

Comparative Analysis of the Performance of Cryptocurrency, Stocks, and Forex as Investment Alternatives, 2021-2024

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ABSTRACT

The purpose of this study is to analyze the performance comparison between cryptocurrency, stocks, and forex as alternative investment assets. This research employs secondary data and a comparative method. The objects of the study consist of the top five assets with the largest market capitalization in each category (cryptocurrency, saham, and forex) for 2024, covering September 2021 to September 2024. Data are monthly closing prices, analyzed via saturated sampling for comprehensive, representative results. Performance is measured using key indicators such as return, risk, and ratios including Sharpe, Treynor, and Jensen. Results show cryptocurrency exhibits superior performance over stocks and forex, with higher returns (19.12% vs. 1.91% for stocks and 0.02% for forex) and optimal ratios: Sharpe (0.83), Treynor (0.1521), and Jensen (0.1705). These metrics highlight cryptocurrency's strong risk-adjusted returns, making it attractive for risk-tolerant investors. However, it carries the highest risk (42.98% vs. 6.42% for stocks and 1.77% for forex), underscoring the need for careful risk management due to its high volatility.

KEYWORDS

Cryptocurrency, Stock, Forex, Investment Performance, Portofolio Diversification



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INTRODUCTION

Changes in global economic dynamics have had a significant impact on financial markets, especially in the 2021-2024 period after the COVID-19 pandemic. The pandemic that caused a global economic slowdown also affected increased volatility in financial markets, which had a direct impact on investment returns in various instruments. This volatility requires investors to be more careful in developing investment strategies to minimize risk and maximize profits (Kim et al., 2017; Koehler et al., 2018; Nafiu et al., 2025; Rachmad, 2025).

In recent years, global market uncertainty triggered by the pandemic has made investors' preferences for investment instruments change (Huber et al., 2021; Otenko et al., 2022). The COVID-19 pandemic has reinforced the dynamics of volatility across emerging markets that have caused investors to be more cautious in determining asset allocation, as well as turning to instruments that are considered safer in critical conditions (Habib et al., 2024). Traditionally, stocks and forex dominated investment choices, but recently there has been a shift to alternative instruments such as gold and crypto, this is influenced by security perception factors, market volatility, and profit potential. Digital assets or crypto are increasingly considered investment instruments that function as a hedge (hedging) during economic uncertainty (Mikhaylov et al., 2019). This is in line with the view that gold is the main choice for investors in dealing with risks.

The rapid development of alternative investment instruments such as cryptocurrencies and forex adds complexity in investment decision-making. This is driven by high price fluctuations, which make it more risky compared to conventional instruments such as stocks. In this context, diversifying investment portfolios is one of the important strategies

implemented by investors to reduce risks and increase profit opportunities. The development of technology and digitalization as well as the increasing accessibility and digital investment platforms have accelerated the adoption of cryptocurrencies, stocks and forex as investment instruments that are increasingly in demand, especially among young investors.

Investors are starting to diversify their portfolios with alternative assets such as crypto and gold due to the prospect of more stable returns compared to stocks and forex (Sudacevschi, 2021). Bitcoin and gold play an important role as hedge assets during the global financial crisis, providing an alternative for investors looking to protect their portfolios from market fluctuations (Ullah et al., 2024). Portfolio diversification that includes cryptocurrencies, stocks, and forex can increase portfolio efficiency, especially in emerging markets (Nurminen, 2024).

Table 1. Investor Growth in Indonesia, 2021-2024

Year	Capital Markets	+	Foreign Currency	+
2021	7.4 million	-	11.2 million	-
2022	10.3 million	38%	16.1 million	43%
2023	12.1 million	17,9%	18.51 million	8%
2024	14.8 million	22,2%	21.63 million	16%



Figure 1. Investor Growth

Source: OJK and Bappebti

Based on a report from the Financial Services Authority, the number of capital market investors in Indonesia continues to grow; as of 2024, the number of investors reached 14.8 million Single Investor Identification (SID) accounts. *Bappebti*, or the Commodity Futures Trading Supervisory Agency, also recorded a total of 21.63 million cryptocurrency and foreign exchange investors in Indonesia as of September 2024. In the context of forex, although regulation and supervision are carried out by the Commodity Futures Trading Supervisory Agency (*Bappebti*), the majority of transactions are conducted through international brokers that are not registered in Indonesia.

Cryptocurrencies have experienced a surge in popularity since the COVID-19 pandemic in 2021, triggered by the increase in Bitcoin's price, which reached an all-time high (ATH) of US\$61,000 in March 2021 (Barry & Abubakar, 2024). This is also reflected in Indonesia, where cryptocurrencies have exerted a significant positive influence on the JCI (Hidayah & Saidah, 2024). This trend shows that cryptocurrencies are an attractive investment alternative despite their high volatility.

Indonesian stocks, represented by the JCI, have also experienced developments since 2021. The market capitalization of the JCI in that year was IDR 8,256 trillion, indicating

increasing investor confidence in the domestic capital market (Ardiansyah, 2024). Stocks are seen as a safer investment instrument than cryptocurrencies, especially for investors oriented toward long-term gains and lower risk.

Forex remains one of the global investment options that offers high liquidity and the potential for quick returns. Dynamic fluctuations in exchange rates make forex riskier than stocks (Hatta, 2024). Nevertheless, forex is attractive to investors who have high risk tolerance and are seeking short-term profit opportunities.

Some previous findings indicate that cryptocurrencies offer higher potential returns than stocks and forex, although they are accompanied by much higher volatility (Tanjung et al., 2024). In contrast, stocks are considered a safer investment in the long term, while forex offers flexibility for investors who want to profit in a short period.

One of the main challenges in comparing these three investment instruments is the difference in risk and the rate of return. Cryptocurrencies have high security risks and volatility, while stocks tend to be more stable but take longer to generate profits (Wulan et al., 2024). Forex, on the other hand, offers the potential for quick profits but requires strong analytical skills to minimize risk. Investment decisions in forex are greatly influenced by the investor's knowledge and experience (Husaeni et al., 2024).

Each investment instrument has its own challenges. Cryptocurrencies are known for their extremely high price volatility, making them risky for short-term investors. Stocks, while more stable, are susceptible to changes in macroeconomic conditions such as inflation and interest rates. Forex offers high liquidity, but it is heavily influenced by monetary policy, geopolitical tensions, and exchange rate fluctuations. These differences in characteristics pose challenges for investors in choosing the instrument that best suits their risk profile and financial objectives.

Most previous findings address only one or two types of investments without making direct comparisons between cryptocurrencies, stocks, and forex simultaneously. This leaves a gap in understanding the best alternatives for investors based on their risk profile and investment goals (Barry & Abubakar, 2024).

The financial literacy gap is one of the main challenges in optimal investment decision-making. Financial literacy has a significant impact on how investors respond to market volatility and portfolio diversification. Effective financial education can improve investors' understanding of risk management concepts and investment portfolios. Investors with knowledge of portfolio diversification are better able to mitigate risk during periods of market uncertainty (Astuti et al., 2021).

This performance comparison includes an analysis of the returns earned by investors and the market volatility that each instrument faces. The research reveals that the returns provided by cryptocurrencies are higher compared to stocks and forex. This research also states that cryptocurrencies are heavily influenced by market sentiment that can change drastically, in contrast to stocks and forex, which have more fundamental factors in determining their value (Liang et al., 2019). The forex market has the highest liquidity, followed by the stock market, while cryptocurrencies have the lowest liquidity. Lower liquidity can lead to more extreme price movements, resulting in a higher level of risk (Liang et al., 2019). Despite the large fluctuations, there is an opportunity to achieve better returns; despite the significant risks, the high profit potential makes cryptocurrency an attractive option for investors who dare to take risks (Barry, 2024). While research by Yanida* et al. (2023) states that cryptocurrencies are

investment instruments with more stable and volatile risks, high volatility also offers high returns proportional to the risks posed by cryptocurrencies. Cryptocurrencies also have a lower correlation with stocks and forex, thus offering greater diversification potential than conventional instruments, which means that adding cryptocurrencies to a portfolio can increase returns without significantly increasing risk (Patel et al., 2024).

The problem in this study is the increasing growth of domestic investors without knowledge of the risks posed, strategies, mechanisms, and factors that affect the price movements of crypto, stocks, and forex. For this reason, this research analyzes the performance of crypto, stocks, and forex. This research aims to provide investors with an overview of the performance of each research object before deciding to enter the world of investment. It also aims to add to the existing literature regarding comparisons of the performance of crypto, stocks, and forex, as well as to contribute to a better understanding of these assets in the context of investment.

METHOD

This research employed a quantitative approach with a comparative method to assess the financial performance of three main investment instruments: cryptocurrency, stocks, and forex. This approach was selected to identify significant differences in returns, risks, and performance ratios. Secondary data consisted of monthly historical closing prices reflecting market dynamics from September 2021 to September 2024. The population comprised all actively traded assets in these categories. A saturated sampling technique, based on highest market capitalization, selected the top five assets from each category, yielding 15 assets total. Data were sourced from trusted public platforms: CoinMarketCap for cryptocurrencies, Yahoo Finance and the official IDX website for stocks, and Investing.com for forex. Prices were compiled in Microsoft Excel for analysis.

Data analysis proceeded in stages. First, monthly returns, risks, and performance ratios (Sharpe, Treynor, and Jensen's Alpha) were calculated. Statistical assumption tests followed: normality (Kolmogorov-Smirnov) and homogeneity of variance (Levene's test) to select appropriate hypothesis testing. If data met normality and homogeneity assumptions, one-way ANOVA was used to compare performance across asset types. Otherwise, the non-parametric Kruskal-Wallis test was applied. All analyses were conducted using SPSS software for accuracy and objectivity.

Descriptive analysis included measures of central tendency (mean, median) and dispersion (standard deviation, variance) to summarize the data. The normality test identified deviations that influenced analysis selection. The homogeneity test, conducted post-normality, ensured equal variances across groups for valid results.

RESULT AND DISCUSSION

Descriptive data of Cryptocurrencies, Stocks and Forex

Return

Table 2. Descriptive Statistics of Return Performance Across Investment Instruments

	Min	Max	Mean
Crypto	-17,71%	65,32%	19,12%
stock	-8,55%	19,94%	1,91%
forex	-1,53%	2,24%	0,02%

Source: Processed secondary data from CoinMarketCap, Yahoo Finance, and Investing.com (2021-2024)

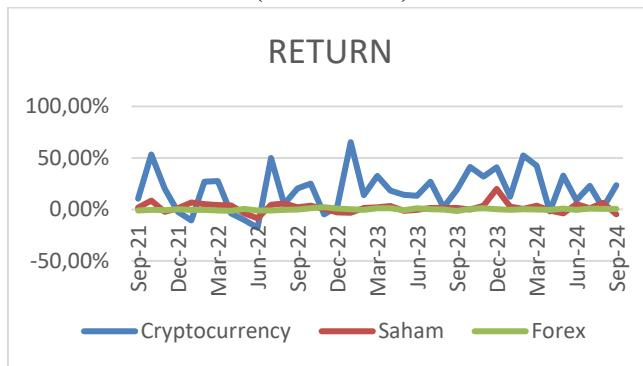


Figure 2. Statistics of Return Performance

Based on the graph above, it can be seen:

During the research period, Cryptocurrency assets showed a higher average return performance compared to the other two instruments, which was 0.1912 or 19.12%. This return identifies that crypto has great potential for profits, along with great risk. The highest return was recorded in January, at 0.6532 or 65.32%. However, the volatile nature of the crypto market was also seen in June 2022, with the lowest return of -0.1771 or -17.71%.

The stock market recorded an average return of 0.0190 or 1.91% during the research period, the stock showed more stable characteristics and was suitable for long-term investment strategies. The highest return occurred in December 2023, at 0.1994 or 19.94% and the lowest point was recorded in June 2022, with a return of -0.0855 or -8.55%.

For forex instruments, the performance during the research period is relatively conservative. The average return was recorded at 0.0002 or 0.02%, reflecting the stability of the forex market which tends to be low in volatility. The highest return occurred in November 2022, at 0.0224 or 2.24% and the lowest in September 2023 at -0.0153 or -1.53%.

Risk

Table 3. Descriptive Statistics of Risk (Standard Deviation) Across Investment Instruments

	min	Max	Mean
crypto	36,60%	55,54%	42,98%
stock	1,31%	32,49%	6,42%
forex	0,27%	4,48%	1,77%

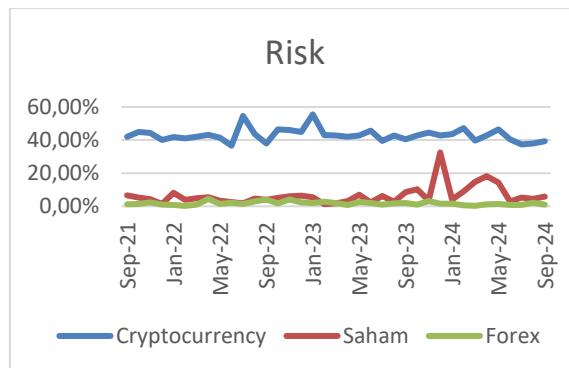


Figure 3. Descriptive Statistics of risk

During the research period, cryptocurrencies appeared as the instruments with the highest level of risk compared to stocks and forex. The average risk value was recorded at 0.4298 or 42.98%, reflecting a very high level of volatility, the highest risk value occurred in January 2023 at 0.5554 or 55.54%, and the lowest in June 2022 with a value of 0.3660 or 36.60%.

The stock market shows a much more moderate risk profile, with an average risk value of 0.0642 or 6.42%, making stocks a relatively more stable instrument. The peak of risk occurred in December 2023, with a value of 0.3249 or 32.49%, and the lowest in February 2023, only 0.0131 or 1.31%, showing a relatively calm and stable market trend.

The forex market displays the lowest risk level with an average value of 0.0177 or 1.77% making it the instrument with the highest stability. The highest risk was recorded in April 2022 at 0.0448 or 4.48% and lowest in March 2024 at 0.0027 or 0.27%, reflecting a very stable market.

Sharpe

Table 4. Descriptive Statistics of Sharpe Ratio Across Investment Instruments

	min	Max	Mean
crypto	-0,85	3,39	0,83
stock	-1,42	2,21	-1,42
forex	-8,26	-1,75	-4,79

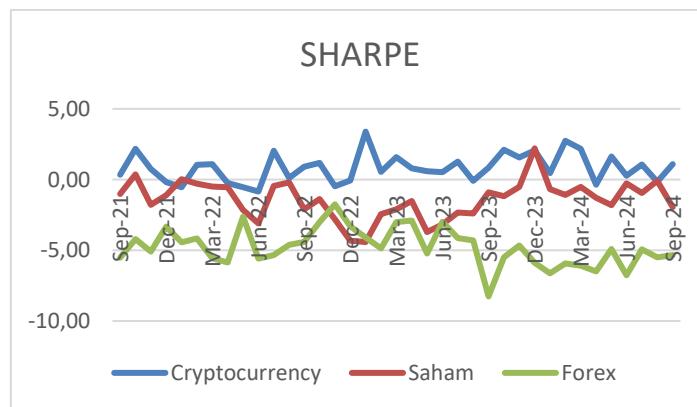


Figure 4. Descriptive Statistics of Sharpe

On the Sharpe index chart can be seen:

Cryptocurrencies recorded an average sharpe index of 0.83, which is relatively positive and risk-efficient. This index identifies that, although crypto is highly volatile it is proportional to the returns generated. The highest value occurred in January 2023, which was 3.39 and the lowest in June 2022, with a value of -0.85.

The stock market recorded a negative average sharpe index of -1.42, which means that the return obtained is not proportional to the risk obtained. The highest figure occurred in December 2023, at 2.21. And the lowest in January 2023 with a value of -1.42.

The forex market exhibits the weakest risk efficiency performance with an average of -4.79, which reflects that the returns obtained do not manage to cover the level of risk at hand. The highest value occurred in November 2022, with a value of -1.75, and decreased in September 2023, which was -8.26.

Treynor

Table 5. Descriptive Statistics of Treynor Ratio Across Investment Instruments

	min	Max	Mean
crypto	-0,1837	0,5967	0,1521
stock	-0,1781	0,1203	-0,0566
forex	0,0493	0,1850	0,1097

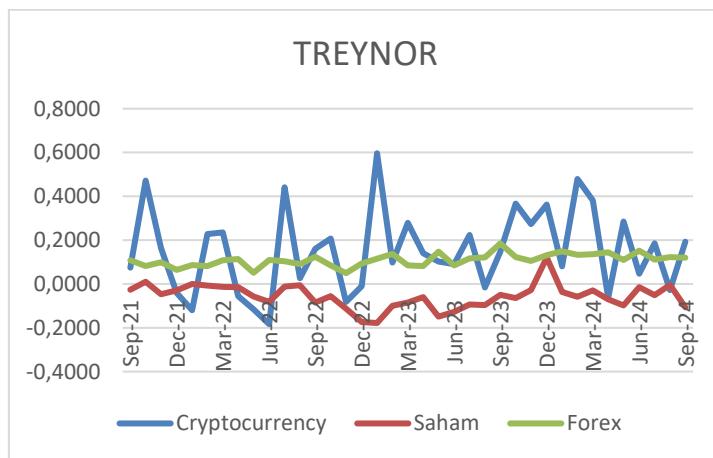


Figure 5. Descriptive Statistics of Treynor

Cryptocurrencies show the most superior performance based on treynor's performance. The average treynor index of 0.1521 indicates that each systematic risk unit borne by investors in crypto assets produces relatively good returns. The highest value occurred in January 2023, with a value of 0.5967 and the lowest in June 2022 with a value of -0.1837.

Stocks recorded an average negative treynor index, which was -0.0566, which means that the returns generated are not able to cover the systematic risks faced by investors. The highest average was recorded in December 2023 at 0.1203 and the lowest in January 2023 with a value of -0.1781.

The forex market performs the most stable and positive consistently with an average treynor index of 0.01097, which means that forex returns are efficient against systematic risk.

The highest value was in September 2023, at 0.1850 and the lowest in November 2022 with a value of 0.0493.

Jensen

Table 6. Descriptive Statistics of Jensen's Alpha Across Investment Instruments

	min	Max	Mean
crypto	0,0092	0,3187	0,1705
stock	-0,0601	0,1760	0,0202
forex	-0,0639	0,0264	-0,0443

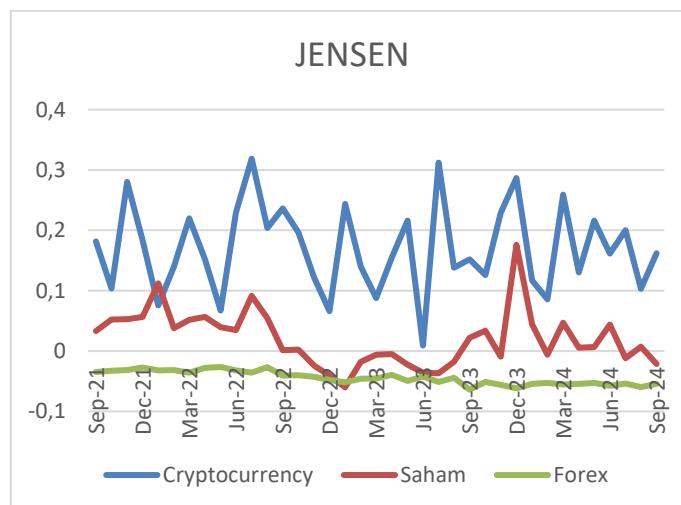


Figure 6. Descriptive Statistics of Jensen

Cryptocurrencies show the best performance based on the Jensen index with an average of 0.1705, which indicates that crypto investments provide abnormal positive returns or successfully beat market expectations. The highest value occurred in July 2022 with a value of 0.3187 and was reached in June 2023 with a value of 0.0092.

The stock market recorded an average Jensen index of 0.0202, which means the stock's performance slightly exceeded market expectations. The highest value was in December 2023 with a value of 0.1760 and the lowest in January 2023 with a value of -0.0601.

The forex market recorded an average of negative Jensen index, which was -0.0443. This shows that the forex market performance is below market expectations. The highest value was recorded in May 2022, with a value of 0.0264 and the lowest in September 2023 with a value of -0.639.

Normality Test

Table 7. Normality Test Results

Variable	Instruments	Kolmogorov-Smirnov ^a		
		Statistic	Df	Sig.
Return	<i>Cryptocurrency</i>	,066	37	,200*
	Stock	,175	37	,006
	Forex	,237	37	,000
Risk	<i>Cryptocurrency</i>	,137	37	,076

	Stock	,247	37	,000
	Forex	,107	37	,200*
Sharpe	<i>Cryptocurrency</i>	,082	37	,200*
	Stock	,088	37	,200*
	Forex	,084	37	,200*
Treynor	<i>Cryptocurrency</i>	,075	37	,200*
	Stock	,101	37	,200*
	Forex	,079	37	,200*
Jensen	<i>Cryptocurrency</i>	,086	37	,200*
	Stock	,135	37	,084
	Forex	,133	37	,094

The results of the normality test show

In the variable return value significance in Cryptocurrency of 0.200 or >0.05 , it shows that the data is distributed normally, and the movement of return is relatively symmetrical to the average value. In stock and forex returns, the significance values of 0.006 and 0.001 or <0.05 show that the data is not distributed normally. This condition refers to the asymmetry of the data caused by high volatility or other external factors.

In the risk variable, the significance value for Cryptocurrency is 0.076 and forex is 0.200 or >0.05 , showing that the risk data for Cryptocurrency and forex are distributed normally. This shows that the fluctuations in risk are still within the reasonable statistical distribution and do not show any major deviations. Meanwhile, the significance value on the risk of Stocks of 0.001 or <0.05 shows that the data on stock instruments are not distributed normally. This shows that the risk level of stocks is erratic and tends to be extreme.

In the Sharpe variable, the significance value of the three instruments, namely Cryptocurrency, stocks, and forex of 0.200 or >0.05 , shows that all sharpe ratio data is normally distributed. This shows that the data on the Sharpe variable indicate that investment performance measured by this method tends to be consistent and not affected by extreme volatility in the three instruments.

In the Treynor variable, the significance value of the three instruments, namely Cryptocurrency, stocks, and forex of 0.200 or >0.05 , shows that the data on the Treynor variable is normally distributed. This indicates that the comparison between return and risk is systematic in Cryptocurrencies, Stocks, and Forex tends to follow a symmetrical and consistent distribution pattern.

In the Jensen variable, the significance value for Cryptocurrency is 0.200, Stocks are 0.084, and forex is 0.94 or the significance value for all three instruments, >0.05 shows normal distributed data. This shows that the excess return generated against the market is quite stable and is not affected by extreme deviations.

Based on the results of the Normality test, some test results are obtained from data that is not distributed normally, then it will be continued with a non-parametric statistical test, namely the Kruskal-Wallis test.

Homogeneity Test

Table 8. Homogeneity Test Result

Variable	Information	Levene Statistic	df1	df2	Sig.
Return	Based on Mean	49,267	2	108	,000
	Based on Median	49,216	2	108	,000
	Based on Median and with adjustedddf	49,216	2	42,306	,000
	Based on trimed mean	49,394	2	108	,000
Risk	Based on Mean	7,470	2	108	,000
	Based on Median	5,332	2	108	,000
	Based on Median and with adjustedddf	5,332	2	59,362	,007
	Based on trimed mean	5,887	2	108	,004
Sharpe	Based on Mean	1,303	2	108	,276
	Based on Median	1,113	2	108	,332
	Based on Median and with adjustedddf	1,113	2	98,852	,333
	Based on trimed mean	1,307	2	108	,275
Treynor	Based on Mean	38,930	2	108	,000
	Based on Median	38,701	2	108	,000
	Based on Median and with adjustedddf	38,701	2	46,119	,000
	Based on trimed mean	38,712	2	108	,000
Jensen	Based on Mean	28,975	2	108	,000
	Based on Median	24,595	2	108	,000
	Based on Median and with adjustedddf	24,595	2	46,119	,000
	Based on trimed mean	28,667	2	108	,000

In the homogeneity test of the Return variable, the significance value of the three instruments was 0.001 or <0.05 , showing that the return variable had inhomogeneous data. This shows that there are significant differences in the variance of returns of cryptocurrencies, stocks and forex, this difference indicates that each instrument has varying return characteristics.

In the homogeneity test of the risk variable, the significance value of the three instruments was 0.001 or <0.05 , showing that the data on the risk variable was not homogeneous. This means that the level of risk variation between instruments is statistically very different, with stock volatility being more volatile than crypto and forex.

In contrast to the previous variable, in the homogeneity test of the Sharpe variable, the significance value on the three instruments was 0.276 or >0.05 showing that the data on the Sharpe variable was homogeneous. This indicates that, although the levels of return and risk between instruments are different, the ratios between the two tend to be similar, creating consistency in the evaluation of portfolio performance.

In the homogeneity test of the Treynor variable, the significance value for the three instruments was 0.001 or <0.05 , indicating that the data on the Treynor variable was not homogeneous. This shows that the efficiency of systematic risk returns varies significantly, indicating that the level of sensitivity to the market is not uniform.

In the Jensen variable homogeneity test, the significance value on the three instruments was 0.001 or <0.05 , indicating that the Jensen variable data was not homogeneous. This means that the ability of instruments to outperform market returns is not uniform, this shows that some instruments have the potential for more stable and consistent market advantage.

Kruskal-Wallis Test

Table 9. Ranking Kruskall-Wallis

Ranks			
	Types	N	Mean Rank
Return	Cryptocurrency	37	77,69
	Stock	37	53,31
	Forex	37	37,00
	Total	111	
Risk	Cryptocurrency	37	93,00
	Stock	37	52,78
	Forex	37	22,22
	Total	111	
Sharpe	Cryptocurrency	37	90,32
	Stock	37	57,14
	Forex	37	20,54
	Total	111	
Treynor	Cryptocurrency	37	71,00
	Stock	37	25,51
	Forex	37	71,49
	Total	111	
Jensen	Cryptocurrency	37	91,68
	Stock	37	55,35
	Forex	37	20,97
	Total	111	

Table 10. Kruskal-Wallis Test

	Test Statistics ^{a,b}				
	Return	Risk	Sharpe	Treynor	Jensen
Chi-Square	29,952	90,025	87,029	49,795	89,290
Df	2	2	2	2	2
Asymp. Sig.	,000	,000	,000	,000	,000

The results of the Kruskal-Wallis test on the return variable showed a significance value of 0.001 or <0.05 . Which means there is a significant difference between the returns of Cryptocurrencies, Stocks, and Forex. This difference reinforces the H1 hypothesis with Cryptocurrencies occupying the top position, followed by Stocks, and Forex being the lowest. These results show that Cryptocurrencies offer higher profits even with great volatility. This return advantage is the main attraction for aggressive investors.

The results of the Kruskal-Wallis test on the risk variable with a significance value of 0.001 or <0.05 show that there is a significant difference between the risk of Cryptocurrency,

Stocks and Forex. The H2 hypothesis is accepted, where cryptocurrencies have the highest mean risk, followed by Stocks, and Forex. The high risk in cryptocurrencies is caused by regulatory uncertainty, extreme price fluctuations, and uneven adoption of technology. Investors entering the crypto market must have a strong risk management strategy and a high tolerance for uncertainty.

The results of the Kruskal-Wallis test on the Sharpe variable with a significance value of 0.001 or <0.05 show that there is a significant difference between the Sharpe method of Cryptocurrency, Stocks and Forex. The H3 hypothesis is accepted, with the highest mean order being Cryptocurrencies, then Stocks, and Forex. The higher sharpe ratio in cryptocurrencies shows that despite the high risk, the return is much greater than the risk faced. Crypto investors tend to earn decent returns even when the market is volatile.

The results of the Kruskal-Wallis test on the Treynor variable with a significance value of 0.001 or <0.05 show that there is a significant difference between Cryptocurrencies, Stocks and Forex through the Treynor Method. The H4 hypothesis is accepted, where Cryptocurrencies have the highest mean treynor followed by Stocks, and the lowest Forex. The high treynor ratio shows that this instrument is able to provide higher returns despite the systematic risks faced are greater. Cryptocurrencies, although highly exposed to market risks, are still able to provide returns that are comparable to or even exceed expectations for those risks.

The results of the Kruskal-Wallis test on the Jensen variable with a significance value of 0.001 or <0.05 show that there is a significant difference between Cryptocurrencies, Stocks and Forex through the Jensen method. The H5 hypothesis is accepted, with Cryptocurrencies having the highest Jensen mean, followed by stocks and Forex with the lowest mean. The Jensen method considers the actual returns obtained compared to the expected returns based on systematic risk. These results show that cryptocurrencies are consistently able to generate returns that exceed market expectations. This cements crypto's position as an instrument with outperforming potential, especially in a dynamic and yet fully efficient market environment.

CONCLUSION

This research concludes that significant differences exist between cryptocurrencies, stocks, and forex in returns, risk, and performance metrics (Sharpe, Treynor, and Jensen's Alpha). Cryptocurrencies demonstrated the highest profit potential but with substantially greater risk, while stocks offered a balanced return-risk profile, and forex provided lower risk alongside more limited returns. Although cryptocurrencies outperformed across all methods, investors should not rush into this market; instead, they must consider price drivers and broader market factors to mitigate potential losses. Future research could expand comparisons to additional alternative assets, such as commodities or real estate, using extended timeframes and advanced risk models like Value at Risk (VaR) for deeper insights.

REFERENCES

Ardiansyah, A. (2024). *Analisis perbandingan kinerja Bitcoin dan indeks saham LQ-45 periode 2023–2024* [Skripsi, Universitas Jambi].

Astuti, W. K., Lestari, N. A. R., & Herlambang, S. (2021). Small town urbanization and project experimentation in Pangandaran region, Indonesia. *Human Geographies*, 15, 169–183.

Barry, S., & Abubakar, A. (2024). Analisis kelayakan investasi pada cryptocurrency sebagai alternatif investasi. *Jurnal Riset Keuangan*, 2.

Habib, S., Habib, M., & Batool, S. (2024). Cross-market volatility dynamics among crude oil and South Asian emerging markets during the COVID-19 pandemic. *International Journal of Management Research and Emerging Sciences*, 14(3). <https://doi.org/10.56536/ijmres.v14i3.644>

Hatta, S. (2024). *Analisis perbandingan imbal hasil dan korelasi investasi pada dolar, emas, dan IHSG periode 2013–2022* [Skripsi, Universitas Islam Indonesia].

Hidayah, N., & Saidah, A. N. (2024). Unveiling the dynamics: Impact of cryptocurrency returns, forex rates, and gold prices on IHSG. 8(3).

Huber, C., Huber, J., & Kirchler, M. (2021). Market shocks and professionals' investment behavior: Evidence from the COVID-19 crash. *Journal of Banking & Finance*, 133, 106247.

Husaeni, U. A., Priyatno, D., Paminto, S. R., & Syaddad, H. N. (2024). Determinants of public investment decision in forex robots trading: Evidence from Indonesia. *Asian Journal of Business and Accounting*, 17(1), 119–145. <https://doi.org/10.22452/ajba.vol17no1.4>

Kim, K., Park, H., & Kim, H. (2017). Real options analysis for renewable energy investment decisions in developing countries. *Renewable and Sustainable Energy Reviews*, 75, 918–926.

Koehler, S., Dhameliya, N., Patel, B., & Anumandla, S. K. R. (2018). AI-enhanced cryptocurrency trading algorithm for optimal investment strategies. *Asian Accounting and Auditing Advancement*, 9(1), 101–114.

Liang, J., Li, L., Chen, W., & Zeng, D. (2019). Towards an understanding of cryptocurrency: A comparative analysis of cryptocurrency, foreign exchange, and stock. In *2019 IEEE International Conference on Intelligence and Security Informatics (ISI)* (pp. 137–139). <https://doi.org/10.1109/ISI.2019.8823373>

Mikhaylov, A., Sokolinskaya, N., & Lopatin, E. (2019). Asset allocation in equity, fixed-income and cryptocurrency on the base of individual risk sentiment. *Investment Management and Financial Innovations*, 16, 171–181.

Nafiu, A., Balogun, S. O., Oko-Odion, C., & Odumuwagun, O. O. (2025). Risk management strategies: Navigating volatility in complex financial market environments. *World Journal of Advanced Research and Reviews*, 25(1), 236–250.

Nurminen, T. (2024). *International diversification: Portfolio optimization with developed, emerging and frontier markets*.

Otenko, I., Hrabynskyi, I., Lytvynenko, A., Lytvynenko, E., Povoroznyk, M., & Nikitin, D. (2022). *The impact of the COVID-19 pandemic on the dynamics of financial instruments in the world trade*.

Patel, R., Gubareva, M., Chishti, M. Z., & Teplova, T. (2024). Connectedness between healthcare cryptocurrencies and major asset classes: Implications for hedging and investment strategies. *International Review of Financial Analysis*, 93, 103181. <https://doi.org/10.1016/j.irfa.2024.103181>

Rachmad, Y. E. (2025). *Danantara's path to economic sovereignty: Strengthening national wealth through strategic investments*. United Nations Global Compact.

Sudacevschi, M. (2021). Diversifying investment portfolios by alternative assets. *Challenges*

of the Knowledge Society, 906–910.

Tanjung, A. F., Adha, R., & Marliyah. (2024). Analisis perkembangan pasar derivatif di Indonesia. *Jurnal EMT KITA*, 8(1), 285–294. <https://doi.org/10.35870/emt.v8i1.2047>

Ullah, M., Sohag, K., Doroshenko, S., & Mariev, O. (2024). Examination of Bitcoin hedging, diversification and safe-haven ability during financial crisis: Evidence from equity, bonds, precious metals and exchange rate markets. *Computational Economics*, 1–33.

Wulan, A., Ma'mun, S. Z., & Maksar, M. S. (2024). Analisis aset safe-haven untuk pasar saham di Indonesia: Studi pada emas dan Bitcoin. *Jurnal Ilmiah Manajemen, Ekonomi, & Akuntansi (MEA)*, 8(1), 753–769. <https://doi.org/10.31955/mea.v8i1.3737>

Yanida, P., Pratiwi, L. N., & Nugrahani, W. P. (2023). Comparative evaluation of portfolio performance: A study of cryptocurrency, stock, and foreign exchange investments. *Jurnal Ilmu Keuangan dan Perbankan (JIKA)*, 13(1), 45–62. <https://doi.org/10.34010/jika.v13i1.10314>