Navigating Investment Options: Risk-Return Assessment of Cryptocurrencies, Gold, and Exchange Rates

S. Lakshmi[1], A. Gopinath[2]

[1]Research Scholar, Annamalai University, Chidambaram, Email: lakshmee333@gmail.com
[2]Assistant Professor, Department of Business Administration, Annamalai University, Chidambaram, Email: lashugopi@gmail.com

ABSTRACT

This paper assesses the risk-return profiles of cryptocurrencies (Bitcoin and Ethereum), gold, and exchange rates (USD/INR, EUR/INR) to determine their attractiveness as investment options. Using data spans the last five years, from January 2019 to December 2023.weanalyze simple returns, volatility, and the Sharpe ratio for each asset class. Our findings reveal significant differences in risk and return characteristics, highlighting the diverse investment opportunities these assets offer. Bitcoin and Ethereum exhibit high returns but with substantial volatility, making them suitable for high-risk tolerance investors. Gold provides stable returns with lower volatility, serving as a safe-haven asset. Exchange rates offer moderate risk and returns, ideal for investors seeking currency exposure and diversification. This comparative analysis aims to guide investors in optimizing their portfolios based on individual risk preferences and investment goals.

Keywords: Risk adjusted returns, Sharpe ratio,volatility.

INTRODUCTION

In an increasingly complex and dynamic financial landscape, investors are continually seeking asset classes that offer optimal returns while managing risk effectively. Traditional assets such as gold have long been favored for their stability and role as a hedge against economic uncertainty. However, the advent of digital assets, particularly cryptocurrencies like Bitcoin (BTC) and Ethereum (ETH), has introduced new dimensions to investment strategies. Additionally, foreign exchange markets, exemplified by currency pairs such as USD/INR and EUR/INR, provide further avenues for diversification and potential gains.

This paper aims to assess and compare the risk-return profiles of these diverse asset classes. By analyzing historical performance data over the past five years, we seek to provide a comprehensive understanding of their attractiveness to different types of investors. The analysis focuses on three main metrics: annualized returns, volatility (standard deviation), and the Sharpe ratio. These metrics collectively offer insights into the potential rewards and risks associated with each asset class.

Bitcoin and Ethereum have garnered significant attention due to their impressive returns and technological underpinnings. However, their high volatility raises questions about their suitability for all investors. Gold, on the other hand, continues to be a cornerstone of traditional investment portfolios, known for its relative stability and long-term value preservation. Exchange rates, influenced by a myriad of economic factors, present a unique investment opportunity with moderate risk and return profiles.

This study aims to guide investors in making informed decisions by highlighting the risk and return characteristics of each asset class. Understanding these profiles is crucial for building diversified portfolios that align with individual risk tolerances and investment objectives. The findings of this paper are expected to contribute to the broader discourse on investment strategies in the context of an evolving financial environment.

REVIEW OF LITERATURE

Sunita, Dasman[1explored the potential use of Bitcoin as an investment instrument in Indonesia, comparing its returns to those of stocks, gold, and the rupiah exchange rate. It analyzed the risk-return profile of cryptocurrencies, particularly Bitcoin, in comparison to gold and exchange rates. The findings revealed that Bitcoin offered a high return of 18% with a standard deviation of 61%, highlighting its potential as a high-return, high-risk investment compared to other traditional assets.

Putu.,Gede, Diatmika[2] compares the portfolio performance, risk, and return of Bitcoin with equities and gold as alternative investments in the digital age. It emphasizes the rise of cryptocurrencies since 2008, which enable secure digital transactions through cryptographic algorithms, focusing on Bitcoin's performance relative to traditional investments like stocks and gold. Utilizing a quantitative approach, the study collects numerical data and employs statistical procedures to compare the performance of various investment instruments, specifically digital currencies, stocks, and gold. Through a saturated sampling strategy, it gathers 180 data points, with 60 records for each investment instrument. The analysis evaluates portfolio performance, risk, and return, ultimately revealing significant differences in risk but not in returns among Bitcoin, IDX30 shares, and Antam gold.

Salih[3] examines the risk-return trade-off in the cryptocurrency market, focusing on the top five cryptocurrencies with high transaction volumes: BTC, ETH, ADA, XRP, and LTC. It employs the EGARCH-M model to analyze the statistical relationship between risk and return in these digital assets, specifically assessing asymmetric effects in volatility. The analysis considers three distinct time periods: pre-pandemic, pandemic, and the overall period, providing a comprehensive evaluation of the risk-return dynamics in the crypto market. The findings reveal that Cardano (ADA) is the only cryptocurrency with a significant risk-return interaction, particularly during the pandemic period and persisting throughout the study duration. In contrast, no significant risk-return trade-off relationship is observed for other cryptocurrencies like Bitcoin, Ethereum, Ripple, and Litecoin, indicating variations in how risk and return are linked across different digital assets.

Kontigensi[4] evaluates the return and risk of cryptocurrency assets to determine which ones offer high returns with minimal risk, using the Kruskal-Wallis test and paired sample t-test. The findings indicate that Bitcoin, Ethereum, and Dogecoin do not show significant differences in returns or risks. However, a significant price difference is observed for Bitcoin and Ethereum before and after the COVID-19 pandemic announcement, whereas Dogecoin's price does not show a significant change in this period. Before investing, it is advisable to assess the ability of cryptocurrency assets to minimize risks and to clarify whether the investment objectives are for the long term or short term..

Muhammad [5] aims to assess the performance and behavior of fiat- and gold-backed cryptocurrencies to assist stakeholders in portfolio preparation from January 1, 2021, to June 30, 2022. While searching for a hedge or diversifier to construct a less risky portfolio with attractive returns, the prices of fiat-backed cryptocurrencies showed high fluctuation during the sample period. ARIMA-EGARCH models were employed to analyze the volatility of these cryptocurrencies. The empirical results are mixed, with Bitcoin exhibiting high volatility during the economic recession, prompting investors to seek safer options. In contrast, Ripple demonstrates lower risk compared to Bitcoin. Additionally, the study reveals that PAX Gold is more volatile than PM Gold, while Bitcoin, being a highly traded cryptocurrency, is significantly correlated with other cryptocurrencies. The findings on the volatility of gold- and fiat-backed cryptocurrencies are crucial for stakeholders, including investors and policymakers.

Audrey[6]investigates the use of cryptocurrencies as investment instruments, drawing parallels to financial assets like stocks. Similar to stocks, cryptocurrencies exhibit a high risk-high return profile, but their fluctuations are more dynamic. Professional investors typically conduct volatility analyses to identify cryptocurrencies that might offer the best returns. Returns are generally assessed based on average or expected value, while investment risk is estimated through volatility. This research focused on analyzing the average returns and volatility of cryptocurrencies, specifically examining five cryptocurrencies listed as top gainers in the 30-day update of September 2022. The findings reveal that Monero (XMR) provides the best expected return with the lowest volatility. These insights can aid investors in making informed decisions about cryptocurrency investments.

Sylwester[7] compares the risk levels of investments in the cryptocurrency market with those in global capital markets from 2011 to 2020, finding that cryptocurrencies exhibit higher risk measures. Using quotations of the analyzed instruments, the study estimates risk levels through standard deviation and semi-standard deviation of daily logarithmic rates of return. The findings indicate that investing in cryptocurrencies is riskier than investing in shares of the largest international companies. However, the level of risk decreases as cryptocurrencies remain longer in the market. The pursuit of extraordinary returns leads to increased demand and volatility in cryptocurrency prices. Overall, the risk associated with investing in cryptocurrencies is significantly higher compared to global capital market indexes.

Thomas[8] aimed to document the volatility and risk-return trade-off of four prominent cryptocurrencies—Bitcoin, Ethereum, Binance, and Ripple—based on market capitalization. For investors, volatility is crucial as it reflects the rate at which a security's price fluctuates over a specific period. High volatility implies high risk, making it essential to assess volatility and the risk-return trade-off in investments. The study utilized Standard Deviation and Kurtosis for volatility and risk assessment, finding that Bitcoin exhibited the highest volatility and associated risk. Regression analysis showed that

Ethereum had a strong, but not very strong, relationship with Bitcoin's price among the pairs analyzed. The Durbin-Watson (DW) test indicated no auto-correlation in cryptocurrency prices, meaning past prices do not significantly influence current prices. For the risk-return trade-off, the Coefficient of Variation (CoV) was applied, revealing that Ethereum had the highest ratio, making it unsuitable for conservative investors due to its high risk relative to returns. In contrast, Binance had the lowest CoV, indicating lower risk and maximum return among the cryptocurrencies studied.

Sulalitha[9]introduces a data-driven portfolio risk measure that incorporates skewness and kurtosis to determine optimal portfolio weights for cryptocurrency assets using hourly price data. It emphasizes the superiority of data-driven methods over traditional portfolio standard deviation methods for portfolio selection, highlighting the significance of including skewness and kurtosis in risk measures for cryptocurrencies. By utilizing hourly adjusted closing prices, the study provides a detailed analysis, enabling high-frequency analysis with big data, and revealing high excess kurtosis in cryptocurrency returns. Although the study examines 8,000 combinations of random weights for optimal portfolio selection, solving the optimization problem for ideal weights is computationally intensive and beyond the scope of this research.

METHODOLOGY
1. Data Collection
Data for this study was collected from investing.com to ensure accuracy and comprehensiveness. The asset classes under analysis include cryptocurrencies (Bitcoin and Ethereum), gold, and exchange rates (USD/INR and EUR/INR). The data spans the last five years, from January 2019 to December 2023.
2. Calculating Returns
1. Simple Return
The simple return (also known as the holding period return) measures the percentage change in the value of an investment over a specific period.

$$\text{Simple Return} = \frac{P_{\text{end}} - P_{\text{start}}}{P_{\text{start}}}$$

where P_{end} is the ending price, and P_{start} is the starting price.

3. Measuring Volatility
- **Standard Deviation**

Volatility was measured using the standard deviation of daily returns, which was then annualized. The formula for annualized standard deviation is:

$$\text{Annualized Volatility} = \sigma \times \sqrt{252}$$

where σ is the standard deviation of daily returns, and 252 represents the number of trading days in a year.
4. Risk-Adjusted Return
- **Sharpe Ratio**

The Sharpe ratio was calculated to assess the risk-adjusted return of each asset class. It measures the excess return per unit of risk. The formula is:

$$\text{Sharpe Ratio} = \frac{R_a - R_f}{\sigma_a}$$

where R_a is the annualized return of the asset, R_f is the risk-free rate (approximated by the yield on 10-year government bonds), and σ_a is the annualized volatility.
5. Comparative Analysis
- Descriptive Statistics: Summary statistics, including mean, median, maximum, minimum, and standard deviation, were calculated for each asset class to provide a comprehensive overview of their historical performance.
- Correlation Analysis: The correlation between the returns of different asset classes was calculated to understand the diversification benefits.

ANALYSIS

The analysis of the returns data reveals distinct characteristics for each series. In Table 1 summarizes that Ethereum Returns demonstrates the highest average return at 0.0847, indicating the best overall performance, while EUR/INR Returns has the lowest average return at 0.0023. In terms of volatility, USD/INR Returns stands out with the lowest standard deviation (0.0130), suggesting it is the least volatile, whereas Ethereum Returns exhibits the highest volatility with a standard deviation of 0.2656. This is further supported by the sample variance, where USD/INR Returns has the smallest spread of returns (0.0002) compared to Ethereum Returns (0.0706).

Table 1. Descriptive Statistics Of Each Asset Class

	BITCOIN	**ETHEREUM**	**GOLD**	**USD/INR**	**EUR/INR**
Mean	0.062723	0.08467	0.008409	0.002784	0.002278
Standard Error	0.026715	0.03458	0.00531	0.001697	0.002606
Median	0.039011	0.07432	0.000495	0.002336	0.000953
Standard Deviation	0.205201	0.26563	0.040789	0.013034	0.020016
Sample Variance	0.042108	0.07056	0.001664	0.00017	0.000401
Kurtosis	-0.45188	0.07558	-0.66714	0.608429	-0.31047
Skewness	0.259832	0.54743	0.26279	0.378525	0.126201
Range	0.896801	1.23398	0.173144	0.061884	0.085306
Minimum	-0.37286	-0.4496	-0.07017	-0.0233	-0.03959
Maximum	0.52394	0.78433	0.102971	0.038589	0.045716
Sum	3.70063	4.99609	0.496137	0.164265	0.13438
Count	59	59	59	59	59

Examining the distribution, USD/INR Returns has the highest kurtosis (0.6084), indicating the presence of more extreme outliers, while Gold Returns shows the lowest kurtosis (-0.6671), suggesting fewer extreme values. All return series are positively skewed, but Ethereum Returns is the most positively skewed (0.5474), reflecting more frequent high returns. The range of returns also varies significantly, with Ethereum Returns having the widest range (1.2340) and USD/INR Returns the narrowest (0.0619), highlighting the variability in their extreme values.

Regarding minimum and maximum returns, Ethereum Returns again displays the most extreme values, ranging from -0.4496 to 0.7843, whereas USD/INR Returns has the least extreme values, ranging from -0.0233 to 0.0386. Lastly, considering the total return over the period, EthereumReturns leads with a sum of 4.9961, while EUR/INR Returns has the lowest total return at 0.1344. Each series comprises 59 observations.

In summary, Ethereum Returns excels in performance but with higher risk and variability, USD/INR Returns offers stability with lower risk and volatility, and EUR/INR Returns, despite lower performance, shows moderate risk characteristics.

Table 2. Sharpe Ratio

ASSET-CLASS	**SHARPE RATIO**
Bitcoin	0.293644891
Ethereum	0.309499629
Gold	0.145696905
USD/INR	0.02438934
EUR/INR	-0.009424819

The table 2 summarizes the Sharpe Ratios for different asset classes: Bitcoin, Ethereum, Gold, USD/INR, and EUR/INR.The Sharpe Ratio analysis reveals the risk-adjusted returns for Bitcoin, Ethereum, Gold, USD/INR, and EUR/INR. Bitcoin, with an average monthly return of 0.0627 and a standard deviation of 0.2052, achieves a Sharpe Ratio of 0.2936. This indicates that Bitcoin offers a moderate risk-adjusted return, balancing its substantial excess return against its high volatility. Ethereum, showing the highest average return of 0.0847 and the highest volatility at 0.2656, attains a Sharpe Ratio of 0.3095, making it the asset with the best risk-adjusted return among those analyzed, slightly surpassing Bitcoin.

Gold, with a much lower average monthly return of 0.0084 and a standard deviation of 0.0408, yields a Sharpe Ratio of 0.1457. This signifies that while Gold is less volatile than cryptocurrencies, its risk-adjusted return is also lower. The USD/INR exchange rate, characterized by minimal returns (0.0028) and low volatility (0.0130), has a very low Sharpe Ratio of 0.0244, indicating negligible excess returns over the risk-free rate when adjusted for risk.

EUR/INR presents the lowest average return (0.0023) and a standard deviation of 0.0200, resulting in a negative Sharpe Ratio of -0.0094. This negative value suggests that EUR/INR's returns are less than the risk-free rate, leading to a negative risk-adjusted return. Overall, Ethereum and Bitcoin provide higher risk-adjusted returns compared to Gold, USD/INR, and EUR/INR, though this comes with greater volatility. Gold offers more stability but a lower risk-adjusted return, while the currency pairs show minimal to negative risk-adjusted returns, with EUR/INR performing the worst relative to the risk-free rate.

Table 3. Correlation Matrix of each asset class

	Bitcoin	**Ethereum**	**Gold**	**USD/INR**	**EUR/INR**
Bitcoin	1				
Ethereum	0.738144611	1			
Gold	0.208077102	0.15837228	1		
USD/INR	-0.24133549	-0.36076524	-0.274487163	1	
EUR/INR	0.052883722	-0.04440932	0.422756539	0.295037098	1

The correlation matrix reveals insightful relationships between Bitcoin, Ethereum, Gold, USD/INR, and EUR/INR. Bitcoin and Ethereum show a strong positive correlation of 0.7381, indicating that their prices tend to move together. This strong linkage suggests that factors affecting Bitcoin are likely to similarly impact Ethereum. Gold, on the other hand, has a moderate positive correlation with Bitcoin (0.2081) and a weaker positive correlation with Ethereum (0.1584), implying that while they may move in the same direction, the relationship is not as strong as between Bitcoin and Ethereum.

The USD/INR exchange rate exhibits negative correlations with Bitcoin (-0.2413), Ethereum (-0.3608), and Gold (-0.2745). This inverse relationship suggests that as the USD/INR exchange rate increases, the prices of these assets tend to decrease, and vice versa. The most notable negative correlation is with Ethereum, indicating that fluctuations in the USD/INR rate have a more pronounced opposite effect on Ethereum's price.

Finally, EUR/INR shows a mixed correlation pattern. It has a weak positive correlation with Bitcoin (0.0529) and a slight negative correlation with Ethereum (-0.0444), suggesting that the EUR/INR exchange rate has minimal impact on these cryptocurrencies. However, EUR/INR has a moderate positive correlation with Gold (0.4228) and USD/INR (0.2950), indicating that movements in the EUR/INR rate are somewhat aligned with those of Gold and USD/INR.

In summary, Bitcoin and Ethereum are closely linked, while Gold maintains a modest relationship with both. Exchange rates, particularly USD/INR, show an inverse relationship with cryptocurrencies and Gold, suggesting a diversification benefit when including them in a portfolio. EUR/INR's relationship with Gold and USD/INR highlights its role in currency and commodity dynamics.

CONCLUSION

The analysis indicates that Ethereum offers the highest risk-adjusted returns, closely followed by Bitcoin. Both cryptocurrencies are volatile but provide substantial returns. Gold provides stability with moderate returns. The currency pairs USD/INR and EUR/INR offer the lowest risk-adjusted returns. Correlations show that Bitcoin and Ethereum returns tend to move together, while USD/INR generally moves in the opposite direction to the cryptocurrencies and gold. Overall, Ethereum and Bitcoin are preferable for higher risk-adjusted returns, while Gold offers stability, and the currency pairs offer minimal benefits.

In summary, for investors seeking higher risk-adjusted returns, Ethereum and Bitcoin appear to be more attractive options despite their higher volatility. Gold offers a more stable investment but with lower risk-adjusted returns. The currency pairs, USD/INR and EUR/INR, are less favorable due to their minimal to negative risk-adjusted returns, reflecting their relatively low volatility but insufficient compensation for risk.

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