

Exploring the Impact of COVID-19 on Financial Derivatives Markets

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Abstract. Currently, financial derivatives are important financial instruments. Financial derivatives can provide investors with the opportunity to hedge, speculate, and arbitrage. But due to the impact of COVID-19. The performance of financial derivatives has changed dramatically compared to the pre-epidemic period. This dissertation focuses on the performance of three major financial derivatives which include futures, options, and credit under COVID-19. The phenotypes of these three major financial derivatives are analyzed separately. In this paper, we examine the extensive literature to demonstrate the changes in financial derivatives during COVID-19. By collecting a large amount of data about financial derivatives during the COVID-19 period and before. And the data are quantitatively analyzed to show the specific performance of financial derivatives under COVID-19. The study found that there is a huge variation in the performance of these three financial derivatives in COVID-19. For futures, foreign performance futures can bring a negative impact on financial markets. As for domestic, the performance is different during the emergency resistance period and the normalized resistance period. The performance of the emergency resistance period is significantly less than the normalized resistance period. For options, the volatile market sentiment and panic caused by recurring epidemics affect investors' judgment, which leads to changes in the implied volatility of options and affects the price of options. For swap specify its basic means of operation in an epidemic state and the basic types.

Keywords: Financial derivatives; COVID-19 pandemic; uncertainty; volatility; strategies.

1. Introduction

A financial derivative is a contract based on an underlying financial instrument whose value is based on one or more underlying assets or indices. Forward, futures, swap, and option contracts are the four fundamental categories of contracts. Financial instruments that combine elements of forwards, futures, swaps, and options are also considered financial derivatives. Derivatives have long been a topic of interest to researchers, policymakers, and financial institutions. It has a crucial role directly in the overall financial system. According to Huan and Parbonetti (2019), the derivatives market has experienced substantial growth over the past 15 years, with the total notional amount of unsettled OTC derivatives reaching \$493 trillion at the end of 2015, an increase of 424% from 2000 [1]. Financial derivatives are extremely important to the development of the world's four largest economies [2]. These represent the fact that financial derivatives have an important place in the overall financial system.

The types of financial derivatives most readily available to investors are futures, options, and swaps. Most of the research on these three main financial derivatives is based on the analysis of pricing models, and a great deal of theoretical and practical research has been carried out. Scholars have used non-parametric testing methods, structural risk rate models for credit risk, and the modeling of corporate payment policies in a barrier options framework [3]. There are also studies related to the valuation of financial derivatives. As Chen and Chan (2002) mention the use of Monte Carlo methods

for the valuation of financial derivatives [4]. However, there are no academic studies on the performance of financial derivatives specifically during the COVID-19 period. Then how these three main categories of financial derivatives specifically performed under the influence of COVID-19 is not understood by scholars. A study of this performance would be of great interest to the financial system.

This study provides a specific analysis of the performance of three major financial derivatives including futures, options, and swaps in the context of the 2019 global outbreak of COVID-19. This performance is placed in the context of an objective analysis of the literature in recent years. This study will present the foreign and domestic performance of futures separately, to find commonalities between the two performances. For options, representative indicators such as implied volatility are used to provide an objective picture of the performance of the options in question under COVID-19. For swaps, we describe their basic operational steps and basic types. The changes in foreign exchange in the context of COVID-19, the changes in interest rates, and the use of swaps by many companies in this period to maintain economic stability in a difficult period for the country.

2. Futures

As a highly important financial derivative in the financial market, futures suffered a huge impact during the COVID-19 in early 2020, with the stock index futures market falling by 10.64% in the same period. In this paper, we analyze the impact of COVID-19 on futures from both domestic and foreign markets.

First, we analyze the foreign futures situation. Since the global outbreak of COVID-19, many scholars have studied and analyzed the impact of the epidemic on the global futures market from different perspectives. Jo et al. (2023) studied the oil futures market in Market efficiency and information flow between the crude palm oil and crude oil futures markets [5]. The market efficiency of CPO futures is examined in this study and contrasted with that of the WTI futures market. Although the WTI futures market is significantly more liquid than the CPO futures market, weak-form EMH still holds for both markets. After looking at speculative trading activity in both markets, they discovered that while it has no detrimental impact on price fairness in the CPO futures market, it crowds out the role of liquidity in the WTI futures market's market efficiency. We show evidence of robust market integration between CPO and WTI futures based on the market efficiency of both of these futures markets, i.e., there is a comparable amount of information flow from one market to the other. They investigate the impact of speculation in the market integration of the two futures markets using the COVID-19 pandemic as a natural experimental setting. They discover that after the pandemic, mutual information flow is increased since there is less speculation. For investors, policymakers, and end users, this study has ramifications. Secondly, because WTI and PO futures have a close relationship, numerous market participants in CPO can closely monitor events relating to crude oil to generate expectations about its price movements. Second, because bidirectional causality guarantees the existence of a dynamic correlation between CPO and WTI futures, investors can utilize WTI futures as a hedging instrument against CPO futures. As long as there is a comparable amount of information transmitted between the two markets, this dynamic hedging approach might be used consistently. Their findings also have ramifications for decision-makers in government. Compared to the WTI futures market, the CPO futures market is subject to tougher controls. The CPO futures market's information efficiency could be negatively impacted by these stringent regulations, which could lead to market friction and investment huddles. Yet, due to limited speculative demand caused by rigorous supervision, the CPO futures market is equivalent to the WTI futures market in terms of information efficiency. As a result, when lawmakers relax CPO futures market laws, they should keep an eye on how information is shared with the WTI futures market. Instead, an imbalanced regulation between the two could lead to regulatory arbitrage and market distortions. Extending trading hours, for instance, might boost the CPO futures market's liquidity, yet loosening the daily

price change limit might boost speculative trading by escalating herding behavior, which would then degrade the market's quality.

The next study examines the domestic futures situation. In the research on the COVID-19 pandemic impact on China's Stock Index Futures Market, Han (2022) focuses on the CSI 300 stock index futures prices and illustrates the impact of COVID-19 on the CSI 300 valuation futures prices by constructing a VAR fitting model [6]. The study finds that the gap between the fitted and actual values of the model is small before the COVID-19 outbreak in January 2020. The gap between the fitted and actual values of the model and futures is large at the beginning of the COVID-19 outbreak, and the gap between the fitted and actual values starts to become smaller in January-March 2021. This finding indicates that the presence of favorable news in the market creates a positive impact on the stock index futures prices. Ye (2022) studied China's steel futures market in his paper and fitted the time-varying characteristics of steel futures price returns through an ARMA model [7]. The results showed that COVID-19 presented a significant impact on the volatility of China's steel futures market. The article divides the epidemic into two phases: the emergency anti-epidemic period and the normalized anti-epidemic period. The data reflects that the steel futures price volatility in the normalized anti-epidemic period is about three times higher than that in the emergency anti-epidemic period, indicating that the steel futures market has higher sensitivity to the normalized anti-epidemic market.

3. Options

There is no doubt that the impact of Covid-19 on financial options is enormous. The goal is to analyze the effects of COVID-19 on option pricing, examine changes in options trading strategies during the COVID-19 pandemic, and analyze the role of options in managing risk during the COVID-19 pandemic.

The effectiveness of the market is affected by the COVID-19 pandemic, which, according to the latest research, has caused extreme volatility in market sentiment. Investments based on implied volatility can often achieve excess returns [8]. However, since COVID-19, the market does not have accurate feedback, so the investment strategy based on the implied volatility can take advantage of the market's reaction lag: after the market fluctuates violently, the implied volatility may experience excessive fluctuations, which presents investment opportunities. However, studies have shown that after the market stabilizes, the return of such a strategy is far lower than the market return because investors need to be more cautious and miss opportunities. In short, an investment strategy based on the implied volatility of options can take advantage of market instability and hysteresis to obtain excess returns during a severe epidemic. However, it should be noted that this strategy requires a relatively in-depth understanding and analytical ability of the options market to obtain a stable return on investment. All in all, the unstable market sentiment and panic caused by repeated epidemics affect the judgment of investors, which leads to changes in the implied volatility of options and affects the price of options.

All in all, the unstable market sentiment and panic caused by repeated epidemics affect the judgment of investors, which leads to changes in the implied volatility of options and affects the price of options. The increase in the instability of solid prices has stimulated uneasiness in the options market, making options trading riskier and bringing new problems and challenges to the risk management of the options market. The epidemic came suddenly, and traditional hedging policies may not be able to adapt to the sudden environment. For example, Vega hedging is an options trading strategy designed to reduce risk by hedging changes in the implied volatility of options. The operation is that if the Vega value of the option is positive, investors can buy a certain number of Options contracts or other derivatives to hedge exposure. If the Vega value of an option is negative, investors can sell a corresponding number of option contracts or other products to hedge their exposure. Then the vagaries of the epidemic will make the data sensitive and more likely to get out of control, leading to a surge in risks.

Investment in real options related to people's livelihood has had many adverse effects under COVID-19. The outbreak of COVID-19 has limited the electricity demand of society. Although the demand for electricity for people's daily life has not decreased or even increased due to the impact of the epidemic, the market demand has shrunk, and the electricity demand for standard production and operation of enterprises has dropped significantly. The decline in electricity demand has led to an imbalance between supply and demand in the electricity market, which has particularly impacted the profitability of the photovoltaic power generation industry [9]. The outbreak of local epidemics may cause enterprises to have the risk of shutdown, which will further affect investors' judgment and thus affect option trading.

Therefore, under the epidemic situation. Investors should consider many aspects. Whether they should buy options contracts depends on the investor's investment objectives, risk tolerance, market conditions, etc. When the market feedback fails, record the changes in the implied volatility of options, don't miss the opportunity, and flexibly use other models to hedge risks and reduce losses when the risk control strategy fails. Wait patiently for the turning point of the epidemic, and maintain a cautious attitude in real options investment. It is necessary to examine whether the epidemic will affect the technology, investment characteristics, and supply chain in many aspects. Because options are a leveraged financial derivative with high risk and high return characteristics, in addition to using option combinations and strategies to reduce risks, investors' judgments and expectations are also critical.

4. Swaps

A swap is a derivative contract that enables two parties to trade the liabilities or cash flows of two different financial instruments. Almost any type of instrument can be used in a swap, but most of them involve cash flows based on a notional principal amount, such as a loan or bond. Normally, the principal is not transferred [10]. There are numerous fundamental varieties of swap derivatives, including those based on interest rates, currency rates, and other rates. Additionally, there are some specific swaps, such as Swaps in plain vanilla. Credit default swaps and currency swaps. Swaps also have the following characteristics: (1) Consciously simultaneous buying and selling; (2) Same currency buying and selling; and (3) Divergent delivery periods. The size of the over-the-counter market is continuing to grow, and swaps, one of the key derivatives, are playing an increasingly essential role.

But default risk probably occurs increased due to the bad operation condition during the post-epidemic time, which damaged the world financial derivative market, due to the globalization of the world's economy. It shows that more and more companies are bankrupted during and after this period, and many of them are big companies or banks. They are crucial participants in the whole derivative market including swaps. At the same time, because derivatives are an over-the-counter business, the regulation of swaps is not enough, which means there is some tricky operation it will damage the whole financial market. However, chances always come up with challenges. The derivative has the function of avoiding risks, it is an important reason for those financial companies to use this tool. There are also more and more companies getting involved in these swap markets to spread their risks, especially since there are many arbitrage chances because covid-19 caused volatility in the economy. Enterprises including insurance companies, and small and medium-sized enterprises, use swaps to avoid the volatility of interest rates and foreign exchange rates. In these cases, many types of swaps are developed, also all these swaps could help countries to hold their economic stability in the hardest time.

The appreciation of the US dollar led to a panic in world currency and also caused an unstable foreign exchange rate. Besides, there occurred regional conflicts in several parts of the world. Foreign exchange rate swaps can eliminate the negative effect of the appreciation of US dollars, they also can reduce the cost of a foreign trade company, for example, transaction cost and transportation cost, because the exchange rate of currency can be set fixed rate to avoid the volatility of the US dollar.

These also can give many companies a chance to earn money, banks can participate in this process to earn a profit as the intermediary. But too much extent relies on foreign exchange swaps to evade the risk of exchange rate volatility could also cause the control of the domestic exchange rate, which makes central banks bear much more risk than before. In China keep an appreciation as well due to the excellent development of the economy. This also means that RMB has become one of the most important currencies in the world and China's enterprises will require swaps more when a trade occurs between other countries' companies, and this will enrich the swap market to a larger one. All in all, foreign exchange rate swaps can be one of the most important tools in the world-wide financial trade.

Interest rate swaps are the most basic swap in the derivative market, they can be used at any time and by any company. These swaps hugely reduce the effects of inflation on the nominal interest rate, because they can lock the cost of interest rate or the profit to avoid risk exposure, which can make both seller and buyer have a lower total interest burden and decrease overall financing cost. From an institutional perspective, interest rate swaps can also be used for negative asset management by combining interest rate swaps with other assets. From a macro perspective, interest rate swaps allow different market participants to express their expectations of market interest rates through market transactions, thus allowing market expectations of interest rates to be expressed through changes in interest rate swap prices, thus effectively promoting the process of interest rate marketization [11]. During the post-epidemic time, people try to use this instrument in many areas to profit, for example, bonds and insurance. More types of swaps are good for investors because they can have more choices and try to portfolio their assets to avoid most of the risks in the financial market.

The most prevalent sort of credit derivative is a credit default swap (CDS), which, although being the primary cause of the 2008 financial crisis after the supervision system was gradually finished, continues to be crucial in the financial market. During the CDS's life, if the reference entity doesn't default, the protection seller just keeps the premium payments. Nonetheless, in the event of a default event, the protection seller is held accountable for the discrepancy between the face value and recovery value of the debt obligations issued by the reference business [12]. Insurance companies can be benefited from CDS in the post-epidemic period, as there will be more demands about health issues, and with the existence of CDS, insurance enterprises can earn more profit and bear less risk.

5. Conclusion

This study finds that futures have had significant volatility over the COVID-19 period. The trend of futures movement varies across commodity markets. Still, the overall decline suggests that COVID-19 has had some impact on the future. For options, the volatility of the market increased under the impact of the epidemic. At the same time, futures risk spiked, and the physical futures market was hit, a concrete example of which was the failure of otherwise effective hedging strategies, leading to increased market instability and thus affecting returns. In addition to this COVID-19 has hit the futures markets related to people's livelihoods, shrinking market demand, and preventing productivity from being fully utilized, which has not only hit people's livelihoods significantly but has also been a huge challenge for investors in livelihood futures. Swaps were an important financial derivative tool during the epidemic and post-epidemic periods. It played an important role in the development of the financial markets and the smooth operation of the markets, providing a way for companies to tide over the difficulties, reduce costs and gain profits. In the future, more swaps will be available, and swaps will be traded on a larger scale, allowing for better risk management. At the same time, it also provides an impetus to the overall development of the financial markets and contributes to their smooth development. As this study demonstrates COVID-19 has a large impact on the overall financial derivatives market. However, the epidemic period has now passed. The performance of the derivatives market is expected to return to pre-epidemic levels or higher than before. The study of financial derivatives during the COVID-19 period is useful in assessing the performance of subsequent financial derivatives.

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