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The Risk & Return Relation in Bitcoin Spot & Futures Intraday Returns

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ABSTRACT

Since The Chicago Board Options Exchange (CBOE) and the Chicago Mercantile Exchange (CME) presented Bitcoin future contracts in December 2017. This study examines the risk and return relationship between Bitcoin spot and futures intraday returns. We have five-minute intraday data for the Bitcoin spot market and futures markets. This data is obtained from Bloomberg between December 10, 2017, at 17:15, and April 6, 2018, at 00:00. The Augmented Dicky Fuller (ADF) test and the GARCH in Mean (GARCH-M) Model through variance of risk and variance of volatility are used to examine this relationship. According to empirical findings, several selected models in various combinations revealed a positive relationship between risk and return for both the spot market and the futures market for Bitcoin. Volatilities and previous returns both suggested a positive, significant effect on current stocks. Based on historical Spot prices and Future prices of Bitcoin, our results indicate that the GARCH in mean (GARCH-M) model is highly helpful to explain the risk and return link in Bitcoin spot and futures intraday returns.

1. Introduction

The possibility of risk can give investor sleepless nights. Moreover, risk can be controlled by proper financial planning. We face risk in our daily lives on a daily basis. Even if we are traveling, there may be some risk involved. Adjusting risk and return from the standpoint of investments can be challenging. Every investor strives to increase their profit with the least amount of risk. They pay closer attention to how risk and return are balanced. They are more cautious when it comes to balancing risk and return. As none of the investments are risk free and all of them are riskier. The riskiest course of action is to forego investing entirely due to risk. A scenario in which an investor might predict the result with 100% assurance is said to be as certainty. Since no one has complete knowledge of the future, investors attempt to account for future uncertainties through risk definition. Investors must undertake extensive research before making an investment. He must determine the specifics of his plan and the level of risk involved in this transaction. How he may reduce risk and increase returns. Whereas speculators take bets to increase risk exposure, risk hedgers take positions to mitigate risk exposure. A rational investor cannot avoid risk since he is constantly seeking to increase returns or obtain some rewards. With his investment, there is always some danger. Risk and return are associated, and their relationship is a crucial component of portfolio management that is commonly miscalculated, with many people assuming that this relationship is direct. The majority of investors saw giving as a way to increase their capital as well as receive a stream of regular income from earnings. This is obviously correct, but the problem is that the majority of financial investors will generally seek returns while

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only a small number are aware of the hazards associated with the earnings. In this article, I might want to briefly discuss the relationship between risk and return and how a financial expert should rightfully take both into account when making a speculative decision.

This study presents the basic cross-sectional mediation model according to Baron and Kenny's (1986) foundational paper, starting with a substantive research issue to be further developed. This is done prior to introducing mediation in a development curve framework. The risk-return trade-off postulates that when risk rises, so does the possible return. According to this theory, people link low levels of uncertainty to low potential returns and high levels of risk or uncertainty to large potential returns. According to the risk-return trade-off, an investor can only earn more money from their investment if they are willing to incur a bigger risk of losing it. There is a risk-return trade-off at the portfolio level as well. An all-equity portfolio, for instance, has both higher risk and larger potential profits. Concentrating investments in particular industries or taking on single positions that make up a significant portion of assets can raise the risk and reward in an all-equity portfolio. An asset portfolio that maximizes expected return for a specific degree of risk can be put together by investors using the Modern Portfolio Theory (MPT), a theory of investments. According to the hypothesis, investors always favor the portfolio with lower risk for a given amount of projected return. So, in accordance with Modern Portfolio Theory, a higher level of risk must be offset by a higher expected return for an investor. The fundamental principle of diversification, according to MPT, is that keeping a portfolio of assets from various classes is less risky than doing the same for a portfolio of similar assets. A portfolio allocation technique called diversification holds assets with imperfectly positively correlated returns in an effort to reduce idiosyncratic risk. Simply said, correlation is the connection between two variables, and it is quantified by the correlation coefficient.

One question that frequently comes in investors' minds is whether the investment in Bitcoin is secure or not since its crypto currency. It does, however, have pros and downsides from different perspectives. Yet, if we're talking about a sensible person, then a rational investor will undoubtedly take into account a number of factors before making a Bitcoin investment. The third aspect of Bitcoin, unlike Proof of Work and Public Key Cryptography, is based on human behaviour rather than mathematics. Bitcoin is entirely supported by a system of financial incentives and the people who receive them. But what precisely is the Bitcoin incentive program, if we're talking about it? The fixed supply, mining subsidies, and transaction fees are the three primary parts. For instance, they have 21 million Bitcoin available. It cannot go over this limit. Hence, if it succeeds, it will become the rarest asset ever, even rarer than diamonds and gold. However, a logical person might choose a scarce asset to increase value. A miner finds a block each time a Bitcoin is created. In contrast, the quantity of Bitcoin created with each block is set to decline exponentially, with a 50% reduction occurring every 210000 blocks, or every four years otherwise. The spot subsidy is 12.5 Bitcoin per block as of this script (Dec 2018). But, if consumers believe that future profits will be larger, they can benefit more from subsidies. When no one else did it, there is a good approach to distribute Bitcoin among those who have made valuable contributions to this project. Also, long-term risk exists with mining subsidies.

Yet, since Bitcoin has gained more attention and increased in value since the Cyprus bank crisis, Cox (2013) Bitcoin acceptability is growing with time, hence Bitcoin's price is constantly rising due to its appeal as a cryptocurrency. Bitcoin is created through a process known as mining. For trading Bitcoin, we only need to install an application. In that situation, it is trading around-the-clock. It's uncontrolled and likely connected to money laundering and cybercrime. As Bitcoin were created as a means of transaction in the form of a digital currency, many economists are now interested in studying the economics of this cryptocurrency. However, given that many investors now buy Bitcoin for its investment worth rather than their exchange value, it is now used more as a tool for investing. Yet, as it is digital money, there is a considerable risk involved because investors can't put their trust in it. Investors are cautious when taking on risk. Because

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regulators are unfamiliar with this currency to a sufficient degree, they are unable to regulate it effectively. As a result of Bitcoin's extreme volatility relative to the US dollar, we might conclude that there is an excessive amount of risk associated with investing in Bitcoin.

One Bitcoin increased in value by 15%, rising from $1,000 in January 2017 to more than $15,000 at the start of December 2017, prompting the Chicago Mercantile Exchange (CME) and the Chicago Board Options Exchange (CBOE) to jointly offer future contracts on the cryptocurrency. Up until that time, price discovery for Bitcoin must only take place via spot trades, which may be spread over various international trading platforms. Depositors would now be able to enter the Bitcoin market on a directed trade thanks to the introduction of future contracts, which might ultimately increase the number of market participants.

By using the GARCH-M model, this study will attempt to address the risk return trade-off in the Bitcoin market and will add to the body of knowledge regarding risk return trade-off in various stock markets. Since systematic risk is a component of total risk and is difficult to eliminate entirely from an investor's portfolio, the main aim of this study is to quantify the total risk associated with Bitcoin transactions. However, by diversifying the portfolio, one can easily eliminate the possibility of unsystematic risk. Owing to this issue, we primarily employ the GARCH-M model, which calculates the Bitcoin risk-return trade-off utilizing both the variance ($\sigma 2$) and volatility (σ) of the risk.

Background of Study

A significant advancement in financial technology has been blockchain technology (FinTech). The high quantity of cryptocurrencies it generates indicates its potential impact on the world economy. The first and arguably most popular cryptocurrency is Bitcoin, which attracts a lot of journalists, venture capitalists, financial institutions, governmental organizations, and other stakeholders. According to Nakamoto (2008), Bitcoin is a pure form of peer to peer electronic cash that is decentralized, anonymous, and transparent with the objective of facilitating online transactions without the use of third parties or financial intermediaries. The price of Bitcoin surged due to its rising popularity, going from less than $1 in February 2011 to $19,783 on December 17, 2017. Despite a price drop to roughly $3,500 in January 2019, Bitcoin still accomplished to set a record high of $58,000 in February 2021.

Since Bitcoin was created to be used globally, it has several distinctive settings and particular characteristics, such as a distributed, peer-to-peer, decentralized payment system (referred by Nakamoto, 2008). The design of Bitcoin also suggests that it cannot be governed by a single organization, state, or large number of people, which may help to explain why it is not controlled or outlawed in the majority of countries. While trade may be limited and the possession of Bitcoin may be prohibited in some places (e.g. Cambodia or Macedonia). An important concession to the consolidated and meticulously controlled futures pricing and futures trading of Bitcoin is the decentralized, global distribution of Bitcoin and the absence of restrictions. Since lately, when Bitcoin's market value reached USD 10 billion, the exchange volume has continued to grow. Bitcoin supports the creation of numerous currencies and is present in numerous nations worldwide. Another factor is the hope that the central bank will guarantee that the value of the money you deposit is comparable to that of digital currencies.

In many countries lack of trust on national bank has not been an issue, but this started to change as a result of the continuous financial unrest and the global euro crisis. Due to the decentralized nature of Bitcoin, there is no such centralized entity in control of its exchange rate. One excellent illustration is the less complicated and more affordable depositing and withdrawal process. Even people from various rich countries who live in undeveloped countries or in tiny towns are drawn to invest in Bitcoin. People can do transaction directly by using Bitcoin since there is no central authority who is controlling Bitcoin stock. Since the beginning of 2010, the value of one Bitcoin has increased by more than $2700, and as of right now, one Bitcoin is equivalent to

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4,027.14 US dollars. It appears that the cost of Bitcoin is rising with time. The entire amount of Bitcoin, however, is already fixed at 21 million, despite the fact that its market capitalization is $46 billion and constantly increasing daily. A significant amount of speculative activity led to the sudden swings in the price of Bitcoin. The Chicago Board Options Exchange (Cboe) formally introduced the standardized futures product on Bitcoin (XBT) on December 10, 2017, in light of the cryptocurrency's high volatility and significant demand. 1 On December 18, 2017, the Chicago Mercantile Exchange (CME) issued its Bitcoin futures contracts (BTC), following suit. By paving the way for additional standardized cryptocurrency derivatives, these Bitcoin futures usher in a new era of Bitcoin trading. With the widespread acceptance of futures as legitimate instruments for hedging and arbitrage, investors should be able to trade and control their exposure to Bitcoin risks using futures (Sebastio and Godinho, 2020). This part in turn might assist in stabilizing the spot market.

People concern that that futures trading may draw a lot of ignorant investors, though. These investors could turn Bitcoin futures into a speculative tool, disrupting the spot market thanks to the enormous leverage utilized in futures trading. There is a theory that Bitcoin futures may have contributed to the market meltdown at the end of 2017 because the launch of Bitcoin futures coincided with that event. On whether Bitcoin futures trading raise the volatility of the spot market, empirical evaluations are divided. Fortunately, it is simple to separate the impact of Bitcoin futures on Bitcoin spot price. Bitcoin futures are the only financial derivative for cryptocurrencies that are accessible in authorized national exchanges, in contrast to stocks where different financial derivatives (such as futures, options, and credit default swaps) coexist. Consequently, the launch of Bitcoin futures offers a convenient test case to investigate how futures trading affect volatility in the spot market. In this study, we examine the short- and long-term impacts of the introduction of futures on volatility.

Research Questions

By conducting this study, the following research questions might be answered:

- Is there a relationship between returns and risk for both future series and spot?
- Previous returns influence spot and future returns.
- Do the past volatilities lead current volatilities of returns in spot and future market?

Contribution to the Literature

If the risk and return relationship of Bitcoin is thoroughly discovered in the spot market or in the futures market, that would be the contribution of this work to the existing literature. So, it follows that an investor would make a sensible choice if he invested in a stock with a higher expected return and lower risk, as this has always been a crucial decision for investors throughout history. We will also attempt to respond to the question of whether or not Bitcoin returns have a rational component. In light of this, providing thoughtful answers to the questions will enable investors to make wise investment decisions.

2. Review of Literature:

Bitcoin is an online payment system that uses open source software. The apparent regrets of governments and national banks during the global economic crisis of 2008 and the European sovereign debt crises of 2010-2013, it has gained widespread attention among economists and professionals. Bitcoin is completely decentralized and relies on a sophisticated protocol that uses only digital currency to control connections, manage supply, and foresee potentially dangerous activities that may endanger the system. In contrast to conventional money, which is guaranteed or governed by concerned institutions and national banks? An investor always pays close attention to his investments.

The risk-return trade-off has been the subject of numerous empirical studies using data from various nations or stock market. Nevertheless, the results are unclear because the available empirical research provides no

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clear proof of this association over time. Hentschel and Campbell (1992), Goyal and Santa-Clara (2003), and French et al. (1992) all discovered that the conditional variance and the conditional expected returns have a meaningful, if often minor, relationship. Using a bivariate GARCH in mean model, Howe and Xuejing Xing (2003) discovered a consistent positive correlation between the variance of return and stock returns in the British stock markets.

For many years, there has been debate in the literature over how futures trading affect spot market volatility. In terms of how the introduction of futures affects the underlying assets' volatility, there are two conflicting theories. According to one argument, futures trading increases the practical pool of risk-management tools investors have access to, which completes markets and stabilizes cash prices. Furthermore, the spot market becomes more liquid and less volatile as a result of futures trading's ability to draw in more knowledgeable traders. For instance, futures trading, according to Danthine (1978), enhance market depth and lowers spot market volatility because it makes it less expensive for knowledgeable traders to react to spot market mispricing. Perold and Froot (1995) demonstrate that market depth rises as market wide information is disseminated more quickly, which happens with the introduction, of index futures. According to the opposing viewpoint, excessive speculation, particularly during tumultuous times, causes cash prices to become unstable in the futures market. For instance, Stein (1987) argues that poorly informed speculators trading futures reduce the price's informativeness, which causes prices to destabilize in the spot market. According to Chen et al. (2013), the large leverage in futures market is probably going to draw inexperienced or loud players. Arbitrageurs may transfer the extra "noise" that futures prices have to the spot market, increasing the volatility of spot prices. The introduction impacts of derivatives, such as futures and options, on spot market volatility have been thoroughly studied in the literature on the empirical side. No consensus has been established, but the conclusions are no more firm than the theoretical arguments. For additional information, read the discussions in Chen et al. (2013) and other publications. The majority of current empirical research impose a regression or GARCH-type model over the entire sample period and utilize a dummy variable to reflect the mean shift in volatility following the introduction of futures.

The Bitcoin futures are likewise subject to the lack of agreement over the effect on the spot market. According to several analyses the introduction of Bitcoin futures has increased volatility, on the spot market. Ironically, the launch of Bitcoin futures markets was followed by a market crash at the end of 2017. It is logical to speculate that the crash may have been brought on by Bitcoin futures. For instance, according to Hale et al. (2018), the launch of Bitcoin futures sparked significant short-selling pressure from negative investors, which caused the price of Bitcoin to drop significantly. Moreover, Liu et al. (2020) concur that the introduction of Bitcoin futures is somewhat to blame for the decline in the price of Bitcoin in 2018. Corbet et al. (2018) assert that the introduction of Bitcoin futures has increased spot market volatility and that Bitcoin futures are not a useful hedging tool since Bitcoin is a speculative asset rather than a currency. The opinions of Blau and Whitby (2019) are congruent. Retailers' trading activities have a negative impact on the market will become unstable as a result of the CME Bitcoin futures price discovery, according to empirical research by Hung et al. (2021). An upward trend in volatility is discovered by Jalan et. al. (2021) using a Bayesian diffusion regression structural time series model.

On the other hand, some research contends that the futures markets help to keep the spot market stable. Futures trading boost the spot market's liquidity and efficiency by increasing the participation of knowledgeable investors. The introduction of Bitcoin futures, for instance, according to Köchling et al. (2019), makes it easier for institutional investor to access the market and provides a productive option to short the crypto-currency. They discover that following the launch, Bitcoin prices are less predictable, indicating that the spot market has become more effective. Shi (2017) found that futures trading greatly lower spot price

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fluctuations, increasing the liquidity of the spot markets in the post futures period.

Finally, several research show that futures trading has little or inconsistent impact on the spot markets. Bitcoin futures trading, according to Hattori and Ishida (2021), are not significantly correlated with returns on Bitcoin futures or the spot market. Thus, Bitcoin future did not cause the collapse of the Bitcoin markets at the end of 2017. Kim et al. (2020) look into how the consequences of Bitcoin futures launch have an impact on the intraday volatilities of Bitcoin. They discover that the Bitcoin markets initially became unstable but eventually stabilized.

These various viewpoints were gathered by various researchers using various sample sizes and approaches. According to what we are aware of, the majority of the literature that is currently available emphases on the introduction effects of Bitcoin futures over a short time period (Hale et al., 2018; Köchling et al., 2019; Liu et al., 2020; Blau and Whitby, 2019; Hattori and Ishida, 2021 and Kim et al., 2020). When we prolong the test duration to two years, it is unknown if the effect persists over the long term. In this work, we attempt to close this gap and investigate the short- and long-term dynamics of the correlation between Bitcoin volatility and futures trading. We also look into how introduction of Bitcoin futures may affect the imbalance in volatility on the spot market. Lastly, we investigate whether higher Bitcoin volatility is related to more active futures trading, as measured by trade volume and open interest. Our work differs from prior research in that we place more attention on an extended sample period analysis, the introduction influence on volatility asymmetry, and the connections between future trading activity and spot market volatility. Our study's methodology will increase our knowledge of market microstructure, price discovery, and the information exchange between the Bitcoin futures and spot markets.

Shimeng (2017) used high-frequency data to investigate the effects of liquidity on volatility in the Bitcoin spot market and futures trading. The spot market fluctuation is substantially reduced by the presentation of future contracts. The spot market shows signs of becoming more nimble after futures trading. The findings held up well against different liquidity and unpredictability intermediates. Hence, at least over a short period of time, trading in Bitcoin futures is essential for reducing spot market volatility and increasing spot price liquidity. According to Shaen et, al. (2018) the level of significance in Bitcoin has increased recently. This examines whether the beginning of Bitcoin trading in the future will be able to identify the issues that prevented Bitcoin from being a well-thought-out currency. This analysis indicates that futures contract are not an effective hedging tool, cash volatility is greater than that of future contracts, and price discovery is determined by shareholders in the spot markets. So, this argument maintains that Bitcoin is a speculative asset as opposed to an exchange and is unaffected by the introduction of futures trading.

An earlier study (Joshua et al., 2019) investigated price discovery in the foreign exchange spot market and future market during a time when spot market validation was lower but spot market volume was higher than the futures market. Chicago Mercantile Exchange traders observed this growth in the foreign exchange. This indicates that both futures and spot orders include one particular piece of information. As a result, this measure uses Gonzalo and Granger's and Hasbrouck's methodologies to contribute to price discovery and the results are consistent.

Tuck et al. (2015) discovered that Bitcoin and the crypto-currency markets have not been fully studied despite increased knowledge and popularity (see, for example, Frisby, 2014). Similar to other assets, the value of Bitcoin first lies on its side beneath bubbles. Second, according to (Dowd, 2014), the bubble component that Bitcoin prices possess is important. Finally, the fundamental value of Bitcoin is $0. Hence, these findings highlight broader scholarly and public concerns about the long-term viability of Bitcoin. They recommended that the amendment show how the cryptocurrency market shares stylised experimental fundamentals with other markets that are prone to speculative bubbles.

Bond and equities markets' risk-return trade-offs and Turan's study of underutilized option chancy resources (2015). They discovered the continuity and significance of relationship between risk, and expected return in

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the markets for foreign exchange. In order to check the presence and relevance of intraday basis return utilizing GARCH realized and range instability estimator, they offered the most recent evidence using intraday return for the spot trading rates of the US dollar on other currencies. The results show a strong positive yet measurably weak relationship between currency risks and return profit. Very recently have academic works on digital currencies like Bitcoin started to surface (Grinberg, 2012). With reference to the adequate explanation of Bitcoin there is at present substantial controversy. Although valuable resources like gold and paper annotations do not generate cash flow, they maintain their value because they may be traded for goods and services. Bitcoin have a digital mining process that is designed to mimic the production costs associated with precious metals.

While Briere et al. (2013), who indicate that Bitcoin price vary on exceptional deals, are the only revision that in brief concentrate to this aim. Their research is motivated by a desire to learn more about this multi-trade environment and, specifically, about cost discovery in Bitcoin trades. Eloquent trading behaviour that reacts faster to new information and accurately reflects Bitcoin's value is presumably important. Together with popular media and the Bitcoin community, this location has attracted a wide range of interests. To the best of their knowledge, this is the earlier investigation of this subject, though. The results of the testing imply that the suggested technique has the potential to be improved. All transactions are carefully stored and recorded on a public ledger technology known as the block chain. While the mathematics underlying Bitcoin suggest a robust defence against copying, the system has shown to be defenceless against criminal activities. At Bitcoin.org. The Bitcoin standards are made clear (Dwyer, 2015). Bitcoin is the primary digital money to appear. Even if there are already other digital currencies like Feather coin and Peer coin, Bitcoin has managed to maintain its dominant position in this industry. By the end of June 2016, the market capitalization of Bitcoin had surpassed $10 billion USD (according to coinmarketcap.com), accounting for more than 80% of the total market value of all cryptographic forms of money in circulation.
We have suggested some hypothetical arguments in order to examine the trade-off between risks and return in Bitcoin market. The relationship between the Bitcoin spot market and futures market will be examined in this article utilizing various statistical methods.
As a result, we have suggested a few research hypotheses for this research. The following research hypotheses are listed:

Research Hypothesis

The main hypotheses for this study are given below:

H1: Risk and returns have a strong relationship..
H2: Previous returns have a substantial impact on the futures and spot markets.
H3: Previous return volatility has a substantial impact on the futures and spot markets.

We will first make an effort to use statistical techniques to examine the relationship between risk and returns. Both the current price and the future price series will be used to examine each of these hypotheses individually. Later, we shall learn exactly what relationships are existing in the Bitcoin market. What will be its future? Will it be a trustworthy portfolio for the investor in the future? We'll try to come to an acceptable agreement. This study incorporates Bitcoin returns combined with spot and forecast price data. One Bitcoin in US dollars is the basis for the future contracts on the CBOE with the symbol XBT. Futures contracts with the BTC sign are reliant on five Bitcoin, and their fulfilment is reliant on CME Bitcoin (BRR). Two CBOE future contracts with the symbols XBTJ8 and XBTH8 are being investigated for this investigation. The information about the price of Bitcoin in US dollars is sourced from Bloomberg.

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3. Design and Methodology

Data

The main objective of this study is to examine relationship between risk and return in Bitcoin spot and futures returns by using spot price and future price. For this study, we used spot price data at five-minute intervals and CBOE and CME Bitcoin futures prices from Blomberg for the time period of December 10, 2017 (17:00) to April 6, 2018. (00:30). But, non-trading hours were also left out of the data that was already available. If there are numerous observations during a single interval or if there is no observation during the period, we have taken the most recent price into consideration as the benchmark for this study. On Fridays at 4:00 pm and on Sundays at 5:00 pm, there is a break. Nevertheless, CME futures contracts can only be traded from Sunday through Friday from 5:00 pm to 4:00 pm. Hence, this removes the two-day hiatus from the data. Nonetheless, interruptions of one hour are taken into account. We remove the non-trading period from the data and take into account corresponding trade hours because the trading of CBOE future contracts is shorter and more directly tied to the trading of the equities market, for instance, the regular trading hours of 8:30 am to 3:15 pm by Monday through Friday (Grammig et al., 2005). The futures contracts' tickers are XBTH8 and XBTJ8. Future agreements with H and J are set to expire in March and April, respectively.

Volatility clustering is one of the stylized facts of financial markets. The family of GARCH models have been widely used to model this dynamic feature of volatility. In these models, the key element is the specification of the conditional variance. Based on the standard GARCH model, new specifications have been proposed over the past decades, such as the component sGARCH (CSGARCH) model (Lee and Engle, 1999), the component sGARCH (TGARCH) model (Zakoian, 1994), the GJR GARCH model (Glosten et al., 1993), the EGRCH model (Nelson, 1991), and others. Time series modeling, primarily GARCH models, has been used in numerous studies to examine the effects of derivatives trading on spot market volatility (e.g., Lee and Ohk, 1992; Antoniou and Holmes, 1995; Xie and Huang, 2014). The GARCH approach is still popular despite the possibility of omitted variable bias when evaluating the effects of derivatives trading, for instance, when it may ignore the existence of uncontrollable market forces and structural changes that may affect market volatility. However, these traditional GARCH models only utilize daily returns (typically, squared returns) to extract some information about current level of volatility, which are slowly at ‘catching up’ new information shocks. To remedy this drawback, Hansen et. al. (2012) introduce a Realized GARCH model by combing the traditional GARCH model with a measurement equation of the realized, measures of volatility such as realized volatility, which leads to improvements in model fitting and forecasting. In the end, its purpose is to provide evidence in favour of an argument: For evaluating the volatility of the returns of groups of stocks with huge numbers (thousands) of observations, GARCH is the most suitable model to apply. The suitability of the model is assessed from a single direction, without taking into account any cost component, by comparing the accuracy of the GARCH volatility forecast with those of any other alternative models. The flexibility and accuracy of GARCH forecasting approaches, among their many benefits, put them in a unique position to meet many of the demands of practitioners, particularly in the front office trading and back office risk management systems. Quantitative approach will be used in this study since we have time series data to examine our research objective. The Augmented Dicky Fuller test and the GARCH in mean (GARCH-M) model through variance of risk and volatility of risk via Gaussian distributions are used in this study to examine the relationship between risk and returns for Bitcoin spot price returns and future market returns using different statistical tool. This study incorporates Bitcoin returns combined with spot and forecast price data. One Bitcoin in US dollars is the basis for the future contracts on the CBOE with the symbol XBT. Futures contracts with the BTC sign are reliant on five Bitcoin, and their fulfilment is reliant on CME Bitcoin (BRR). Two CBOE future contracts with the symbols XBTJ8 and XBTH8 are being considered for this investigation. The information about the price of Bitcoin in US dollars is sourced from Bloomberg.

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GARCH in Mean Model

The return on a security in the financial world often depends on how volatile it is. To classify such situations, think about employing the GARCH-M model, where M stands for GARCH in the mean. The simple GARCH (1, 1)-M model can be written as

$$r_t = \mu + c\sigma_t^2 + a_t, \qquad a_t = \sigma_t \varepsilon_t,$$
$$\sigma_t^2 = \alpha_0 + \alpha_1 a_{t-1}^2 + \beta_1 \sigma_{t-1}^2$$

Where μ and c are constants. The risk premium parameter is denoted by the letter c. If c is positive, the return and volatility are positively connected. In the literature, other risk premium definitions have also been employed, like as

$$r_t = \mu + c\sigma_t + a_t \text{ and } r_t = \mu + c\ln\left(\sigma_t^2\right) + a_t$$

The GARCH-M model's design in the aforementioned equation suggests that the return series exhibits serial correlation. Those involved in the volatility process introduce these serial correlations. So, the existence of risk premium is another element influencing the serial correlations in some historical stock returns. The GARCH-M or mean specification incorporates the volatility factor into the mean equation (risk-return trade off).

GARCH-M Model with Variance of Risk

$$r_{t+1} = \alpha_0 + \gamma\sigma_t^2 + \varepsilon_{t+1} \qquad H_0 : \gamma = 0$$
$$\sigma_t^2 = \beta_0 + \sum_{p=1}^{p} \beta\sigma_{t-i}^2 + \sum_{q=1}^{q} \eta\varepsilon_{t-i}^2 \qquad H_1 : \gamma \neq 0$$

Where
r = Return,
σ2t = Variance of risk
Ɛ2t = square of residuals with respect to mean process

GARCH-M Model with Volatility of Risk

$$r_{t+1} = \alpha_0 + \gamma\sigma_t + \varepsilon_{t+1} \qquad H_0 : \gamma = 0$$
$$\sigma_t^2 = \beta_0 + \sum_{p=1}^{p} \beta\sigma_{t-i}^2 + \sum_{q=1}^{q} \eta\ \varepsilon_{t-i}^2 \qquad H_1 : \gamma \neq 0$$

r = Return,
σt = Volatility of risk
Ɛ2t = square of residuals with respect to mean process

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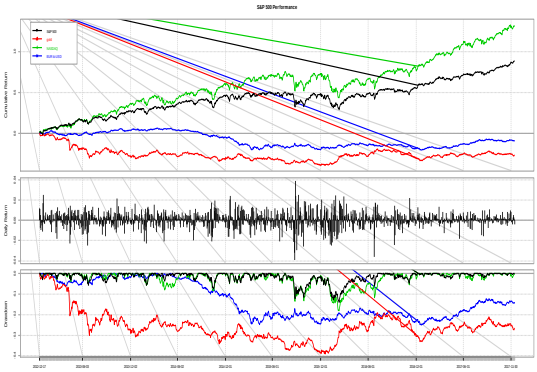
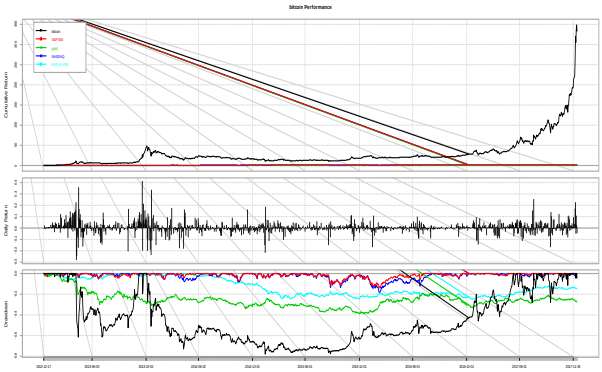
4. Results and Discussion

In this section, we present the findings from regressing various models and regressions. The findings for this study are rather noteworthy, which could be useful for future research.

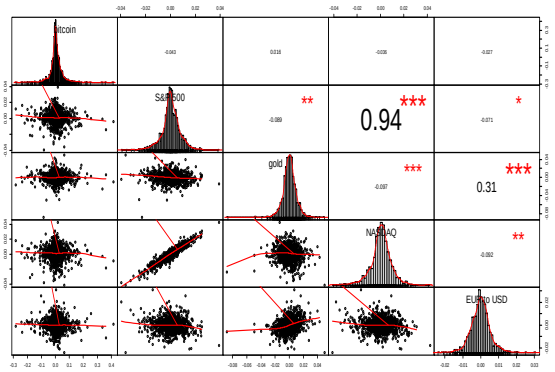
S&P 500 PERFORMANCE against Gold, NASDAQ AND EUR TO USD



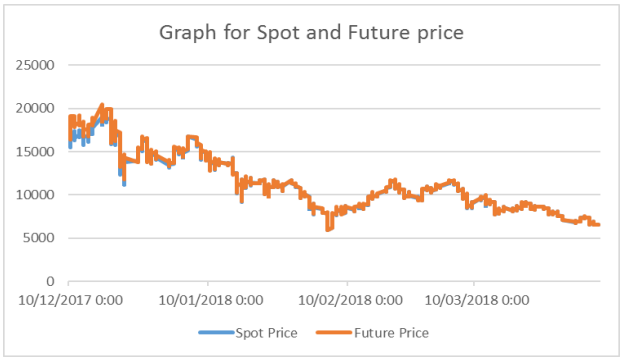
BITCOIN PERFORMANCE



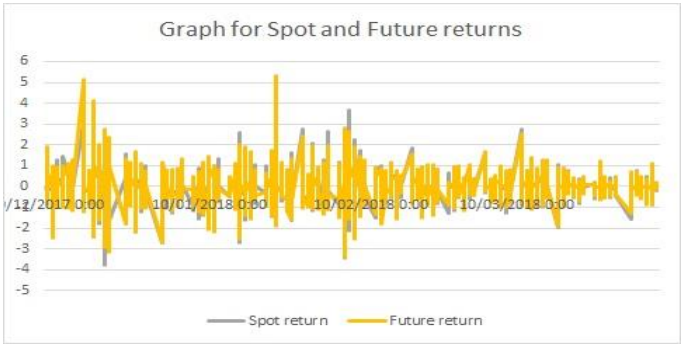
CORRELATION AMONG DIFFERENT COMMODITIES



GRAPHICAL REPRESENTATION OF SPOT PRICE AND FUTURE



Graphical representation of spot return and future returns



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Parameters	Mean	SE (mean)	Std.	P25	P50	P75	Min	Max	Skew	Kurt	AR_1	AR_2	AR_3
Spot return (%)	-0.148	001	0.214	-0.089	0.0004	0.086	-5.727	3.454	-0.475	45.884	-0.005	-0.009	0.004
Future return (%)	-0.299	0.003	0.378	-0.112	0	0.111	-3.322	12.757	4.536	149.963	-0.064	0.010	-0.020
Change in Spot Price ($)	-0.357	0.364	57.673	-21.956	0.098	21.445	-1301.284	1459.805	-0.090	48.609	-0.010	-0.001	0.010
Change in Future Price ($)	-0.820	1.046	104.175	-20	0	20	-1040	2280	2.574	73.385	-0.091	0.015	-0.032

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We have taken into account a number of variables in the Summary Statistics table, including Spot Return, Future Return, Spot Price Change, and Future Price Change. N represents the total number of observations, whereas Min, Max, Skew, Kurt, and AR stand for minimum, maximum, kurtosis, and autocorrelation, respectively. Spot return autocorrelation is low and positive at lag order 3, but negative at lag orders 1 and 2. Compared to spot return, the autocorrelation for future returns at lag order 2 is substantial and positive
.

ADF Test Results

		Test statistics	1% critical value	5% critical value	10 % critical value
Spot return	z(t)	-79.949	-3.960	-3.410	-3.120
Future return	z(t)	-50.807	-3.960	-3.410	-3.120
Change in spot price	z(t)	-80.082	-3.960	-3.410	-3.120
Change in future price	z(t)	-51.958	-3.960	-3.410	-3.120
MacKinnon approximate p-value for Z(t) = 0.0000					

According to the aforementioned ADF Test, this time series appears to be stationary. As a result, we may conclude that both series are constant throughout time because they have constant means, variances, autocorrelations, etc. Future returns and spot returns are both smooth. Both follow a nearly identical trend line.

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Spot Price through Variance of risk (σ^2)

Parameters	N	Coefficient	| t |	p-value	Log Likelihood
Panel A: GARCH (p = 1, q = 1)					
α_0	24994	-0.002	1.73	0.084	6526.276
γ	**24994**	**0.095**	**2.16**	**0.030**	
β_1	24994	0.977	4912.17	0.000	
η_1	24994	0.018	77.76	0.000	
Panel B: GARCH (p = 2, q = 1)					
α_0	24994	-0.002	1.53	0.127	6563.75
γ	**24994**	**0.086**	**1.98**	**0.047**	
β_1	24994	0.164	8.81	0.000	
β_2	24994	0.794	43.13	0.000	
η_1	24994	0.034	62.14	0.000	
Panel C: GARCH (p = 3, q = 1)					
α_0	24994	0.0002	0.23	0.816	10504.91
γ	24994	0.033	1.07	0.283	
β_1	24994	0.395	5.19	0.000	
β_2	24994	0.290	3.25	0.001	
β_3	24994	0.203	2.77	0.006	
η_1	24994	0.115	13.05	0.000	
Panel D: GARCH (p = 1, q = 2)					
α_0	24994	-0.001	0.60	0.549	6675.181
γ	24994	0.049	1.24	0.215	
β_1	24994	0.984	3649.90	0.000	
η_1	24994	0.124	35.41	0.000	
η_2	24994	-0.112	31.12	0.000	
Panel E: GARCH (p = 2, q = 2)					
α_0	24994	-0.002	1.22	0.224	6814.128
γ	**24994**	**0.090**	**2.13**	**0.033**	
β_1	24994	1.733	201.10	0.000	

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β_2	24994	-0.735	86.06	0.000
η_1	24994	0.083	34.64	0.000
η_2	24994	-0.081	34.54	0.000

The risk-return trade-off is the relationship between the risks one takes on when investing and the performance of assets. According to the risk-return trade-off, increased risk entails higher reward, and vice versa. According to this theory, low levels of risk (uncertainty) correspond to low potential returns, whereas high levels of risk (uncertainty) correspond to high potential returns. Using the GARCH-M model, we discovered a substantial positive association between the variance of risk and return of Bitcoin in time series of spot prices, such as those shown in Panels-A, B, and E above which indicate that if the variance of risk increase then return of Bitcoin will also increase since both possessed positive relationship. But if the variance of risk decreases then the return of Bitcoin will also decrease and vice versa. We have employed t-distributions for Panel-C.

Panel F: GARCH (p = 3, q = 2)					
α_0	24994	-0.001	0.87	0.384	6829.647
γ	**24994**	**0.068**	**1.68**	**0.093**	
β_1	24994	1.197	57.32	0.000	
β_2	24994	0.243	6.62	0.000	
β_3	24994	-0.444	25.24	0.000	
η_1	24994	0.116	37.36	0.000	
η_2	24994	-0.114	37.39	0.000	
Panel G: GARCH (p = 1, q = 3)					
α_0	24994	-0.001	0.95	0.342	6719.186
γ	**24994**	**0.071**	**1.75**	**0.080**	
β_1	24994	0.987	3600.92	0.000	
η_1	24994	0.115	34.49	0.000	
η_2	24994	-0.053	11.05	0.000	
η_3	24994	-0.050	16.41	0.000	
Panel H: GARCH (p = 2, q = 3)					
α_0	24994	-0.001	0.60	0.545	6675.711
γ	**24994**	**0.049**	**1.23**	**0.217**	
β_1	24994	0.085	1.26	0.207	
β_2	24994	0.886	13.36	0.000	
η_1	24994	0.125	35.46	0.000	
η_2	24994	-0.001	0.18	0.860	
η_3	24994	-0.098	11.56	0.000	
Panel I: GARCH (p = 3, q = 3)					
α_0	24994	-0.002	0.001	0.119	6914.372
γ	**24994**	**0.111**	**2.99**	**0.003**	
β_1	24994	0.758	90.28	0.000	

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β_2	24994	0.984	2290.90	0.000
β_3	24994	-0.746	90.89	0.000
η_1	24994	0.079	34.06	0.000
η_2	24994	.0009	38.25	0.000
η_3	24994	-0.085	38.99	0.000

The risk-return tradeoff is one of the key factors that investors examine when making decisions. They also utilize it to evaluate their entire portfolios. When building an asset portfolio, an investor needs to be aware of his personal risk tolerance. Investors' levels of risk aversion differHere again same case, there are some Panels where it is easy to observe how Bitcoin's risk against return trade-off appears to be favourable and significant for Spot price series. For instance, Panels F, G, H, and I of the accompanying diagram demonstrate the direct relationship between risk and return.

Future Price through Variance of risk (σ^2)

Parameters	N	Coefficient	| t |	p-value	Log Likelihood
		Panel A: GARCH (p = 1, q = 1)			
α_0	9901	0.008	3.09	0.002	-2026.752
γ	9901	0.020	0.74	0.460	
β	9901	0.900	423.03	0.000	
η	9901	0.146	41.35	0.000	
		Panel B: GARCH (p = 2, q = 1)			
α_0	9901	0.004	2.00	0.046	-1866.287
γ	**9901**	**0.045**	**2.83**	**0.005**	
β_1	9901	1.701	413.08	0.000	
β_2	9901	-0.730	202.05	0.000	
η_1	9901	0.041	38.55	0.000	
		Panel C: GARCH (p = 3, q = 1)			
α_0	9901	0.001	0.92	0.358	-1788.189
γ	**9901**	**0.054**	**10.29**	**0.000**	
β_1	9901	2.606	305.46	0.000	
β_2	9901	-2.310	148.72	0.000	
β_3	9901	0.696	96.44	0.000	
η_1	9901	0.011	31.68	0.000	
		Panel D: GARCH (p = 1, q = 2)			
α_0	9901	0.006	2.48	0.013	-2019.956
γ	9901	0.017	0.62	0.537	
β_1	9901	0.896	388.38	0.000	
η_1	9901	0.088	10.46	0.000	
η_2	9901	0.064	7.40	0.000	
		Panel E: GARCH (p = 2, q = 2)			

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α_0	9901	0.004	1.97	0.049	-1866.279
γ	**9901**	**0.046**	**2.89**	**0.004**	
β_1	9901	1.701	252.59	0.000	
β_2	9901	-.729	126.27	0.000	
η_1	9901	0.040	10.09	0.000	
η_2	9901	0.0008	0.18	0.856	

The table above we have discovered that there is a positive, substantial relationship between the variance of risk and return of Bitcoin in future price time series, such as those in Panel-B, C, and Panel-E as shown above, by using the Gaussian distribution in the GARCH-M model. Positive substantial relationship between the variance of risk and return of Bitcoin in future price time series indicate that both possessed direct relationship. Investors have to keep in mind this scenario while the formation of their portfolio since investor always want to choose right markets which expect high return.

Panel F: GARCH (p = 3, q = 2) By using t-(					
α_0	9901	-0.001	0.60	0.547	583.3028
γ	9901	0.016	0.68	0.497	
β_1	9901	1.357	14.70	0.000	
β_2	9901	-0.025	0.15	0.878	
β_3	9901	-0.339	4.19	0.000	
η_1	9901	0.182	9.29	0.000	
η_2	9901	-0.174	9.39	0.000	

Panel G: GARCH (p = 1, q = 3)					
α_0	9901	0.009	3.56	0.000	-2004.27
γ	9901	0.028	1.03	0.302	
β_1	9901	0.893	407.67	0.000	
η_1	9901	0.094	10.85	0.000	
η_2	9901	-0.051	5.03	0.000	
η_3	9901	0.118	16.22	0.000	

Panel H: GARCH (p = 2, q = 3)					
α_0	9901	0.003	1.65	0.098	-1832.302
γ	9901	0.084	11.83	0.000	
β_1	9901	1.678	238.22	0.000	
β_2	9901	-0.713	118.75	0.000	
η_1	9901	0.105	13.15	0.000	
η_2	9901	-0.157	11.42	0.000	

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η_3	9901	0.101	15.09	0.000	
Panel I: GARCH (p = 3, q = 3) By using t-dist					
α_0	9901	-0.001	0.60	0.551	583.73
γ	9901	0.015	0.67	0.502	
β_1	9901	1.562	6.46	0.000	
β_2	9901	-0.373	0.89	0.372	
β_3	9901	-0.194	1.08	0.280	
η_1	9901	0.193	8.11	0.000	
η_2	9901	-0.230	3.69	0.000	
η_3	9901	0.042	0.96	0.339	

In Panel-I, t-distribution has been used. But for rest of Panels, Gaussian distributions have been used. In Panel-H, there is positive significant trade-off in future price and variance of risk. It has been evident that there is positive trade-off between both future price series of Bitcoin and the variance of risk of Bitcoin. So, if there is external shock to the future price of Bitcoin then market will react quickly and surely the series will react also.

Spot Price through Volatility of Risk (σ)

Parameters	N	Coefficient	| t |	p-value	Log Likelihood
Panel A: GARCH (p = 1, q = 1)					
α_0	24994	-0.006	1.77	0.077	6525.654
γ	**24994**	**0.039**	**1.86**	**0.062**	
β_1	24994	0.977	4919.92	0.000	
η_1	24994	0.018	77.49	0.000	
Panel B: GARCH (p = 2, q = 1)					
α_0	24994	-0.005	1.58	0.114	6563.191
γ	**24994**	**0.035**	**1.69**	**0.090**	
β_1	24994	0.164	8.81	0.000	
β_2	24994	0.794	0.018	43.15	
η_1	24994	0.034	62.11	0.000	
Panel C: GARCH (p = 3, q = 1)					
α_0	24994	-0.0007	0.37	0.712	10504.65
γ	24994	0.012	0.92	0.356	
β_1	24994	0.394	0.076	5.19	

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β_2	24994	0.290	3.25	0.001	
β_3	24994	0.204	2.78	0.006	
η_1	24994				

Panel D: GARCH (p = 1, q = 2)					
α_0	24994	-0.003	1.10	0.272	6675.267
γ	24994	0.026	1.37	0.172	
β_1	24994	0.984	3661.40	0.000	
η_1	24994	0.125	35.46	0.000	
η_2	24994	-0.112	31.18	0.000	

Panel E: GARCH (p = 2, q = 2)					
α_0	24994	-0.006	1.70	0.088	6813.67
γ	**24994**	**0.041**	**2.05**	**0.040**	
β_1	24994	1.733	201.07	0.000	
β_2	24994	-0.735	86.03	0.000	
η_1	24994	0.083	34.66	0.000	
η_2	24994	-0.081	34.57	0.000	

Volatility of risk states which is the risk to the value of an investment-typically an options portfolio-caused by sudden changes in the underlying asset's volatility. Here the above table shows a significant positive association between risk volatility and Bitcoin return in spot time series, as seen in Panels A, B, and E. Gaussian distributions, however, have been replaced in Panel-C with the t-distribution.

Panel F: GARCH (p = 3, q = 2)					
α_0	24994	-0.005	1.46	0.144	6829.599
γ	**24994**	**0.034**	**1.79**	**0.074**	
β_1	24994	1.196	57.55	0.000	
β_2	24994	0.246	6.73	0.000	
β_3	24994	-0.444	25.45	0.000	
η_1	24994	0.116	37.41	0.000	
η_2	24994	-0.114	37.45	0.000	

Panel G: GARCH (p = 1, q = 3)					
α_0	24994	-0.005	1.47	0.142	6719.047
γ	**24994**	**0.034**	**1.79**	**0.074**	
β_1	24994	0.987	3604.87	0.000	

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η_1	24994	0.115	34.56	0.000	
η_2	24994	-0.054	11.21	0.000	
η_3	24994	-0.050	16.37	0.000	
Panel H: GARCH (p = 2, q = 3)					
α_0	24994	-0.004	1.31	0.189	6759.449
γ	**24994**	**0.029**	**1.77**	**0.077**	
β_1	24994	-0.003	9.56	0.000	
β_2	24994	0.972	1946.63	0.000	
η_1	24994	0.127	34.92	0.000	
η_2	24994	0.019	48.33	0.000	
η_3	24994	-0.120	32.78	0.000	
Panel I: GARCH (p = 3, q = 3)					
α_0	24994	-0.005	1.63	0.104	6726.71
γ	**24994**	**0.035**	**1.77**	**0.076**	
β_1	24994	-0.289	289.80	0.000	
β_2	24994	0.270	353.23	0.000	
β_3	24994	0.946	1365.12	0.000	
η_1	24994	0.032	52.17	0.000	
η_2	24994	0.014	31.43	0.000	
η_3	24994	0.017	31.25	0.000	

Volatility is often a measure of price. The probability that you will lose your investment and your wealth and not get it back constitutes the systemic risk inherent in an investment. In above all Panels, there is strong positive significant relationship between volatility of risk and returns series which evident that external shocks will influence the both time series of Bitcoin.

Future Price through volatility of risk (σ)

Parameters	N	Coefficient	| t |	p-value	Log Likelihood
Panel A: GARCH (p = 1, q = 1)					
α_0	9901	-0.0002	0.05	0.961	-2024.274
γ	**9901**	**0.048**	**2.14**	**0.032**	
β	9901	0.900	421.45	0.000	
η	9901	0.147	41.17	0.000	

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Panel B: GARCH (p = 2, q = 1)					
α_0	9901	-0.002	0.46	0.642	-1865.576
γ	**9901**	**0.046**	**2.04**	**0.041**	
β_1	9901	1.699	402.36	0.000	
β_2	9901	-0.728	200.79	0.000	
η_1	9901	0.041	37.19	0.000	
Panel C: GARCH (p = 3, q = 1)					
α_0	9901	-0.002	0.53	0.594	-1863.018
γ	**9901**	**0.051**	**2.28**	**0.023**	
β_1	9901	1.090	12.84	0.000	
β_2	9901	0.320	2.17	0.030	
β_3	9901	-0.454	7.03	0.000	
η_1	9901	0.063	19.41	0.000	
Panel D: GARCH (p = 1, q = 2)					
α_0	9901	0.0005	0.10	0.923	-2018.772
γ	9901	0.036	1.58	0.114	
β_1	9901	0.896	389.19	0.000	
η_1	9901	0.092	10.71	0.000	
η_2	9901	0.060	6.79	0.000	
Panel E: GARCH (p = 2, q = 2)					
α_0	9901	-0.002	0.46	0.643	-1865.573
γ	**9901**	**0.046**	**2.03**	**0.042**	
β_1	9901	1.700	231.16	0.000	
β_2	9901	-0.728	116.24	0.000	
η_1	9901	0.041	9.94	0.000	
η_2	9901	-0.0004	0.09	0.929	

The risk-return trade-off is the relationship between the risks one takes on when investing and the performance of assets. According to the risk-return trade-off, increased risk entails higher reward, and vice versa. According to this theory, low levels of risk (uncertainty) correspond to low potential returns, whereas high levels of risk (uncertainty) correspond to high potential returns. The risk-return trade-off states that investing money can only result in bigger rewards if the investor is willing to tolerate a higher likelihood of losses.

Here above table indicate that there is positive significant relationship between volatility of risk and return of Bitcoin in future time series in Panel-A, B, C and E

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Panel F: GARCH (p = 3, q = 2)					
α_0	9901	-0.002	0.52	0.600	-1862.925
γ	**9901**	**0.051**	**2.24**	**0.025**	
β_1	9901	1.076	5.94	0.000	
β_2	9901	0.342	1.12	0.262	
β_3	9901	-0.463	3.58	0.000	
η_1	9901	0.060	10.55	0.000	
η_2	9901	0.004	0.38	0.707	
Panel G: GARCH (p = 1, q = 3)					
α_0	9901	-0.004	0.98	0.328	-1997.203
γ	**9901**	**0.082**	**3.99**	**0.000**	
β_1	9901	0.890	395.48	0.000	
η_1	9901	0.104	11.49	0.000	
η_2	9901	-0.071	7.26	0.000	
η_3	9901	0.131	20.40	0.000	
Panel H: GARCH (p = 2, q = 3)					
α_0	9901	-0.006	1.28	0.201	-1831.65
γ	**9901**	**0.074**	**3.36**	**0.001**	
β_1	9901	1.665	205.16	0.000	
β_2	9901	-0.699	102.77	0.000	
η_1	9901	0.109	13.38	0.000	
η_2	9901	-0.163	11.73	0.000	
η_3	9901	0.102	15.09	0.000	
Panel I: GARCH (p = 3, q = 3)					
α_0	9901	0.004	0.96	0.335	-1736.518
γ	9901	-0.021	1.06	0.291	
β_1	9901	0.975	566.45	0.000	
β_2	9901	0.835	176.09	0.000	
β_3	9901	-0.812	162.71	0.000	
η_1	9901	0.039	15.95	0.000	
η_2	9901	0.167	29.45	0.000	
η_3	9901	0.204	37.43	0.000	

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T-distribution has been employed in Panel-F in place of the Gaussian distribution. As a result, Panels F, G, and H demonstrate that in future time series, there is a positive significant link between risk and return volatility.

Conclusion

Blockchain technology—an important innovation in FinTech that emerged in the early 2000s—has given rise to a new class of asset called cryptocurrencies. The most well-known cryptocurrency, Bitcoin, has gained interest on a global scale. Even if it is utilized as a payment method, Bitcoin is the target of considerable speculation, which causes far higher volatility than conventional assets. Both CBOE and CME introduced their Bitcoin futures in December 2017. The same as futures on other assets, Bitcoin futures give investors the ability to trade Bitcoin with leverage, either for risk hedging or speculation on the price trend. Bitcoin futures work to rectify mispricing and act as a tool for risk management when utilized for arbitrage or hedging reasons, which may assist stabilize the spot market. Nevertheless, when utilized for speculation, Bitcoin futures may increase price fluctuations, which would disrupt the spot market.

The spot price and future price of Bitcoin were used in this study to explore the relationship between risk and return, following the announcement of Bitcoin future contracts by using intraday high frequency data. Despite the fact that after the futures contracts were presented, the price of Bitcoin started to fall rapidly. It's interesting that the launch of future contracts occurs just as Bitcoin prices reach all-time highs of over US$20,000 before plummeting to values well around US$10,000. Our empirical research of the trade-off between returns and risk in the two markets shows that the risk and return trade-off in Bitcoin stock is strongly positive. Since various models are being compared in this research, it is possible to determine which is more appropriate and produces meaningful findings. Bitcoin's spot market and futures market have both shown a positive correlation between risk and return according to a few chosen models with various combinations. We have discovered that there is a rational component to Bitcoin profits from the viewpoint of a rational investor. Furthermore, there are strong hypothetical considerations in favour of this opinion. Volatilities and previous returns both suggested a favorable, considerable effect on current stocks. Our findings from December 2017 to March 2018 reveal that the GARCH in mean (GARCH-M) model is particularly helpful to understand the trade-off between risk and returns of the Bitcoin price based on historical spot prices and future price data for Bitcoin. In both spot and future time series, there is a sizable positive correlation between the variance of risk and return for Bitcoin. Also, both in spot and future time series, there is a strong correlation between risk and return volatility and return on Bitcoin.

Therefore, based on the statistical findings, we can state that there is a significant positive link between risk and return for both the future and spot markets of Bitcoin, indicating that price movements that are up are very risky and vice versa. Because Bitcoin is different from some other financial market assets, it creates new possibilities for stakeholders in terms of risk management, consumer sentiment analysis, and portfolio analysis. As a result, it would be a beneficial tool for risk management and for portfolio that it would help to investors makes more useful decisions. However, future studies can be extended by using different class of assets or market in order to have new evidence from different market by having sample period of before the launch of future contracts and after the launch of future contracts.

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References

Dwyer, G. P. The economics of Bitcoin and similar private digital currencies [J]. Journal of Financial Stability, 2015(17):81-91.

Shi, Shimeng. The impact of futures trading on intraday spot volatility and liquidity: Evidence from Bitcoin market. (SSRN Paper), 2017.

Marie B, Kim Oosterlinck, and Ariane Szafarz. Virtual Currency, Tangible Return: Portfolio Diversification with Bitcoin . Journal of Asset Management, 2015(16-6): 365–373.

Turan, Bali., and Kamil. The Intertemporal Relation Between Expected Return and Risk on Currency. Handbook of Financial Econometrics and Statistics, Springer Science and Media New Yark, 2015.

Joshua V. Rosenberg & Leah G. Traub. Price discovery in the foreign currency futures and spot market, Staff Reports 262, Federal Reserve Bank of New York, 2006.

Ghysels, E., P. Santa-Clara, and R. Valkanov,. There Is a Risk-Return Tradeoff After All [J]. Journal of Financial Economics, 2005(76):509-548.

Campbell, J., and Hentschel, L,. No News is Good News: An Asymmetric Model of Changing Volatility in Stock Returns [J]. Journal of Financial Economics, 1992(31): 281-318.

Goyal, A. and P. Santa-Clara,. Idiosyncratic Risk Matters [J]. Journal of Finance, 2003:(58) 975-1008.
Xuejing Xing and John S. Howe,. The Empirical Relationship Between Risk and Return: Evidence from the U.K. Stock Market [J]. International Review of Financial Analysis, 2003(12):329-346.

Bali,Turan G. and Lin Peng,. Is there a Risk-Return Tradeoff? Evidence from High-Frequency Data. Journal of Applied Econometrics, 2006(21-8):1169-1198.

Nelson, D,. Conditional Heteroscedasticity in Asset Returns: a New Approach. Econometrica, 1991(59):347-370.

Glosten, L.R., Jagannathan, R., Runkle, D.E,. On the Relation between the Expected Value and the Volatility of Nominal Excess Return on Stocks [J]. Journal of Finance, 1993, (48): 1779-1801.

Shaen Corbet, Brian Lucey, Maurice Peat and Samuel Vigne [J]. Economics Letters, 2018(172):23–27.
Eng-Tuck Cheah, John Fry. Speculative bubbles in Bitcoin markets? An empirical investigation into the fundamental value of Bitcoin. Economics Letters, 2015(130):32–36.

Grinberg., R. Bitcoin: an innovative alternative digital currency [J]. Journal of Hastings Science Technol and Law, 2012 (4):159–208.

Danthine, J. (1978). Information, futures prices, and stabilizing speculation, Journal of Economic Theory, 17, 79–98.

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Froot, K. A., & Perold, A. F. (1995). New trading practices and short-run market efficiency. Journal of Futures Markets, 15(7), 731.

Stein, J. C. (1987). Informational externalities and welfare-reducing speculation. Journal of Political Economy, 95(6), 1123-1145.

Chen, H., Han, Q., Li, Y., & Wu, K. (2013). Does index futures trading reduce volatility in the Chinese stock market? A panel data evaluation approach. Journal of Futures Markets, 33(12), 1167- 1190.

Arkorful, G. B., Chen, H., Liu, X., & Zhang, C. (2020). The impact of options introduction on the volatility of the underlying equities: evidence from the Chinese stock markets. Quantitative Finance, 20(12), 2015-2024.

Antoniou, A., & Holmes, P. (1995). Futures trading, information and spot price volatility: evidence for the FTSE-100 stock index futures contract using GARCH. Journal of Banking & Finance, 19(1), 117-129.

Xie, S., & Huang, J. (2014). The impact of index futures on spot market volatility in China. Emerging Markets Finance and Trade, 50(sup1), 167-177.

Hansen, P. R., Huang, Z., & Shek, H. H. (2012). Realized GARCH: a joint model for returns and realized measures of volatility. Journal of Applied Econometrics, 27(6), 877-906.

Corbet, S., Lucey, B., Peat, M., & Vigne, S. (2018). Bitcoin futures—What use are they?. Economics Letters, 172, 23-27.

Blau, B. M., & Whitby, R. J. (2019). The Introduction of Bitcoin Futures: An Examination of Volatility and Potential Spillover Effects. Economics Bulletin, 39(2), 1030-1038.

Hung, J. C., Liu, H. C., & Yang, J. J. (2021). Trading activity and price discovery in Bitcoin futures markets. Journal of Empirical Finance, 62, 107-120.

Jalan, A. , Matkovskyy, R. , & Urquhart, A. . (2021). What effect did the introduction of bitcoin futures have on the bitcoin spot market?. European Journal of Finance, (2), 1-31.

Köchling, G., Müller, J., & Posch, P. N. (2019). Does the introduction of futures improve the efficiency of Bitcoin?. Finance Research Letters, 30, 367-370.

Shi, S. (2017). The impact of futures trading on intraday spot volatility and liquidity: evidence from bitcoin market. Available at SSRN: https://ssrn.com/abstract=3094647.

Hattori, T., & Ishida, R. (2021). Did the introduction of Bitcoin futures crash the Bitcoin market at the end of 2017?. North American Journal of Economics and Finance, 56, 101322.

Kim, W., Lee, J., & Kang, K. (2020). The effects of the introduction of Bitcoin futures on the volatility of Bitcoin returns. Finance Research Letters, 33, 101204

Corresponding Author:
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Received 22, Mar 2023;
Received in revised form 5, Apr 2023
Accepted 5, Apr 2023

Hale G, Krishnamurthy A, Kudlyak M, et al. (2018). How futures trading changed bitcoin prices. FRBSF Economic Letter, 12, 1-5.

Blau, B. M., & Whitby, R. J. (2019). The Introduction of Bitcoin Futures: An Examination of Volatility and Potential Spillover Effects. Economics Bulletin, 39(2), 1030-1038.

Nelson, D. B. (1991). Conditional heteroskedasticity in asset returns: A new approach. Econometrica, 59(2), 347-370.

Glosten, L. R., Jagannathan, R., & Runkle, D. E. (1993). On the relation between the expected value and the volatility of the nominal excess return on stocks. Journal of Finance, 48(5), 1779- 1801.

Zakoian, J. M. (1994). Threshold heteroskedastic models. Journal of Economic Dynamics and Control, 18(5), 931-955.

Lee, Gary GJ, and Robert F. Engle. (1999). A permanent and transitory component model of stock return volatility. In Cointegration Causality and Forecasting A Festschrift in Honor of Clive WJ Granger, 475-497. Oxford University Press, 1999.

Lee, S. B., & Ohk, K. Y. (1992). Stock index futures listing and structural change in timevarying volatility. Journal of Futures Markets,12(5), 493-509.

Nakamoto, Satoshi. (2008). Bitcoin: A Peer-to-Peer Electronic Cash System, Unpublished Manuscript.

Sebastião, H., & Godinho, P. (2020). Bitcoin futures: An effective tool for hedging cryptocurrencies. Finance Research Letters, 33, 101230.

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