Rise Capital Application

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Executive Summary

Hypothetically, when people finish a deal involving cash with a company. People are willing to give that company one dollar in exchange for that company's product. Once this transaction is completed, the details will be recorded into a ledger (Rise Capital, n.d.). The deal is successful because one dollar is represented a prove that both sides recognize and trust (Rise Capital, n.d.). It is further complicated when it comes to digital cash because it is not easy to confirm a transaction without involving a trusted intermediary like a bank (Rise Capital, n.d.). Bitcoin is an excellent example to illustrate this because it is not issued by the government and intermediaries. The blockchain is a technology that supports crypto-currencies and solves the problem of keeping the integrity and accuracy of transactions over time (Rise Capital, n.d.). The blockchain is a technical framework for reaching consensus through distributed digital ledges (Rise Capital, n.d.). In a blockchain database, each participant or node maintains a digital ledge (Rise Capital, n.d.). Each transaction on the blockchain is recorded in a computer code that shows who the parties to the transaction are and the transaction details and timestamps (Rise Capital, n.d.). Each transaction contains a unique encrypted signature. An encrypted signature is a very vital factor because it allows each block of information to connect securely to all other blocks of information (Rise Capital, n.d.). This connection provides a system that tracks every transaction. Therefore, if there are unauthorized changes, people can check where it is occurring. They can choose whether they would like to accept the change or reject it.

Blockchain technology is revolutionizing the financial industry and enable millions of people around the world to trade immediately without the need for costly intermediaries (Rise Capital, n.d.). Hence, Forkaia started a project called Rise Capital. This project is planned to create unexpected value and opportunities through the use of AI and enable people and businesses around

the world to realize their transactions (Rise Capital, n.d.). In addition, this project hopes to use predictive hybrid recommendation system that converts received data into actionable transactions to help investors predict price, identify trade signals, and recommend new investment strategies (Rise Capital, n.d.). In short, risk capital project combines some minds in blockchain and crypto-currencies with cutting-edge artificial intelligence technologies to provide customers with diversified, affordable and liquid exposure to the most profitable and stringent crypto-asset investment strategies (Rise Capital, n.d.). This paper is aiming to explore the following points: cryptocurrencies' return, volatility, risk, covariance, correlation, Markowitz Portfolio Optimization, CAPM Model, and Monte Carlo Simulation. Finally, I will give some assessments on this company and provide some advice on its future development based on my data analytics.

Background

Forkaia is an artificial intelligence startup and new technology company. Forkaia is an innovation lab and an innovation accelerator that has spawned companies that can revolutionize existing markets (FORKAIA, n.d.). They found that AI startups and early-stage technology companies are undermining the status quo to serve a better future (FORKAIA, n.d.). Forkaia has an open-source ecosystem (FORKAIA, n.d.). It includes some of the world's most talented engineers and scientists, who have implemented some of the most interesting and innovative projects on Earth through artificial intelligence, machine learning, data science and neural networks (FORKAIA, n.d.). The culture of Forkaia is established on collaboration, experimentation, and disruption (FORKAIA, n.d.). Forkaia continues to utilize the Faucia ecosystem to strength and hold its own startup portfolio (FORKAIA, n.d.). Their goal is to destroy conventions, rules, and orders that were no longer sustainable in the past and make room for something new (FORKAIA, n.d.).

My company wants to build an application that selects crypto-currencies based on investors' goals and risk tolerance. I was assigned to do a financial analysis and market analysis through extracting the data of blockchain & crypto-asset investment fund and developed machine learning algorithms based on statistical analysis. Investors need to know where the market is. There is no point in building an application that uses artificial intelligence to choose if there is no cryptocurrency market. That's why this project is so important.

Methodology

In the beginning, I extracted 13 cryptocurrencies that are active from 2018 to 2019 using python from Yahoo Finance. The graph is shown in figure 1. These cryptocurrencies are Bitcoin, Ethereum, Litecoin, Dogecoin, XRP, Monero, Verge, and so on. Generally speaking, when we think of an investment, we must remember two things: one is the positive side of the investment, the other is the negative side of the investment. In other words, if all goes well, we'll consider profit. At the same time, if the investment fails, we must face the risk of loss. Whether people buy stocks in corporate, corporate or government bonds, real estate, gold investment mutual funds or pension funds, it works for every business. People have to consider these parameters, and you can expect the risk of profit and loss. For example, the average return on government bonds was 3 percent. Historically, few governments have gone bankrupt without paying what they owe investors. So, this kind of investment will bring some risks. It's not risk-free, but the risk is very limited. However, many investments have more frequent fluctuations. Generally, they are associated with price changes. Hence, investors need to know they expected high returns at the expense of high risk.

First, I created a chart to show the prices of 13 crypto-currencies. The result is shown in figure 2. According to the figure, the volatility of 13 encrypted currencies is high, and it shows a

downward trend from 2018 to 2019. However, only one crypto-currency, the USDT, has been the least volatile. In other words, from 2018 to 2019, its price is very stable.

Analysis

Calculating Simple and Logarithmic Rate of Return

The main objective of each investor is to achieve a reasonable rate of return. The rate of return is calculated by subtracting the opening price from the closing price and dividing it by the opening price. Obviously, how do people calculate the simple rate of return on investment right? People can use this formula to calculate the rate of return over time, but we should be careful not to compare investments over different holding periods. People should always keep in mind the timetable of the rate of return. People usually work with investors and use daily monthly, quarterly, and annual returns. Besides, we can easily convert daily, monthly, and quarterly reports to annual reports. People just need to apply the following formula. We can easily adjust the daily monthly earnings and quarterly earnings.

Two methods are given: the simple rate of return method and the logarithmic rate of return method. The difference between the two ways is minimal. However, the question is, which one should I choose? There are no general rules. Typically, when people are working on multiple assets over the same time period, they choose a simple rate of returns. When people are calculating individual assets over a period of time, log returns are selected. Because I choose multiple crypto-currencies at the same time, a simple return is better than a log return, even though their graphics are almost identical. I calculated 14 cryptocurrencies' the percentage of return using python. The result is shown in figure 3. I can see that these 14 cryptocurrencies' rate of return have a wavy trend. It means their rate of return is not very stable from 2018 to 2019. To get a better observation of the data, I extracted the Bitcoin and Ethereum as an example. The result is shown in figure 4.

Bitcoin and Ethereum can be regarded as the highest prices of cryptocurrencies. According to figure4, their rate of return still very unstable. It means the whole cryptocurrencies market is very unstable from 2018 to 2019.

Measuring Investment Risk

Investors like high returns and don't like risk and uncertainty — the chance of losing most of their money. I have to admit that risk and return are the two most important aspects of investment decisions. As a result, it is easy to understand why people have to spend a lot of time learning how to measure and predict security risks. In the financial industry, variability plays an important role. This is the best way to measure risk. I will use the stock as an example. We have a volatile stock market that is more likely to deviate from its historical returns and give investors a negative surprise. However, investors do not like surprises and are more sensitive to the possibility of losing their initial investment. Most people prefer to have securities or portfolios of securities that they can buy and are doing their best to reduce the risk they face. Investors are risk-averse. They don't like to take risks for the sake of risks. Their main goal is to measure the risks they face and minimize them as much as possible. Commonly, investors can use statistical methods such as variance and standard deviation.

Firstly, I present a new concept. I will use the company's stock as an example. The relationship between financial instruments can reasonably be expected to be affected by the same factors as stock prices on the Stock Exchange. When people have jobs and money in their pockets, they spend more money. As revenue increases, the company also benefits. In a tough economy, consumers cut back on spending and buy mainly the most relevant products, because profits determine stock prices, and as long as the economy is good, stock prices will be higher. In a recession, investors will pay a high price for profitable companies. The company's profits are low,

and its share price has fallen sharply. So, it is a meaningful relationship. The company's stock is affected by the economic situation. When the economy is terrible, which is more affected, the carmakers or the supermarket chains. There is no doubt that the answer is the carmakers. People cannot stop buying food and groceries, but they can quickly put off buying a new car and keep driving an old one. As a result, economic conditions affect different industries in different ways. If you have some savings, you want to use it to buy shares in a second company. You own stock in a technology company like Apple, and the other two options are Facebook and Walmart. Suppose people expect two shares to return the same. Should people choose LinkedIn or Walmart? The correct answer is Walmart. The reason is that Walmart operates in a different industry, which gives you investor protection. If the situation in the Internet field is not good, you will still own a stake in Wal-Mart, which will not be affected by potential negative developments. Therefore, it is clear that there is a relationship between the prices of different companies, and it is significant to understand the causes of this relationship and how to use this measure to establish the best investment. Knowing the relationship between the prices of companies can help people optimize investment portfolios. Cryptocurrencies have the same situation.

Covariance and Correlation

As we all know, investors like to earn high rates of return. They do not like risk and uncertainty. This is why risk is one of the most critical factors in investment decisions. The first is to calculate variability, which plays an essential role in the financial world. The result is shown in Figure 5. The variability of XVG-USD is 1.45. Compared with the other 13 encrypted currencies, Bitcoin and the US dollar are only 0.45 and 0.01. Hence, I can see that XVG-USD is the worst variability. Bitcoin and USDT-USD are the most stable. In other words, their risk is also the lowest.

The second method that measuring the relationship is called covariance and correlation. Covariance and correlation are associated with risk. We need to qualify this relationship. I analyzed the covariance of Bitcoin and Ethereum. The result is shown in figure 5. I firstly calculated their rate of return on 365 days and calculated their covariance. In general, the output of the measurement relationship is in the range from -1 to 1. The correlation coefficient measures the relationship between two variables. When they move in the same direction, the covariance will have a positive sign. If they move in the opposite direction, the covariance will have a negative sign. According to figure 5, we can see that their covariance is more than zero. Hence, they move in the same direction.

Correlation adjusted covariance. Therefore, the relationship between these two variables becomes easy to understand and intuitive. Now, a correlation, also known as a full positive correlation, means that the second variable is interpreted by the first variable. I will use an example to illustrate this. House price is related to the house area. For example, every additional square foot of space, we expect to increase the price, assuming that the house price is $1,000. Also, we expect to increase another five square feet; the price will increase by $5,000. The investment market is also the same. I will take the company's stock as an example — the more similar the operating environments of the two companies, the higher the correlation between them. Their share prices are affected by the same or similar factors. Zero correlation between two variables means that they are independent with each other. It can be a negative complete negative correlation, or more likely an incomplete or negative correlation between negative 1 and 0.

Finally, I also measured the relationship between 13 cryptocurrencies. As you can see from the figure, as the colors get darker, and the output approaches zero, the correlation between them becomes weaker. I also extract Bitcoin and Ethereum as an example. According to figure 7, I can

see that the coefficient correlation between Bitcoin and Ethereum is 0.82. It means that Bitcoin and Ethereum has a positive relationship. In other words, if Bitcoin's price increased, Ethereum also might increase.

Calculating the Portfolio Variance

If a portfolio contains two cryptocurrencies, then risk will be a function of the difference between the two cryptocurrencies. Risk is a function of the variance of two stocks and its correlation. For example, a portfolio containing Bitcoin and Ethereum have different risks than one containing Bitcoin and Litecoin. Although the difference between Ethereum and Litecoin is the same, the difference will be given by the relationship between the prices of the two companies in the portfolio. Therefore, the weight of the first cryptocurrency is w1, or weight 1. The weight of the second cryptocurrency is W2, which stands for weight 2. The portfolio variance should be calculated to the second degree by multiplying the weight of 1 by the standard deviation of the first stock and the weight of 2 by the standard deviation of the second stock.

I still utilize Bitcoin and Ethereum as an example. I calculated log returns, risks, covariances, and correlations. Then I calculated the portfolio risk. Hypothetically, the portfolio containing Bitcoin and Ethereum has an equally weighted portfolio, 50% in Bitcoin and 50% in Ethereum. The variance of the combination of Bitcoin and Ethereum is calculated to be 78.7%. Also, I calculated the volatility of the portfolio. I just raised this expression to a power of 0.5. The volatility of the portfolio is 88.701%. The result is shown in figure 5.

Calculating Diversifiable and Non-Diversifiable Risk of a Portfolio

The risk of a portfolio can be described as the sum of two components, that is, the variance of the securities contained in the portfolio and the product of the covariance between the securities and their standard deviations. There are two types of investment risk: systemic risk and systemic

risk, also known as unbreakable risk and diversification risk. Systemic risk refers to daily changes in stock prices caused by events affecting all companies. Recession is a systemic risk, and other systemic risks may be adverse consumer demand wars, earthquakes, and all the risks that can affect all companies in an economy. The uncertainty generated by systematic risk is something we must accept when investing. However, regarding part of the non-systemic risk, sometimes we can avoid. I tried to calculate the systematic and unsystematic risks of the portfolio. The result is shown in figure 9.

I still took Bitcoin and Ethereum as an example. I set the weight of the two encrypted currencies. This is a weighted combination of two encrypted currencies. One way to estimate annual diversifiable risk is to get the variance of the portfolio and subtract the weighted annual variance for each crypto-currency. According to the calculation, I got 35% of the dispersible risk and 29.5% of the non-dispersible risk. This risk in the portfolio is very high. In other words, the portfolio of cryptocurrencies containing Bitcoin and Ethereum is unstable.

Markowitz Portfolio Optimization

Markowitz proves the existence of an efficient portfolio that optimizes the investor's return based on the degree of risk that the investor is willing to accept. Markowitz presents that investments in multiple securities should not be analyzed separately but should be considered within a portfolio and that financiers had to understand how different securities in a portfolio interacted. We already know how to measure the relationship between two securities by calculating their covariance. Markowitz recommendation comes from a portfolio of low-correlation securities. Investors can optimize returns without taking additional risks. Markowitz assumes that investors are rational, risk-averse, interested in higher returns and prefer to avoid additional risk. This leads

to the conclusion that investors are only interested in the portfolio with the highest expected return for any level of risk.

The two assets are organized by Bitcoin and Ethereum, both of which are stored in a list called assets. At the beginning of 2018, I still use last year's data. I then went on to perform some standard steps to normalize it to 100 and plot the portfolio data on a chart to see how the two assets performed. The result is shown in Figure 9. To get the efficient frontier of these assets, I calculated log returns, averages, and their covariance correlations. Then I calculated the expected portfolio return and the expected volatility. The figure is shown in Figure 9. From this chart, I can see that as expected returns increase, their volatility gradually becomes more pronounced.

Capital Assets Price Model

Investors avoid risks. They prefer higher returns but are wary of the risks they face and want to optimize their portfolios for both risks and return. Investors are not willing to buy anything other than the best portfolio with optimized expected returns and standard deviations. Whatever bonds or stocks, this portfolio's risk-return portfolio is better than any other portfolio. The expected return of the market portfolio is in line with the expected return of the market, because it is a diversified portfolio, so it is the best in terms of risk. CAPM introduces a new concept, risk-free assets. It means that the market portfolio is not the only asset that rational investors will invest in risk-free investments, which provides investors with something zero risks. Therefore, rational investors will consider both the risk-free interest rate and the market portfolio to form their portfolio. How much they will invest in risk-free investments and how much they will invest in market portfolios. It depends on how much money they want to make. The line connecting the risk-free interest rate and the efficient frontier is called the capital market line. In sum, if each investor is willing to take on more risk, he can invest between risk-free assets and market portfolios

according to his risk preference. If he is not willing to take risks, he will hold more of the market portfolio. He will buy more risk-free assets, while market portfolio investors interested in high expected returns will be able to borrow money and invest it in market portfolios further along with the capital markets.

Capital asset pricing model helps us quantify the relationship between securities and the overall market portfolio, which includes all securities in the market with low expected returns and low risk, as well as securities with high expected returns and high risk. In the event of an economic crisis, it is reasonable to expect that the prices of most of the assets that make up the market portfolio will fall and that the market portfolio will experience negative returns. However, some securities in the market portfolio are less risky. They have a lower standard deviation and will have less reduction than the market. Some stocks are safer than market portfolios, with fewer losses and fewer gains, while others are safer. The risks are higher, with excellent performance in good times and poor performance in times of crisis. This is why using the beta coefficient, which allows us to measure the relationship between a portfolio of stocks and the market. Beta can be calculated by dividing the covariance between the stock and the market by the market. It measures the market risk that cannot be avoided through diversification. Stocks with the coefficient of beta less than one is called defensive stocks because they usually lose less if the market underperforms, and stocks with a beta of 1 perform the same as the market. Finally, stocks with betas above 1 are riskier than the market and do better than the market.

I still took Bitcoin as an example. Firstly, I calculate its beta, and we will approximate the development of the market with the S&P 500. The first is the covariance between Bitcoin and the S & P 500, and the second is the variance of the S & P 500. I still calculated the log return. I calculated, stored in a variable called a security return and created a covariance **matrix between**

Bitcoin and the market portfolio. According to the formula, the result is shown in figure 11. The Beta of Bitcoin is 0.23. Besides, I also calculated the expected return of Bitcoin (CAPM). I used the return of the risk-free assets plus Beta times (the expected return of the market minus the return of the risk-free assets). The result is shown in figure 11. The expected return of Bitcoin is 3.7%.

Recommendations and Conclusion

In sum, I measured the correlation between Bitcoin and Ethereum. According to figure 12, there is a strong correlation between them, with a correlation coefficient of 0.82. I found a portfolio containing two cryptocurrencies will not help investors bring a benefit. On the face of it, it is beneficial for the portfolio. The majority of investors are risk-averse. They are more willing to get higher returns, but they are afraid of the risks they face. They want to optimize their portfolios regardless of risk or return. They are willing to buy the optimal portfolio with optimized expected returns and standard deviations. In a booming economy, a portfolio of two stocks with higher correlation and higher volatility will yield higher returns. However, for a portfolio, this is not a good thing. I will take stocks as an example. In a recession, a portfolio that includes both high-return and high-risk stocks also faces higher risks, because both stocks have high volatility. If an economic crisis appeared, investors would lose a lot of money. Therefore, investors will choose two less correlated assets as a portfolio because they can hedge risk.

I use Python got stock data on 500 companies from the S & P 500. I compared three companies with the lowest correlation to Bitcoin. Figure 12 shows the correlation between S & P 500 stocks and Bitcoin. Their correlation is much lower than the correlation between Bitcoin and Ethereum (Figure 11). Figure 13 shows the efficient boundary between Ethereum and Bitcoin. Figure 14 shows the effective frontier for NRG Energy and Bitcoin. Figure 15 shows the effective frontier for TripAdvisor, Inc. and Bitcoin. Figure 16 shows the efficient boundary between Lamb

Weston Holdings and Bitcoin. Figure 13, 14, 15, and 16 have better efficient boundaries than figure 11. In other words, investors may be willing to invest in a mix of Bitcoin and less relevant company stocks, rather than a combination of the two crypto-currencies. Hence, I conclude that a portfolio of cryptocurrencies is not a good option for investors. This goal of the project is to build an application to help investor pick cryptocurrencies. If the application only would like to recommend a portfolio containing cryptocurrencies, this would not help investors maximize their return and reduce their risk based on my data analytics. Hence, I recommend that the application my company will make should add stocks to the portfolio.

Reflective Essay

Through this internship, I learned how to do a financial analysis using python. I know how to code in python and apply these skills in the world of finance. For example, I learn how to calculate the rate of return of cryptocurrencies, risk of cryptocurrencies, rate of return of cryptocurrency portfolios, risk of cryptocurrency portfolios, the correlation between cryptocurrencies, covariance, diversifiable, non-diversifiable risk, Beta coefficients, Markowitz efficient frontier calculation, and Capital asset pricing model. These skills and knowledge should be beneficial for my future study and career.

Secondly, I learned how to collaborate with my co-workers. Collaboration is a very critical part of teamwork. For a team to achieve their goals and objectives in what they do, they must design their team in a way that produces the desired results (Gustavson, & Liff, 2014). Our team is an environment of collaboration and understanding. To do this, we discussed and agreed to participate actively during team meetings, be good at communicating, share our ideas, and respect each other's opinions and values. Based on mutual respect and trust, we can move forward in our plans to complete the project, while learning how to work in different teams with different cultural

perspectives. It is very significant for a team to agree on and determine their norms and roles. It will help teams become more organized and structured in terms of formation and effectiveness (Gustavson & Liff, 2014). Our team decided that we would create a team contract to clarify our responsibilities as a team. This includes working with motivation, being good at communicating, being responsive to group messages, working hard to learn every step of the way, respecting each other's views and values, and maintaining a positive attitude. As for roles, our team decided that we had better do what we are most interested in. Someone extract, analyze, and interpret the data of blockchain & crypto-asset investment fund. Someone develops algorithms based on statistical analysis. Someone establishes a useful analytical report to the relevant members of the business. Through these methods, our team can achieve our goals and work effectively as a high-performance team.

The most striking about the project is related to this rise capital application. Our company hope to help investors to select cryptocurrencies based on investors' goals and risk tolerance. Although my initial interest in finance arose from my parents' investing activities in China stock market, I never try it. To help do my project better, I download a cryptocurrency application to buy or sell some cryptocurrency to strength my understanding of cryptocurrency. I found that many cryptocurrency applications have many functions, but it doesn't set up an artificial intelligence or recommend the system to help investors to "pick" cryptocurrency. If Forkaia can build this application that can help investors to "pick" cryptocurrency, it would become a definite advantage in the market.

Based on this project, I found that I still would like to pursue a data analyst or financial analyst because I am interested in doing data analysis. I love to use data analytical skills to improve business performance. Meanwhile, this project also cultivates me to have better knowledge and

skills in the field of finance. It will allow me the opportunity to apply financial concepts, principles, and methods to practical business issues.

I have demonstrated analytical and problem-solving skills through this rise capital projects. I am familiar with Python basic grammar like Sklearn, NumPy, Pandas, Matplotlib, Seaborn for data analysis and visualization. In addition, I am also familiar with R. I can use dplylr package, ElemStatLearn package and ggplot2 package for data cleaning, data analysis, and visualization; can use random forest package, rpart package, factoextra package, e1071 package, H2O package for machine learning and related prediction. Through this internship, I always combine two different kinds of programming skills with doing the project. Also, I might still need to strengthen my communication skills. Communication skills are the foundation of teamwork. If I don't have excellent communication skills, I won't have a good relationship with my colleagues. In the future, I will strengthen my capability of communicating with my co-workers because not only promotes my work efficiency but also develops my interpersonal relationship.

The most unexpected part of the project is the application of artificial neural network in the financial field. The rise capital application will create deep learning of an artificial intelligence model because this model has long-term memory like a human's brain. Recurrent neural networks (RNN), as a branch of deep learning, can help our application to achieve this. The classic RNN has a short-term memory function. For this reason, it is neither popular nor influential. But a recent significant improvement in recurrent neural networks has led to the popularity of LSTM (long and short memory RNN), which has completely changed the competitive environment. We can utilize Recurrent neural network to predict the trend of stock or cryptocurrency. According to my analysis above, the cryptocurrency market has been experiencing tremendous volatility, especially Bitcoin Recurrent neural network can help us to predict the price of cryptocurrency as soon as possible

through long and short memory. If we could build the recurrent neural network and use this model in rise capital application, this would help investors to "pick" the optimized portfolio.

Feedback and Responses

I got feedback from other students. They mention my recommendation from my mid-term presentation video is too abstract and couldn't really connect with the analysis. They present that although the explanation of critical factors in cryptocurrency was not very well, there is the missing link between these critical factors. They recommend me to build a prediction price model. According to their recommendation, I create the predication price model using a recurrent neural network, which has the capability of long and short memory. This model can help me predict the trend of cryptocurrency, make my case stronger and promote the application to map it with customer risk tolerance.

Figure 1

```
In [91]: 1 mydata.head()
```

Out[91]:

Date	BTC-USD	ETH-USD	LTC-USD	DOGE-USD	XRP-USD	XMR-USD	XVG-USD	XLM-USD	VTC-USD	ETC-USD	USDT-USD	ZEC-USD
2018-01-01	13444.879883	756.200012	224.339996	0.008739	2.05	338.170013	0.1573	0.4840	6.712	29.230000	1.01	518.489990
2018-01-02	14754.129883	861.969971	251.809998	0.009000	2.19	364.440002	0.1440	0.5560	7.348	31.870001	1.02	549.200012
2018-01-03	15156.620117	941.099976	244.630005	0.009246	2.73	385.820007	0.1452	0.8848	7.168	33.110001	1.01	559.080017
2018-01-04	15180.080078	944.830017	238.300003	0.009563	2.73	372.230011	0.1600	0.6950	6.893	33.770000	1.02	546.950012
2018-01-05	16954.779297	967.130005	244.509995	0.012550	2.51	357.299988	0.1794	0.6400	6.584	31.160000	1.01	545.659973

```
In [6]: 1 mydata.tail()
```

Out[6]:

Date	BTC-USD	ETH-USD	LTC-USD	DOGE-USD	XRP-USD	XMR-USD	XVG-USD	XLM-USD	VTC-USD	ETC-USD	USDT-USD	ZEC-USD
2019-06-29	10769.049805	290.149994	122.160004	0.003231	0.3934	88.010002	0.007754	0.1043	0.463200	7.772	0.9938	102.76000
2019-06-30	10591.870117	294.170013	122.669998	0.003283	0.4057	89.019997	0.008050	0.1056	0.459600	7.842	1.0010	103.80999
2019-07-01	10844.129883	291.609985	118.680000	0.003145	0.3984	86.660004	0.007699	0.1030	0.446800	7.713	1.0020	101.61000
2019-07-02	11981.610352	302.170013	121.970001	0.003235	0.4056	90.040001	0.007788	0.1059	0.456700	7.948	1.0020	106.15000
2019-07-04	11625.730469	292.809998	122.599998	0.003371	0.3930	90.610001	0.007440	0.1021	0.462472	8.177	1.0020	103.00000

Figure 2

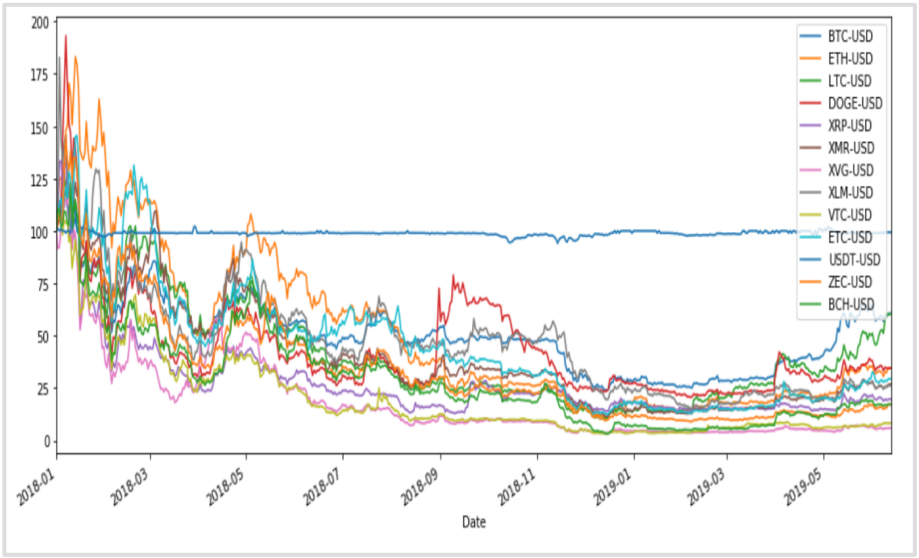


Figure 3

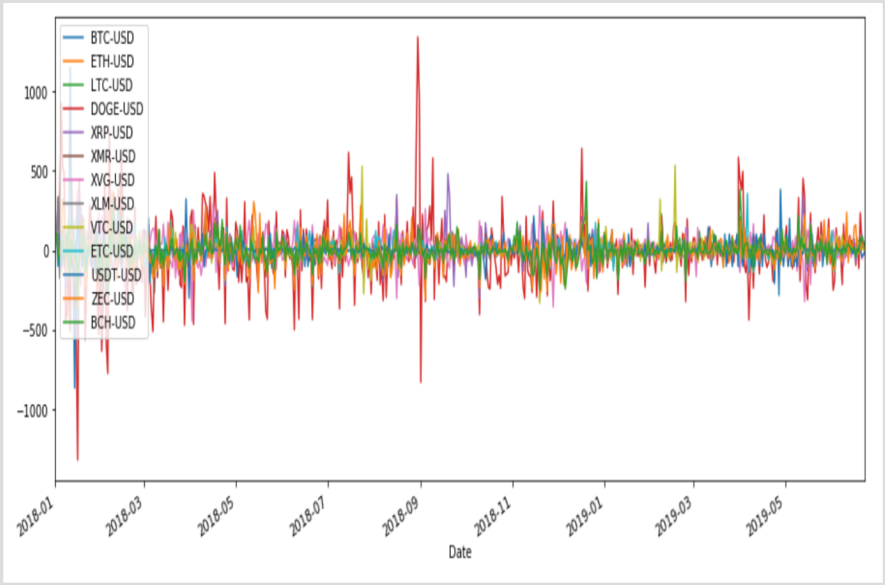


Figure 4

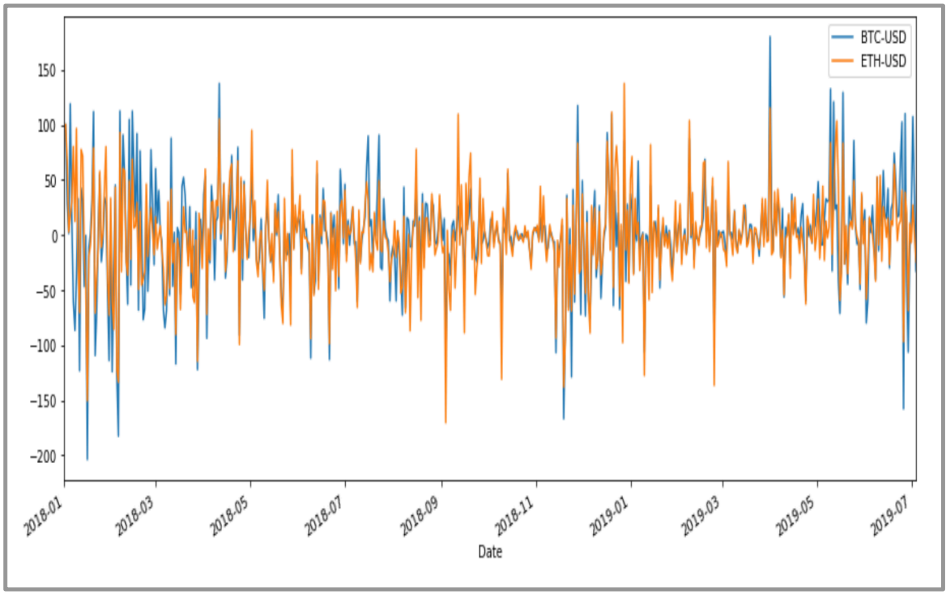


Figure 5

```
1  cov_matrix = sec_returns.cov()
2  cov_matrix
```

	BTC-USD	ETH-USD
BTC-USD	0.001810	0.001915
ETH-USD	0.001915	0.002981

Figure 6

```
BTC-USD     0.417264
ETH-USD     0.739137
LTC-USD     0.787750
DOGE-USD    1.073331
XRP-USD     0.917266
XMR-USD     0.821628
XVG-USD     1.451071
XLM-USD     1.049041
VTC-USD     1.345151
ETC-USD     0.934526
USDT-USD    0.018545
ZEC-USD     0.809958
BCH-USD     1.242680
```

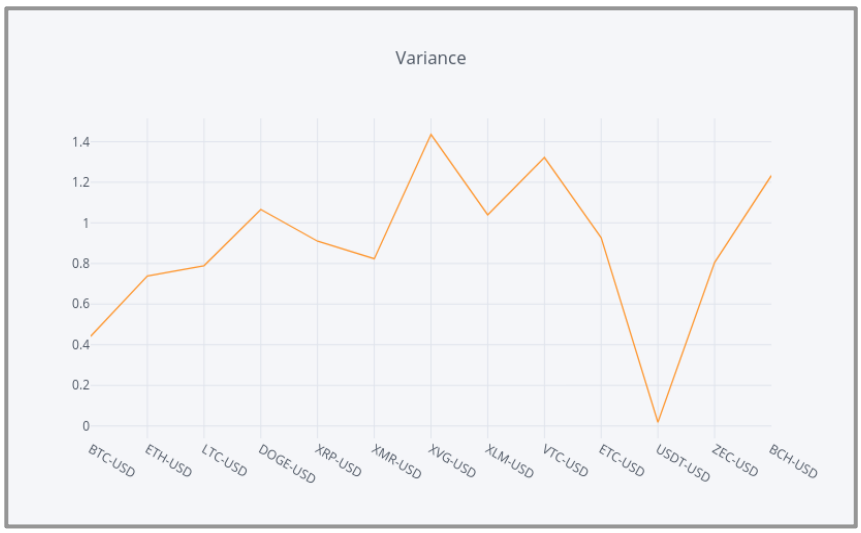
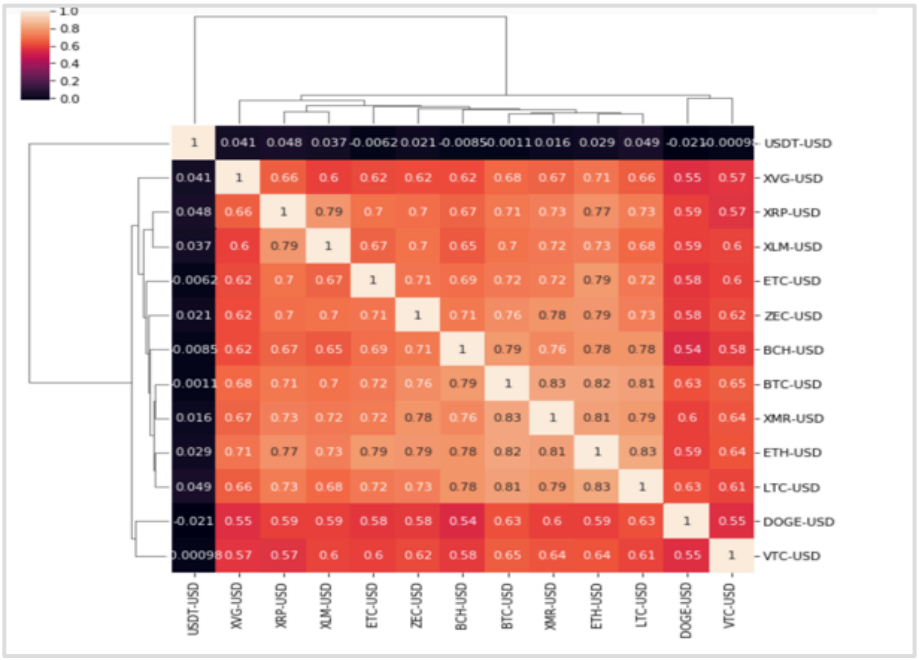

Variance
1.4
1.2
1
0.8
0.6
0.4
0.2
0
BTC-USD
ETH-USD
LTC-USD
DOGE-USD
XRP-USD
XMR-USD
XVG-USD
XLM-USD
VTC-USD
ETC-USD
USDT-USD
ZEC-USD
BCH-USD

Figure 7


1.0
0.8
0.6
0.4
0.2
0.0
USDT-USD
XVG-USD
XRP-USD
XLM-USD
ETC-USD
ZEC-USD
BCH-USD
BTC-USD
XMR-USD
ETH-USD
LTC-USD
DOGE-USD
VTC-USD

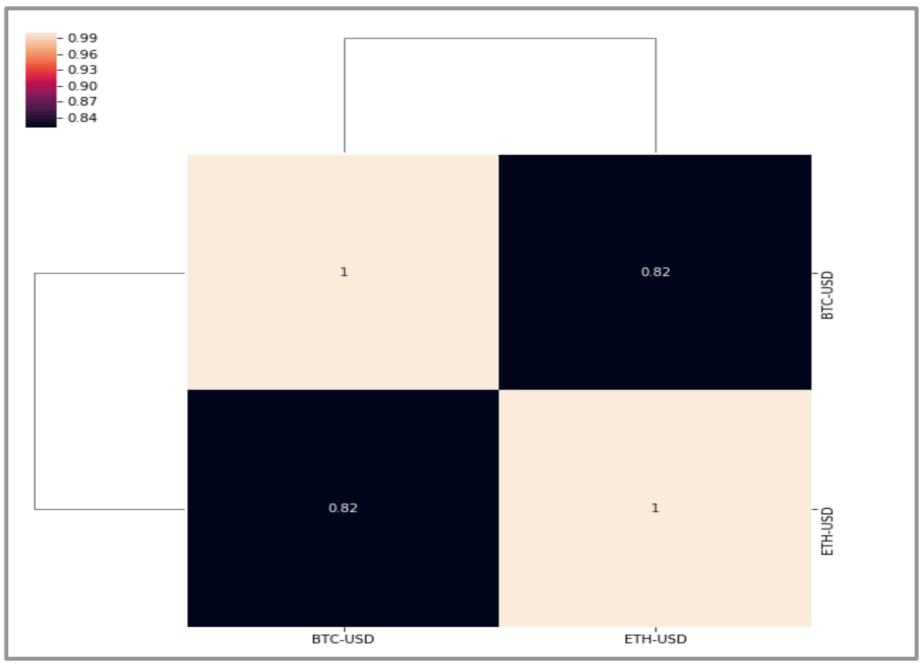


Figure 8

```
#Calculating Portfoilo Risk
```

```
weights = np.array([0.5,0.5])
```

```
pfolio_var = np.dot(weights.T, np.dot(sec_returns.cov()*365,weights))
pfolio_var
```

```
0.7867780858018025
```

```
pfolio_vol = (np.dot(weights.T, np.dot(sec_returns.cov()*365, weights)))**0.5
pfolio_vol
```

```
0.8870051216322274
```

```
print(str(round(pfolio_vol, 5)*100) + '%')
```

```
88.701%
```

Figure 9

```
BTC_var_a =  sec_returns['BTC-USD'].var()*365
BTC_var_a
```

```
0.6606494201505988
```

```
ETH_var_a =  sec_returns['ETH-USD'].var()*365
ETH_var_a
```

```
1.0882053232920395
```

```
#diversifiable risk
dr = pfolio_var - (weights[0] ** 2 * BTC_var_a) - (weights[1] **2*ETH_var_a)
dr
```

```
ETH-USD    0.349564
dtype: float64
```

```
#non-diversifiable risk
#method 1
n_dr_1 = pfolio_var - dr
n_dr_1
```

```
0.29476967575196655
```

Figure 10

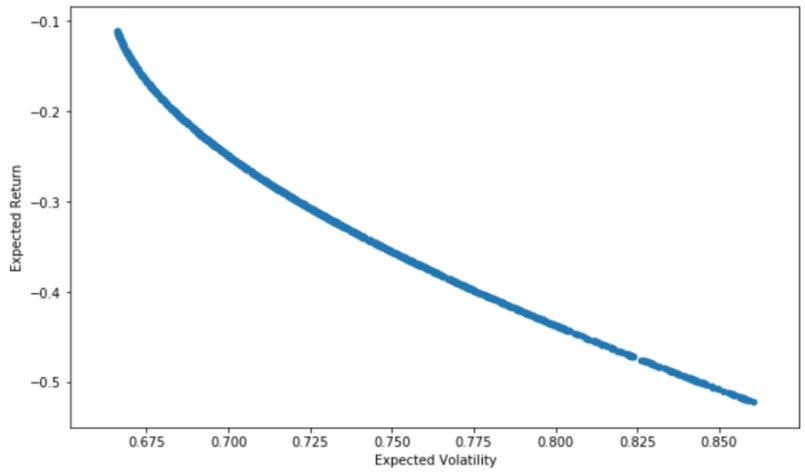


Figure 11

```
cov_with_market = cov.iloc[0,1]*250
cov_with_market
```

```
0.004966519640959774
```

```
market_value = sec_return['^GSPC'].var()*250
market_value
```

```
0.02153234583598596
```

```
Bitcoin_beta = cov_with_market / market_value
Bitcoin_beta
```

```
0.23065390453925702
```

```
Bitcoin_er = 0.025 + Bitcoin_beta * 0.05
```

```
Bitcoin_er
```

```
0.036532695226962855
```

Figure 12

	BTC-USD	ETH-USD
BTC-USD	1.000000	0.824555
ETH-USD	0.824555	1.000000

Figure 13

	NRG	TRIP	LW	FOXA	FL	FOX	SPG	AAP	HRL	ROL	...	HIG	LNC	T
BTC-USD	-0.746409	-0.729383	-0.690315	-0.6823	-0.680748	-0.680543	-0.635349	-0.623055	-0.617852	-0.606824	...	0.739376	0.740701	0.746931

Figure 14 The efficient frontier of Ethereum and Bitcoin

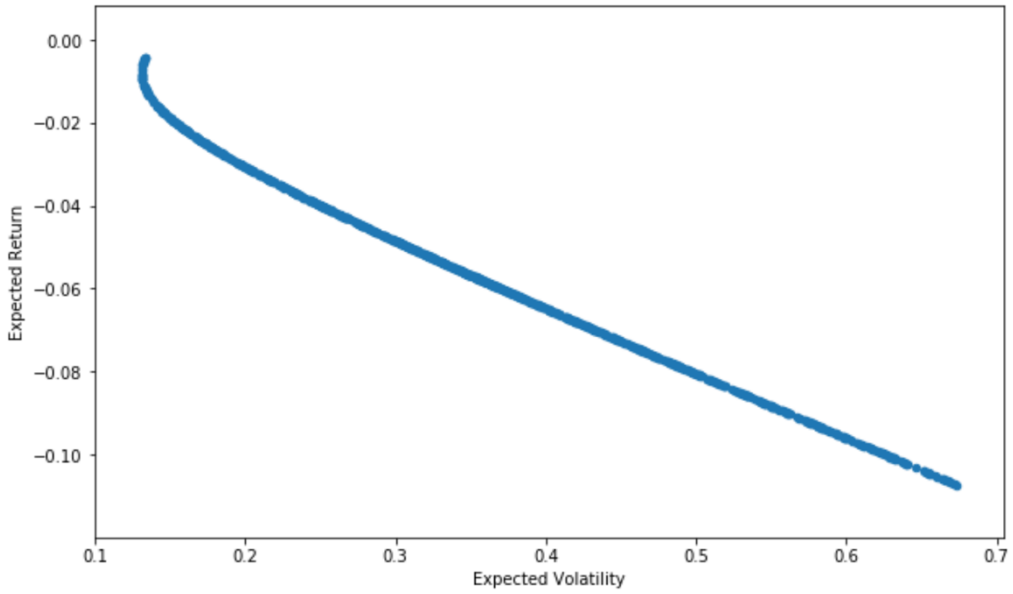


Figure 15 The efficient frontier of NRG energy and Bitcoin

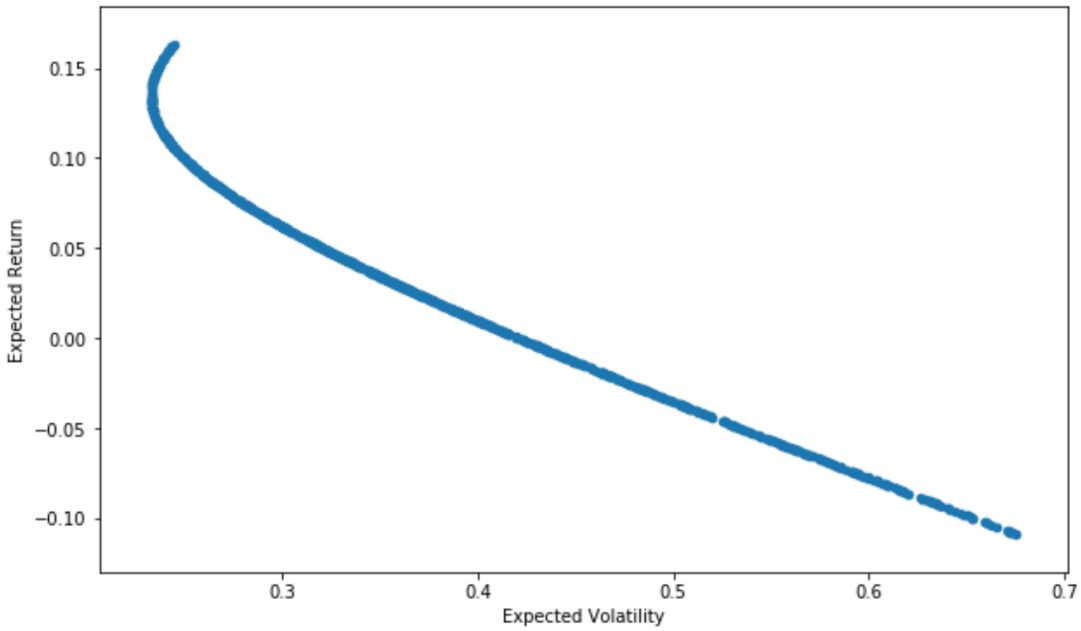


Figure 16 The efficient frontier of TripAdvisor, Inc, and Bitcoin

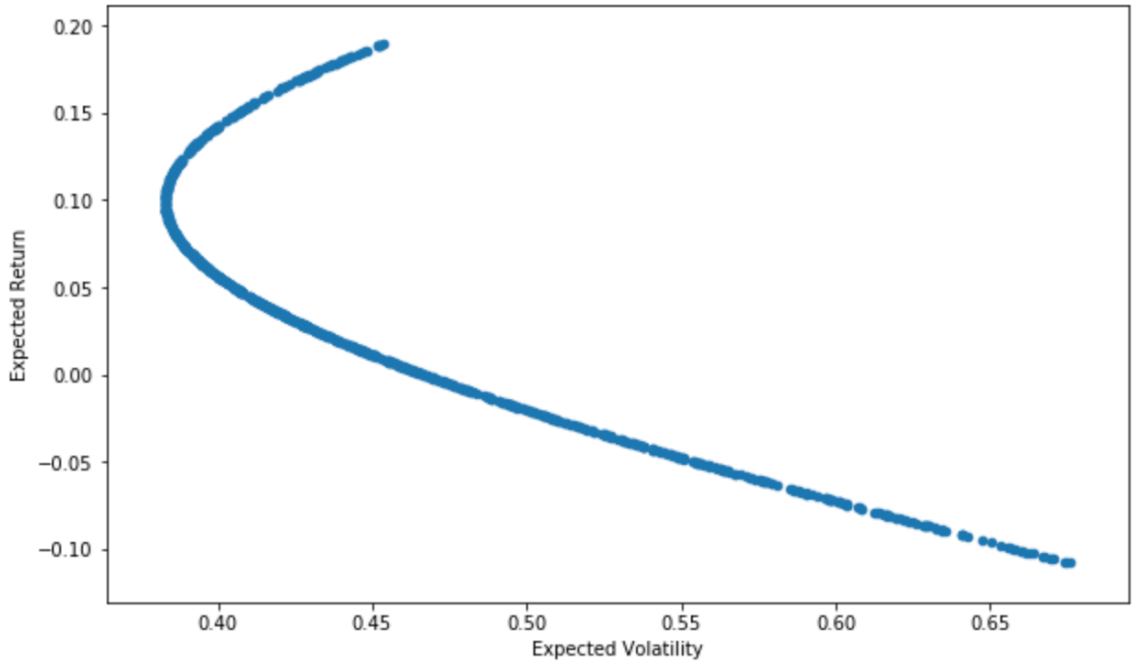
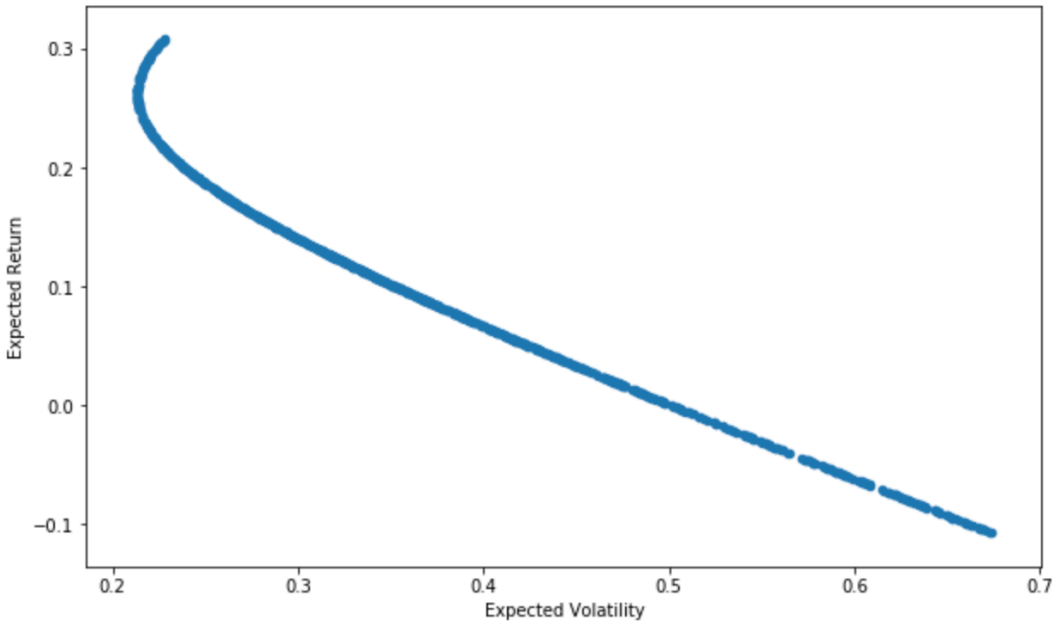


Figure 17 The efficient frontier of Lamb Weston Holdings, Inc and Bitcoin


0.3
0.2
0.1
0.0
−0.1
Expected Return
0.2
0.3
0.4
0.5
0.6
0.7
Expected Volatility

References

FORKAIA. (n.d.). Retrieved from https://www.forkaia.com/viewpoint

Gustavson, P. & Liff S. (2014). *A Team of Leaders: Empowering Every Member to Take Ownership, Demonstrate Initiative, and Deliver Results.* New York, NY: American Management Association.

Rise Capital. (n.d.). Retrieved from https://www.risecapitalfund.com/about-1

forkaia

5141 California Ave. Irvine CA 92617
FORKAIA.com

July 30, 2019

Dear University Professor,

This letter is to confirm that Jingyi Zhang has satisfactorily completed Forkaia internship.

During the internship Jingyi conducted research and analytics on the blockchain and crypto asset investment market. Jingyi's unique combination of business knowledge and data analytics was essential in the pre-production of the rise capital application. We'll use student's detailed report to build our business model around so the interns contributions are immensely important. Taking initiative and figuring things out sound simple but are extremely hard to find in people but we found it in Jingyi.

We're also extremely impressed with Jingyi Zhang work ethic, attention to detail and enthusiasm to continue learning and growing as a person. Leadership, strong communication skills, and good team work are noteworthy strengths that students can continue to build on. Again we're extremely satisfied with student and give our highest remarks and recommendation.

Re: Final Evaluation of Jingyi Zhang
Supervisors Name: Ali Sina
Supervisors email address: Ali@Forkaia.com

Sincerely,

Ali Sina, MBA
CEO | FORKAIA
310.994.1511