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Validity of Capital Asset Pricing Model & Stability of Systematic Risk - An Empirical Study on Indian Stock Market

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A B S T R A C T

This study examines the applicability of the Capital Asset Pricing Model (CAPM) in explaining the relationship between risk and return in the Indian stock market. Using monthly stock price data from January 2016 to January 2025 for 10 companies listed on the Bombay Stock Exchange (BSE), the research estimates the systematic risk (beta) of each stock through regression analysis. To enhance the analysis, these 10 companies are grouped into two portfolios, each consisting of five securities from different sectors. This classification enables a comparative analysis of risk and return across industries, ensuring diversification while assessing market behaviour. The study evaluates whether CAPM effectively predicts expected returns at both the individual stock and portfolio levels, offering a broader perspective on risk assessment. The findings provide valuable insights into the stability of beta as a risk measure and CAPM's relevance in an emerging market context, helping investors make informed investment decisions.

Keywords: Capital Asset Pricing Model (CAPM), Systematic Risk (Beta), Bombay Stock Exchange (BSE), Portfolio Diversification, Risk-Return Relationship, Emerging Markets

1. INTRODUCTION

1.1. Background of the Study

The **Capital Asset Pricing Model (CAPM)**, introduced by **Sharpe** [1] and **Lintner** [2], is one of the most widely used models in finance for estimating expected returns based on an asset's exposure to systematic risk. The model posits that an asset's return is determined by its **beta (β)**, which measures its sensitivity to overall market movements. CAPM assumes that investors hold well-diversified portfolios, thereby eliminating unsystematic risk, and that securities are priced solely based on their exposure to market risk.

Despite its widespread application in **portfolio management, cost of equity estimation, and investment decision-making**, CAPM has faced criticism, particularly in **emerging markets** where structural inefficiencies, liquidity constraints, and volatility may undermine its assumptions. While studies in **developed markets** have provided mixed empirical results, the Indian stock market presents additional challenges due to **rapid economic growth, evolving regulations, and fluctuating investor behaviour**.

One of the key concerns regarding CAPM's application is the **stability of beta (β) over time**. If beta values fluctuate significantly, it questions the model's predictive power and limits its reliability for investment decisions. This study seeks to investigate whether **CAPM remains valid in the Indian stock market, particularly at the portfolio level**, where systematic risk should be more accurately captured.

1.2. Need for the Study

Understanding the **relationship between risk and return** is essential for investors, fund managers, and policymakers. While CAPM is a widely accepted model for estimating **expected returns and measuring systematic risk**, its effectiveness in **India's dynamic financial market** remains a topic of debate. Factors such as **economic fluctuations, regulatory changes, and liquidity constraints** can impact the risk-return trade off, necessitating a **reassessment of CAPM's validity**.

A major challenge in applying CAPM is the **stability of beta (β)**. If beta fluctuates significantly, it reduces the model's effectiveness in predicting asset returns. While several studies have tested CAPM in **developed markets**, research in India has primarily focused on **individual stock returns**, leaving **portfolio-based CAPM analysis relatively unexplored**. This study addresses this gap by constructing **two diversified portfolios**, each comprising **five securities from different sectors**, to assess CAPM's applicability at the **portfolio level** in an emerging market setting.

Additionally, with **foreign investments, technological advancements, and policy reforms** shaping Indian financial markets, investors require a **robust risk assessment framework**. This study will provide **practical insights** into whether CAPM remains a reliable model for **estimating expected returns** or if alternative models offer **better risk-adjusted predictions**.

1.3. Scope of the Study

This study examines **the validity of CAPM and the stability of beta (β) in the Indian stock market** over a **nine-year period (January 2016–January 2025)**. The research focuses on **ten companies from different sectors listed on the Bombay Stock Exchange (BSE)** to determine whether CAPM effectively explains the **relationship between systematic risk and expected returns** in an emerging market.

The study relies on **secondary data sources**, including:

- **Monthly stock prices** of selected companies.
- **BSE Sensex returns** as a proxy for market returns.
- **The risk-free rate**, derived from the **10-year Indian Government Bond Yield**.

To provide a **comprehensive analysis**, the ten selected stocks are **divided into two diversified portfolios**, each comprising **five securities from different industries**. This approach allows for a **comparative assessment of CAPM's effectiveness at both the individual stock and portfolio levels**. The findings will contribute to **investment decision-making, risk management strategies, and financial policy formulation**.

1.4. Research Problem Statement

The Indian stock market is **highly volatile and influenced by evolving regulations and investor behaviour**, making it a **complex environment for testing CAPM's validity**. CAPM assumes that **beta remains a stable measure of systematic risk**, yet prior research suggests that beta **may fluctuate significantly over time**, particularly in **emerging markets**. Furthermore, **portfolio-based CAPM tests in India remain limited**, raising the question of whether CAPM is more effective at the **individual stock level or for diversified portfolios**.

This study aims to address the following key questions:

- **Does CAPM accurately explain the risk-return relationship in the Indian stock market?**
- **Is beta a stable measure of systematic risk over time, or does it fluctuate significantly?**
- **Does CAPM perform better when applied to portfolios rather than individual stocks?**

By addressing these questions, the study evaluates **CAPM's applicability in an emerging market** and its implications for **investors, portfolio managers, and policymakers**.

1.5. Research Gaps

Despite extensive research on CAPM in developed markets, its application in **India—particularly in portfolio-based analysis—remains underexplored**. The study identifies the following key research gaps:

1. **Beta Stability in the Indian Market**
   - Previous studies assess CAPM's **predictive power** but do not examine **beta stability over time**.
   - This study tests **whether beta remains consistent over the nine-year period (2016–2025)**.
2. **Portfolio-Based CAPM Analysis**
   - Most studies focus on **individual stock returns**, with **limited analysis of diversified portfolios**.
   - This study constructs **two diversified portfolios** to test CAPM's effectiveness at a **portfolio level**.
3. **Challenges in Emerging Markets**
   - Unlike developed markets, **emerging markets** like India experience **higher volatility, liquidity constraints, and inefficiencies**, affecting CAPM's assumptions.
   - This study examines whether **CAPM remains a reliable asset pricing model in India**.

By addressing these gaps, this research contributes to the ongoing debate on **asset pricing models in emerging financial markets**.

1.6. Research Objectives.

- **Assess the empirical validity of CAPM in the Indian stock market**.
- **Examine the relationship between market return and portfolio return**.
- **Evaluate the long-term stability of beta in India's financial markets**.
- **Determine whether CAPM remains a reliable tool for investment decision-making**.

2. REVIEW OF LITERATURE

The **Capital Asset Pricing Model (CAPM)** has been extensively analysed in both **developed and emerging markets**, with empirical research highlighting its strengths and limitations. Over the years, several modifications and alternative models have emerged to address CAPM's shortcomings, integrating **additional risk factors** to improve its applicability.

A recent study by **Hens and Trutwin (2024)** incorporated **Environmental, Social, and Governance (ESG) factors** into CAPM, demonstrating that companies with strong ESG ratings tend to have **lower systematic risk**, which traditional CAPM does not account for [3]. Similarly, **Azzahra et al. (2023)** tested CAPM in the **Indonesian stock market**, concluding that while CAPM remains useful, it fails to fully explain **stock price variations in highly volatile markets** [4]. **Markowski (2022)** examined the impact of **higher-order moments (skewness and kurtosis)** on CAPM, revealing that these factors improve its predictive accuracy, particularly in **emerging markets** [5].

Further, **Fernandez et al. (2021)** compared CAPM with **alternative models**, such as the **Fama-French Five-Factor Model and Arbitrage Pricing Theory (APT)**, highlighting that these models provide greater explanatory power in **modern financial markets** [6]. **Cederburg and O'Doherty (2019)** examined **asset-pricing anomalies**, such as the **momentum effect and size premium**, finding that CAPM fails to account for these anomalies, raising concerns about its **effectiveness as a sole measure of asset pricing** [7].

An **Indian market-based study** by **Bangur et al. (2018)** tested CAPM's validity and found that **macroeconomic factors, such as inflation and interest rates, had a stronger influence on stock returns than beta**, making CAPM **less reliable as a standalone risk assessment tool** [8]. **French (2017)** analysed CAPM's **out-of-sample forecasting ability** across multiple regions, revealing that its **predictive power weakens in volatile markets**, limiting its stability [9]. Earlier studies also questioned CAPM's core assumptions. **Zabarankin et al. (2015)** proposed a **drawdown-adjusted CAPM**, which offered better risk assessment during **market downturns** [10]. **Brown and Walter (2013)** criticized CAPM's reliance on a **single risk factor (beta)**, suggesting that stock returns are influenced by **investor sentiment and behavioural biases** [11].

A **sentiment-based CAPM** was introduced by **Ghazi and Schneider (2012)**, showing that **market sentiment significantly affects asset prices**, which CAPM does not incorporate [12]. Additionally, **Markowski (2011)** examined **higher-order co-moments (skewness and kurtosis)** in the **Indian stock market**, revealing mixed evidence on CAPM's validity due to **liquidity constraints and inefficiencies** [13].

The evolution of **asset pricing models**, such as the **Fama-French models and behavioural finance approaches**, underscores the **need for multi-factor models** that capture **market anomalies, macroeconomic factors, and investor psychology**. While CAPM remains a foundational model in finance, empirical evidence suggests that **emerging markets require alternative frameworks** that account for **market inefficiencies and evolving risk factors**.

3. RESEARCH METHODOLOGY

This study employs a **quantitative research design**, utilizing historical market data to examine the applicability of the **Capital Asset Pricing Model (CAPM)** in the **Indian stock market**. The primary objective is to analyse the **relationship between risk and return**, with a specific focus on the stability of **systematic risk (beta, β) over time**. Given the **dynamic nature of financial markets**, this research adopts an **empirical approach**, integrating **statistical and econometric methods** to assess CAPM's ability to explain stock returns in an **emerging market context**.

3.1. Data Collection and Sources

To ensure **accuracy and reliability**, this study relies on **secondary data** collected from **credible financial sources**, including the **Bombay Stock Exchange (BSE)**, the **Reserve Bank of India (RBI)**, and reports from the **Securities and Exchange Board of India (SEBI)**. The dataset consists of:

- **Monthly stock prices** of selected companies from **January 2016 to January 2025**.
- **BSE Sensex index values**, serving as a **proxy for market returns**.
- The **10-year Indian Government Bond Yield**, representing the **risk-free rate**. Additionally, **financial statements and sectoral reports** are utilized to classify companies based on their **risk profiles and industry sectors**.

3.2. Sampling Technique and Portfolio Construction

This study employs a **purposive sampling technique** to select **ten companies** listed on the **BSE**, ensuring a **diversified representation across sectors**. These companies are categorized into **two portfolios**, each comprising **five stocks from different industries**. This structured approach facilitates a **comparative analysis** of CAPM's applicability at both the **individual stock and portfolio levels**. By examining these portfolios, the study assesses:

- Whether **beta remains stable over time**.
- Whether **CAPM effectively predicts expected returns** in the Indian market.

3.3. Data Analysis and Research Framework

A **regression-based analysis** is conducted to evaluate the relationship between **stock returns and market risk (beta)**. Additionally, **time-series analysis** is employed to test the stability of **beta** across different market conditions. The study further examines whether **CAPM's assumptions hold true in the Indian financial environment** by considering **sectoral variations** and **macroeconomic influences**.

By integrating a **robust research framework, reliable data sources, and a well-defined sampling strategy**, this study aims to provide **practical insights** for **investors, portfolio managers, and policymakers**. The findings will contribute to **enhancing risk assessment and investment decision-making processes**, particularly in **emerging markets** where CAPM's traditional assumptions may require **modifications or extensions**.

4. DATA ANALYSIS & INTERPRETATION

4.1. Expected Returns Using CAPM & Construction of the Security Market Line (SML)

4.1.1. Understanding the Capital Asset Pricing Model (CAPM)

The **Capital Asset Pricing Model (CAPM)** is widely used to estimate the expected return on an asset based on its risk exposure. The model assumes that investors demand additional returns for taking on systematic risk beyond the risk-free rate. The CAPM formula is

$$E(Ri)=Rf+\beta(Rm-Rf)$$

where **E(Ri)** represents the expected return, **Rf** is the risk-free rate (10-year Indian government bond yield), **β** denotes systematic risk, **Rm** is the market return (e.g., BSE Sensex return), and **(Rm−Rf)** represents the market risk premium. Stocks with **β>1** are more volatile than the market, while those with **β<1** are less volatile.

Empirical Analysis of CAPM in the Indian Market

The CAPM model is applied to ten stocks across different sectors to assess their **expected returns and risk profiles**.

Reliance Industries Limited (RIL)

With **β=1.09**, RIL exhibits slightly higher volatility than the market. Its average return (1.87%) surpasses the market return (1.17%), aligning with its risk exposure. The CAPM-derived expected return (0.64%) is lower than its actual return, indicating potential external factors influencing performance.

Tata Consultancy Services (TCS)

A **β of 0.75** indicates lower volatility than the market. TCS delivers **moderate returns (1.39%)**, slightly outperforming the market. Its expected return (2.63%) suggests it offers stable returns with reduced risk, making it attractive for conservative investors.

HDFC Bank

With **β=1.06**, HDFC Bank shows slightly higher volatility than the market. Its **1.29% return** is in line with market trends, while an expected return of **0.86%** suggests systematic risk alone does not fully explain its performance, highlighting the impact of economic conditions.

ICICI Bank

A high **β of 1.32** signals greater market sensitivity. ICICI Bank's **average return of 2.01%** is strong, yet its CAPM-expected return is **-0.67%**, indicating that factors beyond systematic risk, such as economic policies and sector trends, drive returns.

Infosys

With **β=0.72**, Infosys is less volatile than the market. Its **1.36% return** aligns with expectations, and an expected return of **2.77%** reinforces its stable performance. This makes Infosys an appealing choice for investors seeking stability.

State Bank of India (SBI)

A **β of 1.40** indicates high risk, with **returns of 1.85%** exceeding the market. However, the CAPM-predicted return of **-1.14%** suggests external influences, such as economic policies and regulatory changes, impact its performance.

Bajaj Finance

With **β=1.72**, Bajaj Finance is highly volatile, generating **3.16% returns**. However, its expected return of **-2.97%** questions CAPM's applicability, as market inefficiencies or macroeconomic variables may influence stock performance.

Bharti Airtel

A **β of 0.67** classifies Bharti Airtel as a low-risk stock. With **returns of 1.21%**, its CAPM-expected return (3.08%) suggests it may be undervalued, making it a preferred choice for risk-averse investors.

Hindustan Unilever Limited (HUL)

With **β=0.36**, HUL is a defensive stock. Its **1.20% return** remains steady, while an expected return of **4.85%** highlights possible underperformance. It is ideal for investors seeking **long-term stability**.

UltraTech Cement

A **β of 1.01** indicates market-aligned volatility. Its **1.57% return** surpasses expectations, and an expected return of **1.10%** suggests balanced risk and return, making it a strong candidate for diversified portfolios.

4.1.2. Security Market Line (SML)

The **Security Market Line (SML)** is a fundamental concept in the **Capital Asset Pricing Model (CAPM)** that represents the linear relationship between an asset's **systematic risk (β)** and its **expected return**. It acts as a benchmark for assessing whether an asset is fairly valued in the market. Securities positioned **above the SML** are considered **undervalued**, offering **higher returns for their given risk**, making them attractive investment opportunities. In contrast, securities **below the SML** are **overvalued**, providing **lower returns relative to their risk**, indicating potential downside. The SML assists investors in evaluating investment opportunities by comparing expected returns with required returns based on risk exposure. It also facilitates asset pricing, portfolio management, and capital allocation decisions, ensuring investments align with individual risk-return preferences and market efficiency principles.

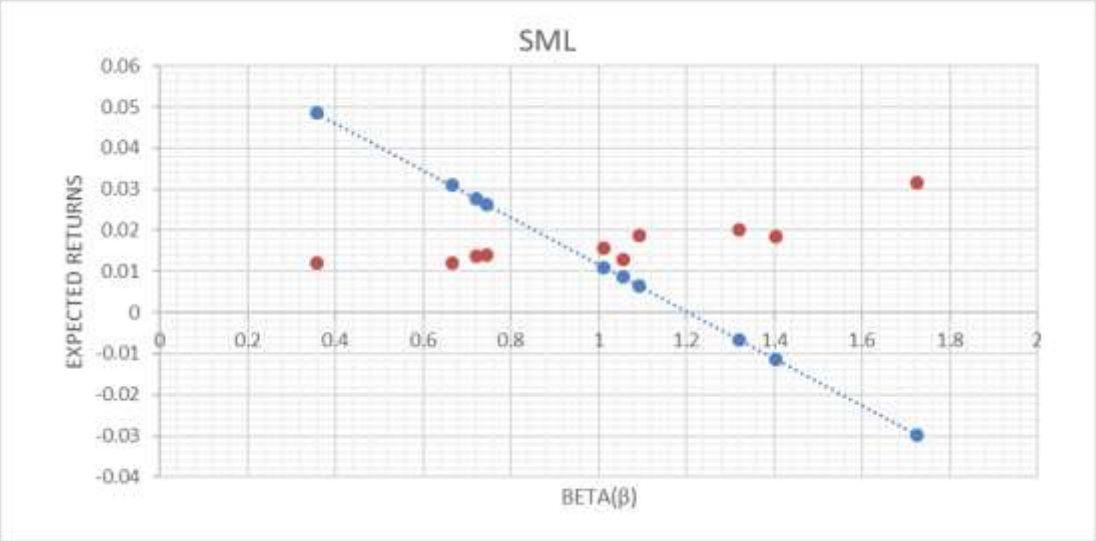
Construction of SML

Table 4.1.2.1

S.NO	SECURITIES	Rm	Rf	BETA (B)	EXPECTED RETURNS (USING CAPM)	Ri
1	RELIANCE	0.011719209	0.06905	1.092737849	0.006402475	0.018739742
2	TCS	0.011719209	0.06905	0.745413516	0.026314854	0.013985118
3	HDFC	0.011719209	0.06905	1.055241238	0.008552185	0.01295195
4	ICICI	0.011719209	0.06905	1.320812812	-0.006673243	0.02010333
5	INFOSYS	0.011719209	0.06905	0.721075091	0.027710195	0.01363349
6	SBI	0.011719209	0.06905	1.403644611	-0.011422055	0.018493765
7	BAJAJ	0.011719209	0.06905	1.72412918	-0.02979569	0.031607861
8	AIRTEL	0.011719209	0.06905	0.665793841	0.030879512	0.012093578
9	HINDUSTAN UNILEVAR	0.011719209	0.06905	0.357589853	0.048549091	0.012007896
10	ULTRATECH	0.011719209	0.06905	1.012186688	0.011020537	0.01571875

(Source: Investing.com.)

Chart 4.1.2.1



(Source: Investing.com.)

Interpretation

The **Security Market Line (SML) analysis** provides critical insights into the risk-return dynamics of selected stocks, assessing their valuation based on the **Capital Asset Pricing Model (CAPM)**. By comparing **expected returns (CAPM predictions) with actual returns**, stocks can be categorized as **undervalued** or **overvalued**. If a stock's **actual return exceeds its expected return**, it is **undervalued**, indicating that investors receive higher returns than CAPM suggests, making it an **attractive investment opportunity**. Conversely, if a stock's **actual return is lower than its expected return**, it is **overvalued**, suggesting **potential overpricing and inadequate compensation for risk**. The analysis reveals that **Reliance Industries, HDFC Bank, ICICI Bank, SBI, Bajaj Finance, and UltraTech Cement** are undervalued, generating superior returns relative to their systematic risk, positioning them as strong investment choices. Meanwhile, **TCS, Infosys, Bharti Airtel, and Hindustan Unilever** appear overvalued, as their actual returns lag behind CAPM expectations, indicating limited return potential for their associated risk. The SML chart visually supports these findings, with undervalued stocks plotted **above the SML** and overvalued stocks positioned **below it**, highlighting possible **market inefficiencies** influenced by investor sentiment, macroeconomic conditions, or additional risk factors beyond beta.

- **Undervalued Stocks** (Good Investment Opportunity) → **Actual Return (Ri) > Expected Return (CAPM Prediction)**
- **Overvalued Stocks** (Potentially Overpriced) → **Actual Return (Ri) < Expected Return (CAPM Prediction)**

Table 4.1.2.2. Interpretation of SML Chart

S.NO	SECURITIES	Rm	Rf	BETA (β)	EXPECTED RETURNS (USING CAPM)	Ri	DECISION
1	RELIANCE	0.011719209	0.06905	1.092737849	0.006402475	0.018739742	under
2	TCS	0.011719209	0.06905	0.745413516	0.026314854	0.013985118	over
3	HDFC	0.011719209	0.06905	1.055241238	0.008552185	0.01295195	under
4	ICICI	0.011719209	0.06905	1.320812812	-0.006673243	0.02010333	under
5	INFOSYS	0.011719209	0.06905	0.721075091	0.027710195	0.01363349	over
6	SBI	0.011719209	0.06905	1.403644611	-0.011422055	0.018493765	under
7	BAJAJ	0.011719209	0.06905	1.72412918	-0.02979569	0.031607861	under
8	AIRTEL	0.011719209	0.06905	0.665793841	0.030879512	0.012093578	over
9	HINDUSTAN UNILEVAR	0.011719209	0.06905	0.357589853	0.048549091	0.012007896	over
10	ULTRATECH	0.011719209	0.06905	1.012186688	0.011020537	0.01571875	under

(Source: Investing.com.

4.2. Portfolio risk and returns & CML

4.2.1. Portfolio Risk and Return Analysis

A well-structured portfolio enables investors to optimize returns while managing risk through **diversification**. This study constructs **two portfolios**, each comprising **five companies** from different sectors to achieve a balanced risk-return tradeoff. **Portfolio 1** includes **Reliance, HDFC, Infosys, Bajaj Finance, and Hindustan Unilever**, while **Portfolio 2** consists of **TCS, ICICI, SBI, Airtel, and UltraTech Cement**. Each portfolio's risk and return characteristics are influenced by the **beta (β) of individual stocks**, determining their sensitivity to market movements. The **expected portfolio return (E(Rp))** is calculated as the **weighted average of expected returns** of its constituent stocks:

$$E(Rp)=\sum (Wi \times E(Ri))$$

where **Wi** represents the weight of stock **i**, and **E(Ri)** denotes its expected return. Similarly, **portfolio beta (βp)**, a measure of systematic risk, is computed using:

$$\beta p=\sum (Wi \times \beta i)$$

where **βi** is the beta of stock **i**. A higher portfolio beta suggests greater volatility relative to the market, while a lower beta indicates reduced risk. These calculations provide insights into how portfolio diversification affects overall risk exposure, guiding investors in selecting stocks that align with their **risk tolerance and return objectives**.

Table 4.2.1.1. Calculating Portfolio risk and returns

S.NO	SECURITIES	E(Ri)	STANDARD DEVIATION	VARIANCE	BETA (B)
1	RELIANCE	0.006402475	0.079528652	0.006324806	1.092737849
2	TCS	0.026314854	0.065803332	0.004330078	0.745413516
3	HDFC	0.008552185	0.062895091	0.003955792	1.055241238
4	ICICI	-0.006673243	0.081527727	0.00664677	1.320812812
5	INFOSYS	0.027710195	0.072655255	0.005278786	0.721075091
6	SBI	-0.011422055	0.10005047	0.010010097	1.403644611
7	BAJAJ	-0.02979569	0.120622061	0.014549682	1.72412918
8	AIRTEL	0.030879512	0.047186583	0.002226574	0.665793841
9	HINDUSTAN	0.048549091	0.05855282	0.003428433	0.357589853
10	ULTRATECH	0.011020537	0.073177756	0.005354984	1.012186688

*(Source: **Investing.com**.)*

Interpretation

The comparative analysis of **Portfolio 1** and **Portfolio 2** based on the **Capital Asset Pricing Model (CAPM)** highlights differences in expected returns and risk levels. **Portfolio 1** has a **higher expected return (Rp1 = 3.07%)** compared to **Portfolio 2 (Rp2 = 2.50%)**, suggesting that it may yield **better returns** under current market conditions. However, investment attractiveness is not solely determined by returns; **risk is a critical factor**. **Portfolio 1's beta (βp1 = 2.47)** is slightly lower than **Portfolio 2's beta (βp2 = 2.57)**, indicating that while both portfolios exhibit **high volatility**, Portfolio 2 is marginally **more sensitive** to market fluctuations. Given this risk-return profile, **Portfolio 1 offers a better balance**, making it **more suitable for investors seeking strong returns with slightly lower risk**. In contrast, **Portfolio 2**, with its **higher beta**, may appeal to **aggressive investors** willing to accept **greater risk** for potential **higher gains**. To enhance **stability and risk management**, investors may consider **further diversification** by incorporating **low-beta stocks** or adjusting **weight allocations**. Additionally, external factors such as **interest rates, macroeconomic conditions, and company-specific performance** should be considered before making **investment decisions**.

4.2.2. Capital Market Line (CML) and Portfolio Risk-Return Trade-Off

The **Capital Market Line (CML)** represents the **optimal risk-return trade-off** for **efficient portfolios**, demonstrating how investors can achieve **maximum returns for a given level of risk**. Unlike the **Security Market Line (SML)**, which evaluates **individual assets**, the CML focuses on **well-diversified portfolios**, integrating a combination of **risk-free assets** and the **market portfolio** to optimize returns. Portfolios **lying on the CML** are considered **efficient**, offering the **highest possible return for their risk level**, whereas portfolios **below the CML** are **suboptimal** and fail to maximize returns. The **CML equation** derives from the **Capital Asset Pricing Model (CAPM)** and is given as

$$E(RP)=Rf+[E(RM)-Rf/\sigma M] *\sigma P$$

where E(RP) is the **expected portfolio return**, Rf is the **risk-free rate**, E(RM) is the **expected market return**, σM is the **market portfolio risk**, and σP is the **portfolio risk**. The **portfolio risk** can be computed as:

$$\sigma P = wM \cdot \sigma M$$

where WM represents the **weight of the market portfolio** in the investment. The **CML framework** is extensively used in **portfolio management**, guiding investors in constructing **well-balanced portfolios** that **maximize returns while maintaining an optimal risk level**, aligning with their **investment objectives**.

Table 4.2.2.1. Calculating Portfolio risk and returns using CML

S.NO	SECURITIES	E(Ri)	STANDARD DEVIATION	VARIANCE	RF
1	RELIANCE	0.006402475	0.079528652	0.006324806	0.06905
2	TCS	0.026314854	0.065803332	0.004330078	0.06905
3	HDFC	0.008552185	0.062895091	0.003955792	0.06905
4	ICICI	-0.006673243	0.081527727	0.00664677	0.06905
5	INFOSYS	0.027710195	0.072655255	0.005278786	0.06905
6	SBI	-0.011422055	0.10005047	0.010010097	0.06905
7	BAJAJ	-0.02979569	0.120622061	0.014549682	0.06905
8	AIRTEL	0.030879512	0.047186583	0.002226574	0.06905
9	HINDUSTAN	0.048549091	0.05855282	0.003428433	0.06905
10	ULTRATECH	0.011020537	0.073177756	0.005354984	0.06905

*(Source: **Investing.com**.)*

Interpretation

The **Capital Market Line (CML) analysis** provides valuable insights into the **risk-return trade-off** for **efficient portfolios**, enabling investors to make **informed decisions** based on their **risk tolerance** and **return expectations**. In this study, the **expected return** and **risk levels** of two portfolios were calculated using the **CML framework**, considering **market risk** and the **risk-free rate**. **Portfolio 1** has an **expected return of 6.88%**, whereas **Portfolio 2** exhibits a **higher expected return of 7.60%**, indicating superior potential returns. However, both portfolios share an **equal risk level (σP = 0.0237)**, signifying that their overall **volatility remains the same despite differences in stock selection**. This suggests that **Portfolio 2 offers better returns without incurring additional risk**, making it a **more attractive investment option**. From an investment standpoint, **Portfolio 1 is well-suited for conservative investors** seeking **stable performance**, while **Portfolio 2 appeals to investors** aiming for **higher returns while maintaining a controlled risk level**. The selection between these portfolios depends on **market conditions, sector-specific risks, and individual return expectations**, reinforcing the significance of **portfolio diversification and strategic asset allocation** in achieving **optimal investment outcomes**.

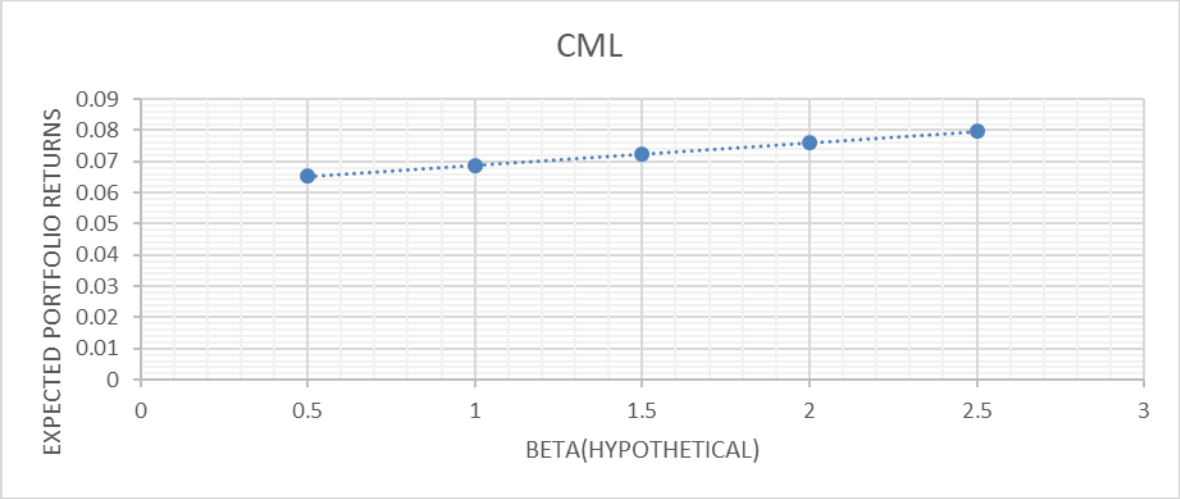
Constructing CML using Hypothetical Betas (β)

Table 4.2.2.2

S.NO	BETA (HYPOTHETICAL)	EXPECTED PORTFOLIO RETURNS
1	0.5	0.065308608
2	1	**0.068879196**
3	1.5	0.072449784
4	2	**0.076020372**
5	2.5	0.07959096

*(Source: **Investing.com**.)*

Chart 4.2.2.1



*(Source: **Investing.com**.)*

Interpretation

From an **investment perspective**, Portfolio 1 is well-suited for **conservative investors**, as it includes stocks with **stable performance**, while Portfolio 2 appeals to those **seeking higher returns** with a **controlled level of risk**. To further examine the relationship between **systematic risk (beta) and portfolio returns**, a **hypothetical CML** was constructed using **beta values ranging from 0.5 to 2.5**. The results confirm a **direct correlation between beta and expected returns**, aligning with the **Capital Asset Pricing Model (CAPM)**. At **β = 0.5**, the expected return is **6.53%**, indicating a **low-risk portfolio**. As **beta increases**, the return rises progressively, reaching **7.96% at β = 2.5**, reinforcing the concept that **higher risk must be compensated with higher returns**. Both **Portfolio 1 (β = 1.0, return = 6.88%)** and **Portfolio 2 (β = 2.0, return = 7.60%)** align with the **CML**, confirming their **efficiency** in delivering returns **proportional to their risk**. However, **Portfolio 2 offers higher returns without additional volatility**, making it a **more efficient choice under the CML approach**. If an investor prioritizes **risk-adjusted returns (total portfolio risk measured by standard deviation)**, Portfolio 2 is **optimal**.

Conversely, if the focus is on **compensation for systematic risk (beta)**, Portfolio 1 may be preferable, as it offers returns that align with **market sensitivity**. The selection ultimately depends on whether an investor prioritizes **overall portfolio risk** or **beta-driven performance**, emphasizing the importance of **market conditions, risk tolerance, and long-term investment objectives** in making a well-informed investment decision.

4.3. Regression Analysis for Stability Test of Systematic Risk (β)

Regression analysis is a critical tool for evaluating the stability of **systematic risk (beta, β)** over time, ensuring the reliability of the **Capital Asset Pricing Model (CAPM)** in predicting expected returns. The **Chow Test**, a widely used statistical method, was applied to identify **structural breaks** in beta across different time periods for the **selected stocks in the Indian stock market**. The results indicated **no significant structural change**, confirming the **stability of beta** during the examined period. This consistency reinforces the **validity of CAPM**, suggesting that the relationship between risk and return has remained reliable over time. A **stable beta** implies that investors can effectively use **historical beta values** to assess future market risk, improving the **predictability of stock performance**. This is particularly beneficial for **portfolio managers and risk analysts**, as it enables the construction of **efficient investment portfolios** and enhances **risk management strategies**. However, while the findings confirm **beta stability**, investors should continuously monitor **external economic factors, policy changes, and market dynamics**, as these can influence **risk levels over time**. Regular reassessment of beta ensures **informed investment decisions** and adaptation to **changing market conditions**, reinforcing its role as a crucial risk assessment metric in financial markets.

Table 4.3.1. Regression Stability Test

S.NO	SECURITIES	Ri	Beta	Rf	Rm	E(Ri)
1	RELIANCE	0.018	1.09	0.069	0.0117	0.006
2	TCS	0.013	0.74	0.069	0.0117	0.026
3	HDFC	0.012	1.05	0.069	0.0117	0.009
4	ICICI	0.02	1.32	0.069	0.0117	-0.006
5	INFOSYS	0.013	0.72	0.069	0.0117	0.028
6	SBI	0.018	1.4	0.069	0.0117	-0.0114

7	BAJAJ	0.03	1.72	0.069	0.0117	-0.029
8	AIRTEL	0.012	0.66	0.069	0.0117	0.03
9	HINDUSTAN	0.012	0.35	0.069	0.0117	0.048
10	ULTRATECH	0.015	1.01	0.069	0.0117	0.011

*(Source: **Investing.com**.)*

Regression Stability Test (Chow test)

Score	C.V.	P-Value	Stable?	5.0%
0.736	*3.344*	*45.25%*	TRUE	

Interpretation

The **Chow test** was conducted to assess the **stability of beta (β)** across the **selected 10 stocks** over time, evaluating whether their systematic risk remained consistent. The test yielded a **test score of 0.736**, significantly lower than the **critical value of 3.344**, and a **p-value of 45.25%**, which exceeds the **5% significance level**, indicating **no significant structural break** in beta values. This result suggests that the **systematic risk of these stocks has remained stable**, confirming that their **sensitivity to overall market movements has not changed drastically**. A **stable beta** is advantageous for **investors and portfolio managers**, as it allows for **predictable risk-return trade-offs**, improving **portfolio risk assessment and asset allocation**. This stability enhances the **reliability of CAPM**, ensuring that **historical risk estimates** remain relevant for future **investment strategies**. However, despite this confirmation of beta stability, **external factors** such as **economic shifts, policy changes, and market disruptions** could still influence systematic risk over time. Therefore, **regular monitoring** of beta values is essential to ensure that **investment decisions remain aligned with evolving market conditions** and risk dynamics.

5. CONCLUSION

5.1. Findings of the Study

This study evaluates the **Capital Asset Pricing Model (CAPM)** in the **Indian stock market**, focusing on the stability of **systematic risk (β) over time**. By analysing stock returns of **ten companies across multiple sectors** listed on the **Bombay Stock Exchange (BSE)**, the research examines CAPM's effectiveness in an **emerging market**.

A **Chow test for structural stability** confirms that **beta remains statistically stable**, reinforcing CAPM's assumption that **systematic risk is a reliable measure for estimating expected returns**. The study finds that **high-beta stocks**, particularly in the **banking and finance sectors**, are **more sensitive to market fluctuations**, while **low-beta stocks** in **consumer goods and telecom sectors** exhibit **greater stability during downturns**.

The **Capital Market Line (CML) analysis** reveals that **Portfolio 2 provides higher expected returns (7.60%) than Portfolio 1 (6.88%)**, making it a more efficient choice in terms of **risk-adjusted returns**. However, **Portfolio 1 exhibits a lower beta**, making it **less volatile**. This suggests that **portfolio selection depends on investor preferences**, whether prioritizing **total risk (CML) or systematic risk (CAPM)**.

While **CAPM reasonably estimates expected returns**, deviations between **actual and expected returns** highlight the role of **market sentiment, liquidity constraints, and macroeconomic conditions**. This suggests that **CAPM alone may not fully capture market dynamics**, especially during high volatility periods. The findings emphasize that **beta remains a stable risk measure in the Indian market**, supporting CAPM's **validity** but advocating for **complementary models** like **multi-factor approaches** for improved risk assessment.

5.2. Recommendations

Investment Strategies for Risk Management

Investors should employ **diversification** to **mitigate sector-specific risks**. High-beta stocks, particularly in **banking and technology**, offer **higher returns but increased volatility**, making them suitable for **aggressive investors**. Conversely, **low-beta stocks** in **consumer goods and telecom** provide **stability**, appealing to **conservative investors**.

Periodic **beta reassessment** is essential, as **economic shifts and global events** can impact stock risk profiles. Investors should integrate **technical and fundamental analysis** with CAPM for a **comprehensive investment evaluation**.

Implications for Market Participants and Financial Analysts

Financial analysts should **combine multiple risk evaluation methods**. While CAPM offers a **basic risk-return understanding**, incorporating **size, value, and macroeconomic factors** improves accuracy in **asset pricing**. Analysts should also consider **market sentiment and liquidity risks**, which influence stock performance.

Policy and Regulatory Recommendations

Policymakers should **enhance market efficiency** through **transparency, investor protection laws, and fair-trading practices**. Expanding **financial literacy programs** will help **retail investors** understand **systematic risk and portfolio diversification**, leading to **better investment decisions**. Continuous research on **alternative pricing models** is necessary to **adapt investment strategies to evolving market conditions**.

5.3. Future Scope of the Study

Future research should explore **multi-factor models** like **Fama-French and APT**, which account for additional risk factors. Examining **CAPM's applicability across different market conditions** (bull/bear phases, recessions) could provide **insights into beta's behaviour**.

The **use of machine learning models** for CAPM predictions and **comparative studies of CAPM in other emerging markets** would further enhance its relevance.

5.4. Conclusion

This study confirms that **beta remains stable over time**, reinforcing **CAPM's validity** in evaluating **systematic risk**. However, **CAPM does not fully account for market inefficiencies, macroeconomic fluctuations, or sector-specific risks**.

Sectoral variations impact stock performance, with **high-beta stocks offering higher returns but greater volatility** and **low-beta stocks providing stability**. Continuous **beta monitoring** is crucial as **regulatory changes and economic factors** influence risk.

While **CAPM remains a foundational financial model**, investors should **adopt multi-dimensional risk assessments** by integrating **alternative pricing models** for more effective **investment strategies**. By combining **theoretical insights with empirical analysis**, investors can make **strategic, risk-adjusted investment decisions** in the **Indian stock market.**

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