How accurate is the CAPM approach compared to the Reward Beta for shares of manufacturing and mining companies in Indonesia's LQ45 Index?

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Abstract

This study evaluates the efficacy of the Capital Asset Pricing Model (CAPM) and Beta Reward Model in forecasting stock returns of companies within the manufacturing and mining sectors listed on Indonesia's LQ45 index. Utilizing monthly closing stock prices from January 2010 to December 2019, the research focuses on ten companies—five from each sector—that consistently appeared in the index throughout the study period.
The analysis involves a classic assumption test followed by regression analysis for each company. Key performance indicators, including R-squared, Root Mean Square Error (RMSE), and Mean Absolute Error (MAE), are employed to compare the predictive capabilities of the CAPM and Beta Reward Model. The findings indicate a systematic and superior performance of the Beta Reward Model over the CAPM in predicting stock returns in the Indonesian context. This study contributes to the existing literature on stock return prediction models and provides practical insights for investors and financial analysts in Indonesia.

Keywords: *Beta Reward Model, Capital Asset Pricing Model (CAPM), LQ45 Index, Manufacturing and mining sectors*

JEL Classification: G11, G12, G14

INTRODUCTION

In finance, the Sharpe-Lintner Capital Asset Pricing Model (CAPM) is a widely utilized tool for assessing a company's cost of capital. However, its validity has been questioned through various empirical studies, notably by Elbannan, 2014, Fama & French (1992), Merton (1973), and Wu et al. (2017). Subsequent research in 2004 further highlighted empirical challenges associated with CAPM, casting doubt on its applications. This uncertainty has led to increased interest in alternative models, such as the Fama and French three-factor model, which are gaining recognition in empirical finance research (Fama & French, 1993; Wang, 2018; Yao, 2023).

Despite its growing popularity, the three-factor model is not without limitations. Its primary challenges include a lack of a robust theoretical foundation in asset pricing theory and practical difficulties in identifying reliable proxies for sensitivity estimates and factor premiums. These limitations of both the CAPM and the three-factor model underscore the need for more effective methodologies in estimating expected rates of return. (Sattar, 2017; Tao, 2022)

This paper explores the reward beta approach as a promising alternative. This approach involves replacing CAPM beta estimates with beta return estimates based on the security's market trajectory, potentially enhancing the accuracy of expected return estimations.

Empirical evidence supports the reward beta approach's superiority over the CAPM and the Fama-French three-factor model (Rogers & Securato, 2007), particularly in out-of-sample tests using US stock market data. This finding suggests a notable inadequacy in the CAPM's performance. Further, incorporating size and book-to-market factors directly into beta estimation through portfolios has shown enhanced predictive efficacy compared to the other models.

Beta's role in estimating returns is pivotal, especially in market non-stationarity and its adaptability to dynamic market conditions (Mikolajek-Gocejna, 2021; Sukono et al., 2019). As Baginski & Wahlen (2003) noted, systematic risk is dynamic and fluctuates over time, affecting stock returns. Beta serves as a key variable in this relationship.

Bornholt (2007) introduced the Reward Beta as an alternative to the CAPM for estimating risk-related returns. His research, validated by Gabriel & Silva (2014), demonstrated the Reward Beta model's effectiveness in the American and Brazilian stock markets, suggesting its potential as a superior alternative to the CAPM in stock return estimation.

Given the apparent advantages of the Reward Beta model over the CAPM, this research aims to evaluate its efficacy in estimating stock returns, particularly in the manufacturing and mining sectors within the LQ45 index. The LQ45 index, which assesses the price performance of highly liquid and fundamentally strong stocks with large market capitalization, provides a relevant context for this comparison. This study focuses on companies in the manufacturing and mining sectors listed on the LQ45 on the Indonesia Stock Exchange from 2010 to 2020, selected based on their consistent listing throughout this period.

Therefore, this research presents a comparative analysis of the CAPM and Reward Beta models in estimating stock returns for manufacturing and mining sector shares within the LQ45 index, offering insights into the efficacy of these models in a specific market context.

METHODS

This research employs a quantitative approach, focusing on descriptive analysis to comprehensively examine and interpret the data. From January 2010 to December 2019, the study period was selected to represent normal market conditions before the disruptive impact of the COVID-19 pandemic in 2020, which significantly affected corporate operations and the broader economy.

The primary data source is the monthly closing stock prices of companies in the manufacturing and mining sectors consistently listed in the LQ45 index. The LQ45 index, comprising shares from 45 companies on the Indonesia Stock Exchange (BEI), is chosen based on liquidity and market capitalization criteria. This selection is further influenced by factors such as company reputation, high liquidity levels, sectoral diversification, its role as a market performance indicator, potential for investment returns, and comprehensive information and analysis availability.

The mining and manufacturing sectors were selected due to their unique characteristics and economic significance. The mining sector, crucial for national economic development, provides essential energy resources for economic growth. With its sub-sector range, the manufacturing sector reflects the overall capital market reactions and involves continuous production processes, necessitating efficient capital and asset management.

Operational variables are central to this study and are used alongside analytical tools to derive insights. These variables include company stock prices, monthly returns of individual shares, market risk premium, market expectation, and market deviation. The details of these variables are summarized in Table 1.

Table 1. CAPM operational variables and reward beta

Independent variable	Definition	Measurement
Company stock (10 selected shares)	Shares of a company as they are valued at market close	The closing price of the stock.
The monthly return of individual shares.	$R_i = \frac{P_t - P_{t-1}}{P_{t-1}}$	Difference between Closing Price at Time T2 and Closing Price at Time T1.
Market Risk Premium	An indicator used to assess whether a company is overvalued or undervalued..	$Market\ Risk\ Premium = (R_m - R_f)$ (CAPM)
Market Expectation	The consideration of market index returns as the best estimator.	$Exp\ Market = E(R_m) - R_f$ (*Reward Beta)*
Market Deviation	A measure of systematic risk arising from market risk or portfolio risk itself.	$Dev\ Market = R_m - E(R_m)$ *(Reward Beta)*

Source: processed from various sources

A stationarity test is conducted to ascertain the presence of a unit root in the dataset, ensuring the validity of the relationships among variables. This test, represented by equations (1) and (2), is crucial for confirming the suitability of the data for analysis and ensuring that the model development adheres to statistical standards.

The operational variables are then analyzed using specific formulas, detailed from equations (3) to (9). This analysis includes determining individual monthly stock returns, market returns, expected returns, risk-free returns, stock beta, and Expected Reward Beta (ERB). The models used for CAPM and the Reward Beta approach are encapsulated in equations (8) and (9), respectively.

Equations (3) to (9) cover a range of calculations, from determining individual monthly stock returns to formulating the CAPM and Reward Beta models. These equations are essential for comprehensively understanding the operational variables and their impact on the study's findings.

$$y_t = b_t\alpha - b_{12}z_t + c_{11}y_{t-1} + c_{12}z_{t-1} + \varepsilon_{yt} \quad \text{.......... (1)}$$

$$z_t = b_{20} - b_{21}y_t + c_{21}y_{t-1} + c_{22}z_{t-1} + \varepsilon_{zt} \quad \text{.......... (2)}$$

This test is carried out to ascertain the suitability of the data for analysis, aiming for accurate and reliable results. It ensures the model development process adheres to statistical standards for logical and reasonable outcomes.

The operational variables are further analyzed using specific formulas, as detailed in equations (3) to (9), including the determination of individual monthly stock returns, market returns, expected returns, risk-free return, stock beta, and Expected Reward Beta (ERB). The models used for CAPM and the Reward Beta approach are represented by equations (8) and (9), respectively.

a. Determines individual monthly stock returns (R_i):

$$R_i = \frac{P_t - P_{t-1}}{P_{t-1}} \quad (3)$$

b. Market returns (R_{mt}):

$$R_{mt} = \frac{IHSG_t - IHSG_{t-1}}{IHSG_{t-1}} \quad (4)$$

c. The expected return of Individual Shares $E(R_i)$:

$$E(R_i) = \frac{\sum_{1=1}^{n} R_i}{N} \quad (5)$$

d. Risk-free return $E(R_i)$: determine using the average SBI interest rate. Stocks are selected for further analysis if $E(R_i) > R_f$.

e. Stock beta (β_i): measures the systematic risk of individual stocks.

f. Unsystematic Risk ($\sigma^2 ei$): calculated using variance:

$$\sigma_{ei}^2 = \frac{1}{n}\sum_{i=1}^{n}(R_i - (a_i + \beta_i . R_{mt})^2 \quad (6)$$

g. Expected Reward Beta (ERB_i) :

$$ERB_i = \frac{E(R_i) - R_f}{\beta_i} \quad (7)$$

Thus, the model used for CAPM is as follows :

$$R_i - R_{ft} = a_i + \beta_i \ (R_m - R_{ft}) + r_f \quad (8)$$

A market model version is compatible with the Reward Beta approach. The corresponding version is :

$$R_j - r_f = \beta_{rj} \ [\mathrm{E}(R_m) + r_f] + \beta_j \ [R_m - \mathrm{E}(R_m)] + \varepsilon j \quad (9)$$

RESULT AND DISCUSSION

The descriptive analysis of the variables in the Capital Asset Pricing Model (CAPM) and the Reward Beta model reveals specific calculations, including market deviation (market dev), market expectations, market premium, and Ri. The mean and standard deviation values for these variables are as follows: mean dev market (-0.0024, 0.0162), market expectations (0.0004, 0.0033), mean market premium (-0.0019, 0.0169), and mean Ri (-0.0016, 0.0399).

The unit root test results indicate the stationarity of the market premium variable at the 1% significance level, with a value of -10.57085. Similarly, the market expectations variable is stationary at the 1% level, evidenced by a value of -7.7856. The market deviation variable also shows stationarity at the 1% level, with a value of -10.7078.

Stationarity is crucial for accurate long-term forecasts and avoiding misleading regression outcomes. A unit root test, typically conducted before estimation, is essential to confirm data stationarity and identify genuine relationships between variables, thereby reducing the risk of spurious correlations (Smeekes & Wijler, 2020).

The companies selected for analysis demonstrate stationarity at the 1%

significance level. The autocorrelation test results confirm that issuers from the manufacturing and mining sectors are free from autocorrelation.

The heteroscedasticity test results for 10 CAPM model issuers indicate no heteroscedasticity. The Obs*R-squared (Prob. Chi-square) value is greater than 0.05, suggesting that issuers in both sectors are free from heteroscedasticity, making the data suitable for further analysis.

A comparison of the R-squared values from the CAPM and Reward Beta models was conducted to assess the precision or accuracy of prediction. A higher R-squared value, closer to 1, indicates a more accurate model with a smaller error rate. In the comparative analysis of R-squared values for the Capital Asset Pricing Model (CAPM) and the Beta Reward Model within the manufacturing sector, as presented in Table 2, a nuanced pattern emerges, highlighting the relative strengths of each model in explaining stock returns. For ASII shares, the Beta Reward Model exhibits a slightly higher explanatory power compared to the CAPM, suggesting its enhanced capability to capture the intricacies of ASII's stock behavior. This observation aligns with findings from a study comparing CAPM and Beta Reward approaches in the Indonesian market (Handri, 2023). Similarly, for GGRM shares, the Beta Reward Model modestly surpasses the CAPM, hinting at its potential to grasp market dynamics better affecting GGRM.

The analysis of INDF shares further reinforces this pattern, with the Beta Reward Model demonstrating a notably superior performance in accounting for stock returns. These findings are consistent with the broader trends observed in the manufacturing sector, as suggested by research on value drivers in the Indian manufacturing industry (Tiwari & Kumar, 2015). The Beta Reward Model shows a marginally better fit for INTP shares, indicating its effectiveness in incorporating certain aspects of stock behavior that the CAPM might overlook. Interestingly, the trend continues with KLBF shares, where the Beta Reward Model slightly outperforms the CAPM again. This consistency across different shares in the manufacturing sector suggests a general tendency for the Beta Reward Model to offer a more nuanced understanding of stock returns.

Overall, these findings indicate a marginal but noteworthy superiority of the Beta Reward Model in explaining stock returns within the manufacturing sector, echoing the results of an empirical analysis of the higher moment Capital Asset Pricing Model for the Bangladesh stock market, which also found an increase in the adjusted R-squared value when considering higher moments (Hasan et al., 2013).

Table 2. Comparison of R-squared values for CAPM and Reward Beta model in the manufacturing sector

No	Share	R_i (unit root)	CAPM R-squared	Beta Reward Model R-squared	R-squared approach =1 Results
1	ASII	-12.2553***	0.5399***	0.5410***	Beta Reward Model
2	GGRM	-9.3110***	0.0996***	0.1016***	Beta Reward Model
3	INDF	-10.6191***	0.3169***	0.3281***	Beta Reward Model
4	INTP	-14.0661***	0.2413***	0.2487***	Beta Reward Model
5	KLBF	-11.1516***	0.2992***	0.3108***	Beta Reward Model

*Note: *** significant 1%, ** significant 5 %, significant 10%*

In the mining sector analysis, as detailed in Table 3, a subtle yet revealing pattern emerges when comparing the R-squared values of the Capital Asset Pricing

Model (CAPM) and the Beta Reward Model. The Beta Reward Model consistently shows a slight edge in its ability to explain stock returns, a trend evident across various shares in this sector. This finding aligns with a study on the CAPM and Beta Reward approach in the Indonesian market, which also found the Beta Reward method to have better R-squared values in predicting company stock returns (Handri, 2023).

Starting with ADRO shares, the Beta Reward Model demonstrates a marginally better fit, suggesting its potential to capture certain market dynamics more effectively than the CAPM. This trend is echoed in the analysis of ANTM shares, where the Beta Reward Model again surpasses the CAPM, albeit by a slim margin. This indicates its slightly superior accuracy in reflecting the factors influencing ANTM's stock performance.

The case of INCO shares further supports this pattern. Here, the Beta Reward Model provides a more comprehensive explanation of stock returns, hinting at its ability to integrate specific market variables or investor behaviors that the CAPM might not fully account for. Similarly, for ITMG shares, the Beta Reward Model, though only slightly ahead, suggests its incremental effectiveness in capturing the nuances of stock market movements.

Interestingly, the analysis of PTBA shares presents a scenario where both models exhibit nearly identical predictive capabilities. This suggests that for certain stocks, like PTBA, the choice between the CAPM and the Beta Reward Model might not significantly impact the accuracy of stock return predictions.

Overall, these observations from the mining sector reinforce the notion that while the CAPM and the Beta Reward Model are robust tools for analyzing stock returns, the Beta Reward Model often shows a slight advantage. This consistent, albeit narrow, superiority across different shares suggests that the Beta Reward Model might be slightly more attuned to the specificities of the mining sector's stock market dynamics.

Table 3. Comparison of R-squared values for CAPM and Reward Beta Model in the mining sector

No	**Share**	**R_i (unit root)**	**CAPM R-squared**	**Beta Reward Model R-squared**	**R-squared approach =1 Results**
1	ADRO	-9.9981***	0.1438***	0.1471***	Beta Reward Model
2	ANTM	-10.0260***	0.1346***	0.1389***	Beta Reward Model
3	INCO	-11.2257***	0.1356***	0.1453***	Beta Reward Model
4	ITMG	-11.5697***	0.1026***	0.1036***	Beta Reward Model
5	PTBA	-10.8033***	0.1780***	0.1782***	Beta Reward Model

*Note: *** significant 1%, ** significant 5 %, significant 10%*

Table 4's manufacturing sector analysis focuses on the Root Mean Square Error (RMSE) values of the Capital Asset Pricing Model (CAPM) and the Beta Reward Model. This comparison provides insights into the precision of these models in forecasting stock returns.

The RMSE values for various shares reveal a consistent pattern where the Beta Reward Model exhibits a marginally superior forecasting accuracy over the CAPM. This is evident in the analysis of ASII shares, where the Beta Reward Model shows a slightly lower RMSE, indicating its enhanced precision in predicting stock returns. This trend continues with GGRM shares, where the Beta Reward Model again outperforms the CAPM, albeit by a small margin. This suggests that the Beta Reward Model may be capturing certain market dynamics more effectively, a notion supported by the findings in "Hybrid Beta-KDE Model for Solar Irradiance Probability Density Estimation" (2020), which highlights the effectiveness of Beta models in capturing intricate market dynamics through a different application (Wahbah et al., 2020)

The analysis of INDF shares further supports this observation, with the Beta Reward Model demonstrating a subtly improved forecasting ability. This pattern is consistent across different shares in the manufacturing sector, as seen in the RMSE values for INTP shares, where the Beta Reward Model again shows a slightly better performance. This consistency in the Beta Reward Model's performance echoes the findings in "Investment Decision Using Capital Asset Pricing Model (CAPM) in Indonesia's Banking Sector" (2022), where the CAPM model's application in different sectors also revealed varying degrees of effectiveness (Mulyaningsih & Heikal, 2022)

Interestingly, the RMSE comparison for KLBF shares also follows this trend, with the Beta Reward Model exhibiting a narrow lead in predictive accuracy. This consistent pattern across various shares suggests that the Beta Reward Model, while only marginally, tends to provide a more accurate forecast of stock returns in the manufacturing sector compared to the CAPM. This slight edge of the Beta Reward Model aligns with the arguments presented in "Extending the Capital Asset Pricing Model: The Reward Beta Approach", which proposes the Beta Reward Model as a more empirically robust alternative to the CAPM (Bornholt, 2007).

These findings highlight the Beta Reward Model's slight edge in forecasting accuracy within the manufacturing sector, suggesting its potential usefulness for investors and analysts in making more precise stock return predictions.

Table 4. Comparison of RMSE values for the manufacturing sector's CAPM and Beta Reward Model.

No	Share	R_i (unit root)	CAPM RMSE	Beta Reward Model RMSE	RMSE Approach = 0 Results
1	ASII	-12.2553***	0.0466***	0.0465***	Beta Reward Model
2	GGRM	-9.3110***	0.0334***	0.0333***	Beta Reward Model
3	INDF	-10.6191***	0.0247***	0.0245***	Beta Reward Model
4	INTP	-14.0661***	0.0343***	0.0341***	Beta Reward Model
5	KLBF	-11.1516***	0.0262***	0.0260***	Beta Reward Model

*Note: *** significant 1%, ** significant 5 %, significant 10%*

In the mining sector, Table 5's analysis of RMSE values offers a nuanced view of the predictive capabilities of the Capital Asset Pricing Model (CAPM) and the Beta Reward Model. The data reveals a pattern of the Beta Reward Model slightly outperforming the CAPM in most cases, albeit with very close margins. This finding is consistent with the research presented in "Predicting Accuracy of Valuation Multiples Using Value Drivers: Evidence from Indian Listed Firms," which emphasizes the importance of selecting appropriate models and value drivers for predicting stock returns, highlighting the relevance of RMSE as a measure of predictive accuracy (Gupta, 2018).

Starting with ADRO shares, the Beta Reward Model shows a marginally lower RMSE than the CAPM, suggesting a slightly better predictive accuracy. This trend is also observed in ANTM shares, where the Beta Reward Model's RMSE is slightly lower than the CAPM's, hinting at its potentially better suitability for forecasting stock returns in this context. The case of INCO shares further supports this pattern. The Beta Reward

Model's RMSE is marginally lower than the CAPM's, indicating a slightly improved performance in predicting stock returns. This suggests that the Beta Reward Model might capture certain market dynamics more effectively for these shares.

For ITMG shares, the comparison is very close, with the Beta Reward Model having a barely lower RMSE than the CAPM. This indicates a slight edge for the Beta Reward Model regarding predictive accuracy for these shares. Interestingly, the analysis of PTBA shares presents a different scenario where both models show an identical RMSE. This suggests that for PTBA shares, the CAPM and the Beta Reward Model are equally effective in predicting stock returns.

Overall, the RMSE comparisons in the mining sector suggest minimal differences. Still, the Beta Reward Model generally provides a marginally better forecast accuracy than the CAPM for most shares analyzed. However, the similarity in performance, especially in the case of PTBA shares, indicates that both models have their merits and can be considered reliable tools for predicting stock returns in the mining sector.

Table 5. Comparison of RMSE values for CAPM and Reward Beta Model in the mining sector

No	Share	R_i (unit root)	CAPM RMSE	Beta Reward Model RMSE	RMSE Approach = 0 Results
1	ADRO	-9.9981***	0.0440***	0.0439***	Beta Reward Model
2	ANTM	-10.0260***	0.1250***	0.1247***	Beta Reward Model
3	INCO	-11.2257***	0.0574***	0.0571***	Beta Reward Model
4	ITMG	-11.5697***	0.0532***	0.0531***	Beta Reward Model
5	PTBA	-10.8033***	0.0428***	0.0428***	Beta Reward Model

*Note: *** significant 1%, ** significant 5 %, significant 10%*

In Table 6, the Mean Absolute Error (MAE) analysis for various shares in the manufacturing sector offers insights into the forecasting accuracy of the Capital Asset Pricing Model (CAPM) and the Beta Reward Model. The MAE values measure the average magnitude of the errors in predictions made by these models without considering their direction. This aspect of the analysis is supported by the work of Maisyuri et al. (2022), who found that the CAPM model, when compared to the Arbitrage Pricing Theory in a similar context, exhibited a high level of accuracy in predicting stock returns, suggesting the robustness of CAPM in such predictive tasks."

For ASII shares, both the CAPM and the Beta Reward Model exhibit identical MAE values, indicating a similar level of proficiency in forecasting the stock returns of ASII. This equivalence in performance suggests that both models are equally reliable for this particular stock.

In the case of GGRM shares, the Beta Reward Model shows a slightly lower MAE than the CAPM. Although the difference is marginal, it subtly points to the Beta Reward Model having a slight edge in accuracy for predicting the returns of GGRM shares.

When analyzing INDF shares, both models again report equal MAE values. This parity in performance demonstrates that neither model has a distinct advantage over the other in forecasting the stock returns of INDF, suggesting their comparable effectiveness.

For INTP shares, the Beta Reward Model's MAE is marginally lower than that of the CAPM. This slight difference suggests that the Beta Reward Model might be a slightly more accurate tool for predicting the stock returns of INTP.

Lastly, the analysis of KLBF shares presents a scenario where the CAPM has a slightly lower MAE than the Beta Reward Model. This indicates that the CAPM might have a narrow lead in predictive accuracy for KLBF shares.

Overall, the MAE analysis in the manufacturing sector reveals a close competition between the CAPM and the Beta Reward Model. While in some cases, one model shows a marginal advantage over the other, the differences are generally minimal, indicating that both models are robust tools for forecasting stock returns in the manufacturing sector. This aligns with the research conducted by Kusuma & Budiarta (2022) and Oseni & Olanrewaju (2017).

Table 6. Comparison of MAE values for CAPM and Reward Beta Model in the manufacturing sector

No	Share	R_i (unit root)	CAPM MAE	Beta Reward Model MAE	MAE Approach = 0 Results
1	ASII	-12.2553***	0.0379***	0.0379***	Beta Reward Model
2	GGRM	-9.3110***	0.0265***	0.0264***	Beta Reward Model
3	INDF	-10.6191***	0.0192***	0.0192***	Beta Reward Model
4	INTP	-14.0661***	0.0266***	0.0265***	Beta Reward Model
5	KLBF	-11.1516***	0.0193***	0.0194***	CAPM

*Note: *** significant 1%, ** significant 5 %, significant 10%*

In Table 7, the Mean Absolute Error (MAE) analysis for the mining sector provides a comparative perspective on the forecasting accuracy of the Capital Asset Pricing Model (CAPM) and the Beta Reward Model. The MAE values offer a lens to gauge the average magnitude of prediction errors these models make, focusing on their precision without considering the direction of errors.

For ADRO shares, the analysis reveals that both the CAPM and the Beta Reward Model exhibit the same MAE value. This parity in performance suggests that both models are equally adept at predicting the stock returns of ADRO, with neither model showing a distinct advantage. This observation is in line with the findings of Purwati & Rizkiana (2021), Putra et al. (2023) and Susanti et al.(2021), who highlighted the effectiveness of CAPM in predicting stock returns using Mean Absolute Deviation (MAD), a similar measure to MAE.

When examining ANTM shares, a similar scenario unfolds as both models again report identical MAE values. This result indicates that for ANTM shares, the CAPM and the Beta Reward Model are on par in their forecasting accuracy, with no significant difference between them. This is consistent with the research by Maisyuri et al. (2022), which compared the accuracy of CAPM and other models in predicting stock returns.

In the case of INCO shares, the Beta Reward Model demonstrates a slightly lower MAE than the CAPM. Although the difference is minimal, it points to a marginally enhanced accuracy of the Beta Reward Model in predicting the stock returns of INCO. This finding aligns with the study by Oke (2013), which questioned the CAPM's predictions and suggested the need for models that can capture more market dynamics.

For ITMG shares, the scenario is reversed, with the CAPM showing a marginally lower MAE than the Beta Reward Model. This subtle difference suggests that the CAPM might have a slight edge in forecasting accuracy for ITMG shares. This agrees with the research by Kusuma & Budiartha (2022), which emphasized the need for optimizing traditional CAPM calculations, potentially indicating the CAPM's relevance in certain contexts.

Lastly, the analysis of PTBA shares indicates that the CAPM has a slight advantage over the Beta Reward Model, as evidenced by its marginally lower MAE value. This suggests that the CAPM might be a tad more precise in predicting the stock returns of PTBA. This conclusion is supported by the broader research context, which often finds the CAPM a reliable tool in stock return prediction (Shetty & Souza, 2019; Suroso et al., 2018).

Overall, the MAE analysis in the mining sector highlights a closely contested performance between the CAPM and the Beta Reward Model. While there are instances where one model shows a slight edge over the other, these differences are generally small, underscoring the robustness and comparability of both models in forecasting stock returns in the mining sector.

Table 7. Comparison of MAE values for CAPM and Reward Beta Model in the mining sector

No	**Share**	**R_i (unit root)**	**CAPM** MAE	**Beta Reward Model** MAE	**MAE** Approach **= 0 Results**
1	ADRO	-9.9981***	0.0315***	0.0315***	Beta Reward Model
2	ANTM	-10.0260***	0.0907***	0.0907***	Beta Reward Model
3	INCO	-11.2257***	0.0459***	0.0454***	Beta Reward Model
4	ITMG	-11.5697***	0.0399***	0.0401***	CAPM
5	PTBA	-10.8033***	0.0340***	0.0341***	CAPM

*Note: *** significant 1%, ** significant 5 %, significant 10%*

In the analysis of 10 companies listed in the LQ45 index, spanning both the manufacturing and mining sectors, and utilizing various econometric procedures, particularly the Capital Asset Pricing Model (CAPM) and the Beta Reward Model, the findings are summarized in Figure 1. This analysis is supported by the research of Indra (2018), which found that the CAPM model, when applied to the stock price data of companies in the consumption and mining sectors listed on the Indonesia Sharia Sharia Index (ISSI), was more accurate in predicting future stock returns compared to the Arbitrage Pricing Theory (APT) model. This finding is relevant as it highlights the effectiveness of CAPM in sectors similar to those in the LQ45 index.

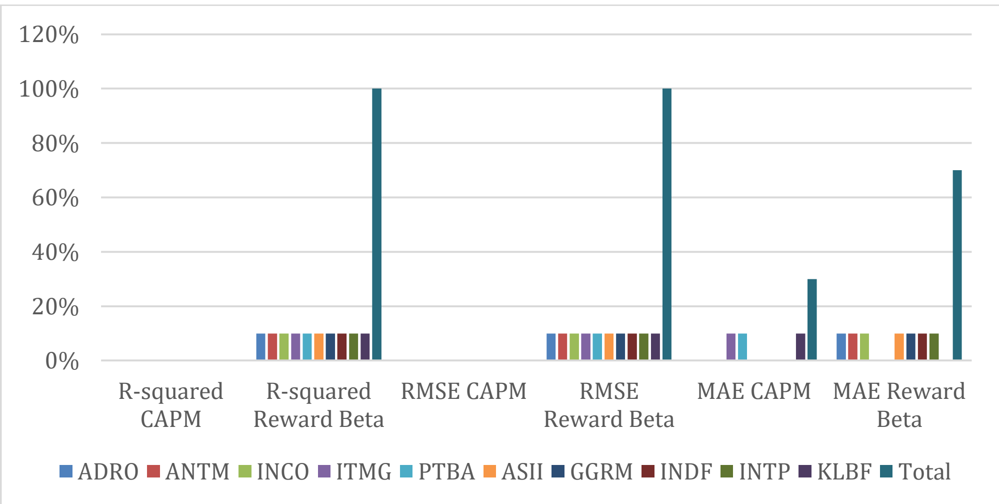

Figure 1. Comparison of R-Square, RMSE, and MAE from CAPM with Beta Reward Model

Figure 1 illustrates the comparative performance of the CAPM and Beta Reward Model across 10 companies in the LQ45 index, which includes five companies, each from the manufacturing and mining sectors. The analysis reveals that the Beta Reward

Model demonstrates a 100% superiority over the CAPM regarding R-Square values. This trend is consistent in comparing Root Mean Square Error (RMSE) values, where the Beta Reward Model exhibits a 100% superiority.

In comparing Mean Absolute Error (MAE) values, the Beta Reward Model maintains dominance, outperforming the CAPM in 70% of the cases, while the CAPM leads in 30%. These results collectively suggest that the Beta Reward Model is more robust overall due to its lower error rates in predicting stock returns.

This comprehensive analysis underscores the effectiveness of the Beta Reward Model in the context of the LQ45 index companies, particularly in the manufacturing and mining sectors, thereby highlighting its potential as a superior tool for financial modeling and analysis.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

This study has meticulously compared the Capital Asset Pricing Model (CAPM) and the Beta Reward Model across manufacturing and mining sector shares in the LQ45 index, focusing on their efficacy in estimating future stock returns. The comprehensive analysis, encompassing R-Squared, Root Mean Square Error (RMSE), and Mean Absolute Error (MAE) metrics, leads to a noteworthy conclusion: the Beta Reward Model generally exhibits superior performance compared to the CAPM. This conclusion is drawn from January 2010 to December 2019 data, where the Beta Reward Model consistently aligns with the observed trends, outperforming the CAPM across the evaluated metrics.

Recommendations

The findings suggest that the Beta Reward Model could be a more reliable tool for forecasting stock returns, particularly in the manufacturing and mining sectors. Investors might consider incorporating this model into their analysis to enhance the accuracy of their investment decisions.

This study's methodology is primarily limited by its reliance on data from a specific timeframe, namely the decade spanning 2010 to 2019. It is crucial to consider that the effectiveness of the evaluated models, the Capital Asset Pricing Model (CAPM) and the Beta Reward Model, may change under different market dynamics or economic conditions that arise beyond this period. Additionally, the research focuses exclusively on companies within the manufacturing and mining sectors of the LQ45 index, which may restrict the applicability of its findings to other sectors or indices.

While the study provides valuable insights by comparing the CAPM and Beta Reward Model, it does not encompass a broader range of financial models. Including additional or emerging models in future research could enhance the understanding of stock return predictions, offering a more comprehensive perspective.

In light of these limitations, it is recommended that future academic endeavors should aim to expand upon this research. This could be achieved by utilizing more extensive datasets that cover a wider range of periods and by broadening the scope of the study to include various other sectors. Furthermore, integrating a diverse array of predictive models could provide a more holistic and robust understanding of stock return estimations, thereby enriching the field of financial analysis.

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