Investment decisions: Comparative analysis of the performance of cryptocurrencies Bitcoin, Gold and Stocks

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Abstract. The purpose of the study is to compare the performance between bitcoin Cryptocurrency, S&P500 stocks and Gold which can be a consideration for investors in determining investment decisions. This research is quantitative research using comparative methods. The population and sample used in this study are the monthly closing prices of the three investment instruments that are the subject of research with saturated sampling in the period 01 January 2019 – 31 December 2022 as many as 144 data. In this study, the type of data used is secondary data in the form of historical data of instruments. Then researchers used a non-parametric statistical test, the Kruskal-Wallis test. The results show that there is no significant difference between Treynor and Jensen's returns from Bitcoin, Gold and S&P500. While the risk and Sharpe Ratio show that there is a significant difference. The best investment instrument in 2019-2022 is bitcoin because when viewed from the average return bitcoin is able to have the highest percentage compared to other instruments. Gold is an asset that is often considered a refuge in situations of economic uncertainty. Meanwhile, stocks in that period experienced a huge price decline, this was caused by the COVID-19 pandemic.

1 Introduction

Technological developments are growing rapidly, especially in the financial sector, especially payment instruments. Starting with a barter system, it was later developed using goods and the latter used metal and paper as money. The development of money as a means of payment continues to change its form, namely in the form of payment of checks and bilyet giro which allows payments by transferring funds from account balances between financial institutions such as banks [13]. Then people realized that by keeping money in savings, they would not get financial benefits, but the money would be trapped by inflation so that another alternative appears. Making more money to provide financial returns in the future or what we know as investment [8]. Investment is an effort made by a person to benefit from the money he has. Today there are dominant investment instruments including bonds, stocks, property, and gold which innovate in the form of cryptocurrency [16].

Generally, investors try to find assets that have safe havens to avoid the impact of the economic crisis. During the global financial crisis in 2008, gold and some currencies such as the dollar became an alternative as an investment because it has relatively high value stability. Gold is known as a safe haven because it is not affected by the economic performance of a country so that the demand for gold increases because gold as a safe alternative in storing wealth [4]. The global crisis of 2008 was caused by Credit Suisse where debtors were unable to pay their installments or loans resulting in higher interest rates (ocbcnisp,2022). At that time, bitcoin was introduced under the pseudonym Satoshi Nakamoto. Bitcoin runs on software with an open-source operating system, can be downloaded by various people around the world, and spread everywhere with a blockchain system. Moreover, the existence of bitcoin does not depend on an institution. Several studies have even highlighted.

Bitcoin's potential as a virtual currency with a bright future [24]. Based on data from www.coinmarketcap.com, www.googlefinance.com and Goldprice.org bitcoin increased by 691.67% from the end of 2019 to the end of March 2022 compared to gold increased by 11.84% while JCI increased by 14.91% in the same period. According to research [4], Gold has a very significant value because of its stable intrinsic value and is not affected by inflation and until now gold is still considered payment even though there are many other digital payment instruments. Research conducted [17] said that stocks, bitcoin, and gold have equal advantages, but the results of the analysis carried out show that the bitcoin cryptocurrency is the optimal investment instrument through consideration with the performance models of Sharpe, Treynor and Jensen. Previous research conducted by [12] found that bitcoin was the best investment in Switzerland during pandemic Covid-19.

Referring to the description of background conflict assessment, problem formulation in this study includes:

A. Is there a difference in return between bitcoin, stocks, and gold?
B. Is there a difference in risk between bitcoin, stocks, and gold?
C. Is there a difference in Sharpe Ratio between bitcoin, stocks, and gold?
D. Is there a difference in Treynor Ratio between bitcoin, stocks, and gold?
E. Is there a Jensen Ratio difference between bitcoin, stocks, and gold?

It is hoped that this research will be able to provide insight for authors on how to make decisions in investments with profitability Sharpe ratio Treynor and Jensen returns via bitcoin, gold, and stocks. The author hopes that this research can contribute to its readers, especially the public to add insight into investment and besides that the results of this research can be used as a reference and comparison for students who can or do identical research because the author.

This research is a development to review research that has been conducted by several researchers who compare several investment instrument performances to find the best instrument for investors amid the soaring investment interest in the community. However, what distinguishes this study from previous studies is that there are differences in the fluctuated period and price of each investment instrument and this study compares the performance of each investment instrument in America.

This study is structured by means of a literature review, then a study methodology. then by data analysis and acquisition and description. then a conclusion is formed as well as a suggestion is made to be shared with related parties.

2 Literature review

2.1 Investment

Investment is growing very rapidly, one of which is Indonesia, investment is an investment activity that aims to make the investment results can provide benefits in the future. Now there are many forms of investment, for example investments in tangible assets and financial assets. Tangible assets consist of investments in gold, silver, precious metals, and others while financial assets such as stocks, bonds, warrants, and most recently cryptocurrencies. Investment is inseparable from risk; therefore, investors are required to deepen their insight in obtaining information so that their investment provides benefits in the future [25].

2.2 Cryptocurrency

Cryptocurrency is a digitally created and stored medium of exchange that is decentralized, not tied to a state like fiat currencies and provides anonymity for users [6]. Cryptocurrency is created using blockchain technology where the transaction system is transparent, each block will be recorded in the ledger accessible to anyone without the consent of any party. Blockchain can provide automated information functions such as verifying, processing, shredding, and reporting independently. Blockchain will make it possible to save time on repetitive tasks such as confirmation and verification of amounts and balances to focus on tasks at higher levels, such as preventative test design and intelligent data analysis [23].

2.3 Bitcoin

Bitcoin is a type of digital currency that relies on cryptography, with a proof-of-work system, to record every transaction history quickly. A network with peer-to-peer computer nodes that work synchronously creates and verifies those currency transfer transactions within the network [20]. Bitcoins can be traded with transactions stored in a ledger. Transactions are digitally challenged with the seller and neither party can keep a transaction history so it cannot be replaced [23].

2.4 Stock

Shares in the form of facts owned by the company where the owner is referred to as the owner of shares. The form of shares is in the form of a piece of paper indicating that the owner of the paper is the owner of the company issuing the securities. The profit obtained from shareholders is to get dividends, which are company profits that are distributed to shareholders. In addition to getting dividends, shareholders will also get capital gains if the selling price of shares exceeds the purchase price. (BEI)

2.5 Gold

Gold in the form of the dominant precious metal is used in various industries such as jewelry, electronics, medical, and technology, as well as used as an investment tool. In finance, gold is considered an investment instrument because it can be a hedge against inflation. Based on the supply demand of gold is very limited so that even though market prices rise, gold prices are relatively fixed and stable because gold production produced every year cannot be increased easily [3].

2.6 Risk dan Return

Based on investment theory, profit and risk have a wire, if the profit is large the threat is also large, and vice versa [2]. Risk is a condition faced by a business or individual with losses from invested returns when an asset has substantial losses. Return The result obtained from investment activities that provide profits or losses in a certain period according to market changes and money distribution. The relationship between risk and return is a fundamental law and principle of investment theory known as high-risk high return, low risk low return. [27]

2.7 Sharpe Ratio

In measuring profits, Sharpe ratio is a method that compares the excess return of an investment portfolio, namely with the profit generated by the investment portfolio with the risk taken [26]. Sharpe ratio is the ratio inter in return portfolio more investment as well. The Sharpe Ratio can also be used to compare
performance between two different investment portfolios or to measure investment performance portfolio in absolute terms [31]. emphasizing that the Sharpe Ratio cannot replace fundamental analysis in choosing a good investment portfolio [30].

2.8 Treynor Ratio

Treynor ratio is an investment portfolio performance measurement ratio that measures the returns obtained from investment portfolio through systematic risk or unavoidable risk. The Treynor ratio can be used to compare performance between two different investment portfolios or to measure the performance of the investment portfolio in absolute terms [31]. The excess returns earned by securities are lowered to proportional through market beta being one of the factors that can help investors in choosing the optimal portfolio [5].

2.9 Jensen Ratio

This ratio is in the form of an investment portfolio measurement ratios that measures the returns obtained from an investment portfolio based on systematic risk that has been calculated through beta. The Jensen ratio calculates the difference between an investment's actual return and expected return through the level of systematic threat of investment [7].

2.10 Hypothesis Development

Research conducted by [16] Finding if there is a significant comparison, in the form of first rank is Bitcoin, the second is stocks, and the last is gold. Then the research was conducted by [8] It was also there is a significant comparison in rankings, the first is Bitcoin, then stocks, and the latter is gold. through research conducted by [19] there is a significant comparison between the returns of gold and Bitcoin. Research conducted by [15] and [14] found that there are differences in stocks, cryptocurrencies, gold and precious metals. Therefore, the hypothesis tested in the study is determined: 

$H_1 = $ there is a comparison between return of Cryptocurrency, Stock and Gold through research conducted by [10] there is a significant comparison between highest risk is bitcoin, second is stocks and third is gold Antm. Then the research was conducted by [12] also gives the same result where there is a significant comparison, the highest risk is bitcoin, second is IDX30 then the lowest risk is gold. Research conducted by [8] the acquisition of the initial assessment shows that there is a significant comparison between the risks of each instrument, the first is Bitcoin, then gold and the last is stocks. Research conducted by [16] It was found that there is a difference in risk, the first rank is Bitcoin, second is antam gold LQ45. Therefore, the hypothesis tested in the study is determined:

$H_2 = $ there is a comparison between risks of Cryptocurrencies, Stocks and Gold through research conducted by [8] Using the Sharpe Ratio shows that the stocks, performance and gold has a significant difference in the highest Sharpe value owned by bitcoin, then gold, and finally LQ45 shares. Then research conducted by [17] also shows that there are differences in the Sharpe Ratio method, showing that during the period the most profitable instruments were LQ45 stocks while the worst instrument was Antam gold. Research conducted [11] also found that there are significant differences between each instrument where the first rank is bitcoin, then JCI and the last is gold. Research conducted by [10] shows the results if there is a significant comparison first rank is bitcoin, then Gold then the last is LQ45 shares. Therefore, the hypothesis tested in this study was determined:

$H_3 = $ There is a Difference between the Sharpe Ratio of Cryptocurrency, Stock and Gold

Research conducted by [8] found if there is a significant comparison between stock performance, Bitcoin as well gold using the Treynor method. The highest Treynor ratio is owned by LQ45 shares, then bitcoin and the last is gold. Research conducted by [10] Finding the bottom there is a significant comparison, the first rank is Bitcoin then Bitcoin and the last is stocks. Research conducted by [17] found that there is a significant difference, namely the first rank occupied by Bitcoin with the Treynor ratio value, the second rank followed by LQ45 shares and the last is Antam gold. Based on research conducted by [12] There is a significant difference, the first rank ranked first is Bitcoin. Research conducted by [16] It also found that there is a significant difference between the Sharpe ratio ranked first is bitcoin, the second rank is gold and the last is LQ45. Therefore, the hypothesis tested in this study was determined:

$H_4 = $ there is a comparison between Treynor Ratio of Cryptocurrency, Stock and Gold

Based on research conducted by [12] There are significant differences between each investment instrument, the first is gold, the second is IDX 30, and the last is bitcoin. Based on research conducted by [17] found that there is a difference in the first rank occupied by Antam gold with, followed by LQ45 Shares while the last rank is Bitcoin. Based on research conducted by [11] there is a comparison between, the first rank is bitcoin, then gold, and the last is LQ45, then the last is bitcoin. Then research conducted by [16] Finding that there is a significant difference, the first is stocks then gold and the last is Bitcoin. Therefore, the hypothesis tested in this study was determined:

$H_5 = $ There is a Difference between Jensen Ratio of Cryptocurrency, Stock and Gold

3 Methodology

3.1 Data Types and Sources

This research uses quantitative research methods by looking for secondary data based on historical data, namely data collected from time to time on an object of research. The time in this study is based on historical data from the last 4 years. The variables used in this study are the performance of bitcoin, gold and stocks as
variables independent. Data from these variables is taken based on investing.com, coinmarketcap.com, and gold price. This performance is expected to influence investment decisions, there are 5 things that influence these decisions, namely return, risk, Sharpe ratio, Treynor ratio and Jensen ratio.

### 3.2 Sample Collection Method

The method of collecting sample data in this study is by taking all monthly closing prices of bitcoin, stocks and gold during the January 2019 to December 2022 period, which is 48 data from each investment instrument so that 48 observations are obtained. For more details, researchers present data in the form of Table 3.2 below:

<table>
<thead>
<tr>
<th>Object of Research</th>
<th>Period</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bitcoin</td>
<td>1 January 2019 – 31 December 2022</td>
<td>48</td>
</tr>
<tr>
<td>Cryptocurrency Price</td>
<td>1 January 2019 – 31 December 2022</td>
<td>48</td>
</tr>
<tr>
<td>Gold Price</td>
<td>1 January 2019 – 31 December 2022</td>
<td>48</td>
</tr>
<tr>
<td>S&amp;P 500 Price</td>
<td>1 January 2019 – 31 December 2022</td>
<td>48</td>
</tr>
</tbody>
</table>

Source: All variables data take from Yahoo Finance through this table using raw data through total observations along with a total closing price of 48.

### 3.3 Data Analysis Method

In this study, data analysis techniques were practiced using the SPSS program. Several tests were carried out in the form of Standard Deviation, Return and performance measurements on the Treynor, Sharpe and Jensen techniques. Then tested for normality to observe whether the data is normally distributed or not and homogeneity test to observe whether there is homogeneous data. As well as a parametric statistical hypothesis test in the form of ANOVA if the normality contribution is not sufficient so that the hypothesis test is carried out using a non-parametric statistical test in the form of the Kruskal-Wallis's test. According to Harry Markowitz, the performance of the portfolio does not need to think too much about the level of risk of an investment, but the investment portfolio will be optimal if it shows assets and diversification to reduce all portfolio risks.

#### 3.3.1 Return

The market rate of return is the rate of return based on the development of the price index. This rate of return can be used as a basis for measuring investment performance [29]. The formula as follow:

\[
R_t = \frac{P_t - P_{t-1}}{P_{t-1}}
\]

#### 3.3.2 Risk

In calculating risk, one of the most used formulas in calculating risk is to use the standard deviation formula:

\[
S = \sqrt{\frac{\sum (S_t - \bar{S})^2}{n-1}}
\]

#### 3.3.3 Sharpe Ratio

The Sharpe measurement method states if this test is calculated to be the net gain through the portfolio at the risk-free interest rate per unit of risk as well as the symbol Sp. The index is calculated using the formula [18]:

\[
S_p = \frac{R_p - R_f}{\sigma_p}
\]

Information:
- \(S_p\) = Sharpe performance index.
- \(R_p\) = portfolio return or market rate of return.
- \(R_f\) = risk-free return risk-free interest rate.
- \(\sigma_p\) = Total risk is the result of the sum of systematic risks and unsystematic risks

#### 3.3.4 Treynor Ratio

Treynor is an index that is used to sort portfolio performance. Treynor said that the portfolio, which is called the Reward to Volatility Ratio.

\[
T_p = \frac{R_p - R_f}{\beta_p}
\]

Information:
- \(T_p\) = Treynor performance index.
- \(R_p\) = portfolio return or market rate of return.
- \(R_f\) = risk-free return risk-free interest rate.
- \(\beta_p\) = Market risk of the portfolio or systematic risk of the portfolio.

#### 3.3.5 Jensen Ratio

Jensen ALPHA is an absolute scale that predicts a constant rate of return since investment. the formula is [18]:

\[
a_p = R_p - \left[ R_f + \beta_p(R_m - R_f) \right]
\]

Jensen ALPHA can be calculated by summarizing the alignment experienced in the form:

\[
R_p - R_f = a_p + \beta_p (R_m - R_f)
\]

#### 3.3.6 Descriptive Analysis

Descriptive statistics are used by researchers to prepare reports as well as the characteristics of the variables used in the assessment. Descriptive statistics share
reports regarding the standard deviation, range and minimum and highest values.

3.3.7 Normality Test

Normality Test is a test used in assessing a variable in a distribution that is normal or not [28]. The normality test is a statistical technique used to test whether data is normally distributed or not. Normality is a condition in which data is symmetrically distributed with most values concentrated around middle values and a small percentage of values distributed around extreme values. Normality is an important assumption in some statistical analysis methods, such as parametric hypothesis testing and regression analysis [9]. In this study, the Kolmogorov-Smirnov test was used: This test tests how well the data matches the normal distribution. The Kolmogorov-Smirnov test can be used for both normal and abnormal data.

3.3.8 Homogeneity Test

A homogeneity test is a statistical test used to test whether two or more groups of data have the same variance or not. Variance is a measure of how far scattered data points are from their average [22]. This study uses the Levene test where this test is used to test the homogeneity of two or more data groups.

3.3.9 One Way Anova Test

The ANOVA (Analysis of Variance) test is a statistical technique used to test whether there are significant differences between the averages of three or more data groups. In the ANOVA test, the null hypothesis states that there is no significant difference between group averages, while the alternative hypothesis states that at least one group has a significantly different average from the other groups [21]. The ANOVA test can be used to test differences between groups, if the distribution of research used in the study is normal and homogenous.

3.3.10 Kruskal Wallis Test

The Kruskal Wallis test is a statistical method used to test for significant differences between three or more groups in a dependent variable that is not normally distributed. This test uses ranking data and does not require the assumption of normal data distribution, so it is suitable for use when the assumption of normal distribution is not met [1]

4 Result And Discussion

4.1 Descriptive Analysis

Based on the data graph above, it shows that bitcoin's highest return was on May 31, 2019 at 60%, bitcoin's lowest return was on June 30, 2022 at -37%, then Gold's highest return was on July 31, 2020 was 10%, Gold's lowest return was on June 30, 2021, and then the highest return on S&P500 was on April 30, 2020 at 12%, then the lowest return on S&P 500 was on June 30, 2021 at -7%.

Based on the data graph above, bitcoin's highest standard deviation risk is on March 31, 2020 at 24%, then bitcoin's lowest risk is on December 31, 2022 at 2%, then gold's highest risk is on November 30, 2019 at 8%, then gold's lowest risk is on January 31, 2020 at 0.36%, then the highest risk of the S&P 500 on March 31, 2020 is 10%. Then the S&P 500's lowest risk on October 31, 2019 was 0.4%.

Based on the data graph above, the highest Sharpe Ratio of bitcoin was on December 31, 2020 of 1.6, then bitcoin's lowest Sharpe ratio was on April 30, 2022 of -4.1, then the highest Sharpe ratio of gold was on June 30, 2020 of 0.87, then the lowest Sharpe ratio of gold was on December 31, 2022 of -4.6, then the highest Sharpe ratio of the highest S&P 500 was on May 31,
2020 of 0.64. Then the S&P 500’s lowest Sharpe ratio was on April 30, 2022 at -6.

![Treynor Ratio](image)

Fig. 4. Caption of Figure Graphic Treynor Ratio Bitcoin, Gold and S&P500 4. Below the figure.

Based on the data graph above, it shows that the highest Treynor ratio of bitcoin was on May 31, 2021 of 60%, then the lowest Treynor ratio of bitcoin was on April 30, 2022, then the highest Treynor ratio of gold was on February 28, 2021 of 0.6% then the lowest Treynor ratio of gold was on August 31, 2019 of -1.15%, then the highest Treynor ratio of the S&P 500 was on April 30, 2020 of 0.029%, Then the S&P 500’s lowest Sharpe ratio was on May 31, 2020 at -6%.

Based on the data graph above, the highest Jensen ratio of bitcoin was on December 31, 2020 at 16%, then the lowest Jensen ratio of bitcoin was on November 30, 2019 at -11%, then the highest Jensen ratio of gold was on July 31, 2020 at 5%, then the lowest Jensen ratio of gold was on February 28, 2021 at -0.03%, then the highest Jensen ratio of the S&P 500 was on April 30, 2020 at 6%, Then Jensen’s lowest S&P 500 ratio was on May 31, 2020 at -6%.

![Jensen Ratio](image)

Fig. 5. Caption of Figure Graphic Jensen Ratio Bitcoin, Gold and S&P500 5. Below the figure.

Based on the data graph above, the highest Jensen ratio of bitcoin was on December 31, 2020 at 16%, then the lowest Jensen ratio of bitcoin was on November 30, 2019 at -11%, then the highest Jensen ratio of gold was on July 31, 2020 at 5%, then the lowest Jensen ratio of gold was on February 28, 2021 at -0.03%, then the highest Jensen ratio of the S&P 500 was on April 30, 2020 at 6%, Then Jensen’s lowest S&P 500 ratio was on May 31, 2020 at -6%.

### 4.2 Normality Test

The study used a normality test with the Kolmogorov-Smirnov method to determine the return, risk, Sharpe Index, Treynor Index and Jensen Index data studied as normally distributed or not, to be continued in the one-way ANOVA test. With a significance value on the test of 0.05 or 5%, it means that the data has a significance value of > 0.05.

In the normality test above, most data have a significance value of < 0.05, it is seen that the average of Return, risk, Sharpe and Jensen shows the probability of a signification value<0.05. Although it can be seen based on the Treynor index has a probability with a significance value>0.05. So based on this Kolmogorov test it can be concluded that in this normality test it is not normally distributed and the one-way anova test cannot be done.

### 4.3 Homogeneity Test

The study used a homogeneity test to assess that the data used in the study was homogeneous or the same, so that the homogeneity test was carried out which has been discussed in the table below. Research data can be assessed as homogeneous data if it has a significance value of > 0.05.

![Table 3](image)

Table 3. Homogeneity Test

<table>
<thead>
<tr>
<th>Tests of Homogeneity of Variances</th>
<th>Levene Statistic</th>
<th>df1</th>
<th>df2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return</td>
<td>Based on Mean</td>
<td>56.281</td>
<td>2</td>
<td>141</td>
</tr>
<tr>
<td></td>
<td>Based on Median</td>
<td>47.619</td>
<td>2</td>
<td>141</td>
</tr>
<tr>
<td></td>
<td>Based on Median and with adjusted df</td>
<td>47.619</td>
<td>2</td>
<td>57.17</td>
</tr>
<tr>
<td></td>
<td>Based on trimmed mean</td>
<td>55.933</td>
<td>2</td>
<td>141</td>
</tr>
<tr>
<td>Risk</td>
<td>Based on Mean</td>
<td>29.078</td>
<td>2</td>
<td>141</td>
</tr>
<tr>
<td></td>
<td>Based on Median</td>
<td>25.280</td>
<td>2</td>
<td>141</td>
</tr>
<tr>
<td></td>
<td>Based on Median and with adjusted df</td>
<td>25.280</td>
<td>2</td>
<td>75.31</td>
</tr>
<tr>
<td></td>
<td>Based on trimmed mean</td>
<td>27.802</td>
<td>2</td>
<td>141</td>
</tr>
<tr>
<td>Sharpe</td>
<td>Based on Mean</td>
<td>.910</td>
<td>2</td>
<td>141</td>
</tr>
<tr>
<td></td>
<td>Based on Median</td>
<td>.639</td>
<td>2</td>
<td>141</td>
</tr>
<tr>
<td></td>
<td>Based on Median and with adjusted df</td>
<td>.639</td>
<td>2</td>
<td>120.9</td>
</tr>
</tbody>
</table>

* This is a lower bound of the true significance.
  a. Lilliefors Significance Correction
Wallis’s test was carried out with the following results: distributed and not homogeneous, so the Kruskal-wallis parametric tests because the data was not normally carried out. However, this study was not eligible to use distributed so that parametric statistical tests can be found results that the data is homogeneous and normally data that has been tested for normality and homogeneity shows that almost all data have a significance value of <0.05 so that the homogeneity test can be concluded that the data used in this study are not homogeneous and not normally distributed, another test that will be used is a non-parametric statistical test, the Kruskal-Wallis’s test.

4.4 Kruskal Wallis Test

Table 4. Kruskal Wallis Rank

<table>
<thead>
<tr>
<th>Ranks</th>
<th>Instrument Investment</th>
<th>N</th>
<th>Mean Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return</td>
<td>Bitcoin</td>
<td>48</td>
<td>73.75</td>
</tr>
<tr>
<td></td>
<td>Gold</td>
<td>48</td>
<td>70.48</td>
</tr>
<tr>
<td></td>
<td>S&amp;P500</td>
<td>48</td>
<td>73.27</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>144</td>
<td></td>
</tr>
<tr>
<td>Risk</td>
<td>Bitcoin</td>
<td>48</td>
<td>114.85</td>
</tr>
<tr>
<td></td>
<td>Gold</td>
<td>48</td>
<td>47.92</td>
</tr>
<tr>
<td></td>
<td>S&amp;P500</td>
<td>48</td>
<td>54.73</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>144</td>
<td></td>
</tr>
<tr>
<td>Sharpe</td>
<td>Bitcoin</td>
<td>48</td>
<td>97.15</td>
</tr>
<tr>
<td></td>
<td>Gold</td>
<td>48</td>
<td>55.81</td>
</tr>
<tr>
<td></td>
<td>S&amp;P500</td>
<td>48</td>
<td>64.54</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>144</td>
<td></td>
</tr>
<tr>
<td>Treynor</td>
<td>Bitcoin</td>
<td>48</td>
<td>65.04</td>
</tr>
<tr>
<td></td>
<td>Gold</td>
<td>48</td>
<td>74.69</td>
</tr>
<tr>
<td></td>
<td>S&amp;P500</td>
<td>48</td>
<td>77.77</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>144</td>
<td></td>
</tr>
<tr>
<td>Jensen</td>
<td>Bitcoin</td>
<td>48</td>
<td>71.31</td>
</tr>
<tr>
<td></td>
<td>Gold</td>
<td>48</td>
<td>73.17</td>
</tr>
<tr>
<td></td>
<td>S&amp;P500</td>
<td>48</td>
<td>73.02</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>144</td>
<td></td>
</tr>
</tbody>
</table>

Parametric statistical tests can be used if the research data that has been tested for normality and homogeneity finds results that the data is homogeneous and normally distributed so that parametric statistical tests can be carried out. However, this study was not eligible to use static parametric tests because the data was not normally distributed and not homogeneous, so the Kruskal-Wallis’s test was carried out with the following results:

Based on the results of Wallis’s Kruskal tests conducted with the help of SPSS, the results of the study can be concluded:

1. The return has a significant rate \(0.918>0.05\) So it can be concluded that \(H_1\) rejected which means that there is no significant difference between the return of bitcoin, gold, and S&P 500 investment instruments.
2. The risk has a significant degree \(0.001<0.05\) so it can be concluded that \(H_2\) rejected which means there is a significant difference between the risks of bitcoin, gold, and S&P 500 investment instruments.
3. The Sharpe ratio has a significant degree \(0.001<0.05\) So it can be concluded that \(H_3\) rejected which means that there is a significant difference between the Sharpe ratio of bitcoin, gold, and S&P 500 investment instruments.
4. The Treynor ratio has a significance rate of \(0.296>0.05\) Until it can be concluded that \(H_4\) rejected which means that there is no significant difference between the return of bitcoin, gold, and S&P 500 investment instruments.
5. Jensen’s ratio has a significant degree \(0.971>0.05\) Until it can be concluded that \(H_5\) rejected which means that there is no significant difference between the return of bitcoin, gold, and S&P 500 investment instruments.

4.5 Discussion

4.5.1 Comparison of Bitcoin, Gold, and Stock Returns

Based on the results of data management in this study shows that the returns provided by bitcoin, gold, and S&P500 do not have a significant difference. Bitcoin had become the highest return of other investments, this is because during the Covid-19 pandemic, people were looking for the latest investment alternatives which caused public interest to increase, but Bitcoin declined due to rising interest rates.

The results of this study show that there is no difference in return between bitcoin, gold and S&P500. The significant return value is \(0.918<0.05\), meaning that there is no significant return difference between bitcoin, gold, and the S&P500. This is in line with research conducted by [10] & [11] which found that the highest return was bitcoin then it was S&P500 and the last one was gold. However, these results are not in line with research conducted by [8] & [16] which found that there is a significant difference between the returns of bitcoin, gold and the S&P500.
4.5.2 Risk Comparison of Bitcoin, Gold, and Stocks

Based on the results of data management in this study, shows that the risks provided by bitcoin, gold, and S&P500 have significant differences. Bitcoin has the highest risk; this is because if the price of bitcoin is high, this also happens with a high decline in the price of bitcoin.

The results of this study show that there is a difference in risk between bitcoin, gold and the S&P500. The value of risk significance is 0.001<0.05, which means that there is a significant difference in risk between bitcoin, gold and the S&P500. This is in line with research conducted by [10], [12], [8] & [16] which found that Bitcoin has the highest risk compared to other investment instruments.

4.5.3 Sharpe Ratio Comparison of Bitcoin, Gold and Stocks

Based on the results of data management in this study, shows that there is a significant difference between bitcoin, gold and the S&P500. Bitcoin has a high Sharpe ratio; this is because bitcoin's return is quite high which is influenced by supply and demand where if demand is high then prices will rise, bitcoin that was previously not well-known is now famous and many people are buying so that prices at that time soared, in contrast to gold and stocks that are influenced by rules, regulations, or rules that cause the rise and fall of a stock and the performance of a company such as financial statements.

The results of this study show that there is a Sharpe difference between bitcoin, gold and the S&P500. The value of Sharpe's significanation ratio is 0.001<0.05, meaning that there is no significant difference from Sharpe between bitcoin, gold and the S&P500. This is in line with research conducted by [11], [10], [17], [8] & [16] which found that bitcoin has a Sharpe ratio that has a high fluctuating value compared to other investment instruments.

4.5.4 Treynor Ratio Comparison of Bitcoin, Gold and Stocks

The results of this study show that there is no difference in Treynor between bitcoin, gold and S&P500. The value of the significant return is 0.296<0.05, meaning that there is no significant difference between bitcoin, gold and S&P500. Based on the calculation of the Treynor ratio, there is no difference because the three investment instruments are compared to each of these instruments to measure market efficiency and risk.

The results of this study show that there is no difference in Treynor between bitcoin, gold and S&P500. The Treynor significanation ratio value is 0.296<0.05, meaning that there is no significant difference from Treynor between bitcoin, gold and the S&P500. This is in line with research conducted by [16] & [11] Where the study shows no significant difference. However, this study is not in line with research conducted by [12], [17], [8] & [9] found that there are significant differences between bitcoin, gold and stocks.

4.5.5 Jensen Ratio Comparison for Bitcoin, Gold, and Stocks

The results of this study show that there is a difference in return between bitcoin, gold and S&P500. The significant return value <0.05, meaning that there is no significant difference between bitcoin, gold and the S&P500. According to the Jensen ratio, based on Jensen's historical data these three instruments have no difference, it can be concluded that all three can be used as investment instruments because they generate the expected profit based on their systematic risk.

The results of this study show that there is no Jensen difference between bitcoin, gold and the S&P500. Jensen’s significanation ratio is 0.971<0.05, which means that there is no significant difference from Treynor between bitcoin, gold and the S&P500. This is in line with research conducted by [8] & [10] The researchers found no significant difference between Bitcoin, Gold, and stocks. However, this study is not in line with research conducted by [12], [17], [11] & [16] The researchers found significant differences between Bitcoin, gold and stocks.

5 Conclusion

After conducting various research processes, ranging from data collection to data processing with the aim of analyzing the comparison of Bitcoin, gold, and S&P 500 performance during the 2019-2022 period as information for investors & the public in choosing the best investment. (1) There is no difference in the returns of bitcoin, gold and the S&P 500 which means bitcoin does not produce better returns than gold and the S&P500. Because the monthly return of bitcoin on and down bitcoin is unstable, this causes there is no significant difference between monthly returns that are plus and mines, in contrast to stocks and gold whose returns are arguably stable. (2) There is a significant difference in risk between bitcoin, gold and the S&P 500 because bitcoin has the highest risk whereas gold and the S&P 500 There is no significant difference in risk, this is because Bitcoin risk is very volatile compared to others, so this affects significant risk. (3) There is a significant difference in the Sharpe index where bitcoin performs better than gold and stocks. Because the return of bitcoin is quite large compared to the return of gold and stocks. (4) There is no significant difference in the Treynor index where the three investment instruments have the same performance when compared to the market risk of each instrument. Because based on Treynor calculations used to measure market efficiency so that each of the three instruments shows the same risk equation when measured by comparing with the same investment instruments. (5) There is no significant difference in the Jensen index where the three investment instruments are located because based on the systematic average value shows almost the same value.

Based on the hypothesis testing that has been done, the analysis and discussion of the best performance is bitcoin because based on the return bitcoin has the highest value and based on the Treynor ratio the three investment instruments do not have a significant
difference when compared to the same investment instrument from each instrument. Then the second rank is occupied by the S&P500 because of period 2019-2022 experienced a huge price decline, this was caused by the COVID-19 pandemic. However, gold is ranked third because gold does not have a high return compared to bitcoin and the S&P500 because the price of gold is not affected by inflation due to the scarcity of gold. A limitation in this study is in processing data where events or rules affect the prices of bitcoin, stocks, and the S&P 500.

The recommendation for the government is to consider the regulation of these assets to ensure that the public is safe in investing so that the regulatory framework can protect the public interest and market integrity with maximum return and minimal risk. For the public, although bitcoin is the best investment in this study, it does not rule out the possibility that stocks and gold are also able to provide the expected return depending on how investors sort and analyze a market situation. Advice can be given for readers, which is expected that the research carried out can add insight and knowledge about portfolio performance. And input for further researchers is expected to be able to explain in more detail about an event because an event can trigger price changes in securities.

References
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