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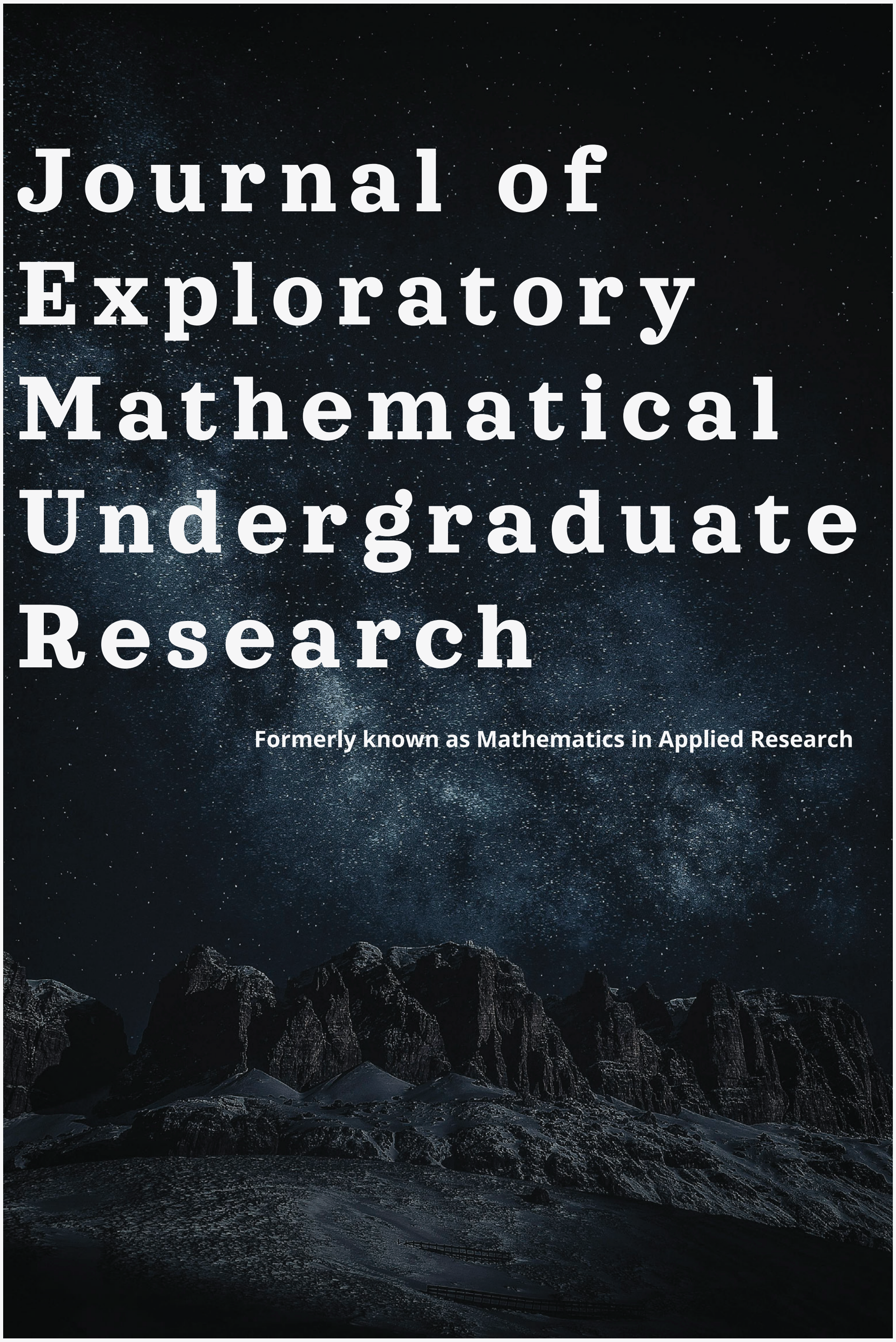

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PORTFOLIO OPTIMISATION FOR MALAYSIAN TOP 30 AND MID 70 ASSETS USING MEAN-MAD MODEL

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Abstract

This study explores Mean Absolute Deviation (MAD) model portfolio optimisation for the Top 30 and Mid 70 Malaysian assets, focusing on risk reduction for higher returns. Implementing MAD model, the research demonstrates its efficacy in achieving intended returns and managing risk for both asset categories. In the in-sample study, a trade-off between maximizing returns and risk management is observed, revealing a positive association between better returns and increased risk. Mid 70 assets show potential for smaller absolute deviation, indicating lower risk and making them ideal for portfolio optimisation. Backtesting results highlight favourable outcomes, but the study emphasizes the need for careful analysis as MAD may understate risk in some cases. Overall, the research significantly contributes to understanding portfolio optimization in the Malaysian market, showcasing MAD model flexibility and providing valuable insights for investors and financial specialists.

Keywords: Portfolio optimisation, mean absolute deviation, Malaysian assets, risk minimization

1. Introduction

Portfolio optimization is crucial in the dynamic Malaysian economy, where market volatility underscores the need for robust investment strategies. Through the Mean Absolute Deviation (MAD) model, this study seeks to optimize portfolios for the Top 30 and Mid 70 Malaysian assets, addressing the urgent demand for strategic investment frameworks. Stemming from Markowitz's seminal work in 1952, the MAD model offers a practical alternative to quadratic programming, simplifying the optimization process. Various extensions and robust optimization models have been explored, including those by Kellerer et al. (2000), Mansini et al. (2014), and Moon and Yao (2011). Leveraging the Mean-MAD model, as pioneered by Konno and Yamazaki (1991), offers a robust approach to minimize portfolio risk, especially in the Malaysian stock market context (Lam et al., 2021). The Mean-MAD model, often integrated with other risk measures like Conditional Value at Risk (CVaR), presents an efficient method for optimizing portfolios across diverse financial assets, including those in Malaysia (Silva et al., 2017).

This study fills a gap by examining the MAD model's performance in optimising portfolios for Malaysia's Top 30 and Mid 70 assets. The research intends to provide insights into creating investment frameworks that correspond with the distinctive characteristics of the Malaysian market. It also investigates the behaviour of in-sample analysis and out-sample analysis to find out if the Mean-MAD model can handle different market or not. The findings add to financial modelling knowledge and have practical consequences for investors and practitioners navigating the intricacies of Malaysia's financial markets. Therefore the objective of this study are (i) to construct a portfolio in which MAD is minimise for Top 30 and Mid 70 Malaysian assets by using the Mean-MAD model; (ii) to analyse the in-sample obtained in (i) in terms of risk measure for portfolios of each Top 30 and Mid 70 Malaysian assets; and (iii) to validate the in-sample results obtained in (ii) by using out-of-sample analysis.

2. Methodology

The mean absolute deviation model is used for portfolio optimization, specifically focusing on the Top 30 and Mid 70 assets in the Malaysian market. This approach allows to analyze and enhance the performance of the portfolio by considering deviations from the mean. According Konno and Yamazaki (1991) the representation of Mean MAD model is given by

$$\begin{aligned}
\text{minimize} \quad & \frac{1}{T}\sum_{t=1}^{T}\left|\sum_{j=1}^{n}(r_{j,t}-r_j)x_j\right| \\
\text{subject to} \quad & \sum_{j=1}^{n} r_j x_j \geq \rho C \\
& \sum_{j=1}^{n} x_j = C \\
& 0 \leq x_j \leq u_j, \quad j = 1, 2, ..., N
\end{aligned}$$

where the notations for the Mean MAD model are:

x_j : Unit of j to be included in the portfolio
y_t : Deviation below the average rate of return at time period
T : the length of the time horizon
t : Each period over the time horizon
p : Minimum rate of return required by an investor
R_j : A random variable representing the rate of return of assets
r_j : The expected return
$r_{j,t}$: The observed return of assets during the period
u_j : The maximum amount of assets
C : The total portfolio expenditure
N : The total number of stocks

The data used in this study consists of the Top 30 Malaysian assets obtained from the Financial Times Stock Bursa Malaysia Kuala Lumpur Composite Index (FBMKLCI) and the Mid 70 Malaysian assets retrieved from Yahoo Finance. Table 1 presents the extracted data of the closing price for the Top 30 assets, while Table 2 exhibits the same information for the Mid 70 assets. The closing prices for the Top 30 are taken from the Financial Times Stock Bursa Malaysia Kuala Lumpur Composite Index (FBMKLCI), which offers a thorough representation of the Malaysian stock market. The information covers a substantial duration of investment, commencing on October 6, 2003, and concluding on October 6, 2023. The index comprises thirty prominent Malaysian corporations. The closing price for the Mid 70 assets, which are constituents of the FTSE Bursa Malaysia Mid 70 Index, obtained from Yahoo Finance. This index represents the stock market performance of the seventy leading Malaysian companies. The dataset includes the closing prices spanning from October 6, 2008, to October 6, 2023.

Monthly closing prices for every asset in the indices are included in the dataset. A more dynamic analysis is made possible by computing monthly returns after the data collection phase. By using the Excel formula "=LN(closing price second month/closing price first month)," which represents the natural logarithm of the ratio between the closing prices of consecutive months, monthly returns can be calculated.

3. Result and Discussion

3.1. *In-sample portfolios*

Figure 1 illustrates the relationship between the number of assets and the absolute deviation across different levels of target return for the top 30 Malaysian assets in the in sample portfolio 1. For the portfolio with a low target return of 0.9%, the absolute deviation is 0.01999. In addition, given the low target return, only 13 assets have the potential to achieve the targeted portfolio return. The portfolio achieved a return of 1.3% and had an absolute deviation of 0.02259 from the medium target return. At the intermediate target return level, the maximum feasible number of assets is 9. In addition, the target return of

Table 1: Example of the first three rows and five columns of the raw data for the Top 30 Malaysian assets

Date	MALAYAN	PUBLIC	CELCOMDIGI	CIMB	GENTING
6/10/2003	6.79	0.85	0.33	1.81	1.96
6/11/2003	7.33	0.95	0.34	2.11	2.14
6/12/2003	6.93	0.95	0.31	1.10	2.11

Table 2: Example of the first three rows and five columns of the raw data for the Mid 70 Malaysian assets

Date	AEON	AIRASIA	ALLIANCE	ALLIANZ	AMMB
1/11/2008	0.71	1.11	1.92	2.31	2.06
1/12/2008	0.78	0.87	1.82	2.40	2.47
1/1/2009	0.76	0.88	1.89	2.35	2.29

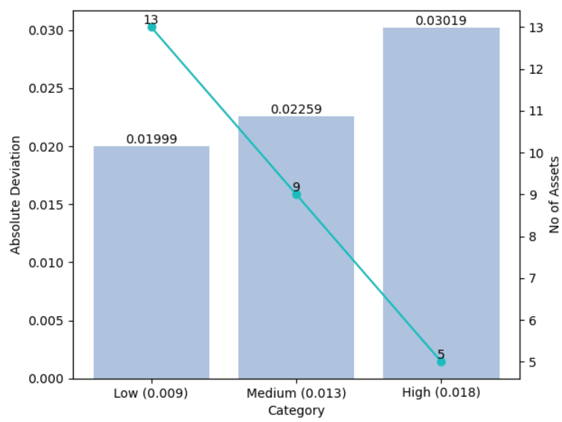

Figure 1: Number of Assets versus the MAD level for in sample portfolio 1 for Top 30 Malaysian Assets

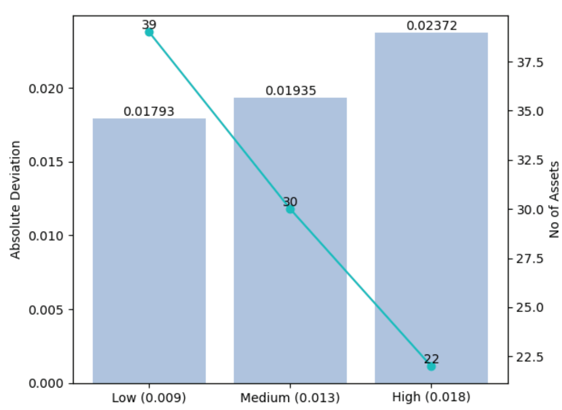

Figure 2: Number of Assets versus the MAD level for in sample portfolio 1 for Mid 70 Malaysian Assets

1.8% is considered high, and the absolute deviation is calculated to be 0.03019. It is feasible to achieve this level of return by having a portfolio comprising of 5 assets.

Figure 2 displays the relationship between the number of assets and the absolute deviation across different levels of target return for a portfolio of 70 Malaysian assets in the Mid 70s, based on the in-sample data of portfolio 1. There are three target returns: low, medium, and high, with values of 0.9%, 1.3%, and 1.8% respectively. These target returns are determined in a similar manner to the portfolios constructed for the Top 30 assets. The number of assets that can be achieved for the low target return is 39, with an absolute deviation of 0.01793. The portfolio with a medium goal return has an absolute deviation of 0.01935. The number of assets that reached this deviation is 30. Furthermore, the 22 assets obtained a high target return, as shown by the absolute deviation of 0.02372.

3.2. *Backtesting: The out-of-sample results*

The Figures 3 and 4 demonstrate that in certain cases, the realised returns exceed the target returns, indicating a favourable outcome. This might be ascribed to favourable market conditions or the efficient optimisation performance of the MAD model. These occurrences are promising since they indicate that the optimised portfolios not only fulfil but surpass the initial expectations.

The result for out-sample 2 and 6 (see Figure 3) and out-sample 2 and 5 (see Figure 4) shows a larger increase in the realised return. The greater increase in realised returns in the out-of-sample indicates strong optimisation performance in favourable market conditions. This further supports the idea that the MAD model is capable of effectively adjusting to advantageous market conditions and producing portfolios that exceed anticipated performance.

In out-of-sample 1 and 8 from Figure 3 and in out-of-sample 1 from Figure 4, there is a decline in realised returns. The MAD model, like other financial models, depends on historical data and certain assumptions. If there are substantial differences in market conditions between the backtesting period and the training period, it is possible for inconsistencies to arise in the realised returns.

3.3. *Validation of the in-sample analysis by mean absolute deviation*

Figure 5 and 6 illustrate the relationship between the Mean Absolute Deviation (MAD) and the realised return obtained from out-of-sample 1 for both the Top 30 and Mid 70 Malaysian assets. The returns are classified into three categories: low, medium, and high.

Based on the provided Figures, it is evident that there is a positive correlation between the realised return and the mean absolute deviation (MAD) for both the Top 30 and Mid 70 Malaysian assets. In other words, when the realised return increases, the MAD also increases. This pattern is consistent with the findings of the in-sample analysis, which indicate that there is a positive correlation between the in-sample return and the mean absolute deviation (MAD). Therefore, the result obtained from the sample is confirmed to be accurate.

4. Conclusion

This study makes a substantial contribution to the field of investment management and portfolio optimisation in the Malaysian market. The research examines the application of the Mean-MAD model and offers helpful information to stakeholders in making informed investment decisions and constructing robust portfolios, particularly in the areas of risk management and portfolio construction. The study's findings provide a foundation for future research to investigate how the model may be adjusted to suit changing market conditions and improve portfolio optimisation tactics in the financial environment of Malaysia.

The aim of this study is to create a portfolio that minimises the Mean Absolute Deviation (MAD) for the Top 30 and Mid 70 Malaysian assets, using the Mean-MAD model. Additionally, the study aims to analyse the risk measure of the Top 30 and Mid 70 Malaysian assets in the in-sample, and validate these results through out-of-sample analysis. Based on an investigation of the top 30 and mid 70 Malaysian assets, it has been demonstrated that the Mean-MAD model portfolio optimisation can be applied to Malaysian assets. Furthermore, the results indicate that there is a positive correlation between risk and return, meaning that as risk increases, so does the potential for higher returns. Conversely, as risk decreases, the potential for lower returns also decreases. This remark has been substantiated by prior research publications and further validated by the findings of this study.

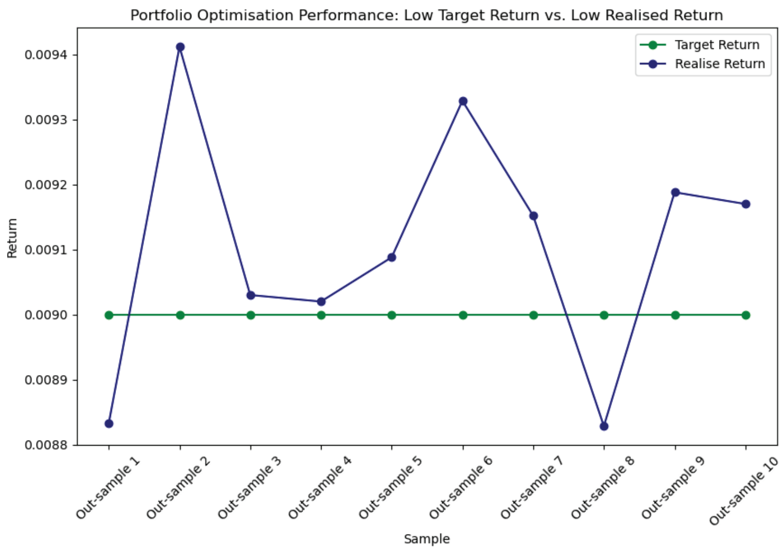

Figure 3: Realised Returns for Portfolios of Top 30 Malaysian Assets

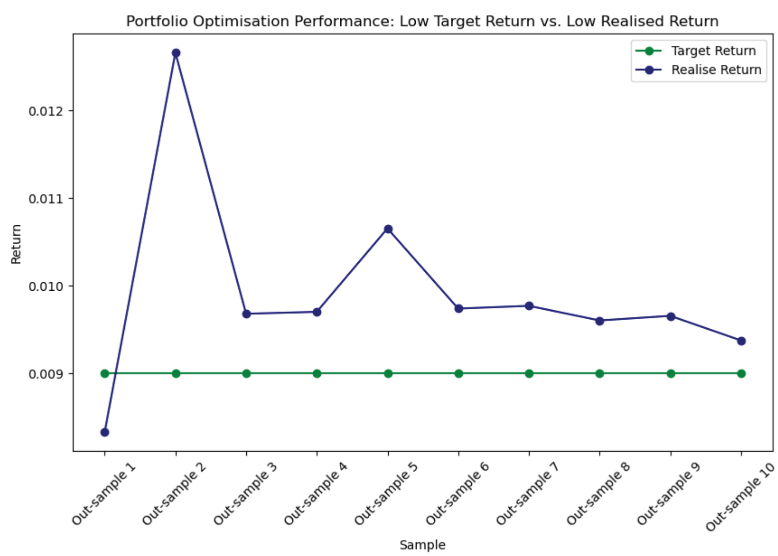

Figure 4: Realised Returns for Portfolios of Mid 70 Malaysian Assets

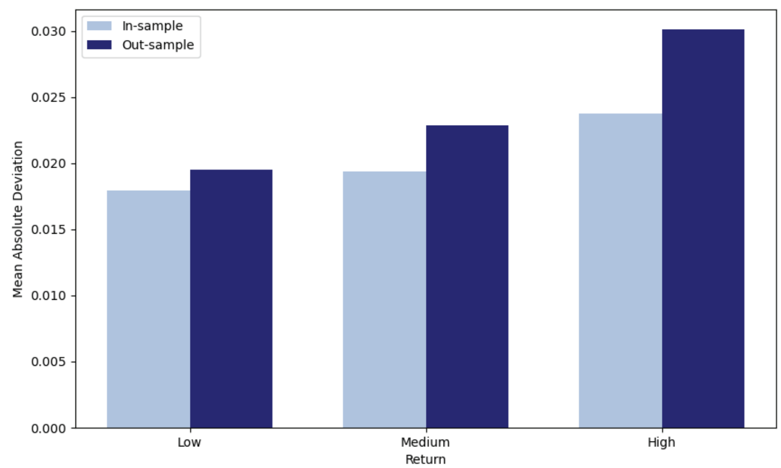

Figure 5: Top 30 Malaysian Assets

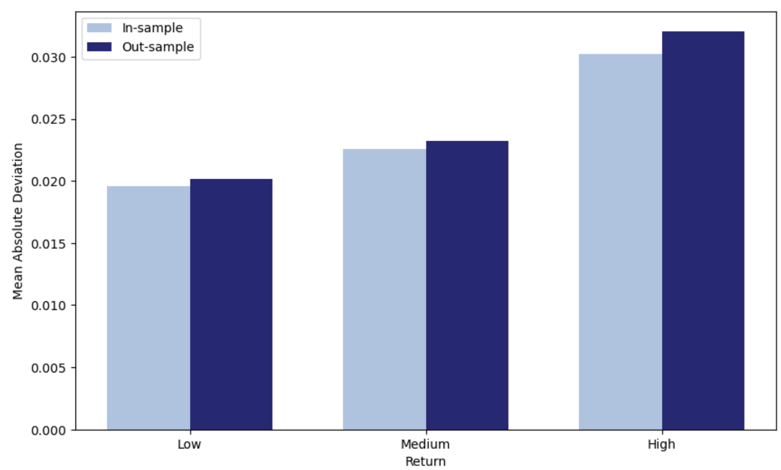

Figure 6: Number of Assets versus the MAD level for in sample portfolio 1 for Mid 70 Malaysian Assets

The analysis conducted on the sample data emphasised the balancing act between increasing returns and effectively managing risk. The pattern observed was consistent in all the samples, highlighting the significance of maintaining diverse approaches in managing portfolios. The correlation between portfolio returns and absolute deviation illustrates that higher returns in the Malaysian market are linked to a proportional rise in risk.

In addition, this study also examines the correlation between the Top 30 and Mid 70 Malaysian assets when comparing both assets with various goal returns. It is evident that the Mid 70s can produce a result with a lower absolute deviation due to the reduced risk of the assets. The model demonstrated its capacity to choose distinct combinations of assets in order to attain goal returns while minimising mean absolute deviation (MAD), highlighting its ability to manage diverse asset categories while maintaining performance.

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