

Sino-US trade conflict and fluctuation of China's stock market: An Empirical Evidence

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Abstract. The trade war between China and the United States has had a significant influence on China's economy, as seen by stock market volatility. The paper uses the ARMA-GARCH model, by selecting the six time-points as the external variables, to analyze the Shanghai and Shenzhen indices in returns and volatility to see whether China can get rid of the negative impact on its economy. The empirical research shows that the impact of the US increased tariffs on China's stock market will be short-term and China's financial market remains resilient. This paper gives predictions about the stock market and reasonable evidence for the conclusion by constructing financial models. It also provides suggestions for investors about how to adjust their investment strategies when major external risks occur.

Keywords: Sino-US Trade War; Stock Market; External Risks

1. Introduction

The Sino-US trade conflict has been a major historical event and a hot topic in recent years. The United States' vision of absolute supremacy in the global economy has clashed with a growing trade imbalance with China, rising competitiveness of Chinese high-tech enterprises, and an increase in China's investment exports [1]. US President Donald Trump has repeatedly increased tariffs on China since taking office. The official start of the trade war began after the United States placed a 25% tax on \$50 billion worth of Chinese goods and China also announced a similar tariff on the same scale to strike back. The Chinese stock market has been severely impacted by these occurrences. This paper tries to answer the question of how much impact these events will have on China's stock market and whether China can effectively deal with the crisis through a series of measures, including negotiation and tariff reduction of other countries.

It is not rigorous to say that the trade conflict has a limited effect on China's economy. The biggest omission in this statement is that it does not take into account the delay in the investment related to exports caused by trade uncertainty, thus underestimating the impact on China's economy. The trade war's overt impact can be expected, but its impact on investment prospects, entrepreneur confidence, the industrial chain, and upstream and downstream industries is difficult to predict.

Several recent research has provided ex-ante estimations of the trade war's impact from various aspects. According to Edward J. Balistreri, Christoph Böhringer, and Thomas F. Rutherford's working papers, The trade war between the United States and China has had a significant negative welfare impact on the global economy, with negative welfare impacts in the order of 1.02 percent and 1.71 percent for the US and China, respectively [2]. The impact on welfare will have a direct impact on people's livelihood. Additionally, the Chinese agriculture and oil industry are the first to be affected. Both import and export and manufacturing of China are restricted to some degree. Many research and statistics emphasize this point, demonstrating that the trade war has a considerable and long-term detrimental impact on the Chinese economy and stock market. According to the paper presented by Fen Ning, the negative impact of the Sino-US trade war on China's stock market is growing as the trade conflict between the two countries heats up, and the stock market, as an economic barometer, reflects that China's economic development has also been hampered. The US pressure on China will lead to a rise in manufacturing costs, the volatility of the stock market, and consumer prices [3]. However, it remains unclear what would China's stock market be if the trade war did

not happen and whether China can take steps, through industry reform or expanding business and trade with other countries, to avoid suffering a great loss during the trade conflict.

By Masahiko Tsutsumi's simulation scenario, the GDP in the US falls by 0.00% points or 0.24% points, while the GDP in China falls by 0.11% points or 0.88% points, which is the effect of retaliation by China [4]. And according to Mary Amity, Sang-Hoon Kong, and David Weinstein's working paper, the announcement of tariffs by the US and China reduced aggregate share prices by 6.0 percentage points in their sample of roughly 3,000 publicly traded companies, resulting in a \$1.7 trillion market value decline [5]. Many papers do similar work about predicting the expected loss of China and the US.

While different from those researches, The purpose of this research is to investigate the impact of Sino-US trade wars on the Chinese stock market. This paper uses financial economic models to analyze data of the Chinese stock market index from 3 months earlier than the Sino-US trade friction to the time before the corona-virus outbreak in China. This is mainly because the data before the trade war is needed to forecast the normal increase and the data after the outbreak of the corona virus cannot be a good representative since it is affected by more than one environmental factor, otherwise, it could be difficult to distinguish their effects respectively. Then the stock market's fluctuations will be shown and the differences between the assumption and the actual situation visualize the influence on it. This can be used to simulate a scenario without a trade war and establish a suitable model to calculate its corresponding value on a given date, thus predicting the expected growth of the Chinese economy and comparing it with the real data.

The significance of the research is to find a model that perfectly suits the features of the stock market when and when not suffering from external influence and use that model to discover the rule of the change in the stock market, therefore making a reasonable forecast and analysis. Here use the method of statistics. This is to confirm whether China can ride out this crisis and to what extent has China's stock market suffered from this trade conflict. In other words, it aims to find out how much China's economic development depends on the trade with the US and whether it is irreplaceable.

The rest of this paper is organized as follows: part 2 introduces the research design, which contains the data source, ADF-test, and model specification; part 3 reports empirical results; part 4 is discussion and part 5 is the conclusion.

2. Research Design

2.1 Data Source

Data of the Chinese stock market index, which are the Shanghai Composite Index (SH index) and Shenzhen Composite Index (SZ index), is derived from the Python Tushare package. TuShare is a well-known open-source Python financial data interface package and can ensure data authentication and accuracy. This paper uses the data of the stock index from 3 months earlier than the Sino-US trade conflict to the time before the corona-virus outbreak in China (avoiding another outside factor's interference). The data before the trade war is used as the representative of the stock market not affected by the external influences.

2.2 ADF-test

The ADF-test is used to check a random process's stability. The covariance value in any two periods depends solely on the distance or lag between the two periods, not on the actual moment at which the covariance is calculated, thus a random process is said to be weakly stationary if its mean and variance are constant throughout time. If the time series is not stable, it is very difficult to reflect on its past and future with models. To show the stability, the SH and SZ index's close price and rate of return are tested by lag 1 ADF test containing time trend term. The model of the ADF test is:

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \dots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t \quad (1)$$

where α is a constant, β is the coefficient on a time trend, and p is the lag order of the autoregressive process.

Table 1 gives the ADF test results of close price and rate of return of the SH index and SZ index:

Table 1. ADF-test

Variable	t-value	p-value
Close price, SH	-2.509	0.3234
Rate of return, SH	-15.665	0.0000***
Close price, SZ	-1.232	0.9037
Rate of return, SZ	-16.028	0.0000***

Note: 1% critical value -3.96, 5% critical value -3.41, 10% critical value -3.12. ***, ** and * indicate that the coefficients are significant at the levels of 1%, 5% and 10%, respectively.

It shows that for both the SH index and SZ index, the close price is unstable while the rate of return is stable.

2.3 ARMA Order-identification

There are two methods for the AR model's order-identification, one is information criterion, and another is PACF. A statistical model's quality is measured using an information criteria. It can be used to discover the order by considering how well the model fits the data as well as the model's complexity. ACF, which is also a useful tool for order identification, is a function of PACF of stationary time series. The AR process order of the Shanghai Stock Index is determined by information criterion while that of the Shenzhen Stock Index is decided by PACF function.

The AR(p) model assumes that the past of the time-series data plays an important role in determining its future. An AR(p) model can be written as:

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

where ϕ_0 is a constant and x_t is the value of the series in period t , while $\{a_t\}$ is a sequence of white noise with mean zero and variance σ_a^2 .

Table 2 gives the result of the information criterion for the SH index:

Table 2. Order-identification for SH index

Lag	FPE	AIC	HQIC	SBIC
0	0.000469	-4.82716	-4.82382	-4.81867*
1	0.000471	-4.82366	-4.81699	-4.80667
2	0.000472	-4.81973	-4.80973	-4.79425
3	0.000468	-4.82887	-4.81553	-4.79489
4	0.000462	-4.8412	-4.82453*	-4.79873
5	0.000462	-4.84138	-4.82137	-4.79041
6	0.000463	-4.83975	-4.8164	-4.78029
7	0.000464	-4.83865	-4.81198	-4.7707
8	0.000462	-4.84139	-4.81138	-4.76494
9	0.000456*	-4.85445*	-4.8211	-4.76951
10	0.000458	-4.85085	-4.81417	-4.75741
11	0.000459	-4.84901	-4.809	-4.74709
12	0.000461	-4.84519	-4.80184	-4.73477

Note: * indicates the choice of each information criterion.

Information criteria are all based on likelihood function and the decision rule for different kinds of information criteria is to choose the one with the lowest satisfying order to reduce complexity. Based on the decisions rule, choose order 4. The MA(q) model can be written as:

$$x_t = c_0 + a_t - \sum_{i=1}^q \theta a_{t-i} \quad (3)$$

where c_0 is a constant, x_t is the present value of the series, and $\{a_t\}$ is a sequence of white noise.

The way to recognize the order of MA is the auto-correlation function ACF. It can reflect the choice of the order very intuitively. Similarly, the lowest satisfied order should be chosen for the MA process. Figure 1 gives the result of order identification for the SH index:

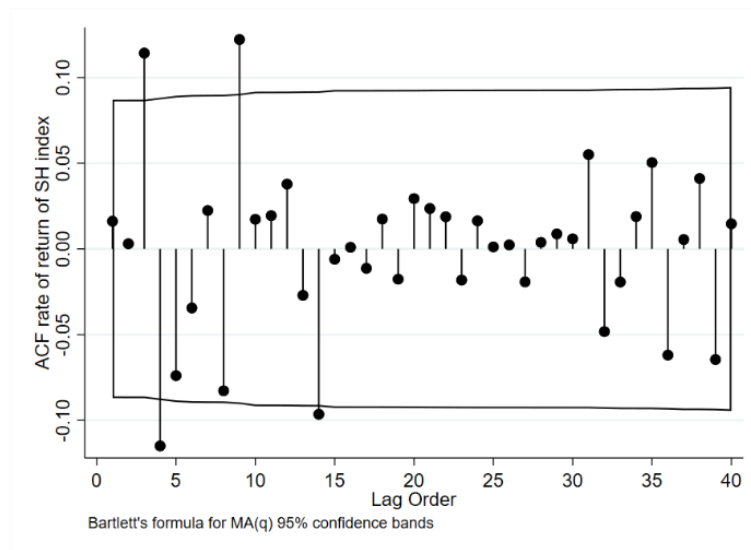


Figure 1. MA order identification for SH index

Choose order 3 for the MA model. Figure 2 gives the result of ARMA order identification for the SZ index:

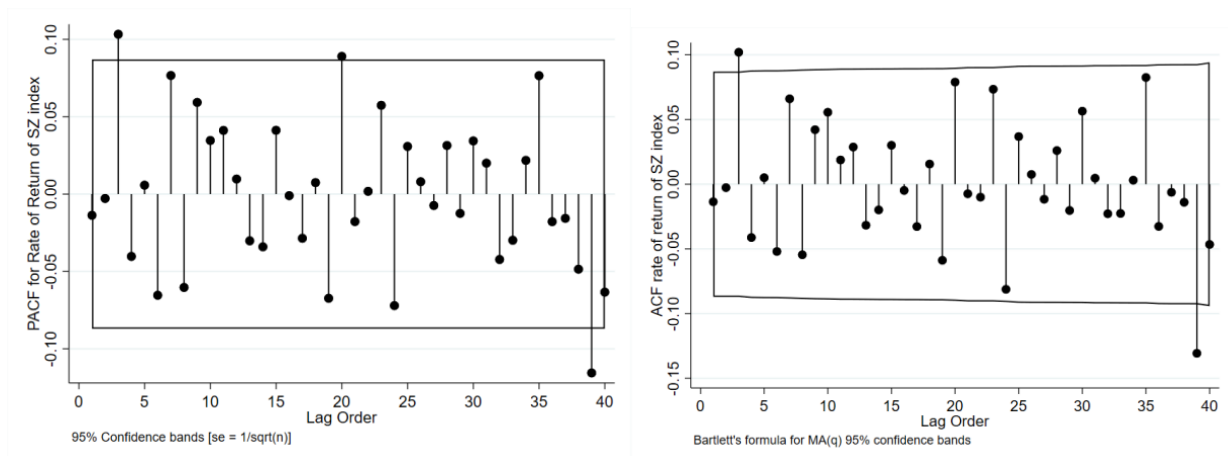


Figure 2. PACF and ACF for ARMA identification

The ARMA(p,q) model can be written as:

$$x_t = \phi_0 + \sum_{i=1}^p \phi x_{t-i} + a_t - \sum_{i=1}^q \theta a_{t-i} \quad (4)$$

where $\{a_t\}$ is a sequence of white noise, p and q are non-negative integers.

2.4 ARMA-GARCH Model Setting

The ARMA-GARCH model consists of the mean equation and variance equation. The mean equation is ARMA and the variance equation is GARCH (1,1) plus external variables. The external variables are imported dummy variables. The model imports two categories of dummy variables. The two categories are the time points at which the increased tariffs were announced by the US and the time point at which they were imposed to China's commodities respectively. The value of the dummy variable is equal to 0 before the selected time-point and is equal to 1 after that. The time points for the increased tariffs announced by the US are March 23, 2018, and September 18, 2018, which belong to the first category, and those for increased tariffs imposed to China's commodities are July 6, 2018, August 23, 2018, September 24, 2018, and May 10, 2019, which belong to the second category. There are six dummy variables.

Then the GARCH model is constructed, the mean equation is a constant, and the variance equation is successively put into the first type of dummy variables to generate N models. The first model is put into $D1t$ (the first dummy variable), and the second model is put $D1t$ and $D2t$ (the second dummy variable). And for the second type of dummy variables, the step is similar, putting into $D3t$, then $D3t$, $D4t$, and then $D3t$, $D4t$, $D5t$ and so on.

The GARCH model was proposed by Bollerslev, which added the autoregressive part of the basis of the ARCH model to reduce the parameters to be estimated and predict the future conditional variance more accurately [6]. The GARCH (p, q) model with external variables can be written as:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \dots + \alpha_q \varepsilon_{t-q}^2 + \beta_1 \sigma_{t-1}^2 + \dots + \beta_p \sigma_{t-p}^2 + \gamma D_t \quad (5)$$

where D_t is a dummy variable.

The most commonly used GARCH model is GARCH (1,1). The GARCH (1,1) model with dummy variable can be written as:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \gamma D_t \quad (6)$$

Take D_{1t} as an example, the dummy variable D_{1t} is defined as:

$$D_{1t} = \begin{cases} 1, & t \geq 2018/03/23 \\ 0, & t < 2018/03/23 \end{cases} \quad (7)$$

By using the ARMA-GARCH model, both returns and volatility can be predicted simultaneously. And its result can reflect the degree of the influence of the Sino-US trade war on the Chinese stock market. Then it is more convincing to confirm whether that is a long-term or short-term influence.

3. Empirical Results and Analysis

3.1 Shanghai Stock Index

Table 3 gives the results of the ARMA-GARCH model for the SH index:

Table 3. ARMA-GARCH model, SH index

	(1)	(2)	(3)	(4)	(5)	(6)
Mean equation						
AR (4)	-0.1081** (0.0423)	-0.1090** (0.0431)	-0.1097** (0.0424)	-0.1092** (0.0438)	-0.1149*** (0.0419)	-0.1143*** (0.0433)
MA (3)	0.1305*** (0.0469)	0.1321*** (0.0469)	0.1327*** (0.0472)	0.1335*** (0.0474)	0.1321*** (0.0471)	0.1145** (0.0463)
Variance equation						
D1	-0.2111 (0.2147)	-0.1132 (0.2471)				
D2		-0.1392 (0.1589)				
D3			-0.1025 (0.1660)	0.1332 (0.3003)	-0.0019 (0.3335)	-0.0337 (0.3228)
D4				-0.2569 (0.2592)	0.6502 (0.6032)	0.1537 (0.5912)
D5					-0.8693** (0.4344)	0.0326 (0.4220)
D6						-0.5815*** (0.1474)
ARCH	0.0416 (0.0351)	0.0406 (0.0348)	0.0458 (0.0334)	0.0464 (0.0337)	0.0172 (0.0181)	0.0307 (0.0330)
GARCH	0.7916*** (0.1914)	0.8047*** (0.1783)	0.7770*** (0.1818)	0.7885*** (0.1698)	0.9024*** (0.0843)	0.6701* (0.3715)
Constant	-9.3096*** (0.9543)	-9.3830*** (0.9425)	-9.3577*** (0.8814)	-9.4312*** (0.8678)	-10.1320*** (0.9070)	-8.8372*** (1.1678)

Note: The numbers in parentheses are standard errors for the coefficients, and all estimates are reserved to 4 decimal places. ***, **, and * indicate that the coefficients are significant at the levels of 1%, 5%, and 10%.

In the variance equation, we can see that none of the estimated coefficients are significantly greater than 0. That is, in the long run, the event that the US raised tariffs on China will not cause fluctuations in China's stock market, and China's financial market remains resilient.

Combined with the background information, it is reasonable to assume that the impact of the US increased tariffs on China's stock market will be short-term.

3.2 Shenzhen Stock Index

Table 4 gives the results of the ARMA-GARCH model for the SZ index:

Table 4. ARMA-GARCH model, SZ index

	(1)	(2)	(3)	(4)	(5)	(6)
Mean equation						
AR (3)	-0.4313 (0.2947)	-0.4286 (0.2952)	-0.4295 (0.2928)	-0.4295 (0.2928)	-0.4410 (0.3136)	-0.4311 (0.3664)
MA (3)	0.5479** (0.2740)	0.5455** (0.2751)	0.5463** (0.2727)	0.5464** (0.2727)	0.5519* (0.2908)	0.5279 (0.3439)
Variance equation						
D1	-0.1344 (0.3177)	0.1272 (0.3893)				
D2		-0.3840 (0.3560)				
D3			-0.2071 (0.2991)	-0.1349 (1.2125)	-0.5607 (1.9449)	0.2165 (0.4155)
D4				-0.0759 (1.1961)	1.6070 (2.1338)	-0.4253 (0.8489)
D5					-1.4312** (0.5883)	0.8488 (0.7015)
D6						-1.0145*** (0.162186)
ARCH	0.0615*** (0.0227)	0.0467** (0.0181)	0.0562*** (0.0201)	0.0556*** (0.0201)	0.0413** (0.0171)	0.0274 (0.0305)
GARCH	0.9064*** (0.0313)	0.9315*** (0.0244)	0.9174*** (0.0276)	0.9180*** (0.0275)	0.9383*** (0.0233)	0.8125*** (0.1065)
Constant	- 11.6552*** (0.5271)	- 12.0512*** (0.5797)	- 11.8149*** (0.4747)	- 11.8209*** (0.4752)	- 12.0785*** (0.4889)	- 10.3960*** (0.5919)

Note: The numbers in parentheses are standard errors for the coefficients, and all estimates are reserved to 4 decimal places. ***, **, and * indicate that the coefficients are significant at the levels of 1%, 5%, and 10%.

From the results of the variance equation, it can be found that the conclusion still holds for the small and medium-sized markets.

According to the empirical results, after the Sino-US trade war, China's financial market has shown a high degree of stability in the long run with a small fluctuation range. China's financial market is stable and normal, and market expectations are stable and normal. The A-share market shows relatively strong resilience and anti-risk ability. The fluctuation range of the A-share market is relatively small. Therefore, China's financial market can effectively deal with external risks in the long run. Since China's stock market took a direct hit day shortly after the trade conflict with the United States, this paper confirmed the long-term stability of China's stock market.

For the investors, a popular defensive manoeuvre against the inflationary effects of a trade war is commodities. Small-cap stocks may also be a viable option, as they represent companies that generate a higher proportion of their revenues domestically than internationally, and so are less likely to be damaged by a trade war. Looking for specific targeted areas in which one country may have leverage over another is also very important. For example, China has an abundance of rare earth and speciality metals, which are used as raw materials in everything from batteries to high-precision electronic equipment. Companies that manufacture rare earth and specialty metals may benefit if China decides to limit supply, leading prices to climb [7].

4. Discussion

From the results of the research, it can be found that the deep impact of the US-China trade war on China's stock market seems not that serious. The data of the Shanghai Stock Index and Shenzhen Stock Index shows that the negative impact does not last so long threatening China's economy, though experiencing huge losses in short term, and China is capable of managing this crisis and recovering in the long run.

According to recent study, the trade war has created significant barriers to China's economic growth and has harmed China's numerous industries [8]. Its focus was on the influence on the Chinese stock market in the days following the application of new tariffs by the US, with empirical evidence demonstrating the size of the impact.

There is no direct empirical evidence of the impact of Sino-US trade tensions on the Chinese stock market. As a result, this paper examines the impact of an event on the stock market and is based on events that occurred at various points in time and reflects its negative effect at the same time.

From the perspective of the transmission mechanism of the trade war, price levels, labor supply, technological level, investor attitude, foreign investment, macroeconomic policies, and the international environment all influence the stock market. Over time, trade battles weaken the protected domestic industry. If there is no outside rivalry, companies in the industry do not need to innovate. When compared to foreign-made goods, the local product's quality will gradually decrease [9]. It isn't restricted to that, however. The trade war will not produce the results that either side desires, and the global economy is beset by uncertainty that threatens its long-term prospects [10].

5. Conclusion

Assume Shanghai Stock Index and Shenzhen Stock Index as the sample, the research measures the influence of the trade war between the US and China on the Chinese stock market. The empirical results show that in the long run, the event that the US raised tariffs on China will not cause fluctuations in China's stock market, and China's financial market remains resilient. Combined with the background information, it is reasonable to assume that the impact of the US increased tariffs on China's stock market will be short-term.

Although the influence is just short-term and the damage it caused to the Chinese stock market is recoverable, it cannot be ignored. Whether China can survive this crisis depends on the success of the structural reform of the Chinese economy. Many Chinese companies suffered varying degrees of loss and their operating conditions directly or indirectly influence the stock market. And many other factors also affect the stock market, which is the deeper reasons and are not analyzed in this research. Therefore, in the long run, if China takes reasonable measures to cope with the trade war, its ultimate impact will be limited. However, it is undeniable that China's economy has suffered a great loss after the trade war, which will do more harm than good.

References

- [1] L. Kapustina, L. Lipková, Y. Silin, and A. Drevalov, US-China Trade War: Causes and Outcomes, in SHS Web Conf., Innovative Economic Symposium 2019 – Potential of Eurasian Economic Union (IES2019), Volume 73, EDP Sciences, 2020, p. 2. DOI: <https://doi.org/10.1051/shsconf/20207301012>
- [2] E. J. Balistreri, C. Böhringer and T. F. Rutherford, Quantifying Disruptive Trade Policies, in: CESifo Working Papers no. 7382, Munich Society for the Promotion of Economic Research, 2018, pp. 15-17
- [3] Feng N., Wu M. and Pang Y., An Analysis of the Impact of the Sino-US Trade War on China's Stock Market, in: Finance, vol. 10, No. 3, Hans Press, 2020, pp. 244-250. DOI: <https://doi.org/10.12677/FIN.2020.103024>
- [4] M. Tsutsumi, The Economic Consequences of the 2018 US-China Trade Conflict: A CGE Simulation Analysis, in: CIS Discussion Paper Series no. 676, Institute of Economic Research, Hitotsubashi University, 2018, pp. 9-22

- [5] M. Amiti, S. H. Kong and D. Weinstein, THE EFFECT OF THE U.S.-CHINA TRADE WAR ON U.S. INVESTMENT, in: NBER Working Paper No. 27114, 2020, pp. 1-32. DOI: <https://doi.org/10.3386/w27114>
- [6] T. Bollerslev, Generalized autoregressive conditional heteroskedasticity, in: Journal of econometrics, vol. 31, issue 3, Elsevier, 1986, pp. 307-327. DOI: [https://doi.org/10.1016/0304-4076\(86\)90063-1](https://doi.org/10.1016/0304-4076(86)90063-1)
- [7] S. Rae and J. Lin, Can Investors Make Money in a US - China Trade War?, 2018
- [8] Yin Z., Lu Z. and Pan B., The Impact of the Sino-US Trade War on China's Stock Market: An Event-Based Analysis, in: Journal of Management, vol. 33 No. 1, 2020, pp. 18-28. DOI: <https://doi.org/10.19808/j.cnki.41-1408/F.2020.01.003>
- [9] B. A. Iqbal, N. Rahman and J. Elimimian, The future of global trade in the presence of the Sino-US trade war, in: ECONOMIC AND POLITICAL STUDIES, Routledge Taylor & Francis Group, 2019, pp. 1-15. DOI: <https://doi.org/10.1080/20954816.2019.1595324>
- [10] K. Amadeo, Trade Wars and their Effect on the Economy and You, 2022