

Does Bitcoin Offer Diversification Benefit in a Portfolio?

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## **1.0.Introduction to the Problem**

### ***1.1.Background to the study***

Market risk in the investment sector has been increasing in recent years. The introduction of Cryptocurrency such as Bitcoin provides new and profitable investment opportunities. However, Bitcoin also brings in new types of risks and volatility into the market. Investors use various strategies to hedge their portfolios against different types of risks. The most basic strategy for minimizing risk is diversification (Lehner, Carter, and Ziegler, 2018). Diversification refers to the risk management technique that mixes a wide variety of investments into a single portfolio. Diversification is based on the rationale that portfolio made of different type of investments will, on average, generate higher returns and exposes the investor to lower level of risk than any individual investing that is a constituent of the portfolio (Kajtazi & Moro, 2017). A well-diversified portfolio consists of various types of securities from various industries with varying level of risk. The objective of diversification is to smooth out unsystematic risk events in a portfolio such that the positive performance of some investments will neutralize the negative performance of others. It is important to note that diversification benefits only hold if securities in a portfolio do not have perfect correlations.

Although it is possible to have a well-diversified portfolio made up of securities that fall in the same category (such as stocks or bonds only), Morgenson and Harvey (2012) recommend that a cross-securities diversification can have more benefits than having portfolio comprising of the same type of securities. One attractive option to add in the portfolio is Bitcoin. Bitcoin was first introduced by a Japanese programmer called Satoshi Nakamoto in January 2009. It was an open-source (the coding is open to the public), peer to peer (transactions without third-party intermediary such as PayPal and MasterCard) cryptocurrency currency (no physical form with

cryptography for security). The Bitcoin system is completely decentralized without any financial institution involved in the transaction. All the transactions are performed by users of the system. Bitcoin has a relatively small scale compared to other electronic payment methods like credit cards, but it's gaining popularity over the years.

### ***1.2.Statement of the Problem***

The value of Bitcoin has grown significantly in value from \$0.003 per 1 BTC in 2009, to \$6471.54 per 1 BTC as at the end of October 2018. This equals over 215.7 million percentage growth in value in 10 years. An investor who invested \$0.003 in 2009 can generate over \$16400 net income by October 2018. However, while the value of Bitcoin has on average increased over the years, it is very volatile as it depends on the volume of transaction per day (controlled by demand and supply). For instance, in 2017 alone Bitcoin rose from just under \$1,000 on January to a new all-time high of \$19,783.06 on December representing over 1400% growth within a year (Bouri et al., 2017). However, the value dropped to current \$16471 representing over 15% decline in value. This means Bitcoin exposes investors to a significant level of risk, but also has high potential to generate the return. Based on the information, this study will seek to evaluate the sustainability of including Bitcoin as one of the sources of diversification in a portfolio. Specifically, the study seeks to answer the following question: does Bitcoin offer diversification benefits in a portfolio?

### ***1.3.Objectives***

The study aimed to meet the following objectives

- 1) Identify the diversifications (if any) Bitcoin offers in a portfolio
- 2) Establish whether Bitcoin offer diversification benefits in a portfolio

- 3) Give recommendations on whether investors should include Bitcoin as part of their portfolio risk diversifications

## **2.0.Literature Review**

Guesmi et al., (2018) revealed that hedging strategies involving cryptocurrency (as represented by Bitcoin) reduce considerably a portfolio's risk as compared to a portfolio that does not have Bitcoin as one of its components. Bitcoin represents such an alternative because of its low correlation with financial asset and average high return. Using different multivariate GARCH specifications, Guesmi and colleagues explore volatility spillover and conditional cross effects between Bitcoin and financial indicators, and findings suggest that short position in Bitcoin market enables hedging of risk for different financial assets including stock and gold. The findings support an argument by Lehner, Carter, and Ziegler (2018) that cryptocurrencies can provide a systematic hedge with an excellent risk-reward profile.

Cryptocurrency can provide meaningful portfolio diversification to the conventional asset allocation. According to Bouri et al., (2017) the reason why Bitcoin provides portfolios diversification is the correlation of returns, politico-economic features, investability, and risk-reward profile. Burniske and White (2017) argue that between 2017 and 2013, Bitcoin has demonstrated a near-zero average correlation with traditional assets, compared to a small average positive correlation that other hedges like Swiss Franc, Japanese Yen, Inflation-linked bonds, gold, and commodity indices often exhibit with other capital market assets. The basis of diversification in a portfolio is correlation and historically most assets were negatively correlated. For this reason, investors are using non-traditional assets such as Bitcoin to minimize risk while maximizing returns.

Carpenter (2016) used an adjusted mean-variance model to evaluate whether it is possible to have portfolio diversification with Bitcoin. The findings indicate that Bitcoin is an attractive investment which can significantly increase risk-return ratios of an efficient portfolio. The findings in the study align with Briere, Oosterlinck, and Szafarz (2015) who used the non-traditional mean-variance framework and spanning tests to show that including a small portion of Bitcoin in a well-diversified portfolio can lead to a significant improvement in risk-return tradeoffs. Similar results were arrived at by Eisl, Gasser, and Weinmayer (2015) using portfolio back testing and Conditional Value-at-Risk framework techniques. However, Carpenter (2016) noted that Bitcoin performance in a well-diversified portfolio does not persist in recent years which was explained by the fact that majority of Bitcoin positive returns come from speculative bubble experienced by Bitcoin between 2013 and 2015.

There are opinions that cast doubt on Bitcoin's diversification benefit. While most of the studies indicate that Bitcoin can play a critical role in improving the risk-reward profile of a portfolio, Perugini and Maioli (2014) argues that Bitcoin plays various roles (as a remittance, currency, and distribute consensus network) which adds to multifactor which affects its perceived utility, and thus including it in a portfolio exposes investors to violent price corrections and speculative bubble. He notes that it is likely that Bitcoin will experience more periods of high volatility, making its viability as part of a diversified portfolio contingent upon its ability to compensate 'extreme' volatility with the significantly high return and continued low correlation. This suggestion aligns with observation by Kajtazi and Moro (2017) that effect of adding Bitcoin to an optimal portfolio is inconsistent over the years (where after 2013 it was found to have no effect while before 2013 there were significant advantages). The study also failed to produce more efficient portfolio when Bitcoin is added which was partly caused by the fact that there was

a significant but weak correlation between various traditional classes of assets and Bitcoin, which shows a more mature profile of Bitcoin.

Literature review suggests various opinions of Bitcoin as a source of diversification. Eisl et al. (2015) and Briere et al. (2015) shows that Bitcoin is an attractive investment which can significantly increase the risk-return ratio of an efficient portfolio. On the other hand, Perugini & Maioli (2014) reveals that in the long run adding Bitcoin to a portfolio has no effect (has minimal significant advantages). This study thus seeks to find whether adding Bitcoin will offer diversification benefits to a portfolio.

### **3.0. Research Methodology**

Given that Bitcoin has a low correlation with conventional assets, and has CAPM beta that is not significantly different from zero, this study hypothesizes that Bitcoin can improve portfolio performance by hedging systematic risk. Instead of using CAPM to get the expected return for Bitcoin, mean historical return was used.

#### **3.1. Correlation**

The correlation coefficient is a statistical measure used to calculate the strength of the relationship between relative movements of two or more variables. Variables with positive correlation move in the same direction while those with negative correlation have an inverse relationship. The Ideal feature of a well-diversified portfolio is that its components should not be related. This means that when one asset changes in price, the other asset should minimize the effect. The study compares the correlation between excess returns for Bitcoin and that of traditional assets as represented by various market indices such as S&P 500, MSCI Emerging market, Gold, and dollar index. The objective of creating the correlation table is to evaluate the extent to which Bitcoin relates to other assets. Higher relation with other assets would mean that

Bitcoin is likely to be affected by similar factors as those that affect the other assets and thus would not offer diversification option. A correlation table was formulated in order to assess Bitcoin's correlations with other assets. A sample period of three months (from 1 August 2018 to 31 October 2018) were used. Different securities from various indexes were used to compare their correlations with Bitcoin. Bloomberg terminal was used to gather the average historical returns for the securities. Bitcoincharts.com was used to gather average historical returns from Bitcoin. Correlations were calculated through regression models, using Bitcoin and different securities average historical returns as X and Y variables.

### ***3.2. Volatility Levels***

The 30 days annualized return volatility is used to compare Bitcoin's volatility level against USD with that of Litecoin (a similar cryptocurrency to Bitcoin) and Chinese Yuan. The comparison helps to reveal the extent to which Bitcoin can be considered better for portfolio diversification. Chart 2.0 was made using the standard deviation of daily returns of Bitcoin, Litecoin and Chinese Yuan against USD with a sample period of three months (from 1 August 2018 to 31 October 2018). Data were collected from Bloomberg terminal and Bitcoincharts.com.

### ***3.3. Optimal Portfolio***

The objective of constituting an optimal portfolio is to have an investment position where the investor gets a higher return and considerably low risk. Portfolio optimization process was used to evaluate the impact of including Bitcoin in a portfolio. To measure diversification, historical return and volatility of a customized portfolio were calculated and compared to the return of various portfolios that have a varying weight of Bitcoin. A sample period of 3 months (from 1 August 2018 to 31 October 2018) was used to conduct the analysis. Average historical returns of 50 securities and assets in the S&P 500, NASDAQ, US 10 Year Treasury, Crude Oil

(WTI), Gold and Dollar index were collected from Bloomberg terminal to calculate the annualized return, standard deviation, Sharp ratio and Sortino ratio for the base portfolio. Then, average historical returns of Bitcoin gathered from Bitcoinchart.com were added to the portfolio in different weights to calculate the changes in the portfolio matrices mentioned above. The comparison of the portfolio with Bitcoin in different weights and that without helps to compare the impact the Bitcoin has on a portfolio.

## 4.0. Results

### 4.1. Correlation Coefficient

The table below shows the correlation between Bitcoin and various market proxies.

Table 1.0: Correlation matrix

	S&P 500	NASDAQ	Europe DJS to xx 600	TOPLX	MSCI Emerging Markets	MSI Global Index	US 10 Year Treasury	Crude OL (WTI)	Gold	Bitcoin
S&P 500	1.00									-0.07
NASDAQ	0.92	1.00								-0.05
Europe DJS to xx 600	0.62	0.54	1.00							-0.02
TOPLX	0.10	0.09	0.24	1.00						0.01
MSCI Emerging Markets	0.21	0.16	0.46	0.48	1.00					0.02
MSI Global Index	0.33	0.27	0.57	0.38	1.00					-0.02
MSCI Global Index	0.89	0.80	0.79	0.35	0.18	1.00				-0.07
US 10 Year Treasury	-	0.05	0.01	-0.03	0.05	0.18	1.00			0.11
Crude OL (WTI)	0.21	0.17	0.09	0.03	0.17	0.12	0.39	1.00		-0.10
Gold	0.06	-0.08	0.03	0.04	0.00	-0.08	-0.37	0.01	1.00	0.07
Dollar Index	0.00	0.03	0.09	0.12	-0.05	-0.08	-0.37	0.00	0.01	0.06

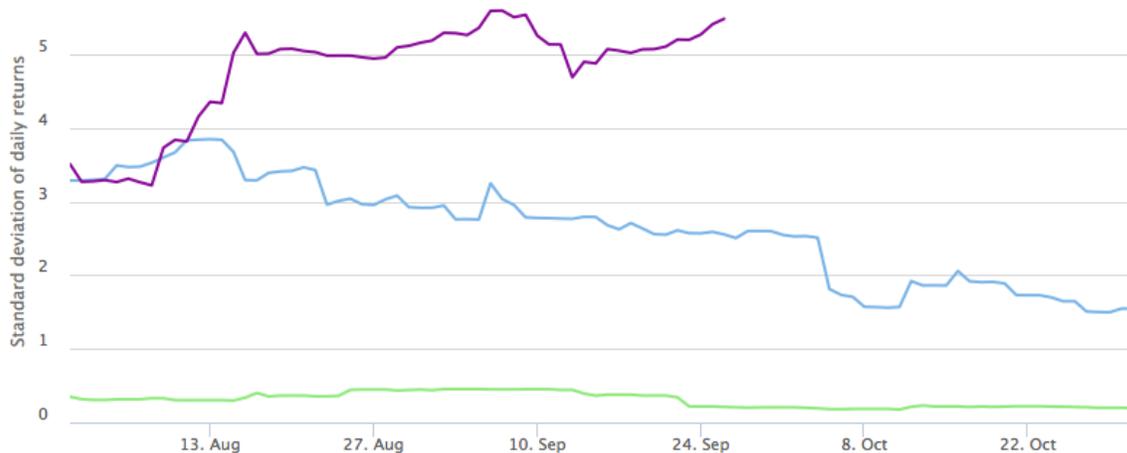
A Well-diversified portfolio should consist of assets that are not correlated. This ensures that when one asset takes a hit, the other components should minimize the loss. In addition to this, the portfolio components should have the potential to improve returns for that risk level. Most traditional assets, (stocks, currency, bonds, and other instruments) are related due to

various fundamental factors. But in the recent years (especially during the 2015 to 2016 period when global commodity prices fell due to a reduction in oil price), the value of most assets was dislocated, but Bitcoin was not affected. This was caused by the factor that Bitcoin has a very little correlation with other classes of assets. When compared to fiat currencies and other assets from a different part of the world (as indicated in the table above), Bitcoin has a very small correlation. The table indicates that Bitcoin correlations with other assets are less than 0.2. In addition, most of its correlations with other assets are negative. This makes it ideal for inclusion in a portfolio to add diversification. The table indicates that Bitcoin has a high correlation with gold and dollar index (which have similar currency features) but has a very small correlation with all the other assets.

**4.2. Volatility Levels**

The chart below shows the 30 days annualized return volatility for Bitcoin vs. USD (blue line), Litecoin vs. USD (purple line) and Chinese Yuan vs. USD (green line).

Chart 2.0: 30 days annualized return volatility



The chart shows that Bitcoin has a relatively high return volatility compared to traditional currency like the Chinese Yuan. This could be a problem to include Bitcoin in a portfolio as

Bitcoin adds in uncertainty. However, the graph also shows that Bitcoin has a significantly less volatility compared to another similar cryptocurrency called Litecoin, which is growing in popularity. In addition, the graph shows that Bitcoin has been decreasing in volatility over the sample period which implies that the currency may be getting stability over time. Based on the observation, although Bitcoin's volatility could become a weakness for the currency in portfolio diversification, Bitcoin's significantly lower volatility compared to the other cryptocurrency and Bitcoin's trend of decreasing in volatility justify the attempt to include the currency for portfolio diversification. In addition, as the adoption and acceptability of Bitcoin continue, Bitcoin can achieve even lower volatility and be a great tool for portfolio diversification.

#### ***4.3. Optimal Portfolio***

Factors	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5
BTC Weight	0	0.016	0.02	0.04	0.14
Sharpe ratio	0.86	1.18	1.21	1.19	1.01
Annualized standard deviation	0.11	0.12	0.14	0.16	0.19
Annualized return	0.10	0.12	0.17	0.16	0.09
Sortino Ratio	1.36	1.42	1.59	1.48	1.37

The table indicates that the portfolios with Bitcoin tends to perform better than those that do not have over the sample period. However, as Bitcoin continues to increase in weight, portfolio returns tend to decrease. Specifically, portfolio returns start to decrease after adding more than 2% of Bitcoin. Compared to the base portfolio, the 2% inclusion of Bitcoin significantly increases the annualized return of Bitcoin from 10% to 17%. When adding more than 2% of Bitcoin, however, portfolio returns start to decrease. This indicates that including a small amount of Bitcoin in a portfolio can result in significant growth in payoff per each unit of risk. Overall, the table shows that Bitcoin can be a good diversification tool for portfolio

investment, but investors need to be careful not to invest too much Bitcoin in their portfolios, as the currency only offers diversification benefits to a certain degree.

## **5.0 Conclusion**

Bitcoin has been increasingly popular over the years. The popularity comes from its high growth in value, which draws in numerous investors to speculate. Although speculation is not beneficial for the currency's development in the long term, Bitcoin can lower systematic risks in a portfolio. Study shows that Bitcoin has very low correlations with other securities, and portfolios with Bitcoins achieve higher returns than those without the currency. However, there are risks to include Bitcoin in a portfolio. It is important to note that Bitcoin still has relatively high return volatility compared to those of other traditional currencies such as the Chinese Yuan. In addition, investors need to understand that over-investing in Bitcoin can lower return in a portfolio. Lastly, Bitcoin's decentralized feature coupled with illegal trading and uncertain network security can increase the risk of including Bitcoin in a portfolio. Based on the research, Bitcoin can offer diversification benefit in a portfolio, but investors need to be cautious when including Bitcoin in their portfolios given all the risks involved.

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