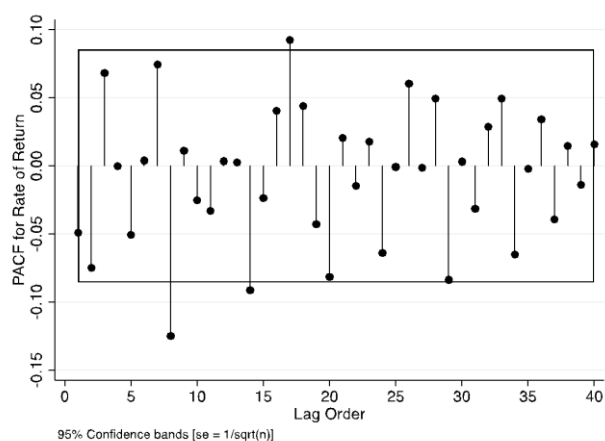


Figure 7 PACF for Rate of Return of
NASDAQ

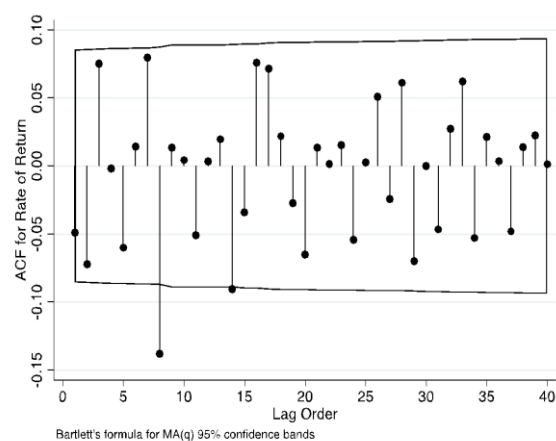


Figure 8 ACF for Rate of Return of NASDAQ

Figures 3 and 4 show that the rate of return of DJI is significant at lag orders 14 and 24.

Figures 5 and 6 show that the rate of return of S&P is significant at lag orders 8 and 14.

Figures 7 and 8 show that the rate of return of NASDAQ is significant at lag orders 8 and 14.

3.2 ARMA-GARCH Estimation Results

From the estimation results of the variance equation, there are significant ARCH effects for the three indices. Therefore, it is suitable for modeling with the GARCH model.

From the estimation results of the dummy variables, the coefficients are insignificant or significantly negative, whether it is the Dow Jones Index, the S&P 500, or the Nasdaq Index, China's imposition of tariffs has not caused volatility in the US stock market.

Therefore, in the US-China trade war, China's imposition of tariffs on the United States did not cause a reaction in the financial market. From the estimated results of the model, there is neither statistical significance nor economic significance.

Via the final experimental data, this paper finds that China's tariffs on the US have minor fluctuations in the Dow Jones, S&P 500, and NASDAQ from the estimated results of dummy variables. In other words, the implementation of China's tariffs on the US does not affect the US stock market and financial market. However, it was evident that there was significant volatility in the US stock market after China first announced its tariff increases against the US, as shown in the Dow Jones, S&P 500, and NASDAQ indexes, which is when dummy variables (IP1) were first introduced. These results are exceptional, as the trade war between China and the United States has had an almost catastrophic negative impact on the economies and trades of all countries in the world [7], but the results suggest otherwise. The stock price was contracted and fluctuated significantly. The majority of the estimated coefficients were negative, indicating the negative correlation of dummy variables with stock price fluctuations. Nevertheless, in general, most of the variables rejected the Null hypothesis in P-test, which is that the tariffs from China had adverse effects on the US stock market.

Table 2 ARMA-GARCH model, variance equation

Variables	(1)	(2)	(3)
	DJI	S&P 500	NASDAQ
IP 1	-0.8354* (0.4575)	-1.0415** (0.4531)	-0.9683** (0.4525)
IP 2	-1.6776 (2.0231)	-1.0596 (1.2279)	-0.1071 (0.8605)
IP 3	1.7172 (2.2263)	0.5989 (1.8685)	-1.1825 (3.8825)
IP 4	0.2446 (0.8062)	1.0751 (1.1630)	2.0950 (3.6603)
IP 5	-0.3517 (0.3001)	-0.4136 (0.4422)	-0.3633 (0.3908)
IP 6	-0.6637 (0.4383)	-0.7945 (0.5660)	-1.0380* (0.5701)
IP 7	-0.0649 (0.6995)	0.1980 (0.7399)	0.1948 (0.7827)
ARCH (-1)	0.1714*** (0.0353)	0.1991*** (0.0406)	0.1450*** (0.0402)
GARCH (-1)	0.7407*** (0.0483)	0.7259*** (0.0439)	0.7817*** (0.0467)
Constant	-11.0127*** (0.3345)	-11.1984*** (0.3403)	-11.1049*** (0.3650)

4. discussion

The reason for this result may be the substitution effect. In 2018, China imposed a 25 percent tariff on US soybean exports, causing considerable losses to the US soybean industry and farmers' incomes. However, the tariffs increase changed the Chinese market's preference. Brazilian soybeans have become a successful substitute for American soybeans. US agricultural exports slumped, and Brazilian soybean prices hit a new high as the attention of the world's biggest soybean importer (China) turned to Brazil [1]. In other words, the United States can also seek new import substitutes among

other countries after imposing tariffs. Prices will be higher than before the trade war, but this indicates that it does not adversely affect its operations, although the tariff increases production costs.

Furthermore, all the agents took the consequences after the trade war. During a trade war, as production costs rise, prices boom, and unemployment gradually rises, consumers ultimately abide by all the unsatisfactory results because businesses need to mitigate the profit lost [8]. This indicates that the US-China trade war has not positively affected economic development and the stock market. The stagnant stock market development and the inflation rate drop imply a decline in consumption and investment by firms and households, indicating an economic recession. Ultimately, consumers will pay high prices, and micro-enterprises will be at risk of bankruptcy.

For investors, both the US-China trade war and the Covid-19 recession have negatively influenced investment. As the shocks arrive, investors are inclined to protect their assets (not invest) in an environment of high investment risk, which is the reason for deflation and stock market crash. However, this article points out that the U.S.-China trade war has had little impact on the stock market. Therefore, households can reduce the risk of investments by shifting their portfolios to low-risk, high-quality funds such as money market funds or funds compensated and protected by the Federal Reserve. So this article is dedicated to presenting constructive conclusions about the impact on stocks in the trade war period and providing evidence for other related studies

Most of the studies from the same period were devoted to the investment markets of some countries or the entire world, the co-movement of Chinese and American stock markets, or the production and price of a particular industry from the perspective of stocks, bonds, and exchange rates [7, 9, and 10]. While these studies provide a comprehensive analysis of the impact of shocks on investment and economic development, these studies tacitly agree on the negative effect of tariffs on the stock market without supportive evidence. Hence, this article is dedicated to presenting constructive conclusions about the impact on stocks during the trade war and providing evidence for other related studies.

To address the influence of the trade conflict, future studies could focus on three following questions. First, the stock market is predominantly influenced by US government policy toward China or the tariffs adjustment by the Chinese government. The high tariffs on China's imports have undoubtedly impacted the market supply and industrial manufacturing, while the restrictions on the US exports have negatively affected the US GDP and output. These two perspectives are essential for the stock market. Furthermore, the domestic economy, which correlates to employment, inflation, and exchange rates, is also critical in the stock market. The government and central bank played the role of adjuster and stimulator for the domestic economy. Hence, the government expenditure and the interest rate are also variables in the model.

5. Conclusion

This essay tests the impact of the US-China trade war on the stock market by applying PACF, ACF, and ARMA-GARCH models to the Nasdaq, Dow Jones, and S&P 500 indices. The results show that the impact of the U.S.-China trade war on the US stock market is insignificant in all three indices, both in terms of statistical and economic significance. Although the data demonstrate insignificance, the negative impact of the US-China trade war on the economic development and investment of both countries is undeniable. Therefore, for individuals with investment needs and enterprises that need to raise capital, although a negative shock will affect investor belief, the impact of this shock on the stock market is insignificant in general. Investors need to be more cautious during this period, but they do not need to be overly apprehensive because the capital outflow from the money market caused by the lack of confidence can exacerbate the economic recession.

References

- [1] Adjemian, M.K., Smith, A. and He, W. Estimating the market effect of a trade war: The case of soybean tariffs. *Food policy*, 105, 2021. p. 102152. doi:10.1016/j.foodpol.2021.102152.

- [2] Archana, V. Who will win from the trade war? Analysis of the US-China trade war from a micro perspective. *China Economic Journal* 13.3, 2020. p. 376-393. doi: <https://doi.org/10.1080/17538963.2020.1785073>
- [3] Burggraf, T., Fendel, R. and Huynh, T.L.D. Political news and stock prices: evidence from Trump's trade war. *Applied economics letters*, 27(18), 2020. p. 1485–1488. doi: <https://doi.org/10.1080/13504851.2019.1690626>
- [4] Itakura, K. Evaluating the Impact of the US–China Trade War, *Asian economic policy review*, 15(1), 2020. p. 77–93. doi:10.1111/aepr.12286.
- [5] Lahaye, J., Laurent, S. and Neely, C.J. Jumps, cojumps and macro announcements. *Journal of applied econometrics* (Chichester, England), 26(6), 2011. p. 893–921. doi:10.1002/jae.1149.
- [6] Larisa Kapustina et al. US-China Trade War: Causes and Outcomes, SHS web of conferences, 73, 2020. p. 01012. doi:10.1051/shsconf/20207301012.
- [7] Moosa, N. et al. The origin of the US-China trade war, *Applied economics*, 52(35), 2020. p. 3842–3857. doi:10.1080/00036846.2020.1722797.
- [8] Nasibitt. B., Whyte, K. The effects of the treade war on inflation. *National Institute Economic Review* No. 251, 2020. p. 38-39.
- [9] Shi, Y., Wang, L. and Ke, J. Does the US-China trade war affect co-movements between US and Chinese stock markets?, *Research in international business and finance*, 58, (2021) p. 101477. doi:10.1016/j.ribaf.2021.101477.
- [10] Wang, Xiaoquan et al. The impact of US-China trade war on Chinese firms: Evidence from stock market reactions. *Applied economics letters*, 28(7), 2021. p. 579–583. doi:10.1080/13504851.2020.1764477.