Alternative Investments Evaluation of Bitcoins, Gold and LQ45 Index

Dini Amalia Dewi, and Subiakto Soekarno

Abstract**—**The purpose of this study is to analyze the risk and return on bitcoins, as an alternative investment, and how the bitcoins' performance compared with other investment instruments such as gold and stock index in Indonesia, which is LQ45 index. The risk and return, performance evaluation and optimum portfolio formulas is applied to find the result. All the analysis is used the data obtained from the middle of July 2010 until the end of May 2014. The finding result shows that bitcoins is good for short–term period investment and it is good for investors who are risk seekers. This results can be used by Indonesia's investors as the consideration to invest in bitcoins.

Keywords**—**Alternative investment, bitcoins, optimum portfolio, risk and return.

I. Introduction

THERE is one currency that continues to increase in value while the others currencies are harassed to arise from the overwhelming economic crash of recent years. This currency is not issued by any bank, controlled by the government, or cannot be own in its physical form.

Bitcoins is an online crypto–currency that is monitored and administered by the enormous peer–to–peer network users. It has no centralized banking or government backing and it has the online exchanges that trade in the commodity. Recently the Bitcoin Central is partnering with a French bank to become a registered Payment Services Provider (PSP) under the European Union law. It means that bitcoins now can offer debit cards, account insurance and other banking facilities to the Bitcoin owners [1].

This phenomenon is quickly taking over the world's economic news because the amount of bitcoins value is infinite and changed drastically from its beginning. Nowadays Bitcoin already becomes a trend that gained worldwide attention. People can sell products or services overseas by using bitcoins and get profit immediately. There are more than twelve million users including the digital miners, traders and small business owners.

American government is looking for how if they treat bitcoins as a stock or a security of some sort rather than as money, but bitcoins visionaries are looking to make it an actual currency. Ben Bernanke, the American economist, mentioned that, "Bitcoins has the potential of being a long–term investment" [2].

Last year in Indonesia, investor's investment portfolios decreases to a negative return, but it does not happen to the bitcoins holder. This virtual currency gets the fantastic profit which is 5,506.92% last year and the average value of bitcoins to U.S. dollar is increasing 458.91% per month [3]. In July 19th 2010 the bitcoins price is IDR 729.7048/BTC and in May 26th 2014 it becomes IDR 6,734,682.2500/BTC, it shows that bitcoins' value is increased about 900,000%. Bitcoins price started get in US$ 100 range since the mid of August 2013.

Different from money that can be print anytime by the Central Bank, the publication of bitcoins is limited because it is arranged using the algorithm calculation which aims to prevent inflation. The amount of bitcoins that will be published is 21 million BTC maximum until next 2140. And now, bitcoins that already published is about 12.3 million BTC [4].

The bitcoins return is big same with its risk investment. Reference [3] mentioned that there are four risks in investing on bitcoins; the first is risk of price fluctuation. The drastic value increases also directly proportional to the price reduction. Second is the risk of others crypto–currencies. There are 88 kinds of crypto–currencies in the world and this competition between crypto–currencies can influence the markets interest to choose what crypto–currency they wanted to buy or sell. More liquid the crypto–currency makes it more interesting for the market. Third, there is no guarantee. Guarantee from the regulator to the money can influence the level of people's trust. Although the value of the material is not the same with the amount listed on the money, but money became valuable because there are people's trust to use it. The trust can come from the guarantee and bitcoins has no similar guarantee. The last is individual careless. The security system of bitcoins is good enough and if there are bitcoins that been stolen then it because the individual careless itself.

The authors will make the analysis more about the risk and return on bitcoins investment and this study attempts to answer how bitcoins performance compared with other investment instruments which are gold and LQ45 index. The objectives of this study are: to know is bitcoins good for a short–term investment whereas its value is increasing every day with unpredictable patterns, to know how big is risk and return of bitcoins compare with gold and LQ45 index, to know who has the best performance based on the comparisons between bitcoins as an alternative investment with gold and LQ45 index as the investment instruments, to know the optimum portfolio of bitcoins with gold and LQ45 index, to know what type of investment strategy that can generate the highest return, and find any recommendation for investors who choose bitcoins as their investment based on the calculation result.

Dini Amalia Dewi, and Subiakto Soekarno, School of Business and Management, Institut Teknologi Bandung, Indonesia.

II. Methodology

All data needed for bitcoins and gold were obtained from its websites, for LQ45 index the data were obtained from Indonesia Capital Market Electronic Library, and all data were gathered from July 19th 2010 until May 26th 2014.

Return measurement is needed for assess risk on the basis of variability of return. There are two methods to calculate return, first with arithmetic average return and second with geometric average return. The authors first calculate the weekly return of each investment instrument then find the arithmetic and geometric average return. Equation (1) is the formula used to find the weekly return.

$$R = \frac{P_t - P_{t-1}}{P_{t-1}} \quad (1)$$

Where:
R = Rate of return
P_t = Price (value) of asset at time *t*
P_{t-1}= Price (value) of asset at time *t–1*

Arithmetic average return is calculating the return in an average year over a particular period and it is estimating the expected return for the next period. The weekly arithmetic average return formula is refer to (2).

$$r_{arithmetic} = (R_1 + R_2 + \cdots + R_n) \,/\, n \quad (2)$$

Where:
$r_{arithmetic}$ = Arithmetic rate of return
$R_1, R_2, \ldots, R_t$ = Weekly return
t = Total number of period

Geometric average return is calculating the average compound return per year over a particular period and it is used by the investors to measure the compound rate of return at which money grew over a specified period of time. The weekly geometric average return formula is refer to (3).

$$r_{geometric} = [(1 + R_1)\, x\, (1 + R_2)\, x \ldots x\, (1 + R_t)]^{1/t} - 1 \quad (3)$$

Where:
$r_{geometric}$ = Geometric rate of return
$R_1, R_2, \ldots, R_t$ = Weekly return
t = Total number of period

The next calculation is finding the annual return for both weekly arithmetic and geometric average return which is refer to (4). The annual return formula is using the effective annual rate formula.

$$r = (1 + j)^{52} - 1 \quad (4)$$

Where:
r = EAR at current year
j = Average weekly return

Reference [5] states that risk is a measure of the uncertainty surrounding the return that an investment will earn or, more formally, the variability of returns associated with a given asset. The more variable the possible outcomes occur, then the greater the risk will be.

Standard deviation calculation is the most common tools to measure the risk itself and it shows how spread a set of values is around its average. The higher the standard deviation is, then the higher the risk also. The weekly risk formula used is refer to (5) and for annual risk the formula used is refer to (6).

$$s = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(x_i - \bar{x})^2} \quad (5)$$

Where:
s = Standard Deviation
N = Number of outcomes
x_i = Return for *i* outcome
$\bar{x}$ = Average return

$$Annualized\ Standard\ Deviation = s\ x\ \sqrt{52} \quad (6)$$

Where:
s = Standard Deviation

Reference [6] states that covariance and correlation is measured how two random variables are related. It aims to know which portfolio that gives maximum return for a given level of risk. For the comparison, first the authors used covariance and correlation calculation and the formula is refer to (7). This calculation will be used to construct the optimum portfolio.

$$\rho_{AB} = Corr\,(R_A, R_B) = \frac{Cov\,(R_A, R_B)}{\sigma_A\ x\ \sigma_B} \quad (7)$$

Where:
ρ_{AB} = Correlation between the return on instrument A and instrument B
$Cov\,(R_A, R_B)$ = Covariance between the return on instrument A and instrument B
σ_A = Standard deviation of instrument A
σ_B = Standard deviation of instrument B

The second comparison is using the constructed optimum portfolio with Sharpe ratio calculation. Optimum portfolio is the combination of assets that provide the best risk and return trade–off [7].

Equation (8) is the formula to calculate the Sharpe ratio as the formula for the performance evaluation. The greater a portfolio's Sharpe ratio, the better its risk–adjusted performance has been. A negative Sharpe ratio indicates that a risk–less asset would perform better than the security being analyzed [8].

$$S_i = \frac{R_i - R_f}{\sigma_i} \quad (8)$$

Where:
S_i = Sharpe ratio of Portfolio *i*
R_i = Return of Portfolio *i*
R_f = Return of risk free rate per year (Indonesia's Central Bank Rate = 7.50%)
σ_i = Standard deviation of Portfolio *i*

The optimum portfolio formulas used are the portfolio return and the portfolio risk. Portfolio return is a weighted average of expected returns on the component securities with portfolio proportions as weights is the expected return on the portfolio. Equation (9) is the formula for portfolio return.

Risk of a portfolio is takes the correlation of each other assets according to the variance formula and the portfolio risk formula is the same as the portfolio variance formula. The formula for portfolio risk is refer to (10).

The optimum portfolio constructed has four types of optimization which are maximizing return, minimizing risk, maximizing Sharpe ratio, and maximizing mean–variance.

$$E(r_p) = \sum W_i E(r_i) \quad (9)$$

Where:
$E(r_p)$ = Expected Return on Portfolio
W_i = Weight of Asset *i*
$E(r_i)$ = Expected Return on Asset *i*

$$\sigma^2{}_p = W^2{}_i \sigma^2{}_i + W^2{}_j \sigma^2{}_j + 2W_i W_j Cov(r_i, r_j) \quad (10)$$

Where:
$\sigma^2{}_p$ = Variance of Portfolio
W_i, W_j = Weight of Asset *i* and Weight of Asset *j*
σ_i, σ_j = Risk of Asset *i* and Risk of Asset *j*
$Cov(r_i, r_j)$ = Covariance of Asset *i* and *j*

The authors creates the investment strategies as the last analysis to give an example of return that will be created by investing an amount of money in the three investment instruments using the optimum weight result. The investment strategies calculations are buy and hold strategy, annual rebalancing strategy, semi–annual rebalancing strategy, and quarterly rebalancing strategy. The authors will decide what investment strategy that can generate the highest return.

III. Data Analysis

The first data analysis is calculating the risk and return. To compare the performance based on the risk and return calculations, the authors firstly find the weekly return of each investment instruments. Since the bitcoins and gold data were gathered in form of U.S. Dollar prices, the authors convert it into Indonesian Rupiah prices using Indonesia's Central Bank exchange rate. Therefore, the weekly return calculations for bitcoins and gold are in two forms, in U.S. Dollar and Indonesian Rupiah. Meanwhile the weekly return for LQ45 index is only in Indonesian Rupiah form. Then the return calculation is continued to the arithmetic and geometric average return calculations both in weekly and annual. The risk calculation also has weekly and annual results. After calculating all risk and return, the authors can create the comparison table of bitcoins, gold and LQ45 index.

TABLE 1
RISK AND RETURN COMPARISON TABLE

		Investment Instruments		
		Bitcoins	Gold	LQ45 Index
Weekly	Arithmetic Average Return	6.740%	0.191%	0.237%
	Geometric Average Return	4.624%	0.161%	0.189%
	Risk	22.817%	2.422%	3.039%
Annual	Arithmetic Average Return	2871.105%	10.454%	13.070%
	Geometric Average Return	948.907%	8.731%	10.323%
	Risk	164.536%	17.465%	21.918%

The annual calculation is from period July 19th 2010 until May 26th 2014. Table 1 shows that bitcoins investment can give the investors high return along with high risk which caused by bitcoins' price that changed drastically day by day. This result shows that bitcoins is good for short–term period investment and it is good for investors who are risk seekers. Gold investment is shown in bad result because it give low return with low risk. Gold is not good for short–term period investment because the inflation is not affected its price, so the price is remain the same day by day. Same with gold, LQ45 index investment result also shown bad, it give low risk with low return even though the result is higher than gold. Its price also unaffected by the inflation so the price is stable and not change drastically.

Then the next comparison is based on covariance and correlation calculation. Table 2 shows that bitcoins and gold has the highest result, whereas the negative result shows by gold and LQ45 index which means it is better to invest in these assets together. And the correlation between bitcoins and LQ45 index also shown in positive result same as the bitcoins and gold which means it is not good to invest in these assets together.

TABLE II
COVARIANCE AND CORRELATION MATRIX

Covariance and Correlation	Bitcoins	Gold	LQ45 Index
Bitcoins	**1.00000**		
Gold	0.13887	**1.00000**	
LQ45 Index	0.00549	-0.04334	**1.00000**

The covariance and correlation calculation is used to construct the optimum portfolio. Table 3 shows that optimization using maximize Sharpe ratio can generate high return with appropriate risk, the calculation is based on geometric average return calculation. The result is high because of bitcoins return which also high. The authors create the optimum portfolio in weekly and annual calculations. The result of the optimum weight is shown by weekly calculation for maximizing Sharpe ratio.

TABLE III
OPTIMUM PORTFOLIO TABLE

Weekly				
Assets	**Weight**			
	Max. Return	Min. Risk	Max. Sharpe	Max. Mean-Variance
Bitcoins	100.000%	0.000%	5.038%	43.303%
Gold	0.000%	96.769%	86.108%	8.710%
LQ45 Index	0.000%	3.231%	8.855%	47.987%
Total	**100.000%**	**100.000%**	**100.000%**	**100.000%**
	Max. Return	Min. Risk	Max. Sharpe	Max. Mean-Variance
Portfolio Return	4.624%	0.162%	0.388%	2.107%
Portfolio Risk	5.206%	0.022%	0.036%	1.005%
Sharpe	86.039%	82.605%	686.297%	195.369%
Mean-Variance	-0.583%	0.140%	0.353%	1.102%

Annual				
Assets	**Weight**			
	Max. Return	Min. Risk	Max. Sharpe	Max. Mean-Variance
Bitcoins	100.000%	0.000%	7.997%	100.000%
Gold	0.000%	60.713%	51.698%	0.000%
LQ45 Index	0.000%	39.287%	40.304%	0.000%
Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**
	Max. Return	Min. Risk	Max. Sharpe	Max. Mean-Variance
Portfolio Return	948.907%	9.356%	84.563%	948.907%
Portfolio Risk	270.721%	1.787%	3.601%	270.721%
Sharpe	347.741%	103.909%	2140.219%	347.741%
Mean-Variance	678.186%	7.570%	80.962%	678.186%

The last data analysis is choosing what investment strategy that can generate the highest return. The investment strategies created by using the optimum weight from optimum portfolio – weekly maximizing Sharpe calculation.

The authors creates the assets allocation using buy and hold strategy and rebalancing strategies every year, six months and three months from May 30th 2011 until May 26th 2014. Table 4 shows the comparison result of buy and hold strategy with the rebalancing strategies. It shows that more frequent the investors rebalance the portfolio, then the lower the return that will be created. The return is in high number because of bitcoins that give the highest contribution in return even though its proportion weight is small. The buy and hold strategy can create the highest return compared with the other three rebalancing strategies.

TABLE IV
RESULT COMPARISON TABLE OF INVESTMENT STRATEGIES

		Return
Investment Strategy	Buy and Hold Strategy	**46159.860%**
	Annual Rebalancing Strategy	**31578.720%**
	Semi-Annual Rebalancing Strategy	**25374.268%**
	Quarterly Rebalancing Strategy	**18259.053%**

Buy and hold strategy means that the investors buy the assets at the beginning of the period and hold it until the end of the period. Table 5 is in form of million rupiahs, it shows that with buy and hold strategy a hundred million rupiahs investment can create 46,159.860% return with IDR 461,598,600 of total investment in the end of the period.

TABLE V
BUY AND HOLD STRATEGY TABLE (PERIOD MAY 30TH 2011 – MAY 26TH 2014)

	Weight	Money	30-May-11 (Units)	26-May-14 (Price)	Profit/Loss
Bitcoins	5.038%	IDR 5,037	67.310	IDR 453,314	IDR 448,276
Gold	86.108%	IDR 86,107	6.589	IDR 97,282	IDR 11,175
LQ45 Index	8.855%	IDR 8,854	13008.448	IDR 11,001	IDR 2,146
Total	100.000%	IDR 100,000	-	-	IDR 561,598
Total Investment in The End of The Period			**IDR 461,598**		
Return			**46159.860%**		

IV. CONCLUSION

From the data analysis, the authors conclude that bitcoins is good for short–term investment based on its return calculations. The bitcoins price is unpredictable and it can change drastically day by day, so it can give investors high return but also with high risk. So, bitcoins investment is for investors who are risk seekers. For investors who are risk averse, gold is the best investment instrument for short–term period because it generate low risk but also with low return. And LQ45 index is the best investment instrument for short–term period for investors who are risk neutral because the risk and return is higher than gold but lower than bitcoins. The authors cannot conclude the result of the comparison for long–term period because bitcoins is a new alternative investment instrument that established on the middle of 2010, so the data is still on the short–term period.

The maximize Sharpe ratio that using geometric average return calculation is showing the best optimization portfolio because it generate appropriate rate of return and risk and the result is still in logical number which is possible. The result of

optimum weight is 5.038% for bitcoins, 86.108% for gold and 8.855% for LQ45 index.

With using optimum weight from weekly maximizing Sharpe ratio calculations based on geometric average return calculation, the investment strategy that can create the highest return is the buy and hold strategy which will generate 46,159.860% return.

REFERENCES

[1] http://www.pcadvisor.co.uk/features/internet/3434167/what-is-bitcoin/

[2] http://soexquisitecharleston.com/2013/12/05/the-bitcoin-phenomena-and-how-it-can-make-you-rich/

[3] Weekly Tabloid Kontan, Indonesia – Edition: February 10th–16th, pp. 7

[4] Weekly Tabloid Kontan, Indonesia – Edition: February 10th–16th, pp. 4

[5] Ross, S.A., Westerfield, R.W., & Jaffe J., *Corporate Finance*, Singapore: Mc Graw Hill International Edition, 2010, 9th Edition.

[6] Gitman, L.J., & Zutter, C.J., *Principles of Managerial Finance*, England: Pearson Global Edition, 2012, 13th Edition.

[7] Bodie, Z., Kane, A., & Marcus, A.J., *Investments*, Singapore: Mc Graw Hill International Edition, 2009, 8th Edition.

[8] http://www.investopedia.com/terms/s/sharperatio.asp