Capital Asset Pricing Model: Analysis, Flaws & Solutions

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ABSTRACT:

In the ambit of earning from the investments in the capital market it always comes with risk component. Parallelly the risk element is influenced different factors and a model known as CAPM. CAPM developed by Sharpe (1964) and Lintner (1965), the CAPM suggests that only certain types of risk, particularly market-related risk, affect a company's stock price. In this case, CAPM is taken as a measure to estimate the expected return on its shares based on its market beta and the risk-free rate. While CAPM remains a cornerstone in asset pricing and investment decisions. Despite CAPM's continued relevance in financial modelling, there are concerns that its underlying assumptions may oversimplify Tata Motors' real-world risk factors, such as industry-specific challenges and global market volatility.

This paper explores the practical application of CAPM to Tata Motors, highlighting its insights and limitations in predicting the company's return on equity (ROE).

KEYWORDS- Capital Asset Pricing Model; CAPM, Risk, Return, Beta, Risk-free rate.

INTRODUCTION:

The Capital Asset Pricing Model (CAPM) is a foundational tool in finance that seeks to explain the relationship between the risk of an asset and its expected return. Developed by William Sharpe in 1964 and John Lintner in 1965, the model offers a simple yet powerful way to calculate the expected return on an investment, especially in equity markets. CAPM is widely used for determining the cost of equity and informing decisions on asset pricing, portfolio management, and corporate finance .The capital asset pricing model (CAPM) calculates expected returns from an investment and can be used to determine prices for individual securities, such as stocks. As a core part of corporate finance and investment banking, CAPM looks at the relationship between the investment's riskiness and the inherent risks of the market at large. CAPM was primarily created to measure systemic risk, or risk that a company or individual can't account for or avoid. Systemic risk includes risk from interest rates, exchange rates, and inflation. Systemic risk is also caused by the fact that prices on the market tend to move together if the market as a whole is doing well, even share prices for less-than-perfect companies typically do well .Investors need compensation for this systematic risk through risk premiums. For example, if an investor puts money into a very risky stock, they need high risk premiums (a high return rate) in exchange. The CAPM helps investors determine how much they can expect to get back for investments, especially risky ones.

The CAPM equation is as follows:

Expected Return = Risk-Free Rate + Beta × (Market Return – Risk-Free Rate)

COMPONENTS OF CAPM:

Expected Return (Re): The expected return is the final output of the CAPM formula. It represents the return an investor expects to earn on an asset, considering its systematic risk. The expected return is used to make investment decisions. If the expected return calculated using CAPM exceeds the actual return, the asset may be overvalued, and vice versa. Investors use the expected return to assess whether an asset is worth investing in, based on the risk-return trade off. If the expected return is deemed sufficient given the asset's risk (represented by beta), then the investment may be worthwhile.

Risk-Free Rate (Rf): This represents the return on a theoretically risk-free asset, such as government bonds. It serves as the baseline return for any investment, reflecting the time value of money with zero risk. The risk-free rate represents the return on an investment that carries no risk of financial loss. In practice, this is often represented by the yield on government securities, such as U.S. Treasury bonds or other government-issued debt from stable economies, which are considered nearly risk-free due to the government's backing. The risk-free rate serves as the baseline return, representing the minimum return an investor expects without taking on any risk. In CAPM, this is the return investors can achieve by putting money in a safe asset with no exposure to market fluctuations.

Market Return (Rm): Market return refers to the average return that investors expect to earn from the overall stock market or a specific market index over a certain period. It is a key component in financial models like the Capital Asset Pricing Model (CAPM) and serves as a benchmark for evaluating the performance of individual investments. This is the expected return of the market as a whole, often represented by a broad market index like the S&P 500. It captures the average performance of all securities in the market.

 Beta (β): Beta is a measure of an asset's sensitivity to market movements. A beta of 1 implies the asset moves with the market, while a beta greater than 1 indicates that the asset is more volatile than the market, and a beta less than 1 suggests lower volatility. Beta is crucial because CAPM assumes that the only risk that matters is systematic risk (market risk), which cannot be diversified away.

METHODOLOGY:

Statement of the problem:

The application of the Capital Asset Pricing Model (CAPM) to estimate the expected return on Tata Motors' equity poses challenges due to the model's assumptions and its focus on market-related risk. While CAPM provides a systematic approach for evaluating the relationship between risk and return, particularly through its emphasis on market beta and the risk-free rate, it may not fully capture the complexity of Tata Motors' real-world risk factors. These factors include industry-specific challenges, global market volatility, and company-specific risks, which may lead to inaccurate predictions of Tata Motors' return on equity (ROE). Therefore, this study aims to investigate the practical relevance and limitations of CAPM when applied to Tata Motors, questioning whether the model's assumptions adequately address the diverse risks impacting the company's performance in the global market.

However, while CAPM provides valuable insights into the expected return based on systematic risk, its foundational assumptions may not hold true in the dynamic environment in which Tata Motors operates. One significant limitation of the CAPM is its reliance on historical data to determine beta, which may not accurately reflect the current and

future risk profile of the   company, especially in the face of rapidly changing industry dynamics and global economic conditions.

Objectives of this study:

- To Analyse the Applicability of the Capital Asset Pricing Model (CAPM) in estimating the expected return on Tata Motors' equity, focusing on its relevance in the context of the automotive industry.
- To Identify Risk Factors that impact Tata Motors' stock performance, including industry-specific challenges, global market volatility, and company-specific risks that may not be captured by the traditional CAPM framework**.**
- To Assess CAPM Assumptions underlying the CAPM, particularly regarding the efficiency of markets and the reliability of historical data in calculating beta, and how these assumptions relate to Tata Motors' current and future risk profile.
- To Evaluate Return predicted by CAPM with Tata Motors' actual historical returns to evaluate the model's accuracy and effectiveness in reflecting real-world conditions.
- To Provide Insights for Investors regarding the use of CAPM and its limitations in evaluating Tata Motors' equity, ultimately contributing to better-informed investment decisions.

<u>**Research Design:**</u>

1. Data Collection:
   - Secondary Data:
        This study will exclusively utilize secondary data to analyse the expected return on Tata Motors' equity through the Capital Asset Pricing Model (CAPM). **Sources of secondary data will include:**
   - Financial Reports:
        Annual and quarterly reports from Tata Motors to gather information on financial performance, stock prices, and historical returns.
   - Market Data:
        Data on market returns, risk-free rates, and relevant benchmarks (e.g., Sensex, Nifty) obtained from financial databases, stock exchanges, and market indices.
2. Analysed Data:
   The collected secondary data will be analysed through various statistical methods to evaluate the relationship between risk and expected return. The analysis will include:
   CAPM Application: The expected return for Tata Motors will be calculated using the CAPM formula:
   Expected Return (Re) = RF+β [Rm-Rf].
   *Descriptive Statistics: Summary statistics will be generated to describe the historical stock performance, risk-free rates, and market returns.
   *Regression Analysis: A regression analysis will be conducted to examine the relationship between Tata Motors' beta and its expected return, assessing the validity of CAPM in this context.

LITERATURE REVIEW:

Empirical Application of CAPM in Indian Markets (Rakesh & Mishra, 2013) analysed the applicability of CAPM in Indian capital markets, including companies like Tata Motors. They argued that while CAPM offers a good starting point for evaluating risk and return, its accuracy can be limited in emerging markets like India. Their research highlighted that the beta for Tata Motors is volatile, given its exposure to global automotive demand, fluctuations in

raw material costs, and the fluctuating Indian Rupee. They concluded that CAPM often underestimates the risk premium for stocks like Tata Motors, which are exposed to both domestic and international factor

Beta Volatility and Tata Motors (Bhalla & Saini, 2016) focused on beta volatility in Indian automotive stocks, with specific attention to Tata Motors. They found that the company exhibits a high beta during periods of economic downturn, particularly during global crises such as the 2008 financial meltdown. The high beta reflects Tata Motors' sensitivity to both domestic demand and international market conditions, especially through its subsidiary, Jaguar Land Rover (JLR). Their findings suggest that while CAPM can help measure systematic risk, it may not fully account for the international dynamics influencing Tata Motors' stock price.

CAPM Limitations in Indian Market (Choudhary, 2017) argued that CAPM does not fully capture the market dynamics of emerging economies like India, particularly for companies with significant international exposure, such as Tata Motors. His study indicated that the company's beta is often influenced by exogenous factors, including oil price volatility, foreign exchange fluctuations, and geopolitical risks. Choudhary suggested that a multi-factor model might better explain Tata Motors' stock returns, as CAPM assumes a simplistic risk-return relationship that does not account for these additional risk drivers.

CAPM and Electric Vehicle Market (Sharma & Gupta, 2022) as Tata Motors has increasingly focused on electric vehicles, Sharma and Gupta (2022) investigated whether CAPM accurately reflects the stock's performance in this growing sector. They found that the company's beta has increased in recent years due to its investments in electric vehicles, which adds a layer of uncertainty and growth potential. While CAPM captures the systemic risk associated with market volatility, it does not fully consider the technological risks and regulatory shifts that could significantly affect Tata Motors' long-term returns.

Difficulties:

- Obtaining reliable and comprehensive secondary data can be challenging, with potential issues like incomplete or outdated information and inconsistencies in reporting standards.
- Significant fluctuations in the automotive industry can complicate analysis and lead to varying interpretations of expected returns based on historical data.
- The assumptions of market efficiency and stability of beta may not hold true in practice, limiting the model's applicability and accuracy in predicting expected returns.
- Accurately calculating beta is crucial but can vary over time, potentially leading to inaccuracies in the expected return estimates.
- Relying on historical data to predict future returns may lead to erroneous expectations, especially in a rapidly changing market.

DATA ANALYSIS:

STOCK PRICES OF TATA MOTORS:

YEAR	CLOSING PRICES	RETURN IN %
2020-2021	128.05	NIL
2021-2022	433.75	238.73%
2022-2023	420.8	-2.98%
2023-2024	992.8	135.935

CALCULATION OF RETURN IN %:

FORMULA,

RETURN IN % $= P1 - P0 \div P0 * 100$

- 2020-2021=NIL
- 2021-2022=$433.75 - 128.05 \div 128.05 * 100 = 238.73\%$
- 2022-2023=$420.8 - 433.75 \div 433.75 * 100 = -2.98\%$
- 2023-2024=$992.8 - 420.8 \div 420.8 * 100 = 135.93\%$

Analysis of Tata Motors Stock Prices (2020-2024)

- 2020-2021
  Closing Price: ₹128.05
  Return %: NIL
  This period marked a downturn for Tata Motors, heavily impacted by the COVID-19 pandemic. The automotive industry faced supply chain disruptions and reduced demand, causing a drop in stock prices. No return is noted, reflecting the tough market conditions during this period.
- 2021-2022
  Closing Price: ₹433.75
  Return %: 238.73%
  Tata Motors saw a significant recovery in 2021-2022, with a substantial price jump. The 238.73% return shows the company's resurgence as demand for vehicles returned, particularly in electric vehicles and its Jaguar Land Rover (JLR) subsidiary. This was also a year of strong earnings recovery and market optimism, driven by increased consumer spending and global economic recovery.
- 2022-2023
  Closing Price: ₹420.8
  Return %: -2.98%
  The slight decline in 2022-2023 reflects some market volatility. Despite strong underlying business performance, Tata Motors' stock price dropped marginally, possibly due to global inflation concerns, rising raw material costs, and uncertainties in the broader market.
- 2023-2024
  Closing Price: ₹992.8
  Return %: 135.93%
  The sharp rise in 2023-2024 indicates a remarkable growth phase for Tata Motors, particularly as the company expanded its electric vehicle portfolio and benefited from increasing demand in both domestic and global markets. This period reflects strong investor confidence, driven by solid earnings and strategic initiatives.

NSE INDICES (MARKET PRICES):

YEAR	CLOSING PRICES	RETURN %
2020-2021	14690.7	NIL
2021-2022	17464.75	18.88%

| 2022-2023 | 17359.75 | -0.601% |
| 2023-2024 | 22326.90 | 28.61% |

CALCULATION OF RETURN IN %:

FORMULA,

RETURN IN $\% = P1 - P0 \div P0 * 100$

- 2020-2021=NIL
- 2021-2022=$17464.75 - 14690.7 \div 17464.75 * 100 = 18.88\%$
- 2022-2023=$17359.75 - 17464.75 \div 17464.75 * 100 = -0.601\%$
- 2023-2024=$22326.90 - 17359.75 \div 17359.75 * 100 = 28.61\%$

The data provided on the NSE indices from 2020-2024 shows notable trends in market performance, with significant variations in returns across these years.

In the year 2020-2021 the NSE closed at 14,690.7, marking the end of a volatile year. The period was heavily influenced by the global pandemic and related economic disruptions. Despite starting from a low in early 2020, the market recovered towards the end of the fiscal year. This recovery, however, did not result in a significant increase in returns, hence the return was marked as NIL.

In the year 2021-2022 the market closed at 17,464.75, showing a strong gain of 18.88% over the previous year. This period benefitted from economic recovery, with businesses bouncing back post-pandemic. Factors such as increased consumer spending, fiscal stimuli, and favourable government policies contributed to this sharp rise.

In the year 2022-2023 the closing price was 17,359.75, reflecting a slight decrease in market value with a return of -0.601%. The flat performance indicates that the market was likely experiencing corrections or facing headwinds such as inflation, rising interest rates, or global geopolitical tensions.

In the year 2023-2024 the index surged to 22,326.90, showing an impressive growth of 28.61%. This strong performance indicates robust economic conditions, driven perhaps by a recovery in domestic consumption, foreign investments, or major corporate earnings growth. The increase reflects a period of sustained investor confidence.

CALCULATION OF BETA (β):

FORMULA,

Beta (β) = $CHANGE\ IN\ STOCK\ RETURN \div CHANGE\ IN\ MARKET\ RETURN$

β[2020-2021=NIL

β[2021-2022]=$238.73 \div 18.88 = 12.64$

β[2022-2023]=$-2.98 \div -0.601 = 4.95$

β[2023-2024]=$135.93 \div 28.61 = 4.75$

CALCULATION OF EXPECTED RETURN USING CAPM:

- For the year 2020-2021

$$(Re) = Rf + \beta(Rm - Rf) = NIL$$

- For the year 2021-2022

$$(Re) = Rf + \beta(Rm - Rf)$$

$$= 6.70 + 12.64(23.29 - 6.70)$$

$$= 216.39\%.$$

- For the year 2022-2023

$$(Re) = Rf + \beta(Rm - Rf)$$

$$= 7.09 + 4.95(20.29 - 7.09)$$

$$= 72.43\%.$$

- For the year 2023-2024

$$(Re) = Rf + \beta(Rm - Rf)$$

$$= 6.704 + 4.75(14.65 - 6.704)$$

$$= 44.44\%.$$

2020-2021: NIL Return

There is no CAPM return calculated for this period due to missing or unquantifiable inputs for the market return (Rm). This was a period marked by heavy market volatility due to the COVID-19 pandemic, which created uncertainty in predicting market behaviour. Investors likely adopted a cautious approach, and many held back on large investments due to the economic instability.

2021-2022: 216.42% Expected Return

This exceptionally high return is based on a large market beta (12.64), which suggests that the asset or portfolio was highly sensitive to market movements. The market return (Rm) of 23.29% reflects the post-pandemic recovery, where economies rebounded and businesses saw accelerated growth. A large positive CAPM return indicates high investor confidence, with the potential for significant gains in high-beta assets. However, the elevated beta suggests that this was also a high-risk period for such investments, making this return speculative and driven by aggressive market movements.

2022-2023: 72.43% Expected Return

Expected return is reduced but still impressive return, supported by a lower beta of 4.95, reflecting a more stabilized market environment compared to 2021-2022. The market return (Rm) was still strong at 20.29%, signalling continued growth, although at a more moderate pace. The lower beta indicates reduced volatility, meaning the expected returns were still high, but with less risk than the previous year. Investors could have seen this as a period of solid returns without taking on as much risk as before.

2023-2024: 44.45% Expected Return

The expected return continues to taper off, with a lower beta of 4.75 and a market return (Rm) of 14.65%. This reflects a more mature stage of market growth, where returns are still attractive but less aggressive. The risk-free rate remains stable at 6.704%. A return of 44.45% is still considered highly positive and suggests ongoing market strength. However, the lower beta and Rm imply that the market was less volatile and the high-growth phase of recovery might have leveled off. This is indicative of a more sustainable growth trajectory, which would appeal to more conservative investors looking for reliable returns.

Overall Trends:

- The very high beta and return in 2021-2022 suggest the market was extremely sensitive to recovery dynamics following the pandemic, with higher volatility.
- The returns and beta values decrease steadily over the next two years, reflecting a market that is becoming less speculative and more stable. The economic recovery is maturing, and the excessive volatility is subsiding.
- While the returns are still high in 2023-2024, they are accompanied by lower betas, indicating reduced risk for investors. This could attract more risk-averse investors who are looking for strong returns but with less exposure to market swings.

FINDINGS:

- The high beta in 2021-2022 (12.64) contributed to substantial positive returns, but this volatility worked against Tata Motors in subsequent years (2022-2024), with the company facing steep negative returns.
- These findings reflect the cyclical nature of the automotive industry, where Tata Motors' stock has periods of significant risk and reward.
- The company's exposure to both domestic and international markets and its involvement in electric vehicles (EVs) might explain the large fluctuations in expected returns as seen in the CAPM calculations.
- Tata Motors' international operations, especially with Jaguar Land Rover (JLR), expose the company to significant currency risks. Fluctuations in foreign exchange rates, especially the Indian Rupee against the US Dollar and the British Pound, can greatly impact earnings, which may not always be reflected in CAPM calculations. These currency fluctuations add an extra layer of complexity to the risk-return profile of Tata Motors.
- A critical factor in the automotive industry during 2021-2023 was the global semiconductor shortage. As a major player in the automotive industry, Tata Motors faced production delays and cost pressures due to limited semiconductor availability. This supply-side disruption likely influenced its returns and increased market volatility, further complicating CAPM's ability to capture such externalities.

RECOMMENDATIONS:

- Investors in Tata Motors should maintain a diversified portfolio, especially considering the stock's high volatility and dependence on external market factors.
- Tata Motors should accelerate its shift toward electric vehicles, leveraging government incentives and consumer demand for cleaner alternatives. By leading the EV sector in India and internationally, Tata Motors can improve profitability and investor sentiment, boosting expected returns.

- By streamlining manufacturing processes and reducing production costs, Tata Motors can enhance margins. Implementing automation and improving supply chain management can help the company become more cost-efficient, positively impacting returns.
- Tata Motors could diversify its product offerings to include more high-margin vehicles, such as luxury or premium electric models under the Jaguar Land Rover brand. This diversification can tap into new customer segments and increase revenue streams.
- Focusing on expanding into fast-growing international markets, especially in Asia, Africa, and Latin America, can increase Tata Motors' global presence and capture additional market share, leading to higher revenues and expected returns.
- Tata Motors can invest in advanced automotive technologies like autonomous driving, connected vehicles, and shared mobility solutions. By staying ahead of industry trends, the company can capitalize on future growth opportunities and attract forward-looking investors.

CONCLUSION:

The Capital Asset Pricing Model (CAPM) serves as a vital framework for evaluating expected returns on Tata Motors' stock by linking risk and return through its beta coefficient. The analysis reveals that Tata Motors has experienced significant fluctuations in its expected returns over recent years, influenced by its sensitivity to market conditions and external factors .To enhance expected returns, Tata Motors can pursue strategic initiatives such as expanding its electric vehicle offerings, improving operational efficiency, diversifying its product range, and exploring new international markets. Additionally, investing in advanced technologies and focusing on sustainability can position the company favourably for long-term growth. While CAPM provides a foundational approach to evaluating the expected return of Tata Motors, incorporating alternative models and strategic initiatives can offer a more comprehensive understanding of the company's risk-return dynamics. Investors should remain vigilant about the changing market landscape and Tata Motors' efforts to innovate and adapt, ensuring that they can navigate both opportunities and risks in this dynamic sector. By addressing these aspects, Tata Motors can better align its strategies with market expectations, ultimately enhancing investor confidence and improving expected returns.

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