

## Risk and Return Analysis of top Crypto Coins

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### Abstract

In this paper, risk and return analysis of the top ten currencies are been presented. How risky are cryptocurrencies, when compared to other forms of investment like stock & commodities, is also been analyzed. An equal-weighted crypto index is taken for the comparison with S&P 500, Crude oil, Gold, and Crypto coins. Among the crypto coins, there are some which are highly risky and some gave high returns. Proper quantitative & statistical analysis is needed to understand the historical behavior. It is important to study the historical behavior patterns to know the future. Descriptive statistical tools are used to see the patterns and Inferential statistical tools are used to understand the estimation of the association between the variables.

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### Introduction

At the end of Aug '21, there are more than 5,800 cryptocurrencies that exist in the market. Cryptocurrency gained popularity during the Bitcoin bubble in 2017 where the value of Bitcoin went up by 1318%. Blockchain is the technology that enables cryptocurrencies to operate. Although cryptocurrency markets are not the only place where Blockchain technology operates but they got significant importance after the advent of cryptocurrency. Many people view that crypto as a cross between stock and currency (like INR).

Cryptocurrencies are seen by many as one of the best areas for investments because of high returns. But before investing, it is wise to see the risks and returns involved in the investments using quantitative methods. Although qualitative data, in the short term influence the crypto markets very frequently. Both qualitative & quantitative assessments should be given importance as people who are going for long-term investments of more than three years should know the historical performance of the Cryptocurrencies if they wish to invest. Certain experts are in the view that Cryptocurrencies are assets without fundamental value and the other important point is there is no regulatory oversight for cryptocurrencies. So, investment without analyzing the historic data can be a bane for the people who are investing.

So, the importance of this research paper is to give the analysis of the historical performances of the cryptocurrencies using certain statistical & financial tools. The first investigation goes into assessing the difference in risk among the Stock Market, Crude oil, Gold, and Cryptocurrencies. As the S&P 500 represents the mood of the stock market in the U.S, the comparison is been done using it. Instead of individual Cryptocurrencies, a crypto index is formulated in this paper and is been compared with S&P 500, Crude oil, and gold. Secondly, analysis of risk and return of top ten cryptocurrencies is also taken in this paper to

understand the historical behavior. Frequency distribution of the daily returns of the portfolio is taken to know where the majority of the daily returns concentrate on. Finally, their comparison is done to know which among them is highly risky. This will give us a picture of the risk and returns of each of them.

### **Literature Review**

Research on Cryptocurrencies was done by many researchers in their way. A few did a statistical analysis of the properties of large cryptocurrencies. A few researched similarities and differences between cryptocurrencies and the stock market. Research on the association between the Daily price movements of cryptocurrencies, stock market, Crude oil, and gold was also been done. Research on social media influence on the movement of Cryptocurrency prices was also been done which gave them a finding of an association between google search and daily returns of cryptocurrencies like Bitcoin.

Yukun Liu and Aleh Tsyvinski<sup>5</sup> in their research paper studied whether three major cryptocurrencies (Bitcoin, Ethereum & Ripple) comove with the stocks & commodities. They found out that there is no association between them. They concluded that cryptomarket-specific factors like the proxies for investors' attention and momentum explain the returns of the cryptocurrencies. They also found out that exposures of cryptocurrencies to the Forex currencies are small and are not statistically significant. They concluded that the cryptocurrencies can be assessed using financial tools but the price movements of Cryptocurrencies can't be compared to other asset price movements.

Isfenti Sadalia & Rico Nur Ilham's paper on 'Risk & Return on Bitcoin' found out that Cryptocurrencies have no exposures to macro-economic factors or the returns of currencies and commodities. They provided an extreme value analysis of bitcoin. They also showed that the volatility of Bitcoin is very high compared to G10 currencies.

Albert S. Hu, Christine A. Parlour, Uday Rajan's paper – 'Cryptocurrencies: Stylized facts on a new investible Instruments' mentions that there is a strong correlation factor between Bitcoin and altcoins. They proved with their analysis that there is a lot of volatility and skewness in the population of returns.

### **Gaps & Fills**

Many research papers did extensive research on the cryptocurrencies, a few of them took only 3 currencies namely Bitcoin, Ethereum & Ripple cryptos to ascertain the risk-return tradeoff. Surely only these three don't represent the entire crypto market. So, in my Research paper, I have taken the top ten cryptocurrencies based on Market capitalization & the period of being traded on market. I chose the cryptocurrencies which were been trading for more than three years in the crypto market. As it is difficult to analyze all the currencies, I have taken these ten crypto coins and analyzed them to find out the risk and return based on the historical data. The latest data of the historic prices of these cryptocurrencies from Sep' 18 to Sep' 21 is been analyzed to find out which currency is riskier from the basket of the ten cryptocurrencies.

## Data sources & Methodology

The historical data that is been analyzed is taken from the coinmarketcap website. The data was taken from 9<sup>th</sup> Sep' 18 to 9<sup>th</sup> Sep' 21 to analyze the data of the cryptocurrencies. As it is difficult to analyze the data of every cryptocurrency, only the top ten cryptocurrencies which include Bitcoin, Ethereum, Cardano, BinanceCoin, Ripple (XRP), Bitcoin Cash, Monero, ChainLink, Litecoin & Dogecoin are been considered, as they are among the top cryptocurrencies in terms of Market Capitalization and these coins are in the market for more than three years. Surely these ten currencies don't represent the entire crypto market but definitely, all of them together have market dominance of almost 75%.

To show how volatile the crypto coins are the monthly data of the ten crypto coins are taken, formed an Index, and compared the index with the monthly data of S&P 500, Gold & Crude oil. There is no correlation found which means there is no association among them. So, only the mean monthly returns, Standard deviation & Correlation coefficients are compared. This gives a picture of the risk & return associated with the crypto coins.

For all the ten coins, using the three-year data, firstly daily returns in percentage are found. There is a huge variation in this daily data. To understand this, the mean of the daily returns, Standard deviation, Median, Coefficient of Variation are found which gives a good picture of the daily fluctuation of the cryptocurrencies. Frequency distribution graph is been taken from the daily returns data to find out where the majority of the daily returns are concentrated on. The frequency distribution is in the form of Normal distribution. The Kurtosis and Skewness of the distribution are found to understand the data.

Equal weighted portfolio's daily returns (in percentage) are taken from the ten cryptocurrencies to understand the daily returns & risks among the cryptocurrencies. Here there is an idea behind taking this portfolio. The author assumed that a person has \$1000 and he invested an equal amount of money (\$100) in all coins. The intention is to know answers for - where does he get maximum returns and which cryptocurrency is having maximum risk? So, regression analysis is done for the daily returns of each coin w.r.t portfolio's daily returns. This is to find out the beta (slope). Other than standard deviation, Beta also gives the risk concerning other currencies together. Beta is considered because there is a good correlation among all currencies themselves. The difference between an equal-weighted crypto portfolio and an equal-weighted crypto index is that the former is formed by putting an equal amount of money in all the crypto coins which are part of that portfolio while the latter is formed by averaging out market prices of all the crypto coins into one single index. If we are comparing with the other asset classes then it is better to use an equal-weighted crypto index. And if we are comparing the percentage of returns of each crypto coin with the other then it is sensible to use an equal-weighted crypto portfolio. This is used in this paper as a Portfolio index.

Finally, the CAGR of all the ten coins, their mean, Std. Dev. & the coefficient of variation of the daily returns are put in one table for comparison.

## Comparison of different asset classes

The three years CAGR of the Equal weighted Crypto Index is very high with 190.27%. The Crypto Index is having high mean monthly returns when compared to the other

asset classes. It is having mean monthly returns of 8.1%. Standard deviation is also high when compared to the other asset classes but crude oil monthly returns' standard deviation is also high but with negative CAGR. Interesting thing is, Coefficient of Variation was low for the Crypto Index when compared to other asset classes which means it was having a more favorable tradeoff between risk and return. Crude oil was having a high Coefficient of Variation.

Monthly data	Crude	Gold	S&P 500	Equal weighted Crypto Index
CAGR	-0.62%	14.64%	15.95%	190.27%
Mean	1.85%	1.23%	1.38%	8.10%
Standard Deviation	20.35%	4.08%	5.33%	22.60%
Coefficient of variation	11.03	3.33	3.86	2.79

From the above, we can understand that there is an upper hand for Crypto coins among different asset classes. In all attributes like CAGR, mean monthly returns, Standard deviation of monthly returns, and coefficient of variation – Cryptocurrencies are ahead in performance. This proves that Cryptocurrencies are the better option for investment.

Now, the question is - which one among the cryptocurrencies is giving maximum returns based on the historic data? which crypto coin is having maximum risk? These two questions are answered based on the qualitative and quantitative analysis given below

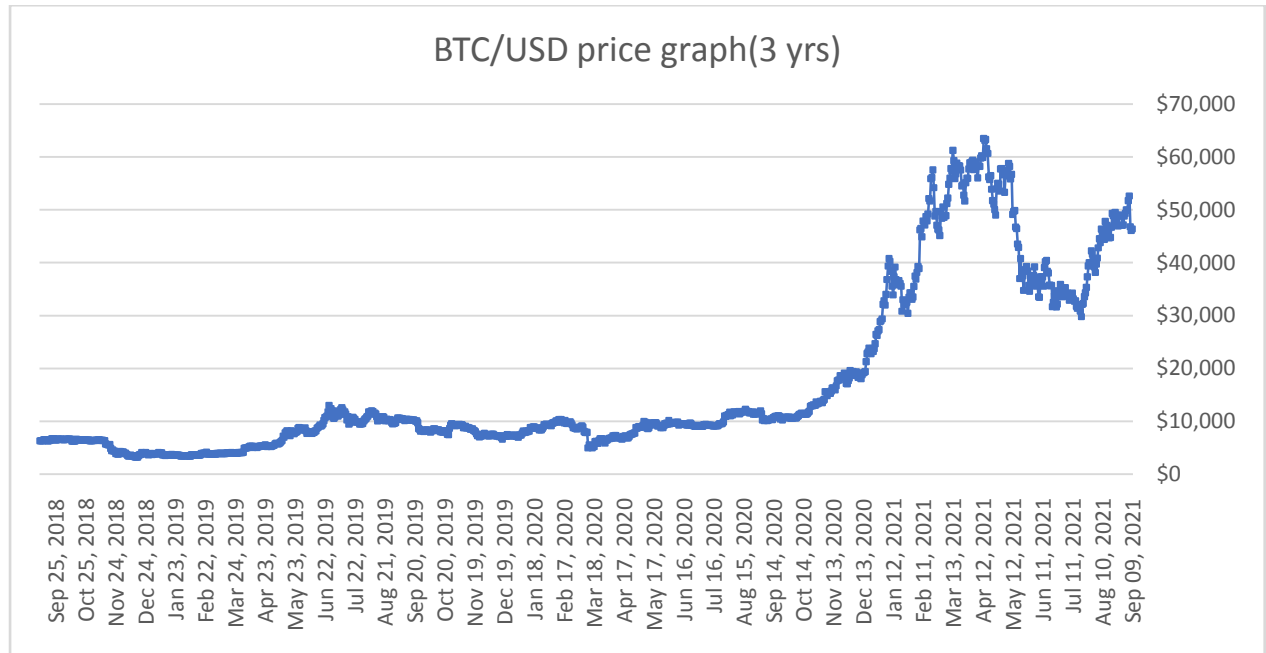
### **Bitcoin**

Bitcoin is the first Decentralized Cryptocurrency in the world that uses blockchain technology to make transactions. It is a kind of digital asset that uses Public Key, Private Key Cryptography to record the transactions and transfer value over the Bitcoin Blockchain. It was launched by Satoshi Nakamoto (anonymous Programmer) in 2009 that uses a native cryptocurrency called Bitcoin to make monetary transactions over the internet. It also acts as a digital asset. The smallest unit of bitcoin is Satoshi i.e 10000000<sup>th</sup> part of the bitcoin making it divisible up to 8 decimal places. It is the first peer-to-peer digital currency. So, value transfers can be made without any intermediary like Banks or payment bank facilitators.

The first unique thing about Bitcoin is, it is the first crypto coin to appear in the market. It created a new industry with thousands of people who create, trade, put money in & use Bitcoin in their day-to-day lives. The dominance of Bitcoin in the crypto coin market as of Sep '21 is around 41% which is very huge, making it undisputedly no. 1. The market capitalization of it is also very high compared to other cryptocurrencies with \$850 Billion as of Sep '21. The current circulation of Bitcoins is around 18.9 million BTC. Bitcoin's supply limit is 21 million BTC. New Bitcoins are created by an online process called crypto mining. After the transactions happen one after another, they are picked by bitcoin miners and packed into blocks. These are secured by intricate cryptographic calculations. As a reward for

expending their time & resources, the miners will receive bitcoins as a reward for the blocks they add to the bitcoin blockchain.

SHA-256 Algorithm is used to secure Bitcoin Transactions which are also used by several other cryptocurrencies.

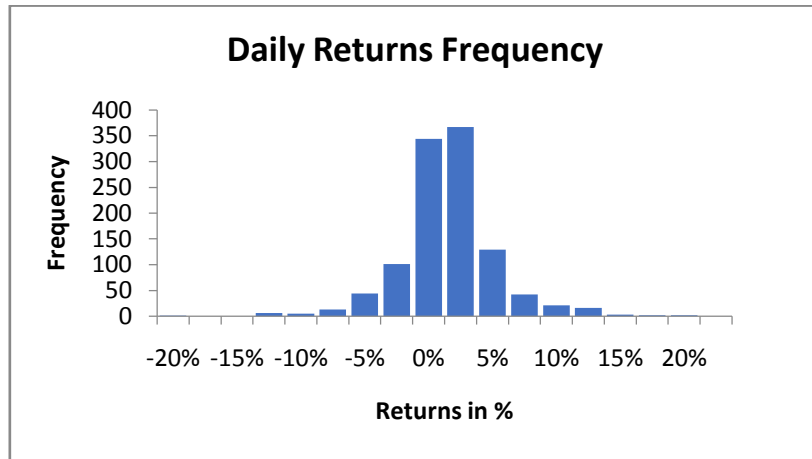


Bitcoin is having Compounded Annual Growth rate of 94.5% which is high if it is compared with the Stock Market returns. But when it is compared to the Crypto portfolio, it is less.

Descriptive Statistics of Daily Returns

Mean	0.259%	Kurtosis	10.33
Standard Error	0.117%	Skewness	-0.50
Median	0.136%	Range	55.92%
Standard Deviation	3.87%	Minimum	-37.2%
Sample Variance	0.15%	Maximum	18.7%
Coefficient of Variation	14.96	Count	1096

The mean daily returns of the coin have a value of 0.259%. It is having a standard deviation of 3.87 with a Coefficient of variation of 14.96.

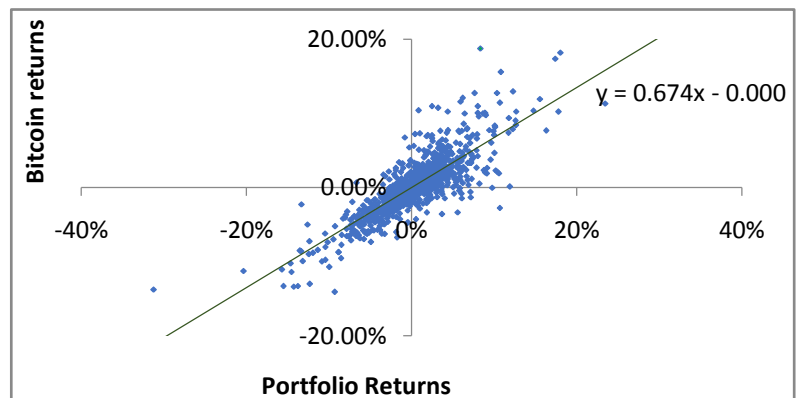


The distribution is negatively skewed which means a greater number of observations are to the right of the mean. There are more positive daily returns than negative daily returns.

Extreme Events of Bitcoin Returns					
Daily loss	Counts	Percentage	Daily Gains	Counts	Percentage
5% - 10%	57	5.20%	5% - 10%	63	5.75%
10% - 20%	11	1.00%	10% - 20%	23	2.10%
20% - 30%	0	0.00%	20% - 30%	0	0.00%
> 30%	1	0.09%	> 30%	0	0.00%

### Regression Analysis

Regression Statistics	
Multiple R	0.831
R Square	0.690
Adjusted R Square	0.690
Standard Error	0.022
Observations	1096



### ANOVA

	df	SS	MS	F	Significance F
				2438.2	
Regression	1	1.134	1.134	6	0.0
Residual	1094	0.509	0.000		
Total	1095	1.643			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0.000	0.001	-0.343	0.731	-0.002	0.001
Portfolio returns	0.675	0.014	49.37	0.000	0.648	0.702

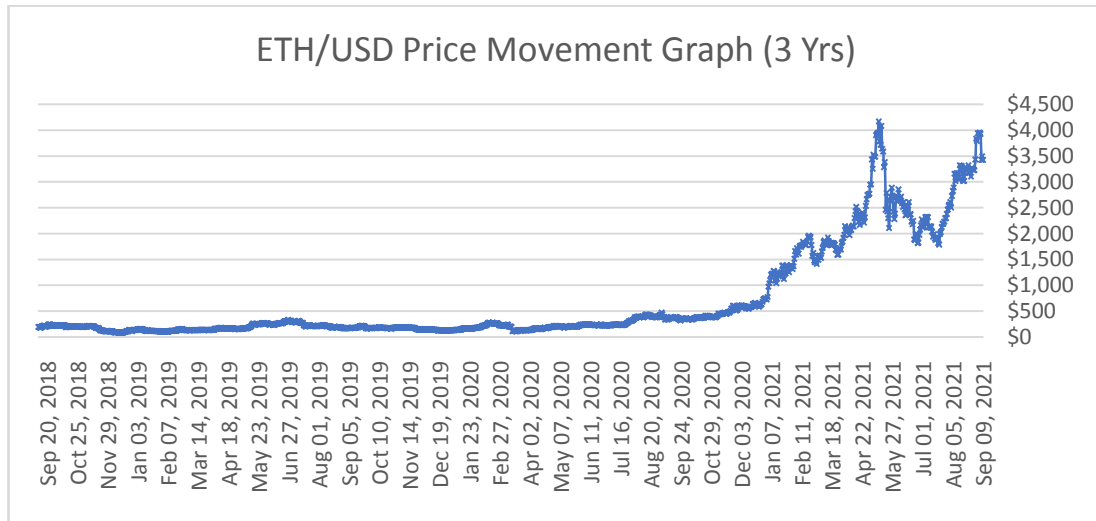
The correlation between the Bitcoin returns and portfolio index is 0.83, which means more than 80% association between the two. The P-value of the Beta is zero, which implies we are rejecting Null Hypothesis i.e  $\beta \neq 0$ . The Beta coefficient of Bitcoin to the weighed Percentage returns is 0.675, which means among the cryptocurrencies, Bitcoin is not that risky.

## Etherium

Etherium is an open-source decentralized blockchain platform for digital money and data-friendly services for anyone. Its digital currency, Ether (ETH) is a cryptocurrency used to send and receive value without any third-party interference. But Etherium also can do more than that. This platform's concept was first introduced by Russian Canadian Programmer VitalikButerin in 2013 in his white paper. His team officially launched this blockchain platform in 2015.

Etherium platform is not only for payments using its cryptocurrencies but also for blockchain smart contracts. Smart contracts are the computer programs which executes automatically the actions necessary to fulfill the agreement between different parties to reduce the breach of contracts which increases the reliability. This platform also reduces the need for intermediaries between the contractors. This also reduces transaction costs. Etherium's unique innovation was creating a platform that allows it to execute small contracts using blockchain technology. It also paved way for Decentralized Finance(Defi) industry. As far as small contracts platforms are concerned, Etherium dominates the space.

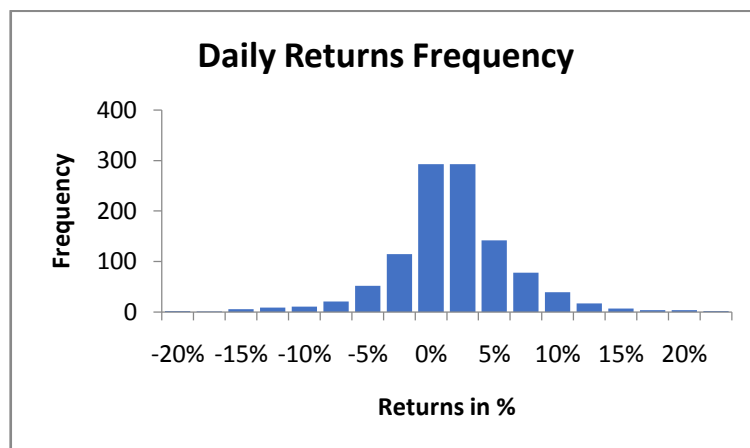
Etherium's Market capitalization is around \$400 Billion as of Sep'21. It is having a circulating supply of around 117.5 million ETH. Ether is ranking second in terms of Market Capitalization and Market price of each Ether.



Etherium has recorded a Compound annual growth rate of 159% in the last three years. Etherium is comparatively stable to the other cryptocurrencies. But highly Variable when compared to stock market returns. It is having a mean daily return of 0.39%.

#### Descriptive Statistics of Daily Returns

Mean	0.394%	Kurtosis	7.305
Standard Error	0.154%	Skewness	-0.437
Median	0.185%	Range	68.3%
Standard Deviation	5.084%	Minimum	-42.35%
Sample Variance	0.258%	Maximum	25.95%
Coefficient of Variation	12.92	Count	1096



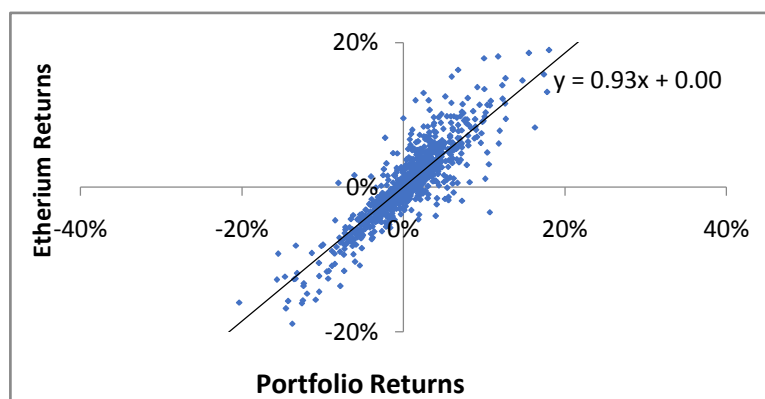


The frequency distribution of the daily returns of the Ethereum is left-skewed. The average mean is around 0.39% & the standard deviation is around 5.08% with a Coefficient of Variation of 12.9.

Extreme Events of Ethereum Returns					
Daily loss	Counts	Percentage	Daily Gains	Counts	Percentage
5% - 10%	73	6.66%	5% - 10%	117	10.68%
10% - 20%	27	2.46%	10% - 20%	32	2.92%
20% - 30%	1	0.09%	20% - 30%	2	0.18%
> 30%	1	0.09%	> 30%	0	0.00%

### Regression Analysis

Regression Statistics	
Multiple R	0.870
R Square	0.757
Adj R Square	0.756
Standard Error	0.025
Observations	1096



### ANOVA

	df	SS	MS	F	Significance F
Regression	1	2.141	2.141	3399.351	0
Residual	1094	0.689	0.001		
Total	1095	2.830			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0.000	0.001	0.090	0.928	-0.001	0.002
Portfolio returns	0.927	0.016	58.304	0.000	0.896	0.958

The correlation coefficient of Ethereum daily returns and the Portfolio index returns is 0.87 with an R square of 0.75 which means there is an association between them. The P-value of the Beta is zero implying the coefficient is not going to be zero. The beta value which we got from the regression analysis is 0.92 which means the Ethereum is almost similarly risky as the remaining cryptocurrencies put together as a portfolio.

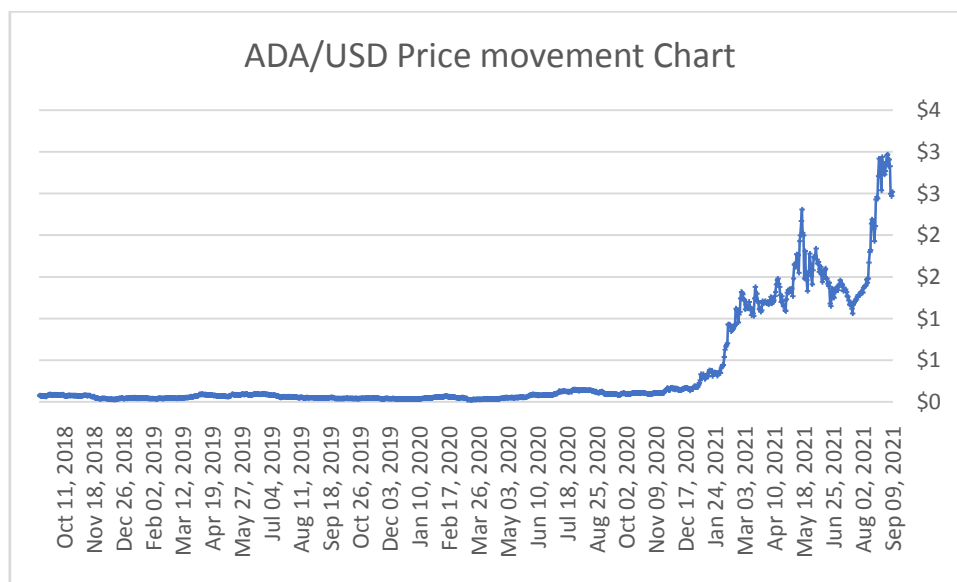
## Cardano

Cardano is a third-generation Proof of stake blockchain platform used to conduct peer-to-peer transfers across the world. It is a cryptocurrency found by Charles Hoskinson, a co-creator of Ethereum. Cardano is one of the fastest-growing platforms in the cryptocurrency space. The platform has grown significantly with its token currency (ADA) currently ranking third as of Sep'21 in terms of Market capitalization. The people who are holding ADA tokens can participate in the operations of the network. They can vote on proposed changes for the software.

Cardano network participants can also take part in staking. Staking is a method of participating in proof of stake systems where users can put their tokens in to serve as a validator to the blockchain.

In Cardano, user can create a collateralized borrowing dApp that loan money to anyone provided they deposit an amount of collateral as deposit in the wallet beforehand. The smart contract is programmed to send the loan amount once the collateral wallet receives the funds required. If the borrower is unable to repay in time, the creditor can liquidate the collateral.

Cardano is currently in the third position with a Market Capitalization of around \$ 83.5 billion. The current circulating supply is around 32 billion ADA with a maximum supply of 85 billion ADA. Cardano currently is priced around \$2.59 with its all-time high of \$3.16.

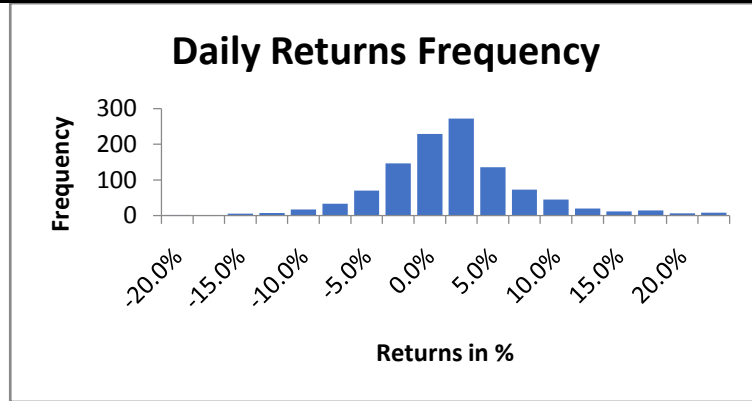


Cardano registered an annual Compounding growth rate of 220.37% during the period of the last 3 years. Cardano is having average daily returns of 0.49% and a standard deviation of 5.9%. The coefficient of variation stood at 12.

### Descriptive Statistics of Daily Returns

Mean	0.494%	Kurtosis	4.403
Standard Error	0.179%	Skewness	0.320

Median	0.217%	Range	71.81%
Standard Deviation	5.929%	Minimum	-39.57%
Sample Variance	0.352%	Maximum	32.24%
Coefficient of Variation	12.001	Count	1096

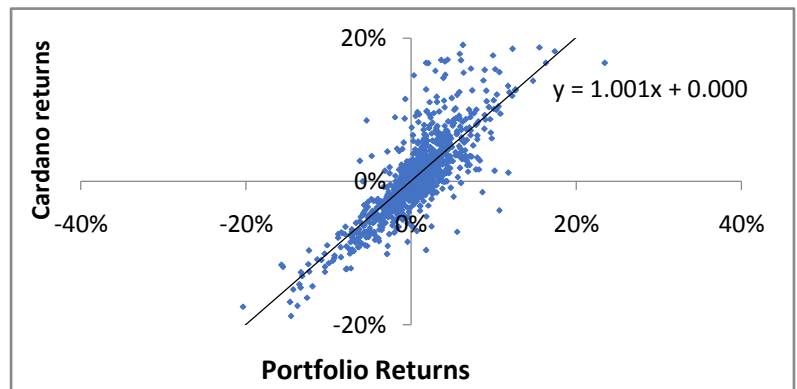


Cardano daily return frequency is right-skewed with a kurtosis of 4.4

Extreme Events of Cardano Returns					
Lost	Counts	Percentage	Gains	Counts	Percentage
5% - 10%	102	9.31%	5% - 10%	117	10.68%
10% - 20%	30	2.74%	10% - 20%	52	4.74%
20% - 30%	1	0.09%	20% - 30%	7	0.64%
> 30%	1	0.09%	> 30%	1	0.09%

### Regression Analysis

Regression Statistics	
Multiple R	0.806
R Square	0.650
Adjusted R Square	0.649
Standard Error	0.035
Observations	1096



	df	SS	MS	F	Significance F
Regression	1	2.500	2.500	2028.05	0.00
Residual	1094	1.349	0.001		

Total	1095	3.849				
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0.001	0.001	0.716	0.474	-0.001	0.003
Portfolio returns	1.002	0.022	45.034	0.00	0.958	1.045

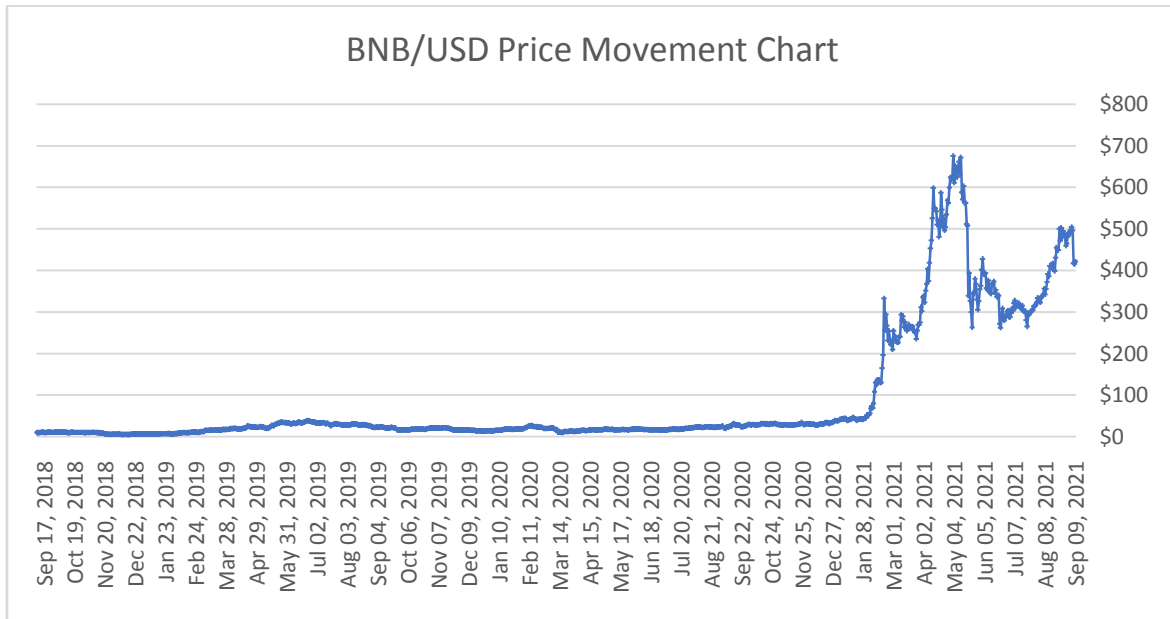
The P-value of beta is zero, which means the null hypothesis is dismissed as its surmises the slope is zero. At the 95% Confidence level, the slope of the line lies between 0.958 and 1.045. The returns of the Cardano are almost the same as the returns of the Portfolio of the top 10 cryptocurrencies.

### **Binance Coin**

Binance coin is traded with BNB symbol is a cryptocurrency issued by Binance, which is the biggest crypto exchange in the world. Binance coin was initially launched on Ethereum as ERC-20 token and later migrated to Binance preoperatory blockchain, the Binance chain. Binance was initially created as a utility token for a discounted trading fee but it expanded into other areas of the sphere such as travel booking, financial services, etc., Every quarter Binance uses one-fifth of its profits to repurchase and burn Binance coins which are there in its treasury.

Binance was found by Changpeng Zhao. He launched the company in 2017 following fundraising of \$15 million during an initial coin offering. Zhao's Binance made a significant impact in the development of the Decentralized Finance (Defi) industry. Currently, Binance is under investigation by the US govt. on allegations of money laundering and tax offenses. UK's regulatory body financial conduct authority asked to stop all its activities in the United Kingdom. Binance acquired CoinMarketCap, the cryptocurrency data provider.

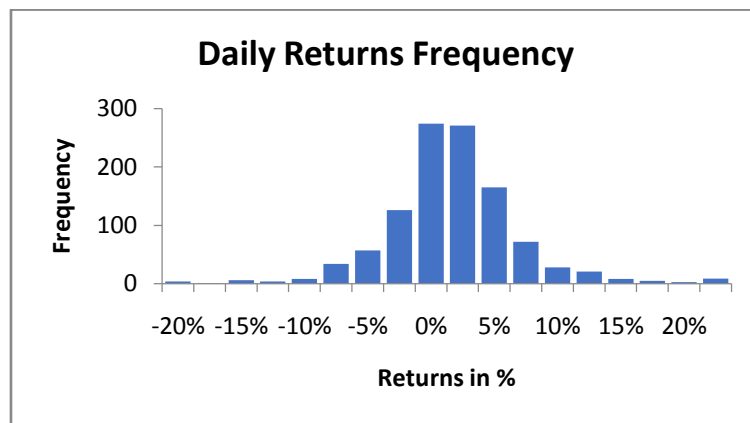
Binance is currently in the fourth position in terms of market capitalization. \$69.7 million in current market capitalization of Binance coin as of Sep'21. It is currently having a circulation supply of almost 168 million BNB coins. The maximum supply of the Binance coin is also 168 million BNB coins



Binance coinshave a Compounding Annual Growth rate of 253.8% with mean daily returns of 0.5% and a standard deviation of 5.88%, both of these are high when compared to the other cryptocurrencies. The coefficient of variation stood at 11.43.

#### Descriptive Statistics of Daily Returns

Mean	0.514%	Kurtosis	23.46
Standard Error	0.178%	Skewness	1.49
Median	0.135%	Range	111.65%
Standard Deviation	5.880%	Minimum	-41.89%
Sample Variance	0.346%	Maximum	69.76%
Coefficient of Variation	11.43	Count	1096

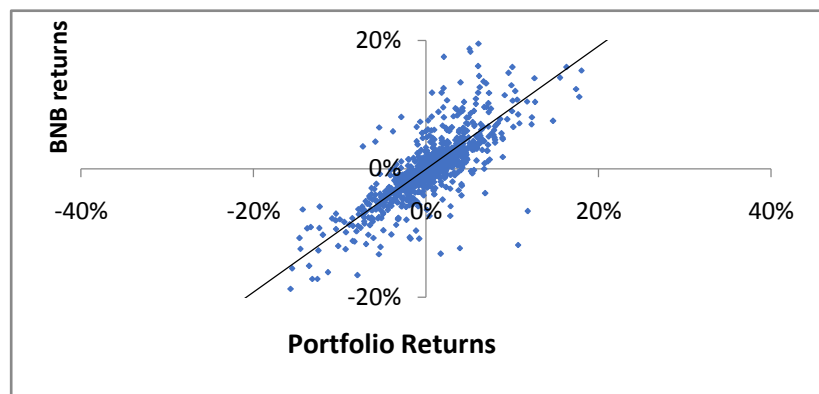


The frequency distribution of daily returns of Binance coin is left-skewed with a skewness of 1.49. Kurtosis is also high which indicates a greater number of the daily returns are between 0 and 5% here.

Extreme Events of Binance Coin Daily Returns					
Lost	Counts	Percentage	Gains	Counts	Percentage
5% - 10%	91	8.30%	5% - 10%	100	9.12%
10% - 20%	19	1.73%	10% - 20%	37	3.38%
20% - 30%	2	0.18%	20% - 30%	6	0.55%
> 30%	2	0.18%	> 30%	3	0.27%

### Regression Analysis

Regression Statistics	
Multiple R	0.726
R Square	0.527
Adjusted R Square	0.526
Standard Error	0.040
Observations	1096



### ANOVA

	df	SS	MS	F	Significance F
Regression	1	1.994	1.994	1216.689	0.000
Residual	1094	1.793	0.002		
Total	1095	3.787			

Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
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Intercept	0.001	0.001	1.152	0.250	-0.001	0.004
Portfolio returns	0.894	0.026	34.881	0.000	0.844	0.945

The correlation coefficient is estimated at 0.72 which means there is a 72% association between the Binance coin returns and portfolio index returns. Beta in the regression analysis has the P-value of zero which means Beta is not zero (null Hypothesis). The value of beta is ascertained as 0.89. At a 95% confidence level, the slope value is between 0.84 and 0.94.

### Ripple (XRP)

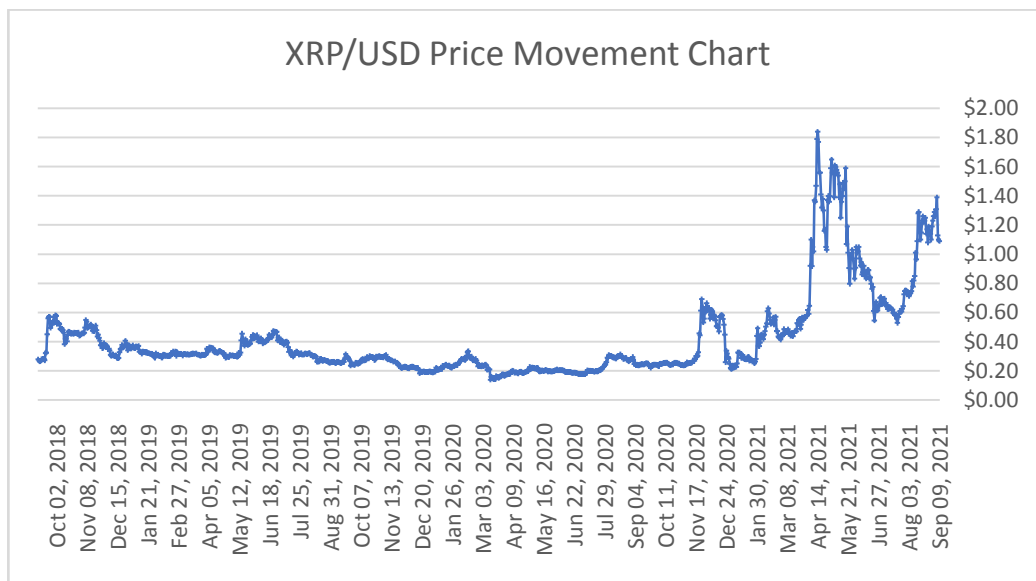
XRP is the cryptocurrency of XRP ledger, a blockchain developed by David Schwartz in 2011. XRP ledger maintained by global XRP community with Ripple as an active member. While XRP and Ripple are intrinsically linked it is to be noted that they operate as separate entities. Instead of mining, it uses a concurrence process, through a bank-owned server, to confirm transactions. XRP transactions happen very fast in a few seconds with a little cost and it takes less energy. Whereas bitcoin uses more time for the transaction and uses more energy. XRP ledger process takes 3-5 seconds roughly.

Ripple runs on a free-source & decentralized digital platform that allows transactions of a high amount of money in all forms. It can be Dollar (\$) or Euro (€) or Litecoin or bitcoin. XRP facilitates quicker transactions.

A medium known as 'Gateway' is used by Ripple as a link in a trust chain between the parties who want to transact. At the gateway, the public can send currencies over the public address and also receives the currencies. This gateway act as a public intermediary. Any individual can register & unlock at the gateway. Their authorization is done for transferring value and for liquidity maintenance. This is how the gateway is useful

XRP also functions as a linked currency to other currencies irrespective of whether it is fiat or cryptocurrency. This helps in the easy exchange of one currency with another. If person A wants to have his payment in Bitcoins, person B can send it in USD. At the person A's gateway he receives Bitcoin as Person B's USD is converted to XRP at his gateway and again it is changed to Bitcoin at Person A's gateway.

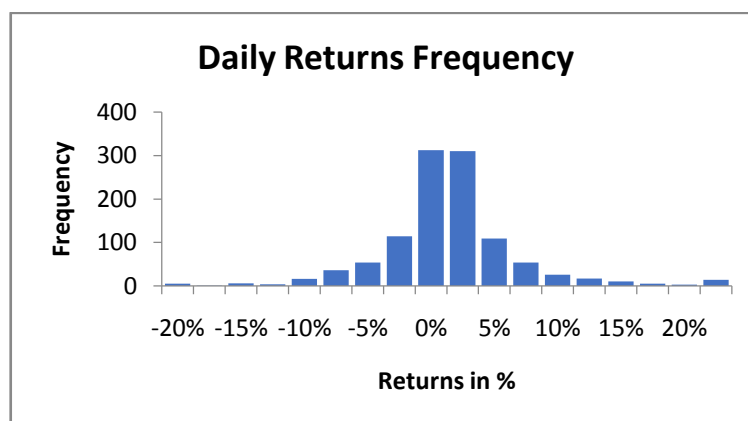
Ripple(XRP) is currently ranked seven as of Sep '21 with a Market capitalization of \$51.4 Billion. It is having a circulating supply of 46.6 billion XRP with a Maximum supply of 100 billion XRP.



XRP has a CAGR of 57.55 which is low when compared to other cryptocurrencies. But when it is compared with S&P 500, the returns of XRP are high. XRP was having average daily returns of 0.322% and a standard deviation of 6.4%

#### Descriptive Statistics of Daily Returns

Mean	0.322%	Kurtosis	15.62
Standard Error	0.193%	Skewness	1.51
Median	-0.009%	Range	98.32%
Standard Deviation	6.40%	Minimum	-42.33%
Sample Variance	0.41%	Maximum	55.99%
Coefficient of Variation	19.87	Count	1096



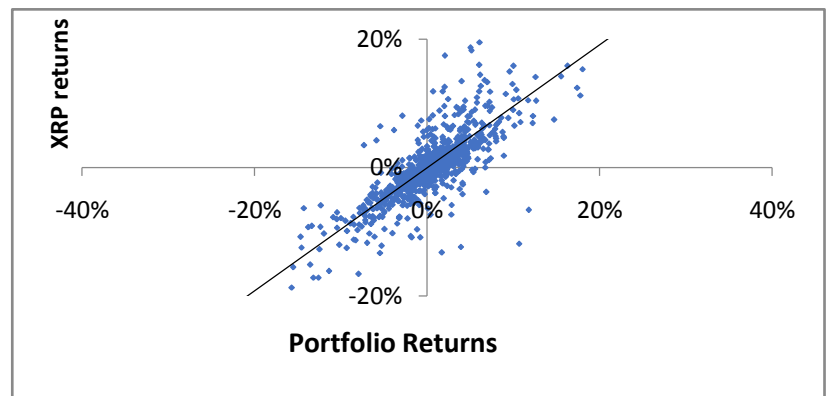


XRP's frequency distribution of daily returns is left-skewed with a skewness of 1.51. Kurtosis of the frequency distribution is high with 15.62 which means a greater number of daily returns are concentrated near the mean.

Extreme Events of Ripple XRP Returns					
Lost	Counts	Percentage	Gains	Counts	Percentage
5% - 10%	90	8.21%	5% - 10%	80	7.30%
10% - 20%	27	2.46%	10% - 20%	35	3.19%
20% - 30%	2	0.18%	20% - 30%	6	0.55%
> 30%	3	0.27%	> 30%	8	0.73%

### Regression Analysis

Regression Statistics	
Multiple R	0.714
R Square	0.510
Adjusted R Square	0.510
Standard Error	0.045
Observations	1096



### ANOVA

	Df	SS	MS	F	Significance F
Regression	1	2.286	2.286	1140.118	0.000
Residual	1094	2.193	0.002		
Total	1095	4.479			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	-0.001	0.001	-0.572	0.567	-0.003	0.002
Portfolio returns	0.958	0.028	33.766	0.000	0.902	1.013

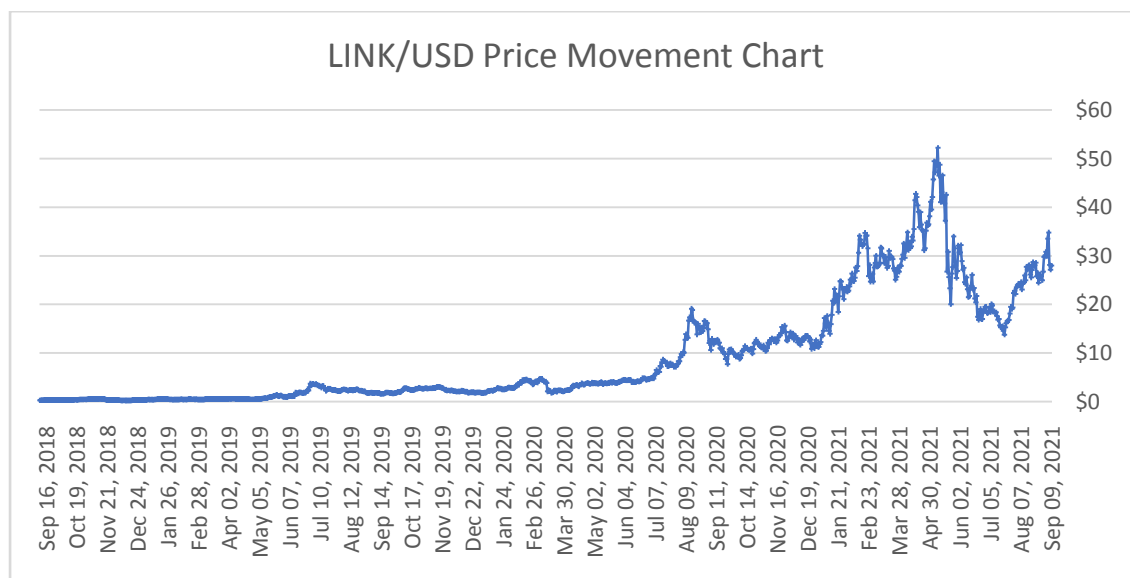
The correlation coefficient is also estimated at 0.714, which means there is a 70% association between the daily returns of XRP and portfolio returns. The regression output shows the P-value of the beta as zero, which means the regression line slope  $\neq 0$  & at 95% confidence level the slope of the line lies between 0.902 and 1.013.

## Chainlink

Chainlink is an abstraction layer of blockchain which enable smart contract that is universally connected. It is a decentralized blockchain oracle network built on Ethereum by Sergey Nazarov in 2017. Chainlink is driven by data providers which are part of a large open-source community, contractors, developers, security auditors, and researchers. Chainlink aims to make smart contracts more powerful by enabling them to draw on dynamic data inputs gathered from outside sources.

Chainlink doesn't have its own blockchain. It provides them all up-to-date information by integrating with multiple blockchains simultaneously. Chainlink purchases data that it streams directly through blockchain. The chainlink oracle network empowers blockchain as well as decentralized apps that run on them to access data and thus make use of a bridge between the real-world and secured blockchain environment.

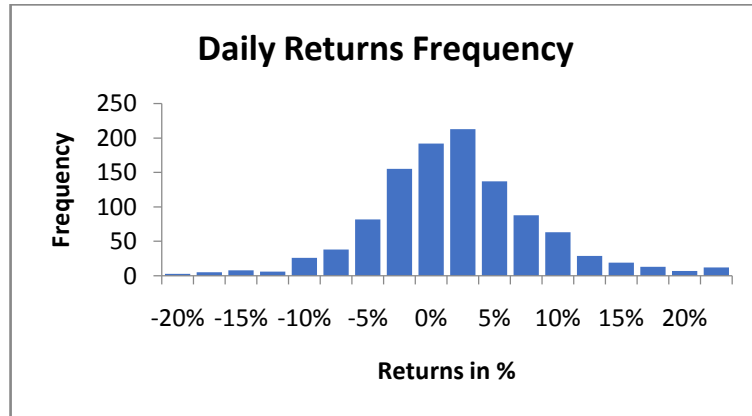
Chainlink is currently having a Market capitalization of \$13 billion as of Sep'21. It is having a circulating supply of 452 million LINK coins.



Chainlink is having a recorded Compounded annual growth rate of 388.7% which is extremely high when compared to the other cryptocurrencies as well as the stock market returns. It is having average daily returns of 0.68% and the standard deviation of these daily returns is given as 7.07% with a coefficient of variation standing at 10.37.

Descriptive Statistics of Daily Returns			
Mean	0.68%	Kurtosis	8.73
Standard Error	0.21%	Skewness	0.67

Median	0.28%	Range	108.35%
Standard Deviation	7.07%	Minimum	-46.07%
Sample Variance	0.50%	Maximum	62.28%
Coefficient of Variation	10.37	Count	1096

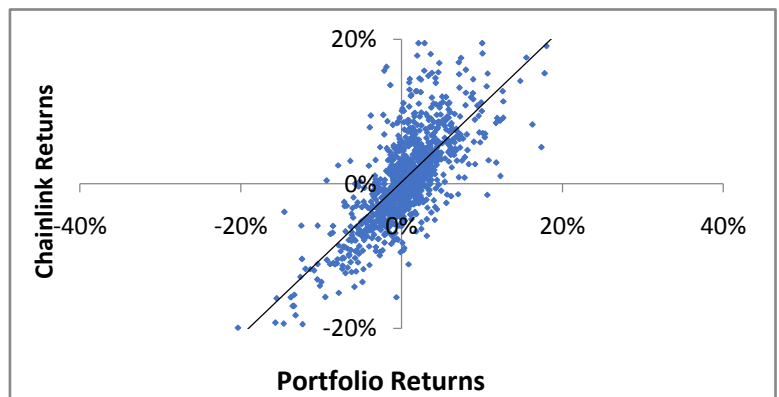


The skewness of the Daily returns' frequency distribution of Chainlink is 0.67 and Kurtosis of the frequency distribution stood at 8.73.

Extreme Events of Chainlink Returns					
Lost	Counts	Percentage	Gains	Counts	Percentage
5% - 10%	120	10.95%	5% - 10%	151	13.78%
10% - 20%	45	4.11%	10% - 20%	68	6.20%
20% - 30%	1	0.09%	20% - 30%	9	0.82%
> 30%	2	0.18%	> 30%	3	0.27%

### Regression Analysis

Regression Statistics	
Multiple R	0.717
R Square	0.514
Adjusted R Square	0.514
Standard Error	0.049
Observations	1096



### ANOVA

	df	SS	MS	F	Significance F
Regression	1	2.82	2.82	1158.74	0.00
Residual	1094	2.66	0.00		

Total	1095	5.47				
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0.002	0.001	1.597	0.111	-0.001	0.005
Portfolio returns	1.063	0.031	34.04	0.000	1.002	1.124

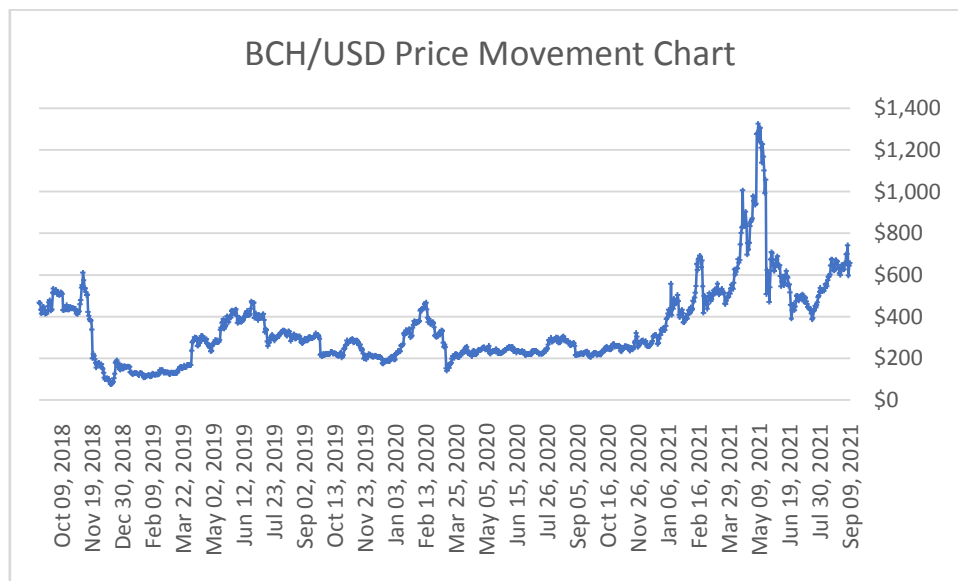
The correlation coefficient of the daily returns of Chainlink and Portfolio returns is around 0.72 which indicates there is a 72% association between both the returns. The P-value of the beta of the regression line with x variable as portfolio index(daily) and y variable as the daily returns is zero which indicated the slope of the line never be zero. With a 95% confidence level, the slope is between 1.002 and 1.124 which is a little higher than the basket of the cryptocurrencies portfolio which we have taken. This indicates the risk compared to other cryptocurrencies is high.

## Bitcoin Cash

Bitcoin Cash is also a peer-to-peer digital system that uses blockchain technology to make transactions. Bitcoin Cash is similar to Bitcoin as it is also a decentralized cryptocurrency where permissions are not required. It means it doesn't require any third party. Bitcoin Cash is launched by the hard forking Bitcoin blockchain. Miners of Bitcoin and its developers started Bitcoin Cash as they are perturbed about the future of the crypto coin and its ability. They enhanced the size limit of the transaction blocks that are added to the blockchain from 1 MB to 8MB and later to 32MB increasing its verification process. This means Bitcoin Cash can make more digital transactions with extremely low fees. Only seven bitcoin transactions can happen in a second which is the reason the bitcoin transactions take a lot of time. With the introduction of Bitcoin Cash, this problem was solved. The large size of the block is one potential threat associated with Bitcoin Cash because of which security might be at stake relative to the network of Bitcoin.

Bitcoin cash itself experienced a hardfork which led to the formation of Bitcoin SV.

Bitcoin cash has a market capitalization of almost \$12 Billion as of Sep'21. Its circulation supply is around 18.8 million BCH with a maximum circulation limit of 21 million BCH.



Bitcoin Cash has Compounded annual growth rate of 11.18% which is low when compared to other currencies. It is on par with returns expected from the stock market. Average daily returns stood at 0.23% with a standard deviation of 6.48%. The coefficient of variation is high with a value of 27.5.

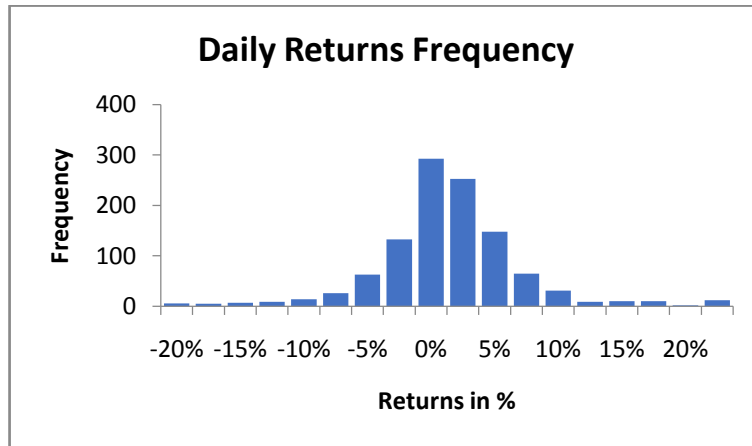
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Descriptive Statistics of Daily Returns

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Mean	0.236%	Kurtosis	13.987
Standard Error	0.196%	Skewness	1.019
			-
Median	0.036%	Range	95.280%
Standard Deviation	6.479%	Minimum	-42.959%
Sample Variance	0.420%	Maximum	52.321%
Coefficient of Variation	27.49	Count	1096

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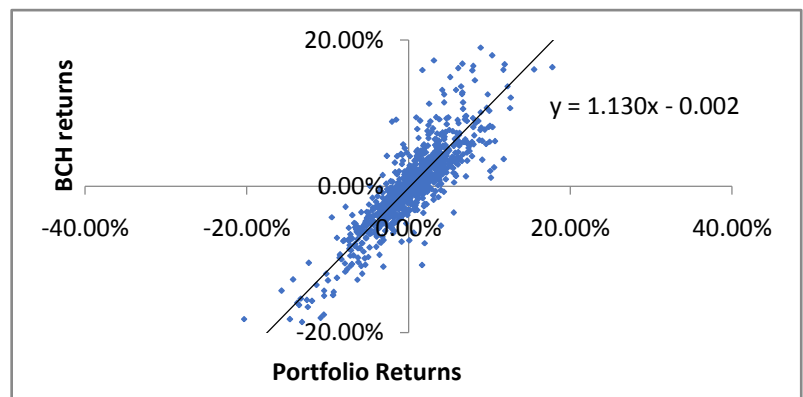


BCH daily returns frequency distribution is left-skewed with a skewness of 1.019 and it is having Kurtosis of 13.98 which is high compared to the other currencies.

Extreme Events of Bitcoin Cash Returns					
Lost	Counts	Percentage	Gains	Counts	Percentage
5% - 10%	89	8.12%	5% - 10%	96	8.76%
10% - 20%	35	3.19%	10% - 20%	31	2.83%
20% - 30%	3	0.27%	20% - 30%	6	0.55%
> 30%	3	0.27%	> 30%	6	0.55%

**Regression Analysis**

Regression Statistics	
Multiple R	0.832
R Square	0.693
Adjusted R Square	0.693
Standard Error	0.036
Observations	1096



**ANOVA**

	df	SS	MS	F	Significance F
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Regression	1	3.185	3.185	2469.034	0.000
Residual	1094	1.411	0.001		
Total	1095	4.596			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	-0.002	0.001	-2.166	0.031	-0.004	0.000
Portfolio returns	1.131	0.023	49.689	0.000	1.086	1.175

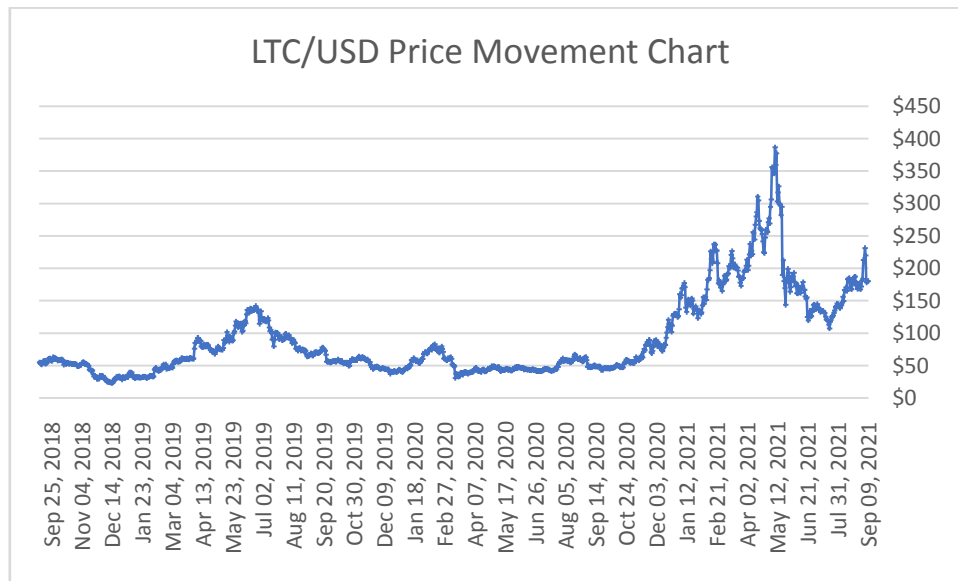
The coefficient of correlation stood at 0.83 which means there is an association between the daily returns in the crypto market and daily returns of Bitcoin cash. The P-value of beta is zero which indicates the slope of the line is not zero. At a 95% confidence level, the slope of the line is between 1.08 and 1.175. The regression line is having a slope of 1.13 which means the daily returns are 1.13 times risky than the daily returns of the portfolio of the cryptocurrencies we assumed.

### Litecoin

Litecoin was designed to provide fast and low-cost payment services. The designers of Litecoin used the same codebase, enhanced the supply, and also enhanced the fastness at which new blocks get added to the blockchain system. Litecoin has a block time of just 2.5 minutes and an extremely less transaction fee. Four times the supply of Bitcoin i.e 84 million Litecoins are created. It is a fork of Bitcoin whose speed and relatively fees making appealing as a payment. But one major drawback with this cryptocurrency is this network has significantly fewer miners than Bitcoins.

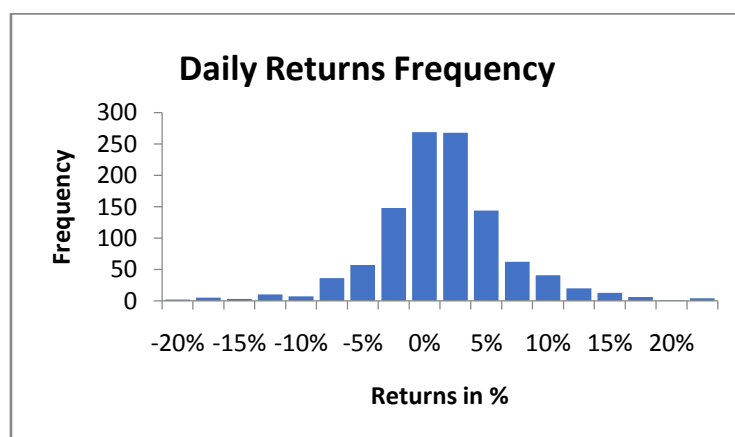
Litecoin was launched by Charlie Lee in 2011. The Litecoin foundation supervises the Litecoin project and it is the one that finances Litecoin's crucial development programs. Litecoin users and coders see the protocol as a complementary testnet for Bitcoin. Bitcoin is seen as digital gold while Litecoin is seen as digital silver by some people. Litecoin launched Mimbalewimbletestnet to improve its scaling and privacy. Mimbalewimble is a protocol that allows for completely private transactions with a unique security framework.

Litecoin is currently having a market capitalization of \$11.8 Billion as of Sep'21. It is currently having a circulating supply of 66.7 million LTC with a maximum supply limit of 84 million LTC.



Litecoin is growing at a rate of 48.65% CAGR. It is having mean daily returns of 0.26% and a standard deviation of 5.39 with a coefficient of variation of 21.05 which is very high.

Descriptive Statistics of Daily Returns			
Mean	0.26%	Kurtosis	6.399
Standard Error	0.16%	Skewness	-0.113
Median	0.04%	Range	67%
			-
Standard Deviation	5.397%	Minimum	36.17%
Sample Variance	0.291%	Maximum	30.82%
Coefficient of Variation	21.05	Count	1096



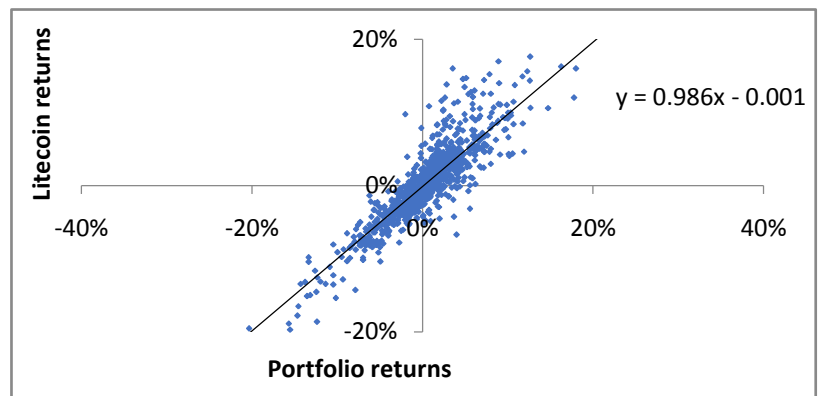


The frequency distribution of Litecoin’s daily returns is right-skewed with a Skewness of -0.113. It is also having a Kurtosis of 6.399.

Extreme Events of Litecoin Returns					
Lost	Counts	Percentage	Gains	Counts	Percentage
5% - 10%	93	8.49%	5% - 10%	103	9.40%
10% - 20%	25	2.28%	10% - 20%	40	3.65%
20% - 30%	0	0.00%	20% - 30%	3	0.27%
> 30%	2	0.18%	> 30%	1	0.09%

### Regression Analysis

Regression Statistics	
Multiple R	0.872
R Square	0.760
Adjusted R Square	0.760
Standard Error	0.026
Observations	1096



### ANOVA

	Df	SS	MS	F	Significance F
Regression	1	2.43	2.43	3472.28	0
Residual	1094	0.76	0.00		
Total	1095	3.19			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	-0.002	0.001	-1.935	0.053	-0.003	0.000
Portfolio returns	0.987	0.017	58.926	0.000	0.954	1.019

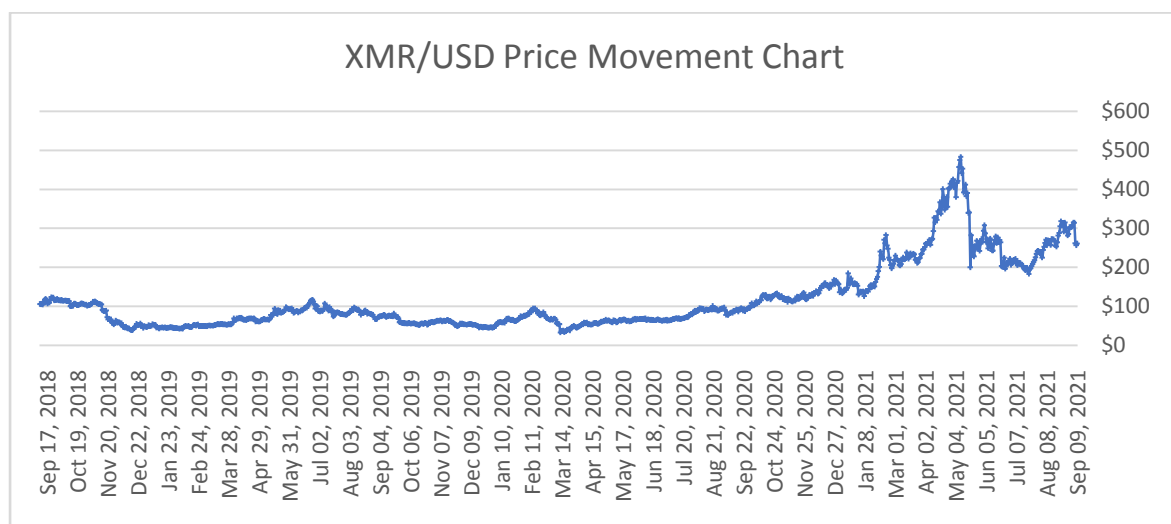
The correlation coefficient of Litecoin’s daily returns to the portfolio returns is 0.872 which means the price movement of the crypto-market influencesthe price movement of Litecoin. The P-value of the beta is zero which indicates the coefficient of the independent variable is not going to be zero. With a 95% of confidence level, the beta value lies between 0.954 and 1.019.

## Monero

Monero is one of the leading cryptocurrencies which focused on private and censorship-resistant transactions. It uses various privacy-enhancing technologies to ensure the anonymity of the users. Transaction on Monero can't be tracked or traced. It uses a Proof of work algorithm to issue new coins and secure transactions. Monero has a special character, the participation in the earlier transaction doesn't influence the value of any other as all the historical transactions are completely undisclosed

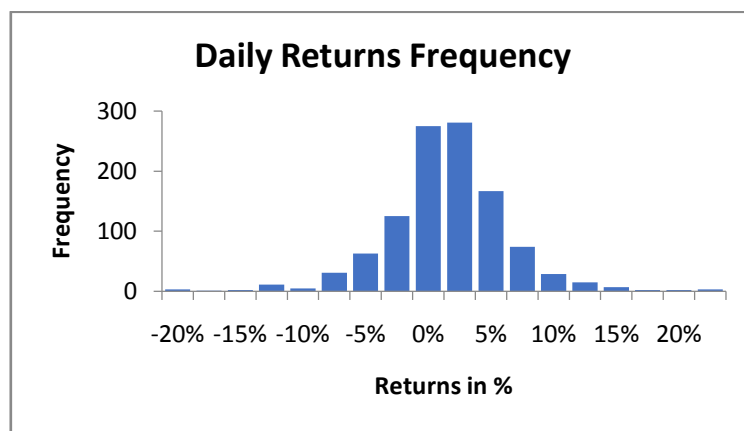
Monero reduces problems related to privacy using the concept of ring signatures. Ring signature enables a sender to veil his identity in the group. Ring signatures make sure that it doesn't disclose which person from the group has authenticated the transaction. It also uses stealth addresses for solving privacy problems. The combination of the sender's account keys is used in the Monero platform. A ring signature is formed by clubbing of senders' account keys with the public keys on the blockchain. These systems ensure the privacy of the transaction.

Monero is having a market capitalization of \$4.5 Billion as of Sep '21. It is having a circulating supply of Monero is around 18 million XMR. It is having a market dominance of around 0.22%.



Monero is having Compounded annual growth rate of 35.02% with a standard deviation of 5.17%. The coefficient of variation stood at 23.47 which is high compared to other cryptocurrencies.

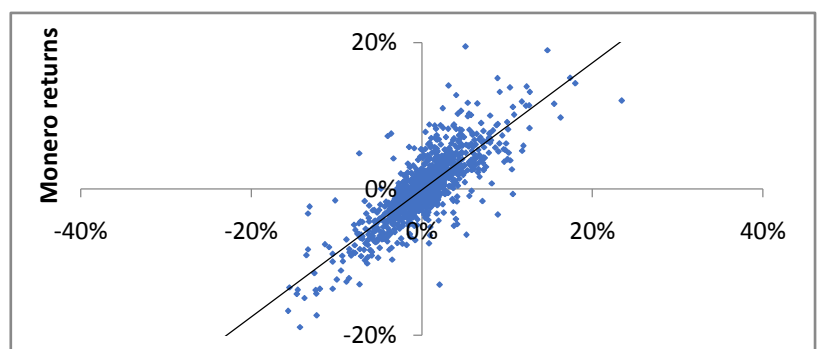
Descriptive Statistics of Daily Returns			
Mean	0.220%	Kurtosis	11.56
Standard Error	0.156%	Skewness	-0.38
Median	0.299%	Range	82.57%
			-
Standard Deviation	5.173%	Minimum	41.38%
Sample Variance	0.268%	Maximum	41.19%
Coefficient of Variation	23.49	Count	1096



The frequency distribution of Monero is slightly right-skewed. It is having a Kurtosis of 11.56.

Extreme Events of Monero Returns					
Lost	Counts	Percentage	Gains	Counts	Percentage
5% - 10%	94	8.58%	5% - 10%	103	9.40%
10% - 20%	19	1.73%	10% - 20%	26	2.37%
20% - 30%	1	0.09%	20% - 30%	2	0.18%
> 30%	2	0.18%	> 30%	1	0.09%

### Regression Analysis



Regression Statistics	
Multiple R	0.801
R Square	0.641
Adjusted R Square	0.641
Standard Error	0.031
Observations	1096

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	1.878	1.878	1953.287	0.000
Residual	1094	1.052	0.001		
Total	1095	2.930			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	-0.001	0.001	-1.509	0.132	-0.003	0.000
Portfolio returns	0.868	0.020	44.196	0.000	0.830	0.907

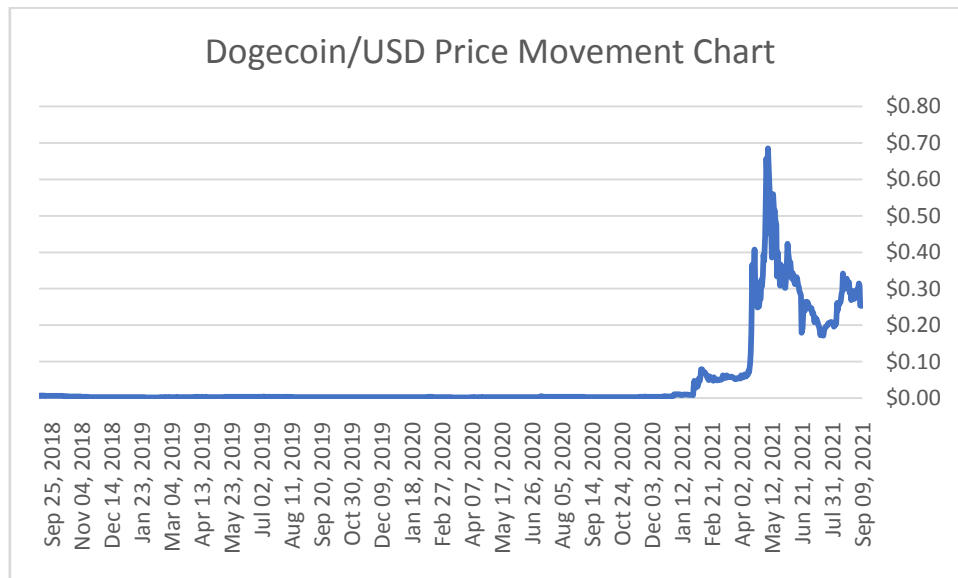
The correlation coefficient of the daily return of Monero and portfolio index is 0.80 which means there is an association between the two. The P-value of the Beta of the regression line is zero which means the slope of the line is not equal to zero. With a 95% confidence level, the slope of the line lies between 0.830 and 0.907.

### Dogecoin

Dogecoin is an open-source digital currency created which was forked from Litecoin. Dogecoin was created based on a dog meme but later it gained a lot of attention. It was participating in Cryptocurrency Bubble, 2017 where the cryptomarket has seen the value of a lot of coins going up, but it lost a lot of its value in the bubble burst in 2018. But it is having a core of supporters.

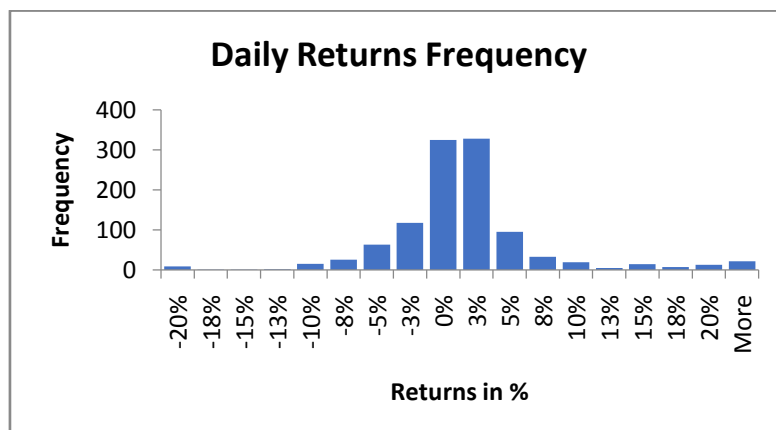
Dogecoin is dissimilar from Bitcoin's Decentralized consensus mechanism Proof of work. One of these is Dogecoin uses script technology. It has a one-minute block time and the total supply of it is unlimited which means there is no cap to the number of Doge coins that can be mined. It has been a tipping currency in social media groups where people who create some good quality content will be rewarded with Dogecoins. People also can get Dogecoins from a Dogecoin faucet where people will be given a few coins for free for creating interest in the currency. There are also more online interaction programs among the people through Dogecoin communities.

Dogecoin is in the top ten with a market capitalization of \$30 billion as of Sep '21. It is having a circulation supply of 131 billion DOGE. It is having a market dominance of 1.52%



Dogecoin is having Compounded an annual growth rate of 251.25% in the past three years with an average daily return of 0.79%. The standard deviation is 13.25% with a coefficient of variation of 16.70.

Descriptive Statistics of Daily Returns			
Mean	0.79%	Kurtosis	473.58
Standard Error	0.40%	Skewness	18.36
Median	-0.10%	Range	395.74%
Standard Deviation	13.25%	Minimum	-40.25%
Sample Variance	1.76%	Maximum	355.49%
Coefficient of Variation	16.70	Count	1096

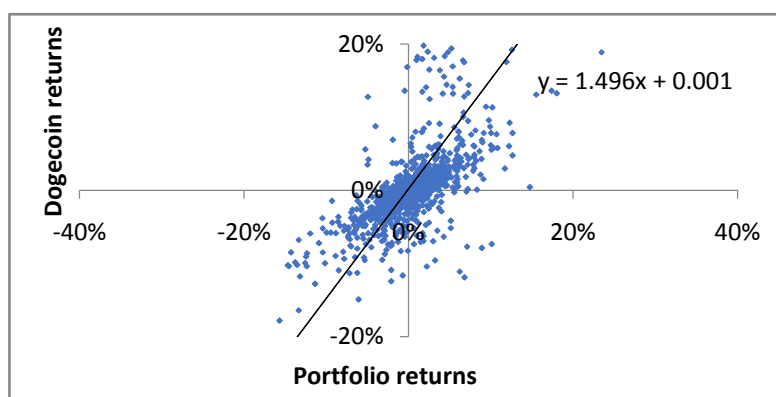


The frequency distribution of Dogecoin daily returns is highly left-skewed and the Kurtosis of it is also very high with the value of 473.58, the reason being a greater number of the daily returns are concentrated at one place.

Extreme Events of Dogecoin Returns					
Lost	Counts	Percentage	Gains	Counts	Percentage
5% - 10%	89	8.12%	5% - 10%	52	4.74%
10% - 20%	19	1.73%	10% - 20%	39	3.56%
20% - 30%	6	0.55%	20% - 30%	11	1.00%
> 30%	3	0.27%	> 30%	11	1.00%

### Regression Analysis

Regression Statistics	
Multiple R	0.538
R Square	0.290
Adjusted R Square	0.289
Standard Error	0.112
Observations	1096



### ANOVA

	df	SS	MS	F	Significance F
Regression	1	5.577	5.577	446.611	0.000
Residual	1094	13.661	0.012		
Total	1095	19.238			

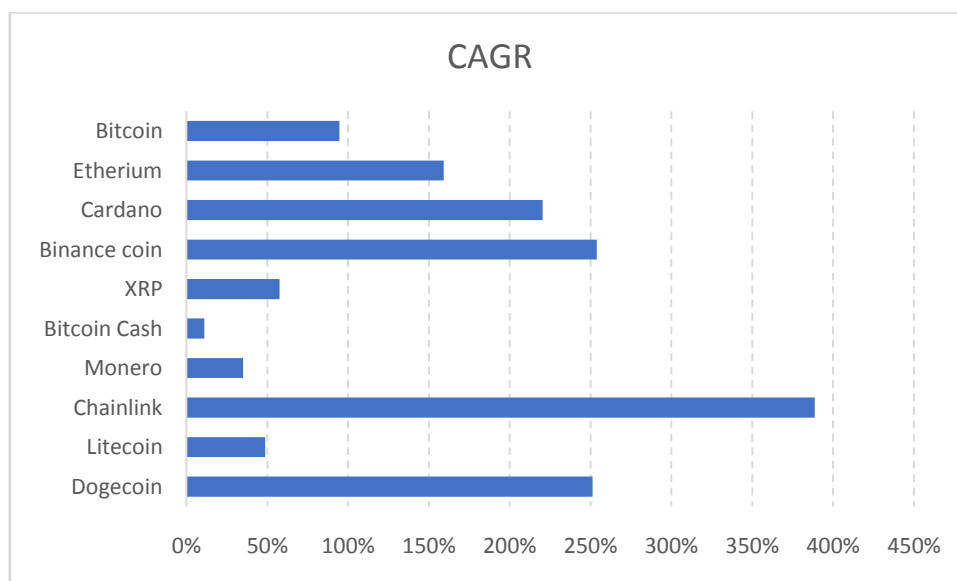
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0.002	0.003	0.501	0.616	-0.005	0.008
Portfolio returns	1.496	0.071	21.133	0.000	1.357	1.635

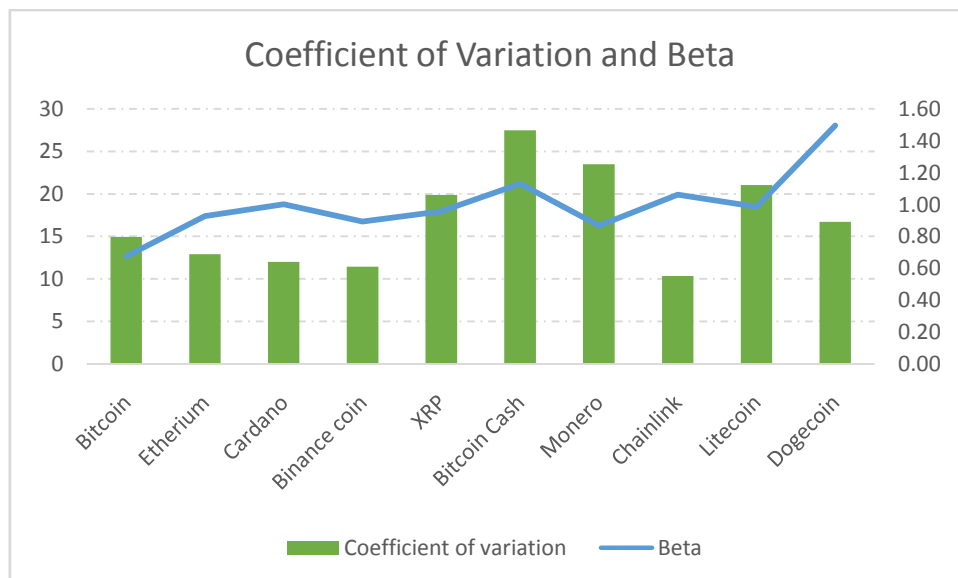
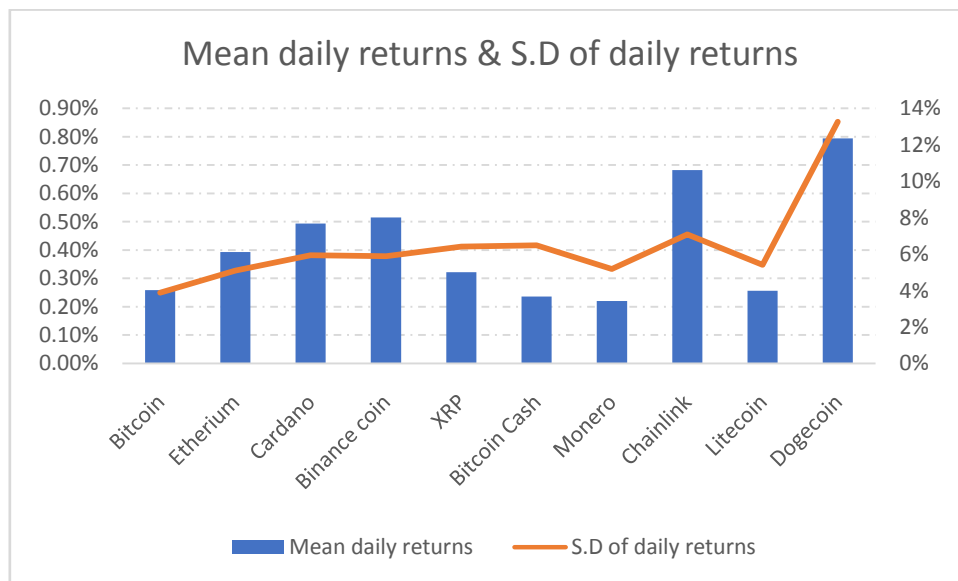
The correlation coefficient of the daily returns of the Dogecoin to Daily returns of the equal-weighted portfolio is 0.538 which means there is less association between the two. The P-value of the beta is zero which indicates rejection of the null hypothesis which assumes

slope is equal to zero. With a 95% confidence level, the beta or the slope lies between 1.357 and 1.635 which means the cryptocurrency is a bit risky compared to the other cryptocurrencies.

### Crypto Comparison:

The below table gives us the comparison of the crypto coins we have chosen for the analysis. Chainlink Coin got the highest Compounded annual returns when compared to others with 388.72%. The least CAGR among the coins is for Bitcoin Cash. The same Bitcoin cash is having the highest Coefficient of variation (based on daily returns). The beta value of the same currency is also high. The highest mean daily returns are for Dogecoin which is also having a high CAGR. Same Dogecoin is having the highest Standard deviation among all. The coefficient of variation is low for Cardano which means it is having a good risk-return tradeoff amongst all. Beta value is highest for Dogecoin with a value of 1.5





## Conclusion

With increasing attention being paid to crypto coins in academic circles, discussing the risks and returns involved in the investment using historical data is needed. Even though there is no fundamental value to the crypto coins yet the disruptive blockchain technology has given a new platform for investors to make money. Based on this analysis which we presented we ascertained that there is a high risk involved in the crypto coins by comparing it with the other asset classes. The qualitative assessment gives us a picture that Bitcoin, Ethereum, Dogecoin will have a bright future because of the brand value these coins have got among others. Quantitatively speaking except for Bitcoin Cash all the other coins outperformed the stock market, derivatives & commodity markets. From the analysis which has been done, surely long-term investment of more than three years will give good results.



The short-term investment could be a disaster unless it is supported by a strong technical analysis.

**References:**

- 1) Information about Dogecoin, Bitcoin Cash, Monero & Chainlink from [www.investopedia.com](http://www.investopedia.com)
- 2) Price movements data of 10 cryptocurrencies taken - [www.coinmarketcap.com](http://www.coinmarketcap.com)
- 3) Information about Bitcoin, Ethereum, Cardano, Binance coin, Bitcoin Cash [www.coindesk.com](http://www.coindesk.com)
- 4) Information about cryptocurrencies [www.coinbase.com](http://www.coinbase.com)
- 5) Yukun Liu and Aleh Tsyvinski – Risks and Returns of cryptocurrencies
- 6) Isfenti Sadalia & Rico Nur Ilham’s paper on ‘Risk & Return on bitcoin’
- 7) Albert S. Hu, Christine A. Parlour, Uday Rajan’s paper – ‘Cryptocurrencies: Stylized facts on a new investible Instruments’
- 8) Cryptocurrencies: market analysis and perspectives - Giancarlo Giudici Alistair Milne
- 9) Cryptocurrency investing for dummies - Kiana Danial
- 10) A Statistical Analysis of Cryptocurrencies - Stephen Chan, Jeffrey Chu, Saralees Nadarajah, and Joerg Osterrieder
- 11) Yukun Liu and Aleh Tsyvinski – Common risk factors in cryptocurrencies