

Constructing an Optimal Portfolio using Efficient Frontier and TOPSIS: A Case Study from Technology Industry

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Introduction

Currently, the technology sector is one of the fastest-growing sectors in the Malaysian market, contributing 18.5% of the country's Gross Domestic Product (GDP) in 2018 and is expected to reach 20% by 2020 (Mangram, 2013). Recently, the stock market all over the world, especially Technology Industry companies faced a major impact during this Covid-19 pandemic season. However, due to the basket of equities available in the local stock market, investors must use certain mathematical techniques or models as a basis to choose a good combination of the stocks to maximize the expected rate of return and minimize the overall risk. Hence, diversification helps in protecting investors against the downside in case a particular asset underperforms (Koumou, 2020).

Previously, various diversification approaches have been developed to determine the optimum weightage in a portfolio to achieve the most significant possible return with the least risk associated. One of the basic concepts of Modern Portfolio Theory (MPT) is Mean-Variance (MV) optimization that was introduced by Harry Markowitz in 1952. MV is a quantitative tool that allows investors to incorporate their preferences by considering the trade-off between the risk and the expected return. The drawback of MV analysis is mainly related to extreme weights that often occur when the sample efficient portfolio comprises a high number of individual stocks (Merton, 1980). Initially, this study will apply Efficient Frontier, a graphical representation of all possible combinations of risky securities for an optimal level of return given a particular level of risk (Markowitz, 1952). A good stock can also be reflected by the performance of respective companies using financial ratios. The right company selection can reduce the influence of firm-specific risk which in turn can maximize the expected return and minimize the portfolio risk (Mohammed Fauzi et al., 2019). Therefore, a proper tool to select a company with the best financial performance is significantly important. Additionally, this study also motivated to employ the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) as an alternative to find the optimal weightage of selected stocks before generating an optimal portfolio (Hwang & Yoon, 1981).

Methodology

The performance of portfolio investment is a classical problem and has been widely discussed by many researchers in the financial sector until today. Thus, this study aims to construct a portfolio consisting of five Shariah-compliant stocks in the technological equipment industry based on Efficient Frontier and the Techniques for Order of Preference by Similarity to Ideal Solution (TOPSIS). Thomson Reuters DataStream and Refinitiv Eikon were used to collect historical monthly closing share prices and financial ratios from 2016 through 2021. This study employed ratios such as current ratio (CR), return on equity (ROE), profit margin (PM), debt on equity ratio (DER), earning per share (EPS), dividend yield (DY) and return on asset (ROA). Finally, the Sharpe ratio is used to compare the performance of diversified portfolios. The portfolio with the highest Sharpe ratio is considered to be the best.

Results and Discussion

The analysis has been done to obtain the optimal weightage using the Efficient Frontier and TOPSIS. It can be observed that the major difference between the two methods employed is the type of data needed as an input to do the analysis. The Efficient Frontier curve requires historical prices of returns and standard deviation of a portfolio to construct a graph of the risk-return relationship, while the ranking of TOPSIS uses financial ratios for each company selected in this study. The optimal weightage using Efficient Frontier and TOPSIS is shown in Table 1 below.



Table 1. The optimal weightage using Efficient Frontier and TOPSIS

Shariah-compliant stocks	Efficient Frontier	TOPSIS
Stock 1	0.33	0.94
Stock 2	0.26	0.64
Stock 3	0.16	0.67
Stock 4	0.08	0.34
Stock 5	0.18	0.37

The results indicate that Stock 1 had excellent performance with the highest average weightage 0.33 and 0.94 in Efficient Frontier and TOPSIS respectively. Thus, Stock 1 was ranked as a superior stock. In contrast, Stock 2 was considered an inferior stock since it has the lowest average weightage of 0.08 and 0.34 in Efficient Frontier and TOPSIS. Additionally, the result also shows that companies with higher financial ratios of the return on equity (ROE), profit margin (PM) and return on assets (ROA) under the profitability category lead to higher ranking in the Technology sector. Meanwhile, if the debt to equity ratio (DER) is high, it may indicate that the company tends to go bankrupt since the ratio is also known as the financial leverage ratio. The empirical results also indicated that the Sharpe ratio using the Efficient Frontier was slightly higher than TOPSIS, 2.497 and 1.979, respectively. Finally, the results proved that a diversified portfolio using Efficient Frontier performs better than the TOPSIS.

Conclusion

Overall, it can be concluded that both methods employed in this study can serve as a guideline for Muslim investors in decision-making based on the principle that investors want the highest return for the lowest risk. The applicability of the TOPSIS method that is previously employed to rank companies has successfully shown that the proposed method is reliable and effective in selecting the right stocks before generating an optimal portfolio in this study.

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