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Contemporary Investment Strategies and Comparison Applications of Bitcoin

William Gregg VI
University of South Carolina Upstate

Thanh Nguyen
University of South Carolina-Upstate

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ABSTRACT. Bitcoin is an effective component to any investor's portfolio. The purpose of this research paper was to study the capabilities Bitcoin has to investors and anyone interested in learning more about cryptocurrencies. What are the strategic applications of Bitcoin and why should it be used over other types of assets? Bitcoin offers diversification capabilities to commodities, equities, bonds, the U.S. dollar, and most stock market indices. It can offer hedging capabilities against the U.S. dollar, Ethereum, stock market indices, and commodity uncertainty. The Financial Times Stock Exchange 100 (FTSE100) is an example of an index that Bitcoin can hedge against. Bitcoin, like gold, has potential as a safe haven asset during market downturns. While Bitcoin is a high risk and high return asset, it is not affected by the same price drivers as most stocks and investors have been able to make impressive returns in short periods of time. Bitcoin can also be useful in the foreign currency exchange market. Eleven formulas were created in this research paper to use Bitcoin as a medium of measurement and exchange between currencies and cryptocurrencies. While the value of Bitcoin will vary over time, the application of the formulas will always be useful. The results reveal that Bitcoin can be useful in many ways rather than just a form of currency.

WILLIAM GREGG VI began a working relationship with Professor Nguyen Thanh in the Spring of 2020. At the end of class one day, William mentioned that he was studying to be an Economics Professor. Professor Thanh asked if William wanted to participate in a professor-student project. Since then, they have published three research projects to Upstate and will continue to work together in the future. The best part of his research experience with Dr. Thanh is the excitement it brings to his life. The excitement of accomplishing meaningful work and having something to show for said work is truly motivating. Professor Thanh's insight and guidance also inspire William as he continues to learn real world applications of Economics and Finance. There is only so much a textbook can teach you, and William has read plenty, but the guidance and friendship of a professional is by far the best vehicle for converting textbook knowledge into real world application. William has tutored Mathematics since high school and currently tutors Mathematics, Economics, and Deductive Logic for USC Upstate. The publishing experience, working connections, and experience as a tutor are all steps in the right direction towards becoming a professor. The best advice William has for anyone interested in conducting research is that the hardest part is finding a starting place. We are but small fish in an ocean of information. The first step is to look through it. Don't start writing anything down until you find a new angle, a self-discovery that sparks your interest, and then see how far the rabbit hole goes. The primary tools you need are a desire to work hard and the humility to ask for help.

THANH NGUYEN is originally from Vietnam and received his Ph.D. from the University of South Florida in 2013. He has been at the University of South Carolina Upstate since August of 2018. Dr. Nguyen's current research focuses on behavioral finance, mergers and acquisitions, market efficiency, IPOs, and payout policies. He has most recently published peer-reviewed articles in the *Journal of Behavioral Finance*; *Global Finance Journal*; *Review of Quantitative Finance and Accounting*; *Review of Accounting and Finance*; *Managerial Finance*; and the *Journal of Accounting and Finance.*

I have been fortunate to have William Gregg in my finance courses. He is a hard-working, bright, and self-motivated student. We talked and he expressed his interest in finance and wanted to do more research in finance. He is a fast learner and can work effectively under pressure to meet the deadlines. I strongly believe he has a potential to be a well-established scholar in the future.

1. Introduction

With over seven thousand cryptocurrencies today, the release of Bitcoin sparked a revolution of digital currency. Bitcoin's appearance occurred during one of the worst financial institution failures since the Great Depression. The collapse of Washington Mutual and IndyMac banks was two of the largest bank catastrophes in U.S history. To introduce a new form of exchange that is free of the control of financial institutions during the collapse of the banking system was impeccable timing. The popularity of Bitcoin grew exponentially and lead to the creation of the many altcoins we have today. Though the intention was to create a new electronic form of currency, cryptocurrencies function more as assets and commodities than banknotes and coins. Infact the U.S. Commodity Futures Trading Commission classified Bitcoin as a commodity in 2015 [1]. There are similarities and differences between Bitcoin and traditional commodities that emphasize its potential in investment. However, the full potential of Bitcoin has yet to be realized and the capabilities it has continue to be discovered.

Bitcoin was released in 2008 during a financial crisis that was caused by deregulation in the financial industry [2]. The timing of the release was purposeful because the creator, who used the alias Satoshi Nakamoto, had a distaste for the banking systems due to flaws he viewed as destructive [3]. The concept was to create a decentralized, peer to peer electronic monetary exchange system by allowing transactions to transpire from one user to another through the solving of complex puzzles, across the data base, without having to go through a financial institution [1]. Bitcoins themselves are a chain of digital signatures created through hashing transactions on the chain. This method is based on proof of work and cannot be undone without having to redo the proof of work. That is also the basis for most cryptocurrencies except for those that follow the proof of stake system. Among the seven thousand plus cryptocurrencies there are today, Bitcoin was the first in the market and owns around 60% of the market share. Although Bitcoin has benefited from being the first in the market, it has also suffered from issues that would arise from factors associated with being first. A few of those issues are length of transaction time that can take up to ten minutes on average, security breaches that resulted in theft of thousands of bitcoins, high transaction fees, a large amount of black-market activity, and an absence of sufficient liquidation making transfer between Bitcoin and financial products difficult.

Three of the primary price drivers of Bitcoin are supply, demand, and hashrate, which is the amount of computing power miners use to validate the Bitcoin blockchain [1]. Public approval is a factor of the demand for Bitcoin, the limited supply creates scarcity, and the more powerful the hash rate the more secure the blockchain. Cryptocurrencies are born to compensate for the faults of another as a compliment or as a byproduct of competition. For example, Litecoin has faster transaction speed and a more accessible mining system for new users, Ethereum has faster transaction speed and is more secure, and Dash has faster transaction speed. There are cryptocurrencies that were born from forks of Bitcoin's code, offspring to Bitcoin itself. Some of these offspring are Litecoin, Dash, and Z-cash, and each one improves upon some shortcoming of Bitcoin. This aspect of creating new cryptocurrencies, to meet the needs and fix the problems of the original, illustrates a self-preservation of cryptocurrencies as if they belong to an evolving eco-system. It can also be harmful if an altcoin overcompensates for an issue and creates another in the process. For example, there is a strong relationship between the security of the individual

and the potential for black market activity. Monero was created on a system where anyone can send transactions, but no one could observe who sent it, how much was sent, and to where it was sent. This extreme private security made Monero very popular when it was released but primarily for black-market transactions. There is a pattern in volume trading through various cryptocurrencies of enormous amounts being purchased one day and sold the next. For example, on Dec. 11th, 2017, Litecoin more than doubled its volume and sold it all the next day; on Dec. 19th, 2017, Dash nearly tripled its volume and sold nearly half the next day; on Jan. 6th, 2018, Z-cash doubled its volume and sold it the next day; on Dec. 5th and 19th, 2017 and Jan. 8th, 2018, Monero saw large increases in volume and dropped the following day; on Jan. 14th-17th, and Feb. 1st, 2nd, and 5th, Cardano saw large increases in volume and rapidly decreased overnight. This was a popular way to keep authorities from being able to track the money being used illegally. To respond to the high levels of black-market activity, in 2018 the United States, Japan, China, the United Kingdom, the European Union, South Korea, Singapore, India, and Switzerland placed heavy regulations on cryptocurrencies. On February 4th of 2018, many if not all cryptocurrencies hit a local minimum in their stock price.

The strengths of Bitcoin include its decentralized nature, ease of access to investors from around the world, and transparency in trading. Then with the launch of futures contracts in 2017, Bitcoin has become a powerful alternative investment over other financial assets [2]. Bitcoin is also very isolated from other asset classes. In a study of the correlation between Bitcoin, the USD/EUR, and gold it was discovered that Bitcoin's returns have a negative 1% correlation with gold's returns and a positive 2.8% correlation with the USD/EUR returns. While the correlation between the returns of the USD/EUR and gold's returns was 30.6%. It was concluded that the USD/EUR and gold have an insignificant effect on Bitcoin's returns [3]. The importance of understanding the capabilities of Bitcoin and other cryptocurrencies is important for participants in the financial market who are seeking protection against market failure. To understand a few of the capabilities of Bitcoin, we will address how it can be used as a diversifier, a hedge, a safe haven tool, and test it as a standard measurement for comparison and conversion between real currencies and cryptocurrencies.

Table 1: Key Terminology Table

Term	Definition	Term	Definition
Diversifier	An asset that's value doesn't change with other assets.	USD	U.S. Dollar
Hedge	An asset that acts like insurance against other assets.	EUR	Euro
Safe Haven	Assets that appreciate during market turmoil.	KRW	Korean Wan
FTSE100	Financial Times Stock Exhange 100	JPY	Japanese Yen
BTC	Bitcoin (Cryptocurrency)	CNY	Chinese Yuan
ETH	Ethereum (Cryptocurrency)	CAD	Canadian Dollar
USDT	Tether (Cryptocurrency)	HKD	Hong Kong Dollar
BCH	Bitcoin Cash (Cryptocurrency)	SGD	Singapore Dollar
BNB	Binance Coin (Cryptocurrency)	MXN	Mexican Peso
LINK	Chainlink (Cryptocurrency)	THB	Thai Baht
ADA	Cardano (Cryptocurrency)	PHP	Philippine Peso
LTC	Litecoin (Cryptocurrency)	RUB	Russian Ruble
XMR	Monero (Cryptocurrency)	MYR	Malaysian Ringgit
ZEC	Zcash (Cryptocurrency)	ZAR	S. African Rand
DASH	Dash (Cryptocurrency)	GBP	British Pound

2. Methodology and Literature Research Rights and Violations Occurring

Diversification is a risk management strategy that contains a mix of distinct asset types and investment vehicles in an attempt at limiting exposure to any single asset or risk. This technique is used so that a portfolio constructed of different kinds of assets will yield higher long-term returns and lower the risk of any individual holding or security, on average [4]. When used in a portfolio, Bitcoin can improve its performance by increasing the risk-return profile of the portfolio [1]. A diversifier is defined as an asset that is positively, but not perfectly correlated to another asset or portfolio on average. Bitcoin can act as an effective diversifier in developed markets, regional indices, and commodities [1]. While commodities can act as effective diversifiers against downside risks in equity markets of advanced and emerging economies, Bitcoin can act as a diversifier in stock market indices because of the weak correlation between them [2]. In another study, Bitcoin was found to be an effective diversifier against general commodities, equities, bonds, and the U.S. dollar. K. Hoang, and his collaborators, concluded that Bitcoin should be characterized as a hybrid investment classified between commodities and currencies, because of its decentralized nature and restricted market dimension. Thereby it is a good instrument for market sentiment analysis, portfolio management, and risk management. The study emphasized the importance of Bitcoin as a risk diversifier because its returns are not associated with commodities, equities, bonds, and the U.S. dollar [5].

A hedge is an asset that is uncorrelated or negatively correlated with another asset or portfolio on average. A strict hedge is strictly negatively corelated with assets or portfolios in times of market stress or turmoil [1]. These can be used in a process called hedging which is an attempt to minimize risk and reduce potential loss. When investing there is an option to hedge which involves making offsetting trades in securities with negative correlations. For example, the Bitcoin price index and the crude oil index is negative 2.14% making Bitcoin a good candidate for hedging against oil [5]. If the investment hedged against makes money, then profit is limited, but if the investment goes under, then the hedge was successful and losses are minimized. Bitcoin can be effective as a hedger against the U.S. dollar, Ethereum, stock market indices, and commodity uncertainty, especially in the long run [5]. In another report it was concluded that Bitcoin could be used to hedge against the FTSE100 index and the U.S. dollar in the short term, and a strong hedge in most developing markets [1].

A safe haven is defined as an asset that is uncorrelated or negatively correlated to another asset or portfolio in times of market stress or turmoil [1]. A common safe haven that investors have relied on in the past is gold. In a study between the correlation between Bitcoin and gold it was found that there is a positive correlation between their returns during heightened risk periods [6]. It was stated that gold and Bitcoin both benefit from market volatility because they are negatively dependent on risky assets [6]. However, Bitcoin is generally chosen as an attractive investment over gold. Its volatility and speculative behavior enable investors and traders to earn impressive returns in short periods [6]. Bitcoin does not abide by the same factors that gold is influenced by as well. Both Bitcoin and gold do not generate cashflows and are both produced through mining. No central authority can control their mining and transactions which makes them independent of inflation [2]. However, in countries where capital flows are strict, Bitcoin can be used to move money out of the country [2]. An example would be China, who has strict regulations on precious metals like gold and silver. Though there are economists who back Bitcoin as a potential safe haven, there are also economists who believe that Bitcoin may not be a reliable safe haven alternative to gold.

Table 2: Investment Tool Summary Table Using Set Notation

Let {C} be the set of percent returns correlation tests between x, some test stock option, and s, a set of stock options in a portfolio; denoted as [{C}={corr(x,s)}]. The range of one individual C in the set {C} is {C|-1≤C≤1}.		
Investment Tool	**Explanation**	**Example**
Diversifier	If {c} is a subset of {C}, where {c|0-ε≤c≤0+ε}, is a set of "weak" correlations for returns between x and s, then, keeping s constant and {c} being the ideal percent returns correlation set, the x stock option that approaches {C}={c} is an effective portfolio diversifier.	If x=Bitcoin, s={Gold, USD/EUR}, Then C1= corr(Bitcoin, Gold) C2= corr(Bitcoin, USD/EUR) {C} = {C1,C2} = {-0.01,0.028} {c} = {c|0-ε≤c≤0+ε} = {-0.01,0.028} = True Therefore {C}={c} =x can diversify portfolio s.
Hedger	If {c} is a subset of {C} where {c|-1≤c≤0+ε}, then keeping s constant and {c} being the ideal percent returns correlation set, the x stock option that approaches {C}={c} is an effective portfolio hedger.	If x=Bitcoin, s={Gold, USD/EUR}, Then C1= corr(Bitcoin, Gold) C2= corr(Bitcoin, USD/EUR) {C} = {C1,C2} = {-0.01,0.028} {c} = {c|-1≤c≤0+ε} = {-0.01,0.028} = True Therefore {C}={c} = x can hedge portfolio s.
Safe Haven	If R is the return of an asset under normal conditions, then Rd is the return of an asset during a market downturn. If Rd≥R then that asset is an effective safe haven.	Let Bitcoin, normal market conditions = R, and Bitcoin, during market downturns = Rd, then if Rd≥R = True = Bitcoin is an effective safe haven.

The comparison and evaluation of real currency and cryptocurrency exchange rates was the primary focus of the research conducted. To study the ability of Bitcoin as a unit of measurement in the exchange rates of currencies and cryptocurrencies, eleven formulas were created and are discussed in the results section. While the formulas are not overcomplicated in nature, the concepts commonly applied to foreign currency exchange rates were scarcely applied to cryptocurrencies. These formulas are the cornerstone of the research because, while the price data of Bitcoin may continue to increase in the future, the application and methodology of the formulas will always be useful. The formulas involved the base banknote values for the calculations. A sample of thirty days of prices was used to add credibility to the data collected by using averages rather than price values of a specific day. Then by taking the averages to two standard deviations, a 95% probability price range table was created to estimate price values of the near future. The capabilities of Bitcoin as a vehicle to measure cryptocurrencies against and in conjunction with real currencies was a concept not yet explored.

3. Results and Discussion

A more unordinary use of Bitcoin is to approach it as a standard unit of measurement between real currencies and cryptocurrencies, a tool for estimating exchange rates between real currencies and cryptocurrencies, and a Bitcoin Conversion Tool. Though currency values are not equal, the value of Bitcoin is equal in every currency which would make it a good unit of measurement. The Bitcoin Conversion Tool will be in Satoshi (1.00E-8) the base unit of Bitcoin. This is a list of formulas I have created during my research.

Table 3: Bitcoin Conversion and Comparison Formulas

Currency Equation Calculation	Equation Results
(Currency/BTC) * (Currency/BTC)	Bitcoin Conversion Tool (BTCCT)
(Currency A/BTC)/BTCCT	BTC / Currency B (approximation)
(Currency B/BTC)/BTCCT	BTC / Currency A (approximation)

[(Currency A/BTC)/BTCCT]/ [(Currency B/BTC)/BTCCT]	Currency A / Currency B
[(Currency B/BTC)/BTCCT]/ [(Currency A/BTC)/BTCCT]	Currency B / Currency A
(BTC/Currency A) * BTCCT	Currency B / BTC
(BTC/Currency B) * BTCCT	Currency A / BTC
(Cryptocurrency A/Currency A)/ (Cryptocurrency B/Currency A)	Cryptocurrency A / Cryptocurrency B
(Cryptocurrency B/Currency A)/ (Cryptocurrency A/Currency A)	Cryptocurrency B / Cryptocurrency A
(Currency A/BTC)/(Cryptocurrency A/BTC)	Currency A / Cryptocurrency A
(Cryptocurrency A/BTC)/(Currency A/BTC)	Cryptocurrency A / Currency A

Table 4: Bitcoin Conversion Tool in Satoshi Units (1St = 1.00E-8)
(Intermediate Calculations Conducted from 10/10/20 Price Data)

	USD	EUR	KRW	JPY	CNY	CAD	HKD	SGD	MXN	THB	PHP	RUB	MYR	ZAR	GBP
USD	X	1.02 ST	.744 ST	.833 ST	1.29 ST	6.54 ST	1.17 ST	6.37 ST	8.06 ST	5.55 ST	3.59 ST	5.69 ST	2.08 ST	5.22 ST	1.11 ST
EUR	1.02 ST	X	.878 ST	.983 ST	.152 ST	.773 ST	.138 ST	.753 ST	.952 ST	.656 ST	.424 ST	.672 ST	.246 ST	.617 ST	1.32 ST
KRW	.744 ST	.878 ST	X	.718 ST	.111 ST	.564 ST	.101 ST	.550 ST	.696 ST	.479 ST	.309 ST	.491 ST	.180 ST	.450 ST	.961 ST
JPY	.833 ST	.983 ST	.718 ST	X	.124 ST	.632 ST	.113 ST	.616 ST	.779 ST	.536 ST	.346 ST	.549 ST	.201 ST	.504 ST	1.08 ST
CNY	.129 ST	.152 ST	.111 ST	.124 ST	X	.097 ST	.017 ST	.095 ST	.120 ST	.083 ST	.053 ST	.085 ST	.031 ST	.078 ST	.166 ST
CAD	.654 ST	.773 ST	.564 ST	.632 ST	.097 ST	X	.088 ST	.484 ST	.612 ST	.421 ST	.272 ST	.432 ST	.158 ST	.396 ST	.845 ST
HKD	.117 ST	.138 ST	.101 ST	.113 ST	.017 ST	.088 ST	X	.086 ST	.109 ST	.075 ST	.048 ST	.077 ST	.028 ST	.071 ST	.151 ST
SGD	.637 ST	.753 ST	.550 ST	.616 ST	.095 ST	.484 ST	.086 ST	X	.596 ST	.410 ST	.265 ST	.421 ST	.154 ST	.386 ST	.824 ST
MXN	.806 ST	.952 ST	.696 ST	.779 ST	.120 ST	.612 ST	.109 ST	.596 ST	X	.519 ST	.335 ST	.532 ST	.195 ST	.488 ST	1.04 ST
THB	.555 ST	.656 ST	.479 ST	.536 ST	.083 ST	.421 ST	.075 ST	.410 ST	.519 ST	X	.231 ST	.366 ST	.134 ST	.336 ST	.717 ST
PHP	.359 ST	.424 ST	.309 ST	.346 ST	.053 ST	.272 ST	.048 ST	.265 ST	.335 ST	.231 ST	X	.237 ST	.087 ST	.217 ST	.464 ST
RUB	.569 ST	.672 ST	.491 ST	.549 ST	.085 ST	.432 ST	.077 ST	.421 ST	.532 ST	.366 ST	.237 ST	X	.138 ST	.344 ST	.735 ST
MYR	.208 ST	.246 ST	.180 ST	.201 ST	.031 ST	.158 ST	.028 ST	.154 ST	.195 ST	.134 ST	.087 ST	.138 ST	X	.126 ST	.269 ST
ZAR	.522 ST	.617 ST	.450 ST	.504 ST	.078 ST	.396 ST	.071 ST	.386 ST	.488 ST	.336 ST	.217 ST	.344 ST	.126 ST	X	.675 ST
GBP	1.11 ST	1.32 ST	.961 ST	1.08 ST	.166 ST	.845 ST	.151 ST	.824 ST	1.04 ST	.717 ST	.464 ST	.735 ST	.269 ST	.675 ST	X

The formula list includes the Bitcoin conversion tool, as well as further applications of using Bitcoin as a standard unit of comparison and conversion. The formula for the tool involved the product of two real currencies measured in units of Bitcoin. The table does not reflect the exchange rate values between the two real currencies but the value of the tool. This is notable because, for example, the USD row mapped to the EUR column is equal to the value of the EUR row mapped to the USD column. This would not be true of currency exchange rates! The Bitcoin Conversion Tool table itself was created from samples of fifteen currencies, but the formula can be applied to include any number of them. If a currency in the units of bitcoins is taken and divided

by the Bitcoin conversion tool, then an approximation of the value of Bitcoin in the units of the opposite currency is yielded. After both approximations are found, then the ratio of the two currencies can be found by dividing the two approximations. If, instead, the value of Bitcoin in the units of two currencies is given, assuming the Bitcoin Conversion Tool chart is accessible, the value of the two currency in units of bitcoins can be found simply by multiplying the value of Bitcoin in currency by the Bitcoin Conversion Tool. If the value of two different cryptocurrencies in the units of the same currency are taken, then the ratio between the two cryptocurrencies can be found by dividing the values of the two different cryptocurrencies in the units of the same currency. The last two formulas describe that a real currency, in units of bitcoins, divided by a cryptocurrency, in unit of bitcoins, will find the ratio between the currency and the other cryptocurrency, and vice versa, find the ratio between the cryptocurrency and real currency. The last two formulas emphasize the ability of Bitcoin as a conversion standard for real currencies and other cryptocurrencies, having already established it as a standard unit of comparison for regular currencies. That is very useful because there is not much data available for the rates of real currencies in units of cryptocurrencies outside of Bitcoin. Here is a sample of fifteen currencies that I have converted into units of bitcoins by averaging the results of a sample of thirty days, September tenth through October tenth of this year, as well as the data statistics of the month I observed.

Table 5: Statistical Analysis of Currency to Bitcoin Price in Scientific Notation

09/10 - 10/10	**USD/BTC**	**EUR/BTC**	**KRW/BTC**	**JPY/BTC**	**CNY/ BTC**
Mean	9.345E-05	1.096E-04	8.009E-05	8.967E-05	1.384E-05
Max	9.80E-05	1.10E-04	8.30E-05	9.00E-05	1.40E-05
Min	8.80E-05	1.00E-04	7.70E-05	8.00E-05	1.30E-05
Range	1.00E-05	1.00E-05	6.00E-06	1.00E-05	1.00E-06
Median	9.30E-05	1.10E-04	8.00E-05	9.00E-05	1.40E-05
Mode	9.30E-05	1.10E-04	8.00E-05	9.00E-05	1.40E-05
Std. Dev.	2.263E-06	1.796E-06	1.599E-06	1.796E-06	3.739E-07
09/10 - 10/10	**CAD/ BTC**	**HKD/ BTC**	**SGD/ BTC**	**MXN/BTC**	**THB/ BTC**
Mean	7.045E-05	1.258E-05	6.865E-05	8.684E-05	5.981E-05
Max	7.30E-05	1.30E-05	7.10E-05	9.20E-05	6.20E-05
Min	6.70E-05	1.10E-05	6.50E-05	8.20E-05	5.80E-05
Range	6.00E-06	2.00E-06	6.00E-06	1.00E-05	4.00E-06
Median	7.00E-05	1.30E-05	6.90E-05	8.80E-05	6.00E-05
Mode	7.00E-05	1.30E-05	6.90E-05	8.80E-05	6.00E-05
Std. Dev.	1.502E-06	5.642E-07	1.380E-06	2.518E-06	1.401E-06
09/10 - 10/10	**PHP/ BTC**	**RUB/ BTC**	**MYR/ BTC**	**ZAR/ BTC**	**GBP/ BTC**
Mean	3.865E-05	6.129E-05	2.245E-05	5.623E-05	1.20E-04
Max	4.00E-05	6.50E-05	2.30E-05	5.90E-05	1.30E-04
Min	3.60E-05	5.50E-05	2.10E-05	5.40E-05	1.10E-04
Range	4.00E-06	1.00E-05	2.00E-06	5.00E-05	2.00E-05
Median	3.80E-05	6.00E-05	2.20E-05	5.60E-05	1.20E-04
Mode	3.80E-05	6.00E-05	2.30E-05	5.70E-05	1.20E-04
Std. Dev.	1.082E-06	2.572E-06	5.680E-07	1.257E-06	2.582E-06

Table 6: Average Currency/Bitcoin Prices for Standard Comparison in Scientific Notation

USD/BTC	9.345E-05	CNY/BTC	1.384E-05	MXN/BTC	8.684E-05	MYR/BTC	2.245E-05
EUR/BTC	1.097E-04	CAD/BTC	7.045E-05	THB/BTC	5.981E-05	ZAR/BTC	5.623E-05
KRW/BTC	8.009E-05	HKD/BTC	1.258E-05	PHP/BTC	3.865E-05	GBP/BTC	1.20E-04
JPY/BTC	8.968E-05	SGD/BTC	6.865E-05	RUB/BTC	6.129E-05		

The currency in units of bitcoins table shows the relationship between the currencies on an even playing field, because of the usage of base banknotes as the standard for conversion to bitcoins. That is why the US dollar and the Korean wan are raised to the same power in scientific notation instead of KRW/BTC being three degrees lower. The comparison between values and the strength, relative to price, of the currencies are easy to determine without much effort required. Due to the fact that we are using very small units, it has proven difficult to collect very precise data through convenient search engines. The issue is that most charts round off the numbers leaving a high probability of being inaccurate. If USD/BTC is equal to 9.3452E-05, but the graphs that can be pulled on a search engine gives the number 0.0001, then the information is initially inaccurate and will make drawing hypothesis more difficult. To compensate we can take a sample of the data points and then use normal distribution to estimate the probability of future data. After taking our sample we can observe that the statistical data shows that the median and mode of the currencies are equal in most cases, except for South Africa's rand and Malaysia's ringgit. The data follows a normal distribution, with a sample size of thirty days, and reveals that both the mean and median are contained inside of one standard deviation for every case. Table seven shows what the 95% price probability range is for tomorrows exchange rate.

Table 7: Normal Distribution 95% Probability Range for Tomorrow's Prices

	95% Price Range Probability for 10/11/20	
USD/BTC	8.893E-5	9.7978E-5
EUR/BTC	1.06E-4	1.13E-4
KRW/BTC	7.69E-5	8.33E-5
JPY/BTC	8.61E-5	9.33E-5
CNY/BTC	1.31E-5	1.46E-5
CAD/BTC	6.74E-5	7.35E-5
HKD/BTC	1.145E-5	1.3709E-5
SGD/BTC	6.589E-5	7.1404E-5
MXN/BTC	8.180E-5	9.1874E-5
THB/BTC	5.701E-5	6.2607E-5
PHP/BTC	3.648E-5	4.0808E-5
RUB/BTC	5.615E-5	6.6433E-5
MYR/BTC	2.132E-5	2.3588E-5
ZAR/BTC	5.371E-5	5.8740E-5
GBP/BTC	1.148E-4	1.2516E-4

Bitcoin can also be used as a medium of conversion to move from cryptocurrency to real currency ratios, which can be easily found, to cryptocurrency values in units of other cryptocurrencies. Bitcoin is the easiest cryptocurrency to use for this due to the amount of information available and the length of time Bitcoin has had to establish itself into the market. To find the relative prices of cryptocurrencies in units of other cryptocurrencies we need to use price data of each cryptocurrency in the units of the same real currency.

The formula: [(Cryptocurrency A/Currency A)/(Cryptocurrency B/Currency A)], to find the conversion between them, will render (Cryptocurrency A/Cryptocurrency B). If we use the USD as Currency A, then the following data is true as of October eleventh of this year.

Table 8: Cryptocurrency Price Data in U.S. Dollars as of Oct. 11th, 2020

Cryptocurrency	USD
BTC/USD	$11,410.31
ETH/USD	$375.71
USDT/USD	$1.00
BCH/USD	$241.60
BNB/USD	$28.69
LINK/USD	$10.88
ADA/USD	$0.11
LTC/USD	$50.84
XMR/USD	$124.73
ZEC/USD	$73.41
DASH/USD	$72.16

Table 9: Cryptocurrency Price Data in Units of other Cryptocurrencies

	BTC	ETH	USDT	BCH	BNB	LINK	ADA	LTC	XMR	ZEC	DASH	
BTC	x	0.03	8.772 E-05	0.021 1738	0.002 5143	0.000 9535	9.517 E-06	0.004 4556	0.010 9313	0.006 4336	0.006 3241	units of BTC
ETH	30.36 9992	x	2.664 E-03	0.643 0491	0.076 3620	0.028 9585	0.000 2890	0.135 3171	0.331 9847	0.195 3900	0.192 0630	units of ETH
USDT	11398 .91	375.3 3466	x	241.3 586	28.66 1338	10.86 9130	0.108 4915	50.78 9210	124.6 0539	73.33 6663	72.08 7912	units of usdt
BCH	47.22 8104	1.555 0910	4.143 E-03	x	0.118 75	0.045 0331	0.000 4495	0.210 4304	0.516 2665	0.303 8493	0.298 6755	units of BCH
BNB	397.7 1035	13.09 5503	3.489 E-02	8.421 0526	x	0.379 2262	0.003 7852	1.772 0460	4.347 5078	2.558 7312	2.515 1620	units of BNB
LINK	1048. 7417	34.53 2169	9.200 E-02	22.20 5882	2.636 9485	x	0.009 9816	4.672 7941	11.46 4154	6.747 2426	6.632 3529	units of LINK
ADA	10506 7.3	3459. 5764	9.217 3	2224. 6777	264.1 8047	100.1 8416	x	468.1 3996	1148. 5267	675.9 6685	664.4 5672	units of ADA
LTC	224.4 3568	7.390 0472	1.968 E-02	4.752 1636	0.564 3194	0.214 0047	0.002 1361	x	2.453 3831	1.443 9417	1.419 3548	units of LTC
XMR	91.48 0076	3.012 1863	8.025 E-03	1.936 9838	0.230 0168	0.087 2284	0.000 8706	0.407 6004	x	0.588 5512	0.578 5296	units of XMR
ZEC	155.4 3263	5.117 9675	1.363 E-02	3.291 1047	0.390 8186	0.148 2086	0.001 4793	0.692 5487	1.699 0873	x	0.982 9723	units of ZEC
DASH	158.1 2513	5.206 6241	1.387 E-02	3.348 1153	0.397 5886	0.150 7760	0.001 5049	0.704 5454	1.728 5199	1.017 3226	x	units of DASH

When we use the table of cryptocurrencies in units of US dollars, through our formula, we can create the chart above. The variable set above the chart is the numerator and the variable set to the left of the chart is our denominator. For example, by taking the numbers from BTC/USD and divide by ETH/USD we get $11,410.31/$375.71 we yield 30.36999 units of Ethereum. We now have the capability of finding the ratios between cryptocurrencies that are not Bitcoin and a real

currency. Like we used the US dollar as the platform from which we yielded our cryptocurrency ratios, we can do something similar by using Bitcoin as the platform in place of the US dollar.

4. Conclusion

There are a few fundamental uses of Bitcoin that could be helpful to anyone looking to start investing, as well as a method of using Bitcoin as a standard unit of measurement for the comparison and conversion of real currencies and cryptocurrencies. The topics discussed were the background of Bitcoin and cryptocurrencies and the strengths and weaknesses they have, the relationship between Bitcoin and commodities, and how Bitcoin can be used for investments. Bitcoin can act as an effective diversifier in developed markets, regional indices, commodities, equities, bonds, and the U.S. dollar. Bitcoin can be effective as a hedger against the U.S. dollar, Ethereum, stock market indices, and commodity uncertainty, especially in the long run. We discussed the controversy over Bitcoin acting as a replacement for gold as a safe haven asset during market turmoil. The invention of the Bitcoin Conversion Tool was discussed, as well as the formulas that can be used for the application of the tool. The tool helped visualize the conversion interactions of bitcoins and real currencies. We were then able to use a normal probability distribution to determine the most likely range that the real currencies would fall in-between. The next milestone on the list was using our formulas to determine the value of a cryptocurrency in units of other cryptocurrencies, which required the use of a common base, the US dollar. Once we were able to create a conversions list of cryptocurrencies to cryptocurrency, then that gave us the potential to find the interchangeable methods of converting cryptocurrencies into units of real currency and currencies into units of cryptocurrencies. Though it is debatable if cryptocurrencies can be trusted as mediums of exchange, there are many possible benefits and uses of them. Bitcoin will continue to be a guide and reference point for investors as we learn more about how cryptocurrencies can be used to benefit the market.

5. References

[1] A. Stensås, M.F. Nygaard, K. Kyaw, and S.Treepongkaruna, “Can Bitcoin be a diversifier, hedge or safe haven tool?”, Cogent Economics & Finance, 7(1), 1593072, retrieved from https://doi.org/10.1080/23322039.2019.1593072

[2] S.J.H. Shahzad, E. Bourib, D. Roubaudc, L. Kristoufekd, and B. Luceyf, “Is Bitcoin a better safe-haven investment than gold and commodities?”, International Review of Financial Analysis. Elsevier, 2019, retrieved from http://library.utia.cas.cz/separaty/2019/E/kristoufek-0506911.pdf

[3] H.M. Ertuğrul, “Pass-Through Effect Between Bitcoin, USD/EUR and Gold: A Dynamic Correlation and Regression Modeling Application,” Economic Issues: Global and Local Perspectives, Cambridge International Academics, 2019, pp.120-127.

[4] T. Segal, and G. Scott, “Diversification,” Investopedia, Mar. 6, 2020, retrieved from https://www.investopedia.com/terms/d/diversification.asp

[5] K. Hoang, C.C. Nguyen, K. Poch and T.X. Nguyen, “Does Bitcoin Hedge Commodity Uncertainty?”, Journal of Risk and Financial Management. MDPI, 2020.

[6] J. Bouoiyour, R. Selmi, and M. Wohar, “Bitcoin: competitor or complement to gold?”, Economics Bulletin, Economics Bulletin, 2019, 39 (1), pp.186-191.