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An Investigation of Volatility Transmission and Hedging Opportunities of Cryptocurrencies towards other Financial Assets

Hassan Raza¹, Aijaz Mustafa Hashmi², Arshad Hassan³

¹ Assistant Professor, Shaheed Zulfiqar Ali Bhutto Institute of Science and Technology, Islamabad

² Assistant Professor, National University of Modern Languages, Islamabad

³ Professor, Capital University of Science & Technology (CUST) - Islamabad

ABSTRACT

Asset allocation towards a specific portfolio is solely based on the diversification property among financial as well as non-financial assets. This paper is an attempt to see the invisibility and role of diversification of cryptocurrencies with other financial assets. The study is utilizing the extensive data on Bitcoins and GSPC-Index, MSCI-Global Index, MSCI-Currency Index, COMEX closing Gold Price, and OPEC Crude oil Prices. The investigation aims to assess the direction and swap capability of the cryptocurrency (Bitcoin) towards the other global financial assets. The hypothesis of the study is whether the volatility created by bitcoin is transmitted towards the other financial assets using multivariate BEKK-GARCH methodology. The results indicated that any shock that appeared in bitcoin is significantly decreasing the volatility of all selected assets except MSCI-Global Index returns. The study found that the use of cryptocurrencies in the portfolio would offer diversification benefits to investors. The results are more beneficial for the risk-averse investor, who wants to hedge their portfolio through the inclusion of the negatively correlated security.

Keywords: Cryptocurrencies, bitcoin, GARCH in mean, Volatility spillovers,

1. INTRODUCTION

The meteoric growth and importance of cryptocurrencies challenging policymakers around the globe as recently, speculative demand for these currencies is increasing day by day (Ballis & Drakos, 2020; Kallinterakis & Wang, 2019). As during the last year, Bitcoin increased from 10.1 to 80 billion in volume and 616 to 4800 in US price. The same growth can be seen in other cryptocurrencies like Ripple, Litecoin, and many others. Therefore, it is not more surprising that the investors are moving to invest in these

Address of Correspondence

Aijaz Mustafa Hashmi
amustafa@numl.edu.pk

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assets to earn high returns.

Different research works can be traced out on cryptocurrencies after their emergence. A variety of issues can be seen to research like hedging properties of cryptocurrencies (Bouri, Hussain Shahzad, et al., 2020; Bouri, Lucey, et al., 2020), its return and volume relationship (Nasir et al., 2019), efficiency or speculation (Selmi et al., 2018) and market efficiency (Caporale & Plastun, 2019). Along the same lines, this work is an attempt towards the investigation of interconnection, volatility spillover, and hedging opportunities of cryptocurrency towards the other financial global assets.

Interconnection of financial markets has been an important topic in the center of the research agenda since the 1990s (e.g., Forbes and Rigobon, 2002; Gande and Parsley, 2005). Because of many economic and financial factors, volatility exists in many markets and financial markets are interlinked with each other. According to Liu & Tsyvinski (2008), there are some economic factors e.g. weather, war, and political issues which affect the prices of alternative assets. So, for Pakistani fund managers and international investors, it is very necessary to study time-varying volatility between different types of markets. The volatility spillover effect among financial markets and different stock markets is studied by many researchers. (e.g., Hassan & Malik, 2002 ; Diebold & Yilmaz, 2012; Kumar, Krishma, Nisar, & Raina, 2017). Five assets have been explained in this research as alternative investments or assets e.g. Gold, MSCI Global index, Crude oil, Mutual funds, and Currencies.

Gold is considered an alternative asset as it provides a good return to investors and it is a very trusted investment. It is very important to study Gold price fluctuations or volatility for making hedging decisions or to understand the economy and financial markets (Malik, 2010). According to research done by Lucey & Tully, (2006) to understand the economy and financial markets in a better way, investors need to study gold price volatility or fluctuation. Many studies in the literature indicate the effect of uncertain macroeconomic factors on gold volatility (see, for example, Asai et al. (2019, forthcoming), Bouri and Jalkh (2019), Pierdzioch et al. (2016), Fang et al., (2018), Gkillas et al. (2019) and Demirer et al. (2019)). When prices of gold fluctuate, then it creates a risk for investors. Crude Oil is also considered an alternative asset or

investment. Prices of crude oil are highly linked with prices of other commodities or goods therefore by raising the prices of crude oil, the cost of transportations and heating costs tends to increase. So, according to Hooker (2002) and Hamilton (2000) when crude oil prices increase it will generate inflation and negatively affect the overall economy.

Likewise, a decrease in oil prices also leads to a decline in prices of other commodities, as during the COVID-19 crises, oil prices collapse. A decline in oil prices leads to decrease oil demand and as a result demand for coal, aviation fuel, and energy products also tends to decrease. Georgieva, (2020), studied that 'The International Monetary Fund' specified that a global crisis or recession is expected and it will be as bad as 2007-8 world financial crises.

MSCI Global index and MSCI Emerging Stock are also treated as alternative investments. MSCI Global and Emerging is also affected by volatility in the stock market. Any uncertain event or crisis can create volatility in MSCI indexes. Currencies (e.g Dollar) is another alternative investment option. Because many investors prefer to invest in the dollar as it also provides a good return. It is very important to explore the volatility spillover effect between US dollar exchange rates and Stock market prices as there exists a strong relation between them. Mutual Funds are another alternative investment class for investors and fund managers. There exist many studies in the literature that shows the association between mutual funds & market volatility. When there is more volatility in markets then the flow of mutual funds is reduced (Cao, Chang, & Wang, 2008). Therefore this study investigates what benefits investors can derive by investing in mutual funds and how they are affected by volatility spillover.

Stylized fact about the asymmetric behavior of different financial markets is documented phenomena, which indicate that information about downside(upside) movements of financial markets transmit asymmetrically (Baruník et al., 2016, 2017; Baruník & Kocenda, 2019). They developed a spillover asymmetry quantitative measure that uses the same popular framework of Diebold & Yilmaz (2012). This study also used the same lines to develop the spillover tool to gauge the asymmetric behavior by connecting Bitcoin (main cryptocurrency) to the traditional market assets trading in global financial markets.

Model Description and Empirical Results:

The current study examines the mean and volatility spillover effect of Bitcoin towards the other financial assets using daily adjusted closing prices for the year 2013 to 2019. Data descriptive, correlation, and detailed results of ARCH(1,1) and GARCH(1,1) have been obtained using the EVIEWS software. All indices have been taken in dollar nomination. Daily prices have been converted into the returns using the log return formula

$$Return = \ln \left(\frac{Price_t}{Price_{t-1}} \right).$$

The summary statistics for the daily returns of the six different assets are reported in table 1. The mean returns of Bitcoin are .4%, which means that one can earn a .4% return daily while investing in Bitcoin, which is also well above the returns of the other selected assets. The standard deviation indicates that this daily return can move up and down by 5.3%. The maximum return that an investor can earn is 52% in a single day and the maximum is a loss that may incur 26.6%. The investment in crude oil and currency index provides average negative returns. The MSCI global index return is .12, which is higher than the second number from the selected assets. The standard deviation of returns ranges between 0.053 for Bitcoin and 0.0054. The highest volatility in terms of standard deviation is seen in the cryptocurrency (Bitcoin) while the lowest volatility is seen in It indicates that the Gold is the most volatile and the Bitcoin market is the least volatile. The high values of kurtosis in these markets suggest that their daily return series have leptokurtic behavior and a skewness shows a fat-tailed distribution. Descriptive analysis of the data suggests that GARCH is a suitable methodology for capturing the fat tails and time-varying volatility.

Table No. 1. Descriptive Analysis						
	Mean(%)	Std. Dev.	max	min	skewness	kurtosis
Bitcoin	0.4	.053	.521	-.266	.533	15.049
GSPC	0.04	.008	.038	-.042	-.589	6.735
Oil	-0.05	.025	.189	-.098	.466	7.988
Msci currency	-0.006	.005	.023	-.038	-.366	7.843
Gold	0.002	.009	.077	-.036	.523	8.433
MSCI Global	0.12	.013	.064	-.053	.073	5.377

The result of the correlations of returns is reported in table 2. These results indicate that there is a negative relationship between Bitcoin and oil returns, MSCI currency returns, and Gold returns, while a positive relationship between GSPC returns, and MSCI global returns.

Table No. 2: Correlation Analysis

	Bitcoin	Gspc	Oil	Msci_currency	Gold	Msci_global
BITCOIN	1					
GSPC	0.028	1				
OIL	-0.0142	0.1947*	1			
MSCI						
CURRENCY	-0.0115	-0.0251	0.0632*	1		
GOLD	-0.0221	-0.097*	0.0741*	0.3320*	1	
MSCI GLOBAL	0.0013	0.6390*	0.0842*	-0.0152	-0.0557	1

This study used a two-stage GARCH in mean methodology (GARCH-M) as proposed by Liu and Pan (1997) to examine the mean & volatility spillover from Bitcoin to the other financial markets. In the first step, Bitcoin mean and volatility is measured through an ARMA (1, 1)-MARCH (1, 1) model as follows ...

$$r_t = \alpha + \beta_1 r_{p,t-1} + \beta_2 h_t + \mu_t \text{-----Mean Equation}$$

And

$$h_t = \phi_0 + \phi_1 h_{t-1} + \phi_2 \mu_{t-1}^2 \text{-----Variance Equation}$$

Where R_t is the daily return of the currency market at time t and μ_t is the residual or unexpected return. The inclusion of ARMA (1,1) and/or MA (1) structure in the model to capture the possible serial independence in the series returns.

In the second step of this procedure, the mean and volatility spillover effects are analyzed of the other markets by incorporating the lag arch and garch term of Bitcoin markets which is obtained from the first step, simply substituting the Bitcoin mean and volatility into the other markets mean and volatility to check the spillover effect. The following equations are used for the said purpose;

$$r_t = \alpha_0 + \beta_1 r_{p,t-1} + \beta_2 h_t + \beta_3 \mu_{t-1} + \beta_4 \mu_{b,t} \text{-----Mean Equation}$$

And

$$h_{a,t} = \phi_0 + \phi_1 h_{t-1} + \phi_2 \mu_{t-1}^2 + \phi_3 UTV_{b,t} \text{-----Variance Equation}$$

Where the a is asset 1, asset 2, etc., $\mu_{b,t}$ is the standardized residual generated by bitcoin returns while UTV_b is the volatility generated by bitcoin returns and tested for each asset.

The study used the daily returns for each asset from May 2013 to September 2019. The figure/numeric in the parentheses under the actual estimates is standard errors. The value of $Q(24)$ statistics indicates the Portmanteau statistics with the assumption of no residual series correlation measured at 24 lag. Similarly, the value of $Q(24)$ Sq exhibits the square of the same test.

Table No. 3: Mean and Volatility Spillover between Bitcoin and Other Assets					
	GSPC	MSCI-Global	Gold	MSCI-Curr	Oil
$\beta_2 h_t$	-14.65981 (15.5437)	-4.734318 (7.8905)	-24.8114** (11.0568)	-38.82915 (20.7067)	1.620366 (5.5076)
α_0	0.00024 (0.0006)	-0.002013 (0.0033)	0.0023** (0.0010)	0.000742 (0.0005)	-0.00162 (0.0077)
$\beta_1 r_{p,t-1}$	1.006207 (0.3757)	3.04743 (2.7837)	0.7924 (0.8676)	-0.037712 (1.4173)	0.038184 (0.4007)
$\beta_3 \mu_{t-1}$	-1.040648 (0.3837)	-3.056429 (2.7877)	-0.8623 (0.8732)	0.049064 (1.4148)	-0.242453 (0.4005)
$\beta_4 \mu_{b,t}$	0.000121 (0.0002)	-0.000558 (0.0004)	-2.03E-05 (0.0002)	7.44E-05 (0.0001)	1.17E-05 (0.0014)
ϕ_0	0.0000142** (0.0000)	2.60E-05** (0.0000)	2.51E-05** (0.0000)	6.2E-06** (0.0000)	0.000477** (0.0002)
$\phi_2 \mu_{t-1}^2$	0.15** (0.0207)	0.144879** (0.0282)	0.14971** (0.0299)	0.15001** (0.0326)	0.15** (0.0719)
$\phi_1 h_{t-1}$	0.6** (0.0415)	0.657349** (0.0548)	0.600031** (0.0666)	0.60006** (0.0681)	0.599999** (0.1662)
$\phi_3 UTV_{b,t}$	-8.06E-10** (0.000)	1.07E-08** (2.23E-09)	-1.33E-09** (5.41E-10)	-3.7E-10** (1.54E-10)	-2.6E-08** (1.27E-09)
Q(24)	0.194	0.812	0.008	0.095	0.041
Q(24) Sq	0.001	0.905	0.449	0.119	0.000

Table 3 reported the detailed results of mean and volatility spillover of Bitcoin and their impact on the other financial markets. The results indicate that the ARCH effect is significant which means that past price behavior influences the volatility of the other financial markets. Results of the study also indicate that small and big shocks in Bitcoin markets create also the same level of the small and big shocks in the other financial

markets, the significance of the Garch term also indicates that these shocks persist over time. The same behavior can also be seen in figure 1. The coefficients of ϕ_3 is highly significant, which reports the presence of volatility spillover from the bitcoin market to all assets to persist and negative for all except MSCI-Global, which indicates that an increase in Bitcoin volatility with decrease the volatility of others assets. These results can be concluded that cryptocurrencies, e.g., Bitcoin, can be used as a good hedge for portfolio diversification. These results are more beneficial to the risk-averse investor, who wants to hedge their portfolios by the inclusion of the negatively correlated securities.

Figure 1: Mean and Variance Graphs

5. CONCLUSION

This study examines the mean and volatility spillover effects from cryptocurrencies, e.g., Bitcoin to other significant assets to see whether Bitcoin can be used as hedging assets from May 2013 to September 2019 by using BEKK-GARCH (1, 1) Model. Historically investors hedge themselves by using other than cryptocurrency

assets but nowadays, high demand for cryptocurrency indicates that cryptocurrency can be used as a hedging asset. The results of the study suggest that the coefficient of volatility spillover is significant and negative for all selected assets except the MSCI-Global index, which shows that volatility created in cryptocurrencies decreases the volatility in other assets markets. These linkages provide a safe hedge to the potential investors to use cryptocurrencies to hedge their portfolios. The results of this study suggest to portfolio managers place the cryptocurrencies into their portfolio analysis and also use them in their risk management procedure. Results also suggest using cryptocurrencies again the hedging of major world indexes. Moreover, due to the availability of high-frequency data on the cryptocurrencies, and even data available when the other markets closed made they used to get speed advantages.

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