“Are bitcoin futures contracts for hedging or speculation?”

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ARE BITCOIN FUTURES CONTRACTS FOR HEDGING OR SPECULATION?

Abstract

The emerging interest in Bitcoin futures market has led to questions on its trading form and contribution to risk minimization. These questions are important for market participants, including hedgers and speculators. This paper addresses the possible trading motive in Bitcoin futures market in being speculation or hedging. The author first tests a model relating Bitcoin futures returns with trading volume and conditional volatility, estimated with a GJR-GARCH specification, on a full sample of daily futures prices. A robustness check is then conducted by investigating the hedging effectiveness of Bitcoin futures and the speculation-hedging ratios on individual Bitcoin futures contracts. The estimation results on Bitcoin futures contracts, spanning from December 2017 to February 2020, show a significant positive relationship between futures returns and lagged volume. The speculation-hedging measures used for Bitcoin futures contracts maturing in March, June, September, and December reveal an increasing demand for speculation. Also, the Bitcoin spot's full-hedge and OLS-hedge strategies with Bitcoin futures provide no gain over a no-hedge strategy. The results reveal strong evidence that traders in the Bitcoin futures market are motivated by speculation rather than hedging. This further puts in evidence the existence of asymmetric information within informed traders in Bitcoin futures market, and therefore market participants would not insure their positions against Bitcoin price movements.

Keywords volume, volatility, trading, asymmetry

JEL Classification C22, G11, G12

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INTRODUCTION

It has now been more than two years since cash-settled Bitcoin futures contracts were provided by the Chicago Mercantile Exchange (CME). Before Bitcoin derivatives market existed, the only possible form of betting against a decline in Bitcoin price was to short sell. For Bitcoin price to go up, optimism was the main driver for speculators to demand Bitcoin. This has convinced investors and market participants that Bitcoin has a speculative nature when compared with real currency. The launch of the first Bitcoin futures contract in December 2017 has put an end to such speculative demand for Bitcoin. The demand for Bitcoin dropped, and therefore the spot price has declined. This has pushed pessimistic traders to short sell and drives the price even lower. Some scholars (see, for example, Hale, Krishnamurthy, Kudlyak, & Shultz, 2018) think that Bitcoin's speculative dynamics have disappeared, and hence avenues are opened for other fundamentals driving Bitcoin price discovery.

The Bitcoin derivatives market has increased awareness and curiosity among institutional investors, hedgers, and speculators in the cryptocurrency market. Ever since, Bitcoin futures, like other futures contracts serving both the purpose of hedging and speculating, have witnessed an increasing interest from investors who can continuously speculate on Bitcoin's future value without actually owning the asset. Investors in Bitcoin market can take short positions on Bitcoin using

Bitcoin futures instruments. This would also ease transferring the risk from hedgers to speculators and attract informed traders, as is the case with other known derivatives. However, and like in other markets, the market could be dominated by uninformed traders, which makes the price discovery of Bitcoin unclear. There is also evidence suggesting that the introduction of Bitcoin futures led to an increase in Bitcoin volatility. Bitcoin lacks fiat currency's main characteristics, lacks regulation, and is subject to activities that increase its volatility.

Given these findings and the increasing interest in Bitcoin futures market's potential for hedging or speculating, it is important to properly investigate the speculation/hedging motives behind trading in the Bitcoin futures market. This paper aims to shed light on whether speculators or hedgers rather dominate the Bitcoin futures market. The author adopts Ciner's (2006) work by testing whether the high trading volume is followed either by price reversals or price continuation. To confirm, the method is extended by looking at the speculation-hedging demand ratios developed in earlier literature. It is found that traders in the Bitcoin futures market are motivated by speculation rather than hedging. This is not in line with earlier conclusions on stock index futures and energy futures markets (see, for example, Chang, Chou, & Nelling, 2000).

1. LITERATURE REVIEW

Many emerging studies on Bitcoin market have dealt with price discovery and transparency of Bitcoin futures market. In one strand of the literature dealing with price discovery, the researchers have sought to identify the effects of fundamental factors on cryptocurrency pricing (see, for example, Bhambhwani, Delikouras, & Korniotis, 2019; Nekhili & Sultan, 2020). Sebastiao and Godinho (2019) extensively reviewed the effect of Bitcoin futures on the cryptocurrency market, concluding that Bitcoin futures can serve its purpose for hedging Bitcoin and other cryptocurrencies. Alexander, Choi, Park, and Sohn (2020) study the informational efficiency and price discovery of BitMEX Bitcoin derivatives exchange. Using intraday data, they find that these derivatives can effectively hedge Bitcoin spot price volatility. Kochling, Muller, and Posch (2019) argue that institutional investors are now easily accessing the cryptocurrency market and taking short positions after introducing Bitcoin futures. They further found that Bitcoin futures brought efficiency in the market pricing of the cryptocurrency. Fassas, Papadamou, and Koulis (2019) explored Bitcoin's discovery price process in light of introducing the Bitcoin futures. Based on price discovery evaluation methodologies, they evidenced that the trading volume of Bitcoin futures provides a new source of information in Bitcoin's price formation. They also empirically put in evidence the existence of an intraday volatility dependence structure between Bitcoin spot market and Bitcoin futures market dynamics. Corbet, Lucey, Peat, and Vigne (2018) examined the volatility dynamics of Bitcoin spot prices after Bitcoin futures had been introduced. Their results confirmed that Bitcoin spot volatility had increased, and that questioned the effectiveness of Bitcoin futures as a hedging instrument. They further stated that uninformed investors are driving Bitcoin price discovery in the spot market, which confirmed the speculative nature of Bitcoin despite the existence of Bitcoin futures.

In other strands of the literature dealing with hedging cryptocurrencies, Karkkainen (2018) argued that Bitcoin futures market had opened avenues for both hedgers and speculators. Bitcoin miners act as "natural hedgers" by settling their positions with high margins, which is beneficial for speculators to minimize their risk exposure. Other recent papers document the potential role of cryptocurrencies for their diversification role in a portfolio (see, for example, Guesmi, Saadi, Abid, & Ftiti, 2019; Kajtazi & Moro, 2019). Most of these studies found that Bitcoin adds diversification benefits. Besides, there is a growing interest in using Bitcoin as investment assets for hedging other financial assets such as commodities. Corbet et al. (2018) discovered that returns on cryptos are negatively correlated with returns on assets such as the VIX, bonds, gold, currencies, S&P500, and the Goldman Sachs Commodity Price Index (SPGSCI). Bouri et al. (2019) documented that Bitcoin can hedge commodities, currencies,

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bonds, and stocks. While these studies focused on Bitcoin price discovery and hedging ability, there is limited attention on the form of trading in Bitcoin futures market. Hale et al. (2018) argued that Bitcoin spot market is dominated by speculative-driven trading and that Bitcoin futures instruments could lower the speculative demand for Bitcoin. They further claimed that Bitcoin price fell with the introduction of the Bitcoin futures because pessimists were shorting futures. Hattori and Ishida (2019) investigated arbitrage opportunities between Bitcoin spot and futures markets. They found that arbitrage prevails during the crash period than during normal periods. Baur and Dimpfl (2019) argued that investors could bet against Bitcoin with low margin requirements in the futures market has substantially increased volatility. Therefore, there seems to be a consensus that Bitcoin remains speculative, albeit hedging instruments such as Bitcoin futures.

Other futures markets have been investigated in terms of hedging benefits or speculation effect on price discovery. To cite a few, Ciner (2006) examined the form of trading in the energy futures market and concluded that hedging is the main form of trading. Chang et al. (2000) addressed the same issue for stock index futures markets and found a similar motive. Huchet and Fam (2016) found that speculation has a positive impact on commodity futures returns with commodity futures. Therefore, it is interesting to investigate the main benefits of the Bitcoin futures market and compare the findings with other existing futures markets.

2. METHODOLOGY

The methodology adopted in this paper starts with modeling the dynamics of the volatility of the Bitcoin futures returns, considering the stylized facts, and addressing the heteroscedasticity problem. The futures returns are assumed to follow a martingale with asymmetric GARCH volatility specifications. One allows for leverage effect and asymmetry between futures returns and volatility, using GJR-GARCH volatility model of Glosten, Jagannathan, and Runkle (1993). The model is pitted against the symmetric GARCH volatility model for best fitting. Let us denote the futures returns by $f_t = \log\left(P_t - P_{t-1}\right)$, where P_t is the daily closing price of a futures contract on day t.

$$f_t = \varepsilon_t,\ \varepsilon_t \to D\left(0, \sigma_t^2\right) \tag{1}$$

GARCH(1,1)

$$\sigma_t^2 = w + \beta\sigma_{t-1}^2 + \alpha\varepsilon_{t-1}^2,$$

GJR-GARCH(1,1)

$$\sigma_t^2 = w + \beta\sigma_{t-1}^2 + \left(\alpha + \delta I_{t-1}\right)\varepsilon_{t-1}^2,$$

with $I_{t-1} = 1$ if $\varepsilon_{t-1} < 0$, and $I_{t-1} = 0$ otherwise.

In this model, α and β represent, respectively, the ARCH and GARCH coefficients, and δ represents the leverage parameter or the scale of asymmetric volatility. The distribution D of shocks follows a skewed Student t distribution, with parameters γ for skewness and v for the degrees of freedom, to accommodate fat tail and skewness in the returns. Such asymmetric leptokurtic distribution with GARCH model fitting is beneficial for highly volatile series such as Bitcoin.

Once the best fitting model for futures returns is determined, the conditional volatility is extracted from the futures contract returns. These volatilities will serve for the main model that examines the role of volume on speculation/hedging, as in Llorente et al. (2002), as follows:

$$f_t = \lambda_1 + \lambda_2 f_{t-1} + \lambda_3 V_{t-1} + \\ + \lambda_4 f_{t-1} V_{t-1}^2 + \lambda_5 f_{t-1}\sigma_{t-1} + u_t, \tag{2}$$

where V_t is the log trading volume. This model suggests that trade volume is a signal that attracts traders in either speculation or hedging. It tests for significance between lagged returns, represented by λ_2, lagged volume, represented by λ_3, nonlinearity between the returns and lagged volume, represented by λ_4, and linkage with conditional volatility, represented by λ_5. The speculating/hedging trading activity is tested via the sign and significance of the parameter λ_3. In case the sign is significantly positive then Bitcoin futures market trading is dominated by speculative demand. If the sign is significantly negative, then the trading activity is motivated by hedging.

For a robustness check, the methodology proceeds with two investigations. The first is to check whether Bitcoin futures contracts are effective instruments in hedging Bitcoin spot long position. Let us denote by s_t the log difference of Bitcoin spot prices. A hedger's exposure to Bitcoin spot market can achieve a minimum hedging ratio from the following regression:

$$s_t = a + bf_t + \varepsilon_t, \quad (3)$$

where ε_t i.i.d error terms. The minimum hedging ratio is $b = \text{cov}(s_t, f_t)/\text{var}(f_t)$. One can obtain different hedging strategies based on the value of b. A no-hedge strategy happens when $b = 0$, a full-hedge strategy happens when $b = 1$, and a partial-hedge strategy is when $b < 1$. One can either run a simple regression (Ordinary Least Squares) or make it dynamic by assuming GARCH volatility model, as one did with the futures returns. The objective here is not to find the best performing hedging model but rather check whether any of the strategies are as good as a no-hedge strategy. This will test Bitcoin futures contracts' hedging capability in protecting a trading exposure in the Bitcoin spot market. Failing to perform better than a no-hedge strategy would give more insights on the form of trading in Bitcoin futures market for being speculative or hedging.

The second investigation measures the speculation and hedging trading activities in individual futures contracts with different maturities. The first measure is the proportional relation between volume and open interest of Garcia, Leuthold, and Zapata (1986). This measure puts in evidence the total volume of traded contracts comparatively to the size of the open positions, and it is defined as follows:

$$HS1_t = \frac{V_t}{OI_t}, \quad (4)$$

where OI_t is the open interest at time t. This ratio can take higher and lower values and infinite values. The second measure is a modified version of $HS1$ developed by Gwilym et al. (2002). Instead of using the open interest series, this ratio uses the changes in the daily open interest to provide more information on the activity of hedgers. It is then defined as follows:

$$HS2_t = \frac{V_t}{|\Delta OI_t|}, \quad (5)$$

where $\Delta OI_t = OI_t - OI_{t-1}$. Relative to open interest, any increase in the trading volume would induce both measures to have higher values, which in return indicate a high speculation trading activity. The opposite would indicate more of hedging trading activity then speculation.

3. RESULTS

3.1. Data description

Bitcoin spot prices, futures contracts prices, volume, and open interest were collected from Bloomberg. The data span from December 17, 2017, the inception of the first futures contract maturing in March, to February 3, 2020. CME offers Bitcoin futures contracts maturing in March, June, September, and December. The sample period taken includes eight futures contracts (2 contracts per maturity), which were rolled over to obtain a series of daily closing prices, volumes, and open interest. Table 1 shows a summary of the descriptive statistics and observes that both the futures returns and volume series have zero mean, with negative skewness and excess kurtosis. Additionally, all series are stationary, as indicated by the Augmented Dickey-Fuller test (p-values are less than 5%). The autocorrelogram of the returns was also diagnosed, and a significant first-order autocorrelation was found, suggesting a possible inclusion of an autoregressive coefficient of order 1 in the speculation-hedging model. Due to procyclicality in the volume series, the trend was removed using a first difference of the daily log volume and ensured stationarity. Figure 1 gives a visual inspection of the stationarity of the Bitcoin futures returns, volume, and open interest.

Table 1. Descriptive statistics

Statistic	Spot returns	Futures returns	Futures volume	Futures open interest
Mean	0.739	–0.001	0.005	0.009
StDev	4.459	0.048	0.890	0.194
Skewness	0.397	–0.190	–0.566	0.557
Kurtosis	10.395	9.905	10.536	26.401
ADF test (*p*-value)	–7.58 (0.01)	–7.69 (0.01)	–8.75 (0.01)	–6.80 (0.01)

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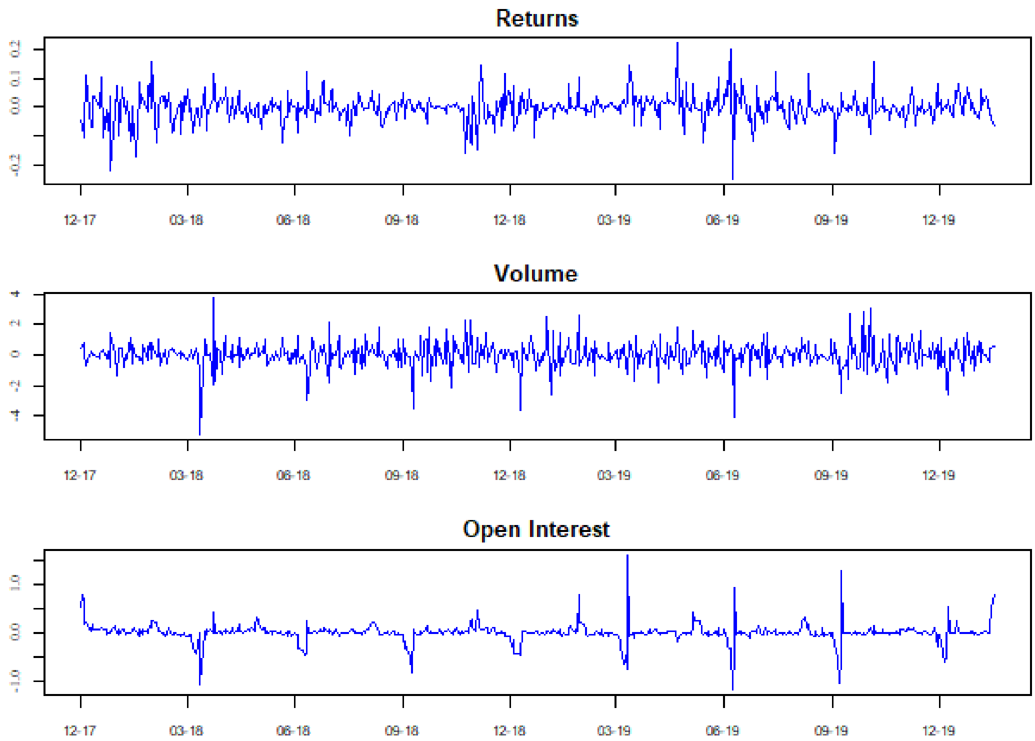

Figure 1. Bitcoin futures contracts returns, volume, and open interest

3.2. Hedging-speculation results

Table 2 displays the estimation of the volatility model and the speculation-hedging model for future returns. Panel (a) shows that the GJR-GARCH(1,1) model has significant goodness of fit that the symmetric GARCH(1,1) model, and presents no serial autocorrelation in the residuals at 5% significance level, as indicated by the Ljung-Box statistics. It is further observed that there is significant short-run volatility dynamics, represented by α and β. This shows a significant volatility reaction to market movements and slow absorbance of shocks to the conditional variance. Moreover, there is a significant leverage effect showing that negative shocks prevail over positive shocks in increasing futures returns' volatility. This model's outcomes in terms of conditional volatility are then used in the speculation-hedging model of Equation 2.

The estimation results reported in Panel (b) indicated a statistically significant positive relationship between futures returns and lagged volume,

Table 2. Estimation results

Volatility model	w	α	β	γ	v	δ	LogLik	Ljung-Box
Panel (a). GARCH estimation								
GARCH(1,1)	0.00002	0.091*	0.907*	0.993*	3.013*	–	942.40	1.925
	(0.0016)	(0.0249)	(0.0247)	(0.0492)	(0.2994)		(0.165)	
GJR-GARCH(1,1)	0.00002	0.082*	0.907*	0.992*	3.006*	0.309*	942.51	1.900
	(0.0000)	(0.030)	(0.0242)	(0.0492)	(0.3008)	(0.092)		(0.168)
Panel (b). Speculation-hedging estimation								
Parameter	λ_1	λ_2	λ_3	λ_4	λ_5			
Estimation	−0.001	0.274***	0.088**	−0.014	−2.939**	–	–	–
	(0.575)	(0.094)	(0.033)	(0.340)	(0.037)			

Note: The table reports the estimates of the GARCH(1,1) and GJR-GARCH(1,1) with skewed Student error model for Bitcoin futures returns (Panel (a)), and the speculation-hedging model of Equation 2 (Panel (b)). For each parameter, *p*-values are reported in parentheses and * indicates significance at 1% level, ** significance at 5% level, and *** significance at 10% level.

as indicated by the coefficient λ_3. This suggests that when futures contracts are traded with high volumes, Bitcoin price continues to rise, which implies that speculation is dominating the trading activities in the Bitcoin futures market. These results are opposed to the findings in energy futures markets (e.g., Ciner, 2006) and stock index futures markets (e.g., Chang et al., 2000). Besides, the estimates of λ_1, and λ_4, respectively, indicate a significant first-order autoregressive coefficient, an insignificant nonlinearity between futures returns autocorrelation and volume. The significance of the coefficient λ_5 indicates that futures returns are impacted by conditional volatility, meaning that chocks from volatility do affect the futures returns.

3.3. Robustness check

This subsection discusses the results of the two investigations conducted for robustness check. The first investigation deals with testing Bitcoin futures' hedging effectiveness on a position in Bitcoin spot market. The author uses Bitcoin spot returns data covering the same time horizon over which the previous study is conducted with Bitcoin futures returns. To detect any deviation from stationarity, Figure 3 presents the two return series. It is observed that the two series are stationary and that both returns display volatility clustering. Besides, the two series evolve within different magnitudes, which are higher for the spot returns than the ones of the futures returns.

Table 3 displays the minimum variance ratio obtained from hedging Bitcoin spot with Bitcoin futures contracts using three hedging strategies, namely no-hedge, full-hedge, and OLS-hedge. For a portfolio composed of Bitcoin spot and Bitcoin futures, it is observed that the variance of OLS-hedge is similar to that of no-hedge and that full-hedge is higher than that of no-hedge. This shows no significant gain in minimizing a hedger's risk exposure of a Bitcoin spot position with Bitcoin futures. Over a no-hedge strategy, there is a positive increase of 0.045% in the minimum portfolio variance with a full-hedge strategy and a minimal reduction by 0.067% with an OLS-hedge strategy. It is then conjectured that there is no incremental benefit for a hedger's exposure in the Bitcoin spot market by being long in Bitcoin futures market. This joins early results that Bitcoin futures market is rather for speculation than for hedging.

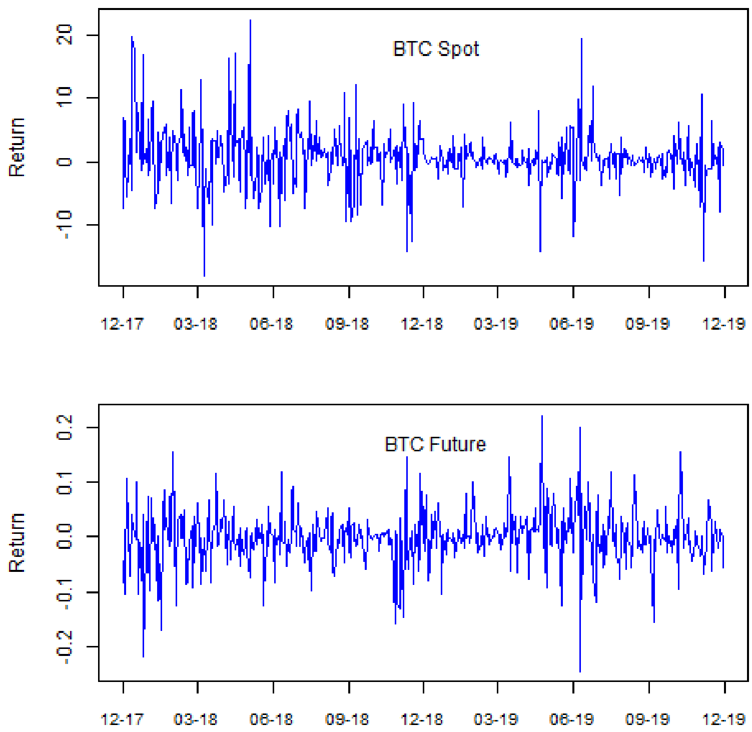

Figure 3. Bitcoin spot and futures returns

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Table 3. Hedging Bitcoin spot with Bitcoin futures

Hedging strategy	No-hedge	Full-hedge	OLS-hedge
Portfolio variance	4.459	4.461	4.456
% reduction	–	0.045%	–0.067%

Table 4. Speculation-hedging demand measures

Statistic	March contracts		June contracts		September contracts		December contracts	
	HS1	HS2	HS1	HS2	HS1	HS2	HS1	HS2
Mean	3.840	12.087	8.897	89.234	8.101	70.857	7.587	70.656
Median	0.679	5.339	1.720	8.867	1.213	13.646	1.412	18.637
StDev	67.32	20.11	139.72	578.93	248.7	518.85	91.26	315.53

The second robustness check deals with investigating the speculation-hedging demand ratios for individual futures contracts. Table 4 reports statistics of the two speculation-hedging ratios measured on the Bitcoin futures contracts maturing in March, June, September, and December, respectively. It is observed that the mean, median, and standard deviation of the ratios are higher for contracts maturing in June, September, and October than those maturing in March. This would suggest that trading contracts maturing in June, September, and December are highly motivated by speculation than with March futures contracts. Overall though, the speculation dominates trading in each futures contract.

Figure 2 displays the dynamics of the two speculation-hedging ratios. It is observed that the two ratios are higher around the contracts' maturities, which could be associated with trading noises close to the settlement dates of the individual contracts. A particular focus on the speculation-hedging ratio HS2 reveals an increasing trend in the magnitude from the inception of the first futures contract of March and onwards. This corroborates previous findings that trading activities in the Bitcoin futures market are driven by speculation motives rather than hedging. It seems like from the inception of the first Bitcoin futures contract, maturing in March 2018, traders in the Bitcoin spot market were hedging their positions in the Bitcoin futures market. However, their trading motives seem to shift direction after that. This leads to agree with the consensus that Bitcoin still lacks the main characteristics of real currency, and its value remains speculative as per its demand from traders.

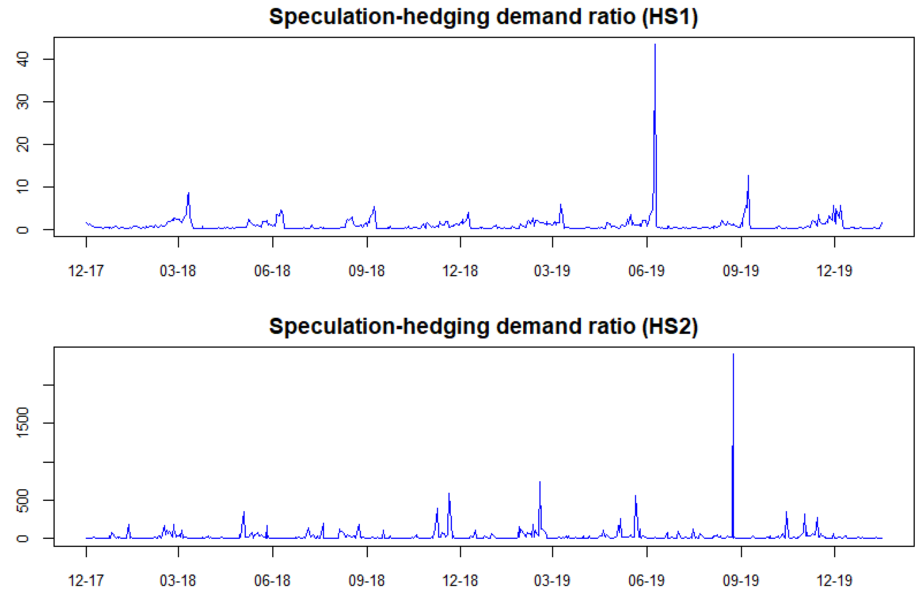

Figure 2. Speculation-hedging ratios for Bitcoin futures contracts

4. DISCUSSION

The main findings of this paper indicate the speculation nature of trading in the Bitcoin futures market. A significant positive relationship between futures returns and lagged volume shows that Bitcoin price formation momentum is driven by large trading volume. Also, and looking at futures contracts individually, the speculation-hedging ratio results highlight a higher demand for speculation than for hedging. This demonstrates that Bitcoin market is dominated by speculators and confirms its speculative trading nature. Moreover, any adopted hedging strategy with Bitcoin futures contracts, whether naïve-hedging or OLS-hedging, is as good as a no-hedge position in the Bitcoin spot market. This shows that Bitcoin futures are not a safe haven for hedgers in the spot market.

Overall, the results reveal strong evidence that traders in the Bitcoin futures market are motivated by speculation rather than hedging. Unlike other commodities that play roles of safe haven, Bitcoin futures display speculative characteristics rather than hedging ones. This further puts in evidence the existence of asymmetric information within informed traders in Bitcoin futures market, and therefore market participants would not insure their positions against Bitcoin price movements. This speculative behavior leads to conclude that Bitcoin market is price inefficient. Regulatory authorities of the commodity markets would be required to enforce legal measures to protect traders and investors in the Bitcoin market.

CONCLUSION

There is a growing interest in the recent emergence of Bitcoin futures market and its hedging/speculation capabilities. This may trigger a new risk level in the financial markets and raises various questions to institutional traders, regulators, and market participants. Based on a model that relates futures returns with trading volume and conditional volatility, estimated with a GJR-GARCH specification, the author finds evidence that traders in the Bitcoin futures market are motivated by speculation more than hedging. There is a significant positive relationship between futures returns and lagged volume. The robustness check conducted on testing the hedging effectiveness of Bitcoin futures and on measuring the speculation-hedging ratios on individual Bitcoin futures contracts suggests that Bitcoin futures price formation evolves in a continuous fashion rather than in a reversal way. Such findings may imply that, for hedgers and investors, the existence of asymmetric information within informed traders in Bitcoin futures market would not insure their positions against Bitcoin price movements. Additionally, and because Bitcoin has witnessed wild price volatility, increasing trading volume may destabilize the Bitcoin spot market.

This study presents some limitations, which can be due to the limited sample size of Bitcoin futures contracts. Future research could check the robustness of our results using a larger dataset or at a higher frequency.

AUTHOR CONTRIBUTIONS

Conceptualization: Ramzi Nekhili.
Data curation: Ramzi Nekhili.
Formal analysis: Ramzi Nekhili.
Investigation: Ramzi Nekhili.
Methodology: Ramzi Nekhili.
Validation: Ramzi Nekhili.
Writing – original draft: Ramzi Nekhili.
Writing – review & editing: Ramzi Nekhili.

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REFERENCES

1. Alexander, C., Choi, J., Park, H., & Sohn, S. (2020). BitMEX Bitcoin derivatives: Price discovery, informational efficiency, and hedging effectiveness. *Journal of Futures Markets, 40*(1), 23-43. https://doi.org/10.1002/fut.22050
2. Baur, D. G., & Dimpfl, T. (2019). Price discovery in bitcoin spot or futures? *Journal of Futures Markets, 39*(7), 803-817. https://doi.org/10.1002/fut.22004
3. Bhambhwani, S., Delikouras, S., & Korniotis, G. M. (2019). *Do fundamentals drive cryptocurrency returns?* http://dx.doi.org/10.2139/ssrn.3342842
4. Bouri, E., Molnár, P., Azzi, G., Roubaud, D., & Hagfors, L .I. (2017). On the hedge and safe haven properties of Bitcoin: Is it really more than a diversifier? *Finance Research Letters, 20,* 192-198. https://doi.org/10.1016/j.frl.2016.09.025
5. Chang, E., Chou, R. Y., & Nelling, E. F. (2000). Market volatility and demand for hedging in stock index futures. *Journal of Futures Markets, 20,* 105-25. https://doi.org/10.1002/(SICI)1096-9934(200002)20:2%3C105::AID-FUT1%3E3.0.CO;2-Q
6. Ciner, C. (2006). Hedging or speculation in derivative markets: the case of energy futures contracts. *Applied Financial Economics Letters, 2,* 189-192. https://doi.org/10.1080/17446540500461729
7. Corbet, S., Lucey, B., Peat, M., & Vigne, S. (2018). Bitcoin Futures – What use are they? *Economics Letters, 172,* 23-27. https://doi.org/10.1016/j.econlet.2018.07.031
8. Fassas, A. P., Papadamou, S., & Koulis, A. (2019). Price Discovery in Bitcoin Futures. *Research in International Business and Finance, 52,* 101116. https://doi.org/10.1016/j.ribaf.2019.101116
9. Garcia, P., Leuthold, R. M., & Zapata, H. (1986). Lead-lag Relationships between Trading Volume and Price Variability: New Evidence. *Journal of Futures Markets, 6*(1), 1-10. Retrieved from https://search.proquest.com/openview/92923ba61b598c757fb43c2c91408277/1?pqorigsite=gscholar&cbl=47957
10. Glosten, L., Jagannathan, R., & Runkle, D. (1993). On the Relation between the Expected Value and the Volatility of the Nominal Excess Return on Stocks. *Journal of Finance, XLVIII, 5,* 1779-1801. https://doi.org/10.1111/j.1540-6261.1993.tb05128.x
11. Guesmi, K., Saadi, S., Abid, I., & Ftiti, Z. (2019). Portfolio diversification with virtual currency: Evidence from bitcoin. *International Review of Financial Analysis, 63,* 431-437. https://doi.org/10.1016/j.irfa.2018.03.004
12. Gwilym, O. A., Buckle, M. J., & Evans, P. (2002). *The Volume-maturity Relationship for Stock Index, Interest Rate and Bond Futures Contracts* (EBMS Working Paper. European Business Management School, University of Wales, Swansea). Retrieved from https://www.worldcat.org/title/volume-maturity-relationship-for-stock-index-interest-rate-and-bond-futures contracts/oclc/50464942&referer=brief_results
13. Hale, G., Krishnamurthy, A., Kudlyak, M., & Shultz, P. (2018). *How Futures Trading Changed Bitcoin Prices*. FRBSF Economic Letter, May 7 Research from Federal Reserve Bank of San Francisco. Retrieved from https://www.frbsf.org/economic-research/publications/economic-letter/2018/may/how-futures-trading-changed-bitcoin-prices/
14. Hattori, T., & Ishida, R. (2019). *The Relationship between Arbitrage in Futures and Spot Markets and Bitcoin Price Movements: Evidence from the Bitcoin Markets*. http://dx.doi.org/10.2139/ssrn.3209625
15. Huchet, N., & Fam, P. G. (2016). The role of speculation in international futures markets on commodity prices. *Research in International Business and Finance, 37,* 49-65. https://doi.org/10.1016/j.ribaf.2015.09.034
16. Kajtasi, A., & Moro, A. (2019). The role of Bitcoin in well diversified portfolios: A comparative global study. *International Review of Financial Analysis, 61,* 143-157. https://doi.org/10.1016/j.irfa.2018.10.003
17. Karkkainen, T. (2018). *Price Discovery in the Bitcoin Futures and Cash Markets*. http://dx.doi.org/10.2139/ssrn.3243969
18. Kochling, G., Muller, Y., & Posch, P. N. (2019). Does the introduction of futures improve the efficiency of Bitcoin? *Finance Research Letters, 30,* 367-370. https://doi.org/10.1016/j.frl.2018.11.006
19. Llorente, G., Michaely, R., Saar, G., & Wang, J. (2002). Dynamic volume-return relation of individual stocks. *Review of Financial Studies, 15*(4), 1005-1047. https://doi.org/10.1093/rfs/15.4.1005
20. Nekhili, R., & Sultan, J. (2020). Jump Driven Risk Model Performance in Cryptocurrency Market. *International Journal of Financial Studies, 8,* 19. https://doi.org/10.3390/ijfs8020019
21. Sebastiao, H., & Godinho, P. (2019). Bitcoin futures: An effective tool for hedging cryptocurrencies. *Finance Research Letters, 33,* 101230. https://doi.org/10.1016/j.frl.2019.07.003