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# *The Impact of COVID-19 on the US Oil Stock Market and Currency*

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***Abstract:*** The purpose of this article is to examine the impact of covid on the U.S. exchange rate and the oil market. Previous scholarly studies have shown that currency and oil markets have a significant impact on the global economy, so the article wants to investigate whether the relationship between the two will be stronger under the influence of pandemics and the impact on each. By building a table of daily U.S. to RMB exchange rates during the pandemic, and a chronologically derived stock index with corresponding graphs and literature data, it concludes that currency exchange rates are an irreplaceable determinant of stock market returns. The 0.534% depreciation of the U.S. dollar under the impact of the epidemic improved the average stock market return.

***Keywords:*** COVID-19, US oil stock, GARCH, Exchange rate.

## 1. Introduction

For nearly half a century, the relationship between stock market changes and currency exchange rate and current affairs and politics has been the main research object of economists. Many scholars have conducted many data comparison and research on issues affecting stocks and exchange rates in real time, trying to understand the changes of various stocks in various current events. For example, COVID-19 has caused a strong disruption and shock to established and mature economic, financial, and social systems around the world, and has had a very serious impact on the global financial market. The United States is a highly developed financial and economic country in the world, and its medical facilities are also at the top level. This work's goal was to collect data from a timeline throughout the pandemic and to try to find evidence that stock market and currency returns in the United States were closely correlated with current events during the pandemic (the study period is From April 26, 2019, to December 3, 2021, and beyond). The comparison with the period before THE outbreak of COVID-19 is to compare the size and way of the impact on the stock market before and after the outbreak. Meanwhile, this work will also carry out the cognition of the current situation and forecast the future situation according to the current data.

Due to the outbreak of COVID-19, countries around the world are in a panic, and markets have been affected by volatility. The oil industry's output is changing as the global economy falters. As

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people around the world cut back on their outdoor activities to better contain the virus, the economy and people's incomes are suffering. Regional demand for oil and crude products has also fallen sharply as economic activity has fallen sharply, and oil prices have collapsed as suppliers have added extra supplies to boost their profits. At the same time, prices of petroleum-based products and a range of products that rely on oil for expansion have been affected. On the other hand, with the impact of oil and other important enterprises to the country, America's own currency also began to decline gradually over time. However, with the gradual recovery of the economy and the government's assistance, the oil price in the United States has partially recovered, and at the same time, enterprises have reduced part of the additional products and provided some new market demand.

Currency exchange rates are relative rather than absolute, and this is how they are responding to the COVID-19 pandemic. Countries with large increases in daily new cases often have devalued currencies. When countries make progress in epidemic prevention and control, they usually create favorable conditions for currency values to rise. From a fundamental point of view, the impact of COVID-19 on the foreign exchange market is mainly because the epidemic has changed the market's relative expectations of future economic growth. When a region or country is affected by the pandemic, economic growth is expected to decline due to fears that some economic activity will be blocked. By contrast, as the epidemic is brought under control and the daily number of confirmed cases gradually declines, plans and sentiment for an economic restart will dominate the market. As Putnam (2020) said, at the same time, when The Chinese economy gradually recovered in the summer of 2020, the epidemic spread from the US sunbelt and the US economic growth expectations were hit by the recurrence of the epidemic. The strong rebound in the renminbi from July to September was partly explained by the effective containment of the virus in China and the continuing spread in the US. The exchange rate of the yuan against the DOLLAR rose from 7.16 in late May to 6.75 at the end of September 2020, an increase of about 6%. The currencies of European countries with the same currency were all hit hard by the epidemic at the same time, but miraculously, the euro-dollar exchange rate rebounded and rose sharply by August 2020.

As provided in the paper by Camp, David, Stephen, and Sitter (2020), the calculation of crude oil PPI is based on monthly price data from a sample of US oil producers, using a monthly reference period. However, under the influence of the COVID-19 pandemic and the stock market, little progress has been made. The outbreak of 2019 will also affect investor expectations and may lead to a decline in stock returns. However, as the government intervened in the market, subsidized some important enterprises, and manipulated the market transactions, the trend of the crude oil market began to smooth out, and then showed a recovery and rebound in the following time.

Most of the studies on the relationship between oil stock market and currency exchange rate have concluded in a relatively uniform way that the two are inversely proportional to each other. There are many articles supporting this point, which will be one of the research objectives of this paper, as we can see in this paper. If interested in this topic, please refer to the articles by authors such as Farley (2020) and Rejeb (2017). Therefore, the objective of the article is clear. This is a paper that examines the impact of COVID-19 on the U.S. dollar exchange rate and the U.S. oil stock market and the relationship between them. The main entry point of the article is to document and analyze the fluctuations in the relationship between the U.S. dollar exchange rate and oil stock returns due to the COVID-19 situation. It was found that after the COVID-19 outbreak, the dollar exchange rate had a much weaker impact on the market than in normal times, and the value of the dollar has been declining as the pandemic continues to affect the market. In contrast to the value of the dollar, the oil market experienced the effects of the pandemic. Although the oil stock market also suffered severely in the early stages, it gradually recovered and even surpassed its pre-pandemic peak. Therefore, based on some information and data, it can be tentatively inferred that the dollar exchange rate is inversely proportional to the value of the oil stock market. The impact of COVID-19 on global

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financial markets will also be covered; data will be provided to support the article's arguments, simulations, and future projections based on past and present trends. The article will also include many images and data tables to better present the data; some notable papers will also be cited and summarized.

## 2. Literature Review

China's global economy be caught off guard as New Coronavirus's disease spread and worsened outside China. It fell into a new round of sharp adjustment. The epidemic has created an additional negative impact on the global economy. The impact on the global energy industry obviously exceeded the initial expectations.

### 2.1 China's oil demand fell

According to the report of the New York Times and the Houston Chronicle on February 4, just a few weeks after the outbreak of the virus, China's daily oil demand has decreased by 20% due to the contraction of aviation, road traffic and production. As China consumes 13% of the world's crude oil production, it can be said that every oil company in the world has been hit to a certain extent. American oil companies are struggling with falling profits, rising layoffs and weakened international demand due to the virus. On the same day, the price of U.S. crude oil fell below $50 a barrel. ConocoPhillips reported on the same day that its quarterly profit decreased by more than 60%, compared with us $1.9 billion in the same period in 2018, it is only US $720 million at present. ConocoPhillips has been favored by Wall Street for its conservative spending and good dividends, but it is not immune to oil prices below $50 / barrel.

In Asia, considering the epidemic situation, international airlines flew around China, causing serious damage to the aviation fuel market. In January, aviation fuel price and production profit margin showed the largest monthly decline in more than 10 years. The supertanker freight rate from the Middle East Gulf and the US Gulf route to Asia has fallen to the lowest level since mid-September last year. Some analysts predict that China's daily oil demand may decrease by 250000 barrels in the first quarter of 2020. S & P said the virus would reduce global oil demand by about 4% in February, or 4.1 million barrels a day. For the whole year, demand is expected to decrease by 290000 to 1 million barrels per day. According to a public opinion survey released by Reuters on February 28, oil prices will be under pressure this year due to the impact of the spread of the new coronavirus on the global economy and demand. This has cast a shadow over OPEC's efforts to curb production to support the market.

According to the above survey of 42 economists and analysts, the average price of Brent crude oil in 2020 is US $60.63 per barrel, down about 5% from US $63.48 the previous month. So far this year, the global benchmark average price is US $59.8. "In the first quarter, we expect the economic chaos caused by the epidemic to put heavy pressure on oil demand and prices," said Caroline Bain, a financial analyst.

### 2.2 US oil prices reacted strongly

Recently, with the emergence of more COVID-19 cases around the world, the industry is concerned about the decline in energy demand. After reports that dozens of people in New York were monitored for possible exposure to COVID-19, people worried about the outbreak of the outbreak in the United States. At present, the international oil price is nearly 30% lower than the high in January, and the U.S. crude oil price has fallen below $50 a barrel.

According to Reuters, as the market is worried about the sharp decline in oil prices and commodity prices, both U.S. and European stock markets have suffered the largest decline since mid-2016.

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On February 24, international oil prices plunged nearly 3% to a one week low. As of 1:58 GMT, Brent crude oil fell $1.69, or 2.9%, to $56.81 a barrel. U.S. crude oil futures fell $1.40, or 2.6%, to $51.98. At 2:04 p.m. EDT on February 26, Brent crude oil fell $1.77, or 3.2%, to $53.18 a barrel, while West Texas medium crude oil fell $1.45, or 2.9%, to $48.45 a barrel. Michael McCarthy, chief market strategist of CMC markets in Sydney, an online financial services dealer, said on February 24: "In the middle of last week, the consensus of all parties was very clear, that is, this is a temporary economic impact, which will at least be offset by the actions of the central bank. However, as seen with the reaction of European and U.S. markets on the night of Feb. 21 and the news on Feb. 15 about the spread of the virus around the world, investors are now questioning previous assumptions about economic growth. This will, of course, put pressure on the oil markets."

Stephen Ince, chief market strategist of Australian axicorp, a financial service provider, also said in a report: "we should not underestimate the economic chaos. Because the super disseminator of the virus may cause a sharp decline in global business activities, the scale of which is unprecedented in the world." However, the current crude oil production of many countries has increased a lot. For example, the United States continues to produce more oil in the global oversupply market, which also boosts the benchmark oil price of the United States. On February 4, it fell to $49.61 a barrel, compared with the previous month.

### 2.3 Decline more than 20% over the previous year

The transportation situation affected by the epidemic and the warmer winter all hit the growth of market demand, which led to oversupply in the oil market. In addition, although the development of the epidemic situation will bring more uncertainty to the international oil price, the oil price may rise slightly. Due to the commitment of the organization of petroleum exporting countries to keep the global market supply close to balance, the threat of sanctions against Russian crude oil producers by the United States and the interruption of supply in some countries, including Libya, the oil price is likely to rise.

## 3. Model and results

As shown in Figure 1, the exchange rate between the Chinese yuan and the U.S. dollar fluctuates considerably from 2015 to 2020. In the middle of this period, the highest exchange rate value reaches 7.18 (2019/ August/26); while the lowest rate is as low as 6.19 (2015/ March/30). What can be seen in the graph is that the highest exchange rate was reached in the summer of 2019, when China was suffering from the COVID-19 outbreak. However, from 2019 until 2022, the foreign exchange rates of both currencies are gradually decreasing [1].

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Year, Jul/03/2015 to Dec/03/2021

Figure 1: The exchange rate of the U.S. dollar to the Chinese yuan from 2015 to 2021.

Table 1 records the China/US foreign exchange rates - historical annual data from 2015 to 2022. It includes average closing price; annual opening price; annual high price; annual low price; annual closing price; annual % change.

Table 1: China/US foreign exchange rates-historical annual data from 2015 to 2022.

| Year | Average Close Price | Year Open | Year High | Year Low | Year Close | Annual % Change |
|---|---|---|---|---|---|---|
| 2022 | 6.36 | 6.36 | 6.38 | 6.33 | 6.33 | -0.43% |
| 2021 | 6.45 | 6.53 | 6.57 | 6.34 | 6.36 | -2.71% |
| 2020 | 6.90 | 6.96 | 7.17 | 6.52 | 6.53 | -6.18% |
| 2019 | 6.91 | 6.88 | 7.18 | 6.69 | 6.96 | 1.23% |
| 2018 | 6.63 | 6.49 | 6.98 | 6.26 | 6.88 | 5.72% |
| 2017 | 6.76 | 6.96 | 6.96 | 6.49 | 6.51 | -6.32% |
| 2016 | 6.65 | 6.53 | 6.96 | 6.45 | 6.95 | 7.18% |
| 2015 | 6.28 | 6.20 | 6.49 | 6.19 | 6.48 | 4.52% |

As seen in the table 1 above of the dollar to yuan exchange rate provided by the Federal Reserve, the dollar was in a range of 6.7-7.1 against the yuan from November 2018 to December 2019; this was the period when COVID-19 first spread from China and had a serious impact on China. During this period, the dollar price climbed from 6.9 in 2018 to 7.1 in 2019, and even almost reached a high of 7.2 at one point. However, as the epidemic spread further around the world, it in turn affected the global economy. At the same time, the U.S. was also affected, which resulted in the dollar exchange rate generating constant fluctuations during 2020, varying back and forth between 7.0 and 6.7 on average. Today, the dollar remains in the range of 6.3-6.4 and continues to decline slightly [2-4].

Selected descriptive statistics. Table 2 reports descriptive statistics (i.e., mean, standard deviation

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(SD), maximum (Max.), and minimum (Min.). the Narayan and Popp (NP, 2010) structural break unit root test, skewness, autoregressive conditional heteroskedasticity Lagrange multiplier (ARCHLM) test for heteroskedasticity, and the Jarque-Bera (JB) test (p-values are reported). The variables are the logarithmic percentage return (ER) of the exchange rate of the U.S. dollar, the logarithmic percentage return and percentage return (SR) of the Nikkei Stock Average Price Index, the change in the Dow Jones Index (DOW), and the Chicago Board Options Exchange Market Volatility Index (VIX). The article collates data from three subsamples. the results in group A are based on data covering the COVID-19 sample (31/12/2018 to 17/08/2020); the statistics in group B cover the pre-COVID-19 sample (03/01/2010 to 31/12/2019); the statistics obtained in group C cover the pre-COVID-19 corresponding COVID samples (31/12/2018 to 30/07/2019), in line with the number of observations in the COVID-19 sample (group A) [3-7].

Table 2: descriptive statistics (i.e., mean, standard deviation (SD), maximum (Max.), and minimum (Min.)

| **Panel A: COVIS-19 sample** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SR | -0.23 | 10.29 | 42.6 | -72.03 | -1.610 | 20.37 | -76.01 | 16.8 | 2055.35 |
| ER | -0.005 | 0.289 | 1.50 | -0.712 | 1.253 | 7.868 | -4.449 | 5.22 | 197.36 |
| DOW | -0.013 | 2.811 | 10.8 | -13.09 | -0.6321 | 8.44 | -133.37 | 65.31 | 205.35 |
| VIX | 0.232 | 10.162 | 39.1 | -26.62 | 1.5149 | 6.722 | -17.367 | 21.94 | 151.64 |
| **Panel B: Pre-COVID-19 Sample A** | | | | | | | | | |
| SR | -0.011 | 2.1456 | 14.2 | -15.11 | 0.03151 | 7.55024 | -1224.31 | 202.63 | 2118.32 |
| ER | 0.001 | 0.1859 | 1.82 | -1.242 | 0.90921 | 16.4241 | -23.2432 | 80.66 | 18771.85 |
| DOW | 0.04 | 0.8888 | 4.12 | -6.183 | -0.4714 | 6.77862 | -24.7551 | 420.4 | 1551.43 |
| VIX | -0.01 | 7.7685 | 76.8 | -35.06 | 1.11319 | 9.79455 | -2.06684 | 118.72 | 5229.42 |
| **Panel C: Pre-COVID-19 Sample B** | | | | | | | | | |
| SR | 0.13 | 2.0983 | 5.68 | -8.724 | -0.7804 | 5.14476 | -6.51489* | 15.15 | 45.44 |
| ER | 0.02 | 0.2689 | 1.56 | -0.707 | 1.40965 | 10.0547 | -2.55741* | 4.75 | 372.76 |
| DOW | 0.08 | 0.8018 | 3.11 | -2.828 | -0.4936 | 5.76824 | -3.01426* | 24.53 | 55.78 |
| VIX | -0.28 | 8.1879 | 33.4 | -19.93 | 0.79712 | 5.29134 | -3.01426* | 24.96 | 50.32 |

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Putting aside the impact on the dollar exchange rate, the U.S. stock market also suffered serious impacts due to the epidemic, and the most serious and volatile of these are the oil stock market. Due to the impact of the COVID-19 epidemic, U.S. stocks experienced a rare short-term "meltdown" in March 2020 and quickly turned into a technical bear market. However, in the second half of the year, U.S. stocks quickly rebounded sharply from the March lows and not only recovered their losses before closing the year with a sharp economic contraction but even hit new all-time highs in the stock market several times. Signs of a global recession continue to emerge in 2019, and the downward trend is being accelerated by a new crown epidemic that is deepening the recessionary phenomenon. 2.9% global economic growth in 2019, which is defined by the World Monetary Fund (IMF) as a recessionary phenomenon when economic growth is below 2.5%. OECD (Organization for Economic Cooperation and Development) estimates that for 2019-2020, the global economic growth rate may even be reduced to 1.5%. Later facts also proved the OECD's prediction. By 2020, the three major stock indices of the U.S. stock market fell, and the S&P 500 recorded the largest quarterly decline since the financial crisis. This also led to a redefinition of the epidemic's impact on the global economy. As the epidemic worsened further globally and economic activity stalled, the S&P 500 and the Dow ended the first quarter of 2020 down more than 20% from the end of 2019, making it one of the fastest bull-to-bear turnarounds in history. In March 2020, oil prices fell sharply in Asian stock markets due to the epidemic; the next day, the S&P 500 fell by 7% when the U.S. stock market opened, triggering a meltdown. After 15 minutes of the meltdown, U.S. stocks continued to trade, and the three major stock indexes fell by more than 7% that day - the Dow Jones index closed more than 2,000 points or 7.79%; the S&P 500 closed 225.81 points or 7.6%; the Nasdaq Composite Index closed 624.94 points or 7.29%. A series of data shows that U.S. stocks, especially oil stocks, are falling sharply due to the epidemic's impact. Funds are flocking to relatively low-risk industries and stock markets, with U.S. Treasury yields falling below 1%, the lowest in history, and prices of gold and other preservatives moving higher. Countries issued fiscal policies and invested money in markets to slow down the recession to slow down the effects of the economic decay, leading to a 9% spike and then a 12% plunge in the S&P 500 for two consecutive trading days. The Dow Jones Industrial Average closed 410.32 points, or 1.84%, higher at 21,917.16 after the first quarter of 2020; the S&P 500 index closed 42.06 points, or 1.6%, higher at 2,584.59; and the Nasdaq index concluded 74.05 points, or 0.95%, higher at 7,700.10.

Table 3 documents the results generated by controlling or not controlling for the Dow Jones and Chicago Board Options Exchange market volatility indices for the QMLF data, and the differences in the data generated by controlling for endogeneity or not. The results in panel A are based on data from the COVID-19 sample; the statistics in panel B are from the pre-COVID-19 sample; the statistics in panel C are from the matching pre-COVID-19 sample; and the data from all three COVID-19 sample groups improve the comparison of the data when endogeneity is controlled or not.

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Table 3: QMLF data controls or does not control for the results generated by the Dow Jones and Chicago Board Options Ex-change market volatility indices, as well as for endogenous data differences.

| Panel A:QMLF | | | Panel B:QMLF with control for endogeneity | | | Panel A:QMLF |
|---|---|---|---|---|---|---|
| No controls | DOW controls | DOW+VIX controls | No controls | DOW controls | DOW+VIX controls | No controls |
| -1.4521*(0.8152) | -1.2227**(0.5867) | -1.2660**(0.5766) | -1.5626*(0.8543) | -1.6434*(0.9860) | -1.2438***(0.4675) | -1.4521*(0.8152) |
| -0.9707***(0.1893) | -0.769073***(0.176851) | -0.764174(0.176484) | -0.969343***(0.189646) | -0.772023***(0.176965) | -0.767110***(0.176642) | -0.9707***(0.1893) |
| -1.4240***(0.5409) | 0.6241***(0.1603) | -0.6450(0.5603) | -2.5703(1.7443) | -0.8690(0.5325) | -5.3403(5.3232) | -1.4240***(0.5409) |

Table 4 shows the volatility of financial asset returns by using GARCH to count and measure three sample data sets (i.e., for three different periods of time that are in the COVID-19 period). Concerning GARCH. The statistical model of generalized autoregressive conditional heteroskedasticity (GARCH) is used to examine time-series data in which the variance errors are continuously autocorrelated. The variance of the error terms is assumed to follow an autoregressive moving average process in the GARCH model.

Table 4: the volatility of financial asset returns by using GARCH to count and measure three sample data sets

| | GARCH(1,2) | GARCH(2,1) | GARCH(2,2) |
|---|---|---|---|
| COVIS-19 sample | -1.4359**(0.6837) | -1.4603*(0.8135) | -1.4829**(0.6761) |
| Pre-COVID-19 Sample A | -0.971416***(0.189665) | -0.974907***(0.190170) | -0.984977***(0.190853) |
| Pre-COVID-19 Sample B | -1.5853***(0.5437) | -1.5526***(0.5259) | -2.0044***(0.5455) |

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The impact of the epidemic was also having an impact on oil prices. As a result of the epidemic, the demand for oil in various countries has slowed down, negatively impacting oil supply and demand activities. However, the control and timely adjustment of market strategies among countries led to a slow recovery in their economies from mid-2020 onwards, and during June and July 2020, global oil demand showed greater growth, with demand increasing to 6.0 million barrels per day and 3.1 million barrels per day; the growth in these two months was a sign of a gradual recovery in the oil market, while global oil demand in August, as well as September, increased by Global oil demand, increased by 0.6 million BPD and 1.3 million BPD in August and September respectively. US crude oil production was also impacted, falling to a new low of 10 million barrels per day (BPD) in May 2020, the lowest level in the last two years, before rebounding to 11 million BPD in July. However, crude oil production recovery then stagnated, with US crude oil production anticipated at 11.2 million BPD in September, but then declining to 11 million BPD by summer 2021. By the summer of 2021, US crude oil output is predicted to drop to 11.0 million barrels per day, before rising to 11.2 million barrels per day in October 2021. US crude oil production falls from 12.2 million barrels per day in 2019 to 11.5 million barrels per day in 2020 and 11.1 million barrels per day in 2021 throughout the year [2,5,8-11].

## 4. Conclusion and Conjecture

In this paper, the impact of the epidemic on the oil equity market is analyzed by assessing the exchange rate between the U.S. dollar and the Chinese yuan in recent years. The expectation is that COVID-19 has had a significant impact on U.S. currency exchange rates and oil stock returns due to COVID-19 and its increasing impetus on the financial and economic system.

COVID-19 is thought to have influenced the link between exchange rates and oil stock returns in the US. It can be concluded that currency exchange rates are an important determinant of stock market returns that cannot be replaced using daily U.S. currency exchange rates during the epidemic, as well as stock indices, synthesized chrono-logically in a table and with corresponding graphs and literature data. The main contribution of the article is the finding that during COVID-19, when the dollar depreciates by one standard deviation, equivalent to 0.534%, it improves the average stock market return. The proportional increase in stock returns before COVID-19 is substantially higher. The essay concludes that, as the function of currency exchange rates in affecting the stock market has grown stronger during the COVID-19 pandemic, the economy and financial system would suffer increasingly severe impacts and losses as the epidemic spreads. Therefore, the forecast for future currency exchange rates is for a brief, small recovery due to national policies, only to continue to fall again soon after. (Due to past reference data) For the stock market, some stocks will rise (e.g. technology stocks), while energy stocks such as oil will recover more slowly.

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